Encyclopaedia Britannica:

OR, A

DICTIONARY

OF

ARTS, SCIENCES, AND MISCELLANEOUS LITERATURE;

ENLARGED AND IMPROVED.

THE FIFTH EDITION.

Illustrated with nearly six hundred Engravings.

VOL. XIV.

INDOCTI DISCANT; AMENT MEMINISSE PERITI.

EDINBURGH:
Printed at the Encyclopædia Press,
FOR ARCHIBALD CONSTABLE AND COMPANY, AND THOMSON BONAR, EDINBURGH:
GALE, CURTIS, AND FENNER, LONDON; AND THOMAS WILSON
AND SONS, YORK.

1815.

ENCYCLOPÆDIA BRITANNICA.

MICROSCOPE, an optical inſtrument, conſiſting of lenſes, or mirrors, by means of which ſmall objects appear larger than they do to the naked eye. *Single* microſcopes conſiſt of a ſingle lens or mirror; or if more lenſes or mirrors be made uſe of, they only ſerve to throw light upon the object, but do not contribute to enlarge the image of it. *Double* or *compound* microſcopes are thoſe in which the image of an object is compoſed by means of more lenſes or mirrors than one.

For the principles on which the conſtruction of microſcopes depends, ſee OPTICS. In the preſent article, it is intended to deſcribe the finiſhed inſtrument, with all its varied apparatus, according to the lateſt improvements; and to illuſtrate by proper details its uſes and importance.

I. *Of* SINGLE *Microſcopes.*

THE famous microſcopes made uſe of by Mr Leeuwenhoeck, were all, as Mr Baker aſſures us, of the ſingle kind, and the conſtruction of them was the moſt ſimple poſſible; each conſiſting only of a ſingle lens ſet between two plates of ſilver, perforated with a ſmall hole, with a moveable pin before it to place the object on and adjuſt it to the eye of the beholder. He informs us alſo, that *lenſes* only, and not *globules*, were uſed in every one of theſe microſcopes.

Plate CCCXXXVII Fig. 1.

1. The ſingle microſcope now moſt generally known and uſed is that called *Wilſon's Pocket Microſcope*. The body is made of braſs, ivory, or ſilver, and is repreſented by AA, BB. CC is a long fine threaded male ſcrew that turns into the body of the microſcope; D a convex glaſs at the end of the ſcrew. Two concave round pieces of thin braſs, with holes of different diameters in the middle of them, are placed to cover the above-mentioned glaſs, and thereby diminiſh the aperture when the greateſt magnifiers are employed. EE, three thin plates of braſs within the body of the microſcope; one of which is bent ſemicircularly in the middle, ſo as to form an arched cavity for the reception of a tube of glaſs, the uſe of the other two being to receive and hold the ſliders between them. F, a piece of wood or ivory, arched in the manner of the ſemicircular plate, and cemented to it. G, the other end of the body of the microſcope, where a hollow female ſcrew is adapted to receive the different magnifiers. H is a ſpiral ſpring of ſteel, between the end G and the plates of braſs, intended to keep the plates in a right poſition and counteract the long ſcrew CC. I is a ſmall turned handle, for the better holding of the inſtrument, to ſcrew on or off at pleaſure.

To this microſcope belong ſix or ſeven magnifying glaſſes: ſix of them are ſet in ſilver, braſs, or ivory, as in the figure K; and marked 1, 2, 3, 4, 5, 6, the loweſt numbers being the greateſt magnifiers. L is the ſeventh magnifier, ſet in the manner of a little barrel, to be held in the hand for the viewing of any larger object. M is a flat ſlip of ivory, called a *ſlider*, with four round holes through it, wherein to place objects between two pieces of glaſs or Muſcovy talc, as they appear at *dddd*. Six ſuch ſliders, and one of braſs, are uſually ſold with this microſcope, ſome with objects placed in them, and others empty for viewing any thing that may offer: but whoever pleaſes to make a collection, may have as many as he deſires. The braſs ſlider is to confine any ſmall object, that it may be viewed without cruſhing or deſtroying it. N is a tube of glaſs contrived to confine living objects, ſuch as frogs, fiſhes, &c. in order to diſcover the circulation of the blood. All theſe are contained in a little neat box of fiſh-ſkin or mahogany, very convenient for carrying in the pocket.

When an object is to be viewed, thruſt the ivory ſlider, in which the ſaid object is placed, between the two flat braſs plates EE: obſerving always to put that ſide of the ſlider where the braſs rings are fartheſt from the eye. Then ſcrew on the magnifying glaſs you intend to uſe, at the end of the inſtrument G; and looking through it againſt the light, turn the long ſcrew CC, till your object be brought to ſuit your eye; which will be known by its appearing perfectly diſtinct and clear. It is moſt proper to look at it firſt through a magnifier that can ſhow the whole at once, and afterwards to inſpect the ſeveral parts more particularly with one of the greateſt magnifiers; for thus you will gain a true idea of the whole, and of all its parts. And though the greateſt magnifiers can ſhow but a minute portion of any object at once, ſuch as the claw of a flea, the horn of a louſe, or the like; yet by gently moving the ſlider which contains the object, the eye may gradually examine it all over.

As objects muſt be brought very near the glaſſes when the greateſt magnifiers are made uſe of, be careful not to ſcratch them by rubbing the ſlider againſt them as you move it in or out. A few turns of the ſcrew CC will eaſily prevent this miſchief, by giving them room enough. You may change the objects in your ſliders for any others you think proper, by taking out the braſs rings with the point of a penknife; the talcs will then fall out, if you but turn the ſliders; and after putting what you pleaſe between them, by replacing the braſs rings you will faſten them as they were before. It is proper to have ſome ſliders furniſhed with talcs, but without any object between them, to be always in readineſs for the examination of fluids, ſalts, ſands, powders, the farina of flowers, or any other caſual objects of ſuch ſort as need only be applied to the outſide of the talc.

The circulation of the blood may be eaſieſt ſeen in the tails or fins of fiſhes, in the fine membranes between a frog's toes, or beſt of all in the tail of a water-newt. If your object be a ſmall fiſh, place it within the tube N, and ſpread its tail or fin along the ſide thereof: if a frog, chooſe ſuch a one as can but juſt be got into your tube; and, with a pen, or ſmall ſtick, expand the tranſparent membrane between the toes of the frog's hind foot as much as you can. When your object is ſo adjuſted that no part of it can intercept the light from the place you intend to view, unſcrew the long ſcrew CC, and thruſt your tube into the arched cavity, quite through the body of the microſcope; then ſcrew it to the true focal diſtance, and you will ſee the blood paſſing along its veſſels with a rapid motion, and in a moſt ſurpriſing manner.

The third or fourth magnifiers may be uſed for frogs or fiſhes: but for the tails of water-newts, the fifth or ſixth will do; becauſe the globules of their blood are twice as large as thoſe of frogs or fiſh. The firſt or ſecond magnifier cannot well be employed for this purpoſe; becauſe the thickneſs of the tube in which the object lies, will ſcarce admit its being brought ſo near as the focal diſtance of the magnifier.

An apparatus for the purpoſe of viewing opaque objects generally accompanies this microſcope; and which conſiſts of the following parts. A braſs arm QR, which is ſcrewed at Q, upon the body of the microſcope at G. Into the round hole R, any of the magnifiers ſuitable to the object to be viewed are to be ſcrewed; and under it, in the ſame ring, the concave poliſhed ſilver ſpeculum S. Through a ſmall aperture in the body of the microſcope under the braſs plates EE, is to ſlide the long wire with the forceps T: This wire is pointed at one of its ends; and ſo, that either the points or forceps may be uſed for the objects as may be neceſſary. It is eaſy to conceive, therefore, that the arm at R, which turns by a twofold joint at *a* and *b*, may be brought with its magnifier over the object, the light reflected upon it by the application of the ſpeculum, and the true focus obtained by turning of the male ſcrew CC as before directed.—As objects are ſometimes not well fixed for view, either by the forceps or point, the ſmall piece ſhown at V is added, and in ſuch caſes anſwers better: it ſcrews over the point of T; it contains a ſmall round piece of ivory, blackened on one ſide, and left white upon the other as a contraſt to coloured objects, and by a ſmall piece of watch-ſpring faſtens down the objects upon the ivory.

2. *Single Microſcope by reflection.* In fig. 2. A is a ſcroll of braſs fixed upright upon a round wooden baſe B, or mahogany drawer or caſe, ſo as to ſtand perfectly firm and ſteady. C is a braſs ſcrew, that paſſes through a hole in the upper limb of the ſcroll into the ſide of the microſcope D, and ſcrews it faſt to the ſaid ſcroll. E is a concave ſpeculum ſet in a box of braſs, which hangs in the arch G by two ſmall ſcrews *ff*, that ſcrew into the oppoſite ſides thereof. At the bottom of this arch is a pin of the ſame metal, exactly fitted to a hole *h* in the wooden pedeſtal, made for the reception of the pin. As the arch turns on this pin, and the ſpeculum turns on the end of the arch, it may, by this twofold motion, be eaſily adjuſted in ſuch a manner as to reflect the light of the ſun, of the ſky, or of a candle, directly upwards through the microſcope that is fixed perpendicularly over it; and by ſo doing may be made to anſwer many purpoſes of the large double reflecting microſcope. The body of the microſcope may alſo be fixed horizontally, and objects viewed in that poſition by any light you chooſe; which is an advantage the common double reflecting microſcope has not. It may alſo be rendered further uſeful by means of a ſlip of glaſs; one end of which being thruſt through between the plates where the ſliders go, and the other extending to ſome diſtance, ſuch objects may be placed thereon as cannot be applied in the ſliders: and then, having a limb of braſs that may faſten to the body of the microſcope, and extend over the projecting glaſs a hollow ring wherein to ſcrew the magnifiers, all ſorts of ſubjects may be examined with great convenience, if a hole be made in the pedeſtal, to place the ſpeculum exactly underneath, and thereby throw up the rays of light. The pocket-microſcope, thus mounted, ſays Mr Baker, "is as eaſy and pleaſant in its uſe; as fit for the moſt curious examination of the animalcules and ſalts in fluids, of the farinæ in vegetables, and of the circulation in ſmall animals; in ſhort, is as likely to make conſiderable diſcoveries in objects, that have ſome degree of tranſparency, as any microſcope I have ever ſeen or heard of."

The braſs ſcroll A is now generally made to unſcrew into three parts, and pack with the microſcope and apparatus into the drawer of a mahogany pocket-caſe, upon the lid of which the ſcroll is made to fix when in uſe.

The opaque apparatus alſo, as above deſcribed, is applicable this way by reflection. It only conſiſts in turning the arm R (fig. 1.), with the magnifier over the concave ſpeculum below (fig. 2.), or to receive the light as reflected obliquely from it: the ſilver ſpeculum ſcrewed into R will then reflect the light, which it receives from the glaſs ſpeculum, ſtrongly upon the object that is applied upon the wire T underneath.

This microſcope, however, is not upon the moſt convenient conſtruction, in compariſon with others now made: it has been eſteemed for many years paſt from its popular name, and recommendation by its makers. Its portability is certainly a great advantage in its favour; but in moſt reſpects it is ſuperſeded by the microſcopes hereafter deſcribed.

3. *Microſcope for Opaque Objects, called the Single Opaque Microſcope.* Fig. 3. This microſcope remedies the inconvenience of having the dark ſide of an object next the

the eye, which formerly was an inſurmountable objection to the making obſervations on opaque objects with any conſiderable degree of exactneſs or ſatisfaction . for, in all other contrivances commonly known, the nearneſs of the inſtrument to the object (when glaſſes that magnify much are uſed) unavoidably overſhadows it ſo much, that its appearance is rendered obſcure and indiſtinct. And, notwithſtanding ways have been tried to point light upon an object, from the ſun or a candle, by a convex glaſs placed on the ſide thereof, the rays from either can be thrown upon it in ſuch an acute angle only, that they ſerve to give a confuſed glare, but are inſufficient to afford a clear and perfect view of the object. But this microſcope, by means of a concave ſpeculum of ſilver highly poliſhed, in whoſe centre a magnifying lens is placed, ſuch a ſtrong and direct light is reflected upon the object, that it may be examined with all imaginable eaſe and pleaſure. The ſeveral parts of this inſtrument, made either of braſs or ſilver, are as follow.

Through the firſt ſide A, paſſes a fine ſcrew B, the other end of which is faſtened to the moveable ſide C. D is a nut applied to this ſcrew, by the turning of which the two ſides A and C are gradually brought together. E is a ſpring of ſteel that ſeparates the two ſides when the nut is unſcrewed. F is a piece of braſs, turning round in a ſocket, whence proceeds a ſmall ſpring tube moving upon a rivet; through which tube there runs a ſteel wire, one end whereof terminates in a ſharp point G, and the other with a pair of pliers H faſtened to it. The point and pliers are to thruſt into, or take up and hold, any inſect or object; and either of them may be turned upwards, as beſt ſuits the purpoſe. I is a ring of braſs, with a female ſcrew within it, mounted on an upright piece of the ſame metal; which turns round on a rivet, that it may be ſet at a due diſtance when the leaſt magnifiers are employed. This ring receives the ſcrews of all the magnifiers. K is a concave ſpeculum of ſilver, poliſhed as bright as poſſible; in the centre of which is placed a double convex lens, with a proper aperture to look through it. On the back of this ſpeculum a male ſcrew L is made to fit the braſs ring I, to ſcrew into it at pleaſure. There are four of theſe concave ſpecula of different depths, adapted to four glaſſes of different magnifying powers, to be uſed as the objects to be examined may require. The greateſt magnifiers have the leaſt apertures. M is a round object-plate, one ſide of which is white and the other black: The intention of this is to render objects the more viſible, by placing them, if black, on the white ſide, or, if white, on the black ſide. A ſteel ſpring N turns down on each ſide to make any object faſt; and iſſuing from the object plate is a hollow pipe to ſcrew it on the needle's point G. O is a ſmall box of braſs, with a glaſs on each ſide, contrived to confine any living object, in order to examine it: this alſo has a pipe to ſcrew upon the end of the needle G. P is a turned handle of wood, to ſcrew into the inſtrument when it is made uſe of. Q, a pair of braſs pliers to take up any object, or manage it with conveniency. R is a ſoft hair-bruſh for cleaning the glaſſes, &c. S is a ſmall ivory box for talcs, to be placed, when wanted, in the ſmall braſs box O.

When you would view any object with this microſcope, ſcrew the ſpeculum, with the magnifier you think proper to uſe, into the braſs ring I. Place your object, either on the needle G in the pliers H, on the object-plate M, or in the hollow braſs box O, as may be moſt convenient: then holding up your inſtrument by the handle P, look againſt the light through the magnifying lens; and by means of the nut D, together with the motion of the needle, by managing its lower end, the object may be turned about, raiſed, or depreſſed, brought nearer the glaſs, or removed farther from it, till you find the true focal diſtance, and the light be ſeen ſtrongly reflected from the ſpeculum upon the object, by which means it will be ſhown in a manner ſurpriſingly diſtinct and clear; and for this purpoſe the light of the ſky or of a candle will anſwer very well. Tranſparent objects may alſo be viewed by this microſcope; only obſerving, that when ſuch come under examination, it will not always be proper to throw on them the light reflected from the ſpeculum; for the light tranſmitted through them, meeting the reflected light, may together produce too great a glare. A little practice, however, will ſhow how to regulate both lights in a proper manner.

4. *Ellis's ſingle and Aquatic Microſcope.* Fig. 4. repreſents a very convenient and uſeful microſcope, contrived by Mr John Ellis, author of An Eſſay upon Corallines, &c. To practical botaniſts, obſervers of animalcula, &c. it poſſeſſes many advantages above thoſe juſt deſcribed. It is portable, ſimple in its conſtruction, expeditious, and commodious in uſe. K repreſents the box containing the whole apparatus: it is generally made of fiſh-ſkin; and on the top there is a female ſcrew, for receiving the ſcrew that is at the bottom of the pillar A: this is a pillar of braſs, and is ſcrewed on the top of the box. D is a braſs pin which fits into the pillar; on the top of this pin is a hollow ſocket to receive the arm which carries the magnifiers; the pin is to be moved up and down, in order to adjuſt the lenſes to their focal or proper diſtance from the object. [*N. B.* In the repreſentations of this microſcope, the pin D is delineated as paſſing through a ſocket at one ſide of the pillar A; whereas it is uſual at preſent to make it paſs down a hole bored through the middle of the pillar.] E, the bar which carries the magnifying lens; it fits into the ſocket X, which is at the top of the pin or pillar D. This arm may be moved backwards and forwards in the ſocket X, and ſideways by the pin D; ſo that the magnifier, which is ſcrewed into the ring at the end E of this bar, may be eaſily made to traverſe over any part of the object that lies on the ſtage or plate B. FF is a poliſhed ſilver ſpeculum, with a magnifying lens placed at the centre thereof, which is perforated for this purpoſe. The ſilver ſpeculum ſcrews into the arm E, as at F. G, another ſpeculum, with its lens, which is of a different magnifying power from the former. H, the ſemicircle which ſupports the mirror I; the pin R, affixed to the ſemicircle H, paſſes through the hole which is towards the bottom of the pillar A. B, the ſtage, or the plane, on which the objects are to be placed; it fits into the ſmall dove-tailed arm which is at the upper end of the pillar DA. C, a plane glaſs, with a ſmall piece of black ſilk ſtuck on it; this glaſs is to lay in a groove made in the ſtage C. M, a hollow glaſs to be laid occaſionally on the ſtage in-

Fig. 4.

ſtead of the plane glaſs C. L, a pair of nippers. Theſe are fixed to the ſtage by the pin at bottom; the ſteel wire of theſe nippers ſlides backwards and forwards in the ſocket, and this ſocket is moveable upwards and downwards by means of the joint, ſo that the poſition of the object may be varied at pleaſure. The object may be fixed in the nippers, ſtuck on the point, or affixed, by a little gum-water, &c. to the ivory cylinder N, which occaſionally ſcrews to the point of the nippers.

To *uſe* this microſcope: Take all the parts of the apparatus out of the box; then begin by ſcrewing the pillar A to the cover thereof; paſs the pin R of the ſemicircle which carries the mirror through the hole that is near the bottom of the pillar A; puſh the ſtage into the dove-tail at B, ſlide the pin into the pillar (ſee the *N. B.* above); then paſs the bar E through the ſocket which is at the top of the pin D, and ſcrew one of the magnifying lenſes into the ring at F. The microſcope is now ready for uſe: and though the enumeration of the articles may lead the reader to imagine the inſtrument to be of a complex nature, we can ſafely affirm that he will find it otherwiſe. The inſtrument has this peculiar advantage, that it is difficult to put any of the pieces in a place which is appropriated to another. Let the object be now placed either on the ſtage or in the nippers L, and in ſuch manner that it may be as nearly as poſſible over the centre of the ſtage: bring the ſpeculum F over the part you mean to obſerve; then throw as much light on the ſpeculum as you can, by means of the mirror I, and the double motion of which it is capable; the light received on the ſpeculum is reflected by it on the object. The diſtance of the lens F from the object is regulated by moving the pin D up and down, until a diſtinct view of it is obtained. The beſt rule is, to place the lens beyond its focal diſtance from the object, and then gradually to ſlide it down till the object appears ſharp and well defined. The adjuſtment of the lenſes to their focus, and the diſtribution of the light on the object, are what require the moſt attention: on the firſt the diſtinctneſs of the viſion depends; the pleaſure ariſing from a clear view of the parts under obſervation is due to the modification of the light. No preciſe rule can be given for attaining accurately theſe points; it is from practice alone that ready habits of obtaining theſe neceſſary properties can be acquired, and with the aſſiſtance of this no difficulty will be found.

Fig. 5.

5. A very ſimple and convenient microſcope for botanical and other purpoſes, though inferior in many reſpects to that of Mr Ellis, was contrived by the ingenious Mr Benjamin Martin, and is repreſented at fig. 5. where AB repreſents a ſmall arm ſupporting two or more magnifiers, one fixed to the upper part as at B, the other to the lower part of the arm at C; theſe may be uſed ſeparately or combined together. The arm AB is ſupported by the ſquare pillar IK, the lower end of which fits into the ſocket E of the foot FG; the ſtage DL is made to ſlide up and down the ſquare pillar; H, a concave mirror for reflecting light on the object.—To *uſe* this microſcope, place the object on the ſtage, reflect the light on it from the concave mirror, and regulate it to the focus, by moving the ſtage nearer to or farther from the lens at B. The ivory ſliders paſs through the ſtage; other objects may be fixed in the nippers MN, and then brought under the eye-glaſſes; or they may be laid on one of the glaſſes which fit the the ſtage. The apparatus to this inſtrument conſiſts of three ivory ſliders; a pair of nippers; a pair of forceps; a flat glaſs and a concave ditto, both fitted to the ſtage.

The two laſt microſcopes are frequently fitted up with a toothed rack and pinion, for the more ready adjuſtment of the glaſſes to their proper focus.

Fig. 6.

6. *Withering's portable Botanic Microſcope.* Fig. 6. repreſents a ſmall botanical microſcope contrived by Dr Withering, and deſcribed by him in his *Botanical Arrangements.* It conſiſts of three braſs plates, ABC, which are parallel to each other; the wires D and E are rivetted into the upper and lower plates, which are by this means united to each other; the middle plate or ſtage is moveable on the aforeſaid wires by two little ſockets which are fixed to it. The two upper plates each contain a magnifying lens, but of different powers; one of theſe confines and keeps in their places the fine point F, the forceps G, and the ſmall knife H.—To *uſe* this inſtrument, unſcrew the upper lens, and take out the point, the knife, and the forceps; then ſcrew the lens on again, place the object on the ſtage, and then move it up or down till you have gained a diſtinct view of the object, as one lens is made of a ſhorter focus than the other; and ſpare lenſes of a ſtill deeper focus may be had if required. This little microſcope is the moſt portable of any. Its principal merit is its ſimplicity.

7. *Botanical Lenſes or Magnifiers.* The haſte with which botaniſts, &c. have frequently occaſion to view objects, renders an extempore pocket-glaſs indiſpenſably neceſſary. The moſt convenient of any yet conſtructed, appears to be that contrived, in regard to the form of the mounting, by Mr Benjamin Martin; and is what he called a *Hand Megalaſcope*, becauſe it is well adapted for viewing all the larger ſort of ſmall objects univerſally, and by only three lenſes it has ſeven different magnifying powers.

Fig. 7.

Fig. 7. repreſents the caſe with the three frames and lenſes, which are uſually of 1, 1½, and two inches focus: they all turn over each other, and ſhut into the caſe, and are turned out at pleaſure.

The three lenſes ſingly, afford three magnifying powers; and by combining two and two, we make three more: for *d* with *e* makes one, *d* with *f* another, and *e* with *f* a third; which, with the three ſingly, make ſix; and laſtly, all three combined together make another; ſo that upon the whole, there are ſeven powers of magnifying with theſe glaſſes only.

When the three lenſes are combined, it is better to turn them in, and look through them by the ſmall apertures in the ſides of the caſe. The eye in this caſe is excluded from extra light; the aberration of the ſuperfluous rays through the glaſſes is cut off; and the eye coincides more exactly with the common axes of the lenſes.

Plate cccxxxviii.

Fig. 8.

A very uſeful and eaſy kind of microſcope (deſcribed by Joblot, and which has been long in uſe), adapted chiefly for viewing, and confining at the ſame time, any living inſects, ſmall animals, &c. is ſhown at fig. 8. where A repreſents a glaſs tube, about 1¼ inch diameter, and 2 inches high. B, a caſe of braſs or wood, containing a ſliding tube, with two or three magnifying

ing glaſſes that may be uſed either ſeparately or combined. In the inſide, at the bottom, is a piece of ivory, black and white on oppoſite ſides, that is occaſionally removed, and admits a point to be ſcrewed into the centre. The cap unſcrews at D, to admit the placing of the object: the proper diſtance of the glaſſes from the object is regulated by pulling up or down the braſs tube E at top containing the eye-glaſſes.

This microſcope is particularly uſeful for exhibiting the well-known curious *curculio imperialis*, vulgarly called the *diamond beetle*, to the greateſt advantage; for which, as well as for other objects, a glaſs bottom, and a poliſhed reflector at the top, are often applied, to condenſe the light upon the object. In this caſe, the ſtand and braſs-bottom F, as ſhown in the figure, are taken away by unſcrewing.

Fig. 9.

9. *Mr Lyonet's Single Anatomical Diſſecting Microſcope.*—Fig. 9. repreſents a curious and extremely uſeful microſcope, invented by that gentleman for the purpoſe of minute diſſections, and microſcopic preparations. This inſtrument muſt be truly uſeful to amateurs of the minutiæ of inſects, &c. being the beſt adapted of any for the purpoſes of diſſection. With this inſtrument Mr Lyonet made his very curious microſcopical diſſection of the *chenille de ſaule*, as related in his *Traité Anatomique de la chenille qui ronge le bois de ſaule*, 4to.

AB is the anatomical table, which is ſupported by a pillar NO; this is ſcrewed on the foot CD. The table AB is prevented from turning round by means of two ſteady pins. In this table or board there is a hole G, which is exactly over the centre of the mirror EF, that is to reflect the light on the object; the hole G is deſigned to receive a flat or concave glaſs, on which the objects for examination are to be placed.

RXZ is an arm formed of ſeveral balls and ſockets, by which means it may be moved in every poſſible ſituation; it is fixed to the board by means of the ſcrew H. The laſt arm IZ has a female ſcrew, into which a magnifier may be ſcrewed as at Z. By means of the ſcrew H, a ſmall motion may be occaſionally given to the arm IZ, for adjuſting the lens with accuracy to its focal diſtance from the object.

Another chain of balls is ſometimes uſed, carrying a lens to throw light upon the object; the mirror is likewiſe ſo mounted, as to be taken from its place at K, and fitted on a clamp, by which it may be fixed to any part of the table AB.

To uſe the Diſſecting Table.—Let the operator ſit with his left ſide near a light window; the inſtrument being placed on a firm table, the ſide DH towards the ſtomach, the obſervations ſhould be made with the left eye. In diſſecting, the two elbows are to be ſupported by the table on which the inſtrument reſts, the hands reſting againſt the board AB; and in order to give it greater ſtability (as a ſmall ſhake, though imperceptible to the naked eye, is very viſible in the microſcope), the diſſecting inſtruments are to be held one in each hand, between the thumb and two forefingers.

II. *Of* DOUBLE *Microſcopes, commonly called* COMPOUND *Microſcopes.*

Double microſcopes are ſo called, from being a combination of two or more lenſes.

The particular and chief advantages which the compound microſcopes have over the ſingle, are, that the objects are repreſented under a larger field of view, and with a greater amplification of reflected light.

Fig. 10.

1. *Culpeper's Microſcope.*—The compound microſcope, originally contrived by Mr Culpeper, is repreſented at fig. 10. It conſiſts of a large external braſs body A, B, C, D, ſupported upon three ſcrolls, which are fixed to the ſtage EF; the ſtage is ſupported by three larger ſcrolls, that are ſcrewed to the mahogany pedeſtal GH. There is a drawer in the pedeſtal, which holds the apparatus. The concave mirror *I* is fitted to a ſocket in the centre of the pedeſtal. The lower part LMCD of the body forms an exterior tube, into which the upper part of the body ABLM ſlides, and may be moved up or down, ſo as to bring the magnifiers, which are ſcrewed on at N, nearer to or farther from the object.

To *uſe* this microſcope: Screw one of the buttons, which contains a magnifying lens, to the end N of the body: place the ſlider, with the objects, between the plates of the ſlider-holder. Then, to attain diſtinct viſion, and a pleaſing view of the object, adjuſt the body to the focus of the lens you are uſing, by moving the upper part gently up and down, and regulate the light by the concave mirror.

Fig. 11.

For opaque objects, two additional pieces muſt be uſed. The firſt is a cylindrical tube of braſs (repreſented at L, fig. 11.), which fits on the cylindrical part at N of the body. The ſecond piece is the concave ſpeculum *h*; this is to be ſcrewed to the lower end of the aforeſaid tube: the upper edge of this tube ſhould be made to coincide with the line which has the ſame number affixed to it as to the magnifier you are uſing; e. g. if you are making uſe of the magnifier marked 5, ſlide the tube to the circular line on the tube N that is marked alſo with Nº 5. The ſlider-holder ſhould be removed when you are going to view opaque objects, and a plane glaſs ſhould be placed on the ſtage in its ſtead to receive the object; or it may be placed in the nippers, the pin of which fits into the hole in the ſtage.

The apparatus belonging to this microſcope conſiſts of the following particulars: viz. Five magnifiers, each fitted in a braſs button; one of theſe is ſeen at N, fig. 10. Six ivory ſliders, five of them with objects. A braſs tube, to hold the concave ſpeculum. The concave ſpeculum in a braſs box. A fiſh pan. A ſet of glaſs tubes. A flat glaſs fitted to the ſtage. A concave glaſs fitted to the ſtage. A pair of forceps. A ſteel wire, with a pair of nippers at one end and a point at the other. A ſmall ivory cylinder, to fit on the pointed end of the aforeſaid nippers. A convex lens, moveable in a braſs ſemicircle; this is affixed to a long braſs pin, which fits into a hole on the ſtage.

The conſtruction of the foregoing microſcope is very ſimple, and it is eaſy in uſe; but the advantages of the ſtage and mirror are too much confined for an extenſive application and management of all kinds of objects. Its greateſt recommendation is its cheapneſs; and to thoſe who are deſirous of having a compound microſcope at a low price, it may be acceptable.

2. *Cuff's Microſcope.*—The improved microſcope next in order is that of Mr Cuff. Beſides remedying the diſadvantages above mentioned, it contains the

Fig. 11.

addition of an adjuſting ſcrew, which is a conſiderable improvement, and highly neceſſary to the examination of objects under the beſt defined appearance from the glaſſes. It is repreſented at fig. 11. with the apparatus that uſually accompanies it. A, B, C, ſhows the body of this microſcope; which contains an eye-glaſs at A, a broad lens at B, and a magnifier which is ſcrewed on at C. The body is ſupported by the arm DE, from which it may be removed at pleaſure. The arm DE is fixed on the ſliding bar F, and may be raiſed or depreſſed to any height within its limits. The main pillar *a b* is fixed in the box *b e;* and by means of the braſs foot *d* is ſcrewed to the mahogany pedeſtal XY, in which is a drawer containing all the apparatus. O is a milled-headed ſcrew, to tighten the bar F when the adjuſting ſcrew *c g* is uſed. *p q* Is the ſtage, or plate, which carries the objects; it has a hole at the centre *n*. G, a concave mirror, that may be turned in any direction, to reflect the light of a candle, or the ſky, upon the object.

To *uſe* this microſcope: Screw the magnifier you intend to uſe to the end C of the body; place the ſlider-holder P in the hole *n*, and the ſlider with the object between the plates of the ſlider-holder; ſet the upper edge of the bar DE to coincide with the diviſions which correſpond to the magnifier you have in uſe, and pinch it by the milled nut; now reflect a proper quantity of light upon the object, by means of the concave mirror G, and regulate the body exactly to the eye and the focus of the glaſſes by the adjuſting ſcrew *c g*.

To view *opaque* objects, take away the ſlider-holder P, and place the object on a flat glaſs under the centre of the body, or on one end of the jointed nippers *o p*. Then ſcrew the ſilver concave ſpeculum *h* to the end of the cylinder L, and ſlide this cylinder on the lower part of the body, ſo that the upper edge thereof may coincide with the line which has the ſame mark with the magnifier that is then uſed: reflect the light from the concave mirror G to the ſilver ſpeculum, from which it will again be reflected on the object. The glaſſes are to be adjuſted to their focal diſtance as before directed.

The *apparatus* conſiſts of a convex lens H, to collect the rays of light from the ſun or a candle, and condenſe them on the object. L a cylindrical tube, open at each ſide, with a concave ſpeculum ſcrewed to the lower end *h*. P the ſlider-holder: this conſiſts of a cylindrical tube, in which an inner tube is forced upwards by a ſpiral ſpring; it is uſed to receive an ivory ſlider K, which is to be ſlid between the plates *h* and *i*. The cylinder P fits the hole *n* in the ſtage; and the hollow part at *k* is deſigned to receive a glaſs tube. R is a braſs cone, to be put under the bottom of the cylinder P, to intercept occaſionally ſome of the rays of light. S, a box containing a concave and a flat glaſs, between which a ſmall living inſect may be confined: it is to be placed over the hole *n*. T a flat glaſs, to lay any occaſional object upon; there is alſo a concave one for fluids. O is a long ſteel wire, with a ſmall pair of pliers at one end, and a point at the other, deſigned to ſtick or hold objects: it ſlips backwards and forwards in the ſhort tube *o;* the pin *p* fits into the hole of the ſtage. W, a little round ivory box, to hold a ſupply of talc and rings for the ſliders. V, a ſmall ivory cylinder, that fits on the pointed end of the ſteel wire: it is deſigned for opaque objects. Light-coloured ones are to be ſtuck upon the dark ſide, and *vice verſa*. M, a fiſh-pan, whereon to faſten a ſmall fiſh, to view the circulation of the blood: the tail is to be ſpread acroſs the oblong hole *k* at the ſmall end, and tied faſt, by means of a riband fixed thereto; the knob *l* is to be ſhoved through the ſlit made in the ſtage, that the tail may be brought under the magnifier.

Fig. 12.

3. This microſcope has received ſeveral material improvements from Mr Martin, Mr Adams, &c. By an alteration, or rather an enlargement, of the body of the tube which contains the eye-glaſſes, and alſo of the eye-glaſſes themſelves, the field of view is made much larger, the mirror below for reflecting light is made to move upon the ſame bar with the ſtage; by which means the diſtance of it from the ſtage may be very eaſily and ſuitably varied. A condenſing glaſs is applied under the ſtage in the ſlider-holder, in order to modify and increaſe the light that is reflected by the mirrors below from the light of a candle or lamp. It is furniſhed alſo with two mirrors in one frame, one concave and the other plane, of glaſs ſilvered; and by ſimply unſcrewing the body, the inſtrument, when deſired, may be converted into a ſingle microſcope. Fig. 12. is a repreſentation of the inſtrument thus improved; and the following is the deſcription of it, as given by Mr Adams in his Eſſays.

AB repreſents the body of the microſcope, containing a double eye-glaſs and a body-glaſs: it is here ſhown as ſcrewed to the arm CD, from whence it may be occaſionally removed, either for the convenience of packing, or when the inſtrument is to be uſed as a ſingle microſcope.

The eye-glaſſes and the body-glaſſes are contained in a tube which fits into the exterior tube AB; by pulling out a little this tube when the microſcope is in uſe, the magnifying power of each lens is increaſed.

The body AB of the microſcope is ſupported by the arm CD; this arm is fixed to the main pillar CF, which is ſcrewed firmly to the mahogany pedeſtal GH; there is a drawer to this pedeſtal, which holds the apparatus.

NIS, the plate or ſtage which carries the ſlider-holder KL: this ſtage is moved up or down the pillar CF, by turning the milled nut M; this nut is fixed to a pinion, that works in a toothed rack cut on one ſide of the pillar. By means of this pinion, the ſtage may be gradually raiſed or depreſſed, and the object adjuſted to the focus of the different lenſes.

KL is a ſlider-holder, which fits into a hole that is in the middle of the ſtage NIS; it is uſed to confine and guide either the motion of the ſliders which contain the objects, or the glaſs tubes that are deſigned to confine ſmall fiſhes for viewing the circulation of the blood. The ſliders are to be paſſed between the two upper plates, the tubes through the bent plates.

L is a braſs tube, to the upper part of which is fixed the condenſing lens before ſpoken of; it fits into the under part of the ſlider-holder KL, and may be ſet at different diſtances from the object, according to its diſtance from the mirror or the candle.

O is the frame which holds the two reflecting mirrors,

rors, one of which is plane, the other concave. Theſe mirrors may be moved in various directions, in order to reflect the light properly, by means of the pivots on which they move, in the ſemicircle QSR, and the motion of the ſemicircle itſelf on the pin S: the concave mirror generally anſwers beſt in the day-time; the plane mirror combines better with the condenſing lens, and a lamp or candle. At D there is a ſocket for receiving the pin of the arm Q (fig. 31.), to which the concave ſpeculum, for reflecting light on opaque objects, is fixed. At S is a hole and ſlit for receiving either the nippers L (fig. 31.) or the fiſh-pan I; when theſe are uſed, the ſlider-holder muſt be removed. T, a hole to receive the pin of the convex lens M.

Plate CCCXLI. fig. 31.

To *uſe* this microſcope: Take it out of the box. Screw the body into the round end of the upper part of the arm CD. Place the braſs ſliders, which contain the magnifiers, into the dove-tailed ſlit which is on the under ſide of the aforeſaid arm, as ſeen at E, and ſlide it forwards until the magnifier you mean to uſe is under the centre of the body: oppoſite to each magnifier in this ſlit there is a notch, and in the dove-tailed part of the arm CD there is a ſpring, which falls into the above-mentioned notch, and thus makes each magnifier coincide with the centre of the body. Paſs the ivory ſlider you intend to uſe between the upper plates of the ſlider-holder KL, and then reflect as ſtrong a light as you can on the ſubject by means of one of the mirrors; after this, adjuſt the object to the focus of the magnifier and your eye, by turning the milled ſcrew M, the motion of which raiſes and depreſſes the ſtage NIS. The degree of light neceſſary for each object, and the accuracy required in the adjuſtment of the lenſes to their proper focal diſtance from the object, will be eaſily attained by a little practice.

When *opaque* objects are to be examined, remove the ſlider-holder, and place the object on a flat glaſs, or fix it to the nippers L, the pin of theſe fit into the hole on the ſtage; ſcrew the concave ſpeculum R into the arm Q (fig. 31.), and then paſs the pin of this arm through the ſocket D (fig. 12.); the light is now to be reflected from the concave mirror to the ſilver ſpeculum, and from this down on the object. No exact rule can be given for reflecting the light on the object; we muſt therefore refer the reader to the mother of all aptneſs, practice. The ſpeculum muſt be moved lower or higher, to ſuit the focus of the different magnifiers and the nature of the object.

The foregoing directions apply equally to the uſing of this inſtrument as a *ſingle microſcope;* with this difference only, that the body AB is then removed, and the eye is applied to the upper ſurface of the arm CD, exactly over the magnifiers.

This microſcope is ſometimes made with the following *alterations*, which are ſuppoſed to make it ſtill more convenient and uſeful. The arm CD that carries the body and magnifiers is made both to turn on a pin, and to ſlide backwards and forwards in a ſocket at C; ſo that, inſtead of moving the objects below on the ſtage, and diſturbing them, the magnifiers are more conveniently brought over any part of the objects as deſired. The condenſing glaſs is made larger, and ſlides upon the ſquare bar CF quite diſtinct from the ſtage, like the mirrors below; and it is thereby made uſeful for any other objects that may be applied on glaſſes fitted to the ſtage, as well as thoſe put into the ſlider-holder K. It is thereby not confined to this ſtage alone as in the preceding. When the body AB is taken away, the arm CD may be ſlipt away from its bar, with the magnifiers, and the forceps, wire, and joint, applied to it; and it thereby ſerves the purpoſe of a ſmall ſingle or opaque hand microſcope, for any object occaſionaily applied to this wire. The magnifiers in the ſlider E are mounted in a wheel caſe, which perhaps prevents its being in the way ſo much as the long ſlider E before deſcribed.—This contrivance is repreſented at X, fig. 12.

4. *Martin's New Univerſal Compound Microſcope.*—This inſtrument was originally conſtructed by Mr B. Martin, and intended to compriſe all the uſes and advantages of the ſingle, compound, opaque, and aquatic microſcopes. The following is a deſcription of it.

Plate CCCXXXIX. fig. 13.

Fig. 13. is a repreſentation of the inſtrument placed up for uſe. ABCD is the body of the microſcope: which conſiſts of four parts, viz. AB the eye-piece, or that containing the eye-glaſſes, and is ſcrewed into C, which is a moveable or ſliding tube on the top; this inner tube contains the body-glaſs ſcrewed into its lower part. D is the exterior tube or caſe, in which the other ſlides up and down in an eaſy and ſteady manner. This motion of the tube C is uſeful to increaſe and decreaſe the magnifying power of the body-glaſs when thought neceſſary, as before mentioned. E is a pipe or ſnout ſcrewed on to the body of the microſcope D, and at its lower part, over the ſeveral magnifying lenſes hereafter deſcribed. FGHI is the ſquare ſtem of the microſcope, upon which the ſtage R moves in an horizontal poſition, upwards or downward, by means of the fine rack work of teeth and pinion. KL is a ſtrong ſolid joint and pillar, by which the poſition of the inſtrument is readily altered from a vertical one to an oblique or to a perfectly horizontal one as may be required: it is thus well adapted to the caſe of the obſerver either ſitting or ſtanding; and as it is very often convenient to view objects by direct unreflected light, when the ſquare ſtem FI is placed in a horizontal poſition for this purpoſe, the mirror T is then to be taken off in order to prevent the obſtruction of the rays. M is a circular piece of braſs, ſerving as a baſe to the pillar. NOP, the tripod or foot by which the whole body of the microſcope is ſteadily ſupported; it folds up when packed into the caſe. W is a braſs frame, that contains the condenſing lens, and acts in conjunction with the large concave and plane mirrors below at T; the reflected rays from which, either of the common light or of that of a candle or lamp, it agreeably modifies, and makes ſteady in the field of view.

The particulars of the apparatus to this microſcope are as follow: Q is a circular braſs box, containing ſix magnifiers or object lenſes, numbered 1, 2, 3, 4, 5, 6; the digits of which appear ſeverally through a ſmall round hole in the upper plate of it. To the upper ſide is fixed a ſmall circle of braſs, by which it is connected with, and ſcrewed into, the round end of the arm *abcd;* which is a long piece of braſs, and moves through either by teeth or pinion, or not, as may be deſired, in *ef;* which is a ſocket on the upper part of the pillar, and admits, with a motion both eaſy and ſteady, the

braſs

braſs arm. R is a fixed ſtage, upon which the objects to be viewed are to be placed: it is firmly faſtened to the ſquare pillar, which is moved by the rack-work. In the middle is a large circular hole, for receiving concave glaſſes, with fluids, &c. it has alſo a ſliding ſpring frame to faſten down ſlips of glaſs or other things: at *abc* are three ſmall ſockets or holes, intended to receive ſeveral parts of the apparatus. S is the refractor, or illuminating lens, for converging the ſun's rays upon opaque objects laid upon the ſtage R. To this purpoſe it moves on a ſemicircle upon a long ſhank *g*, in a ſpring ſocket *h*, in the arm *i*; this arm moving every way by a ſtout pin *k* in the ſocket *a* of the ſtage. In this manner it is eaſily adjuſted to any poſition of the ſun, candle, &c.—T, the reflecting-glaſs frame, containing a concave and plane ſpeculum, which is moved upon the ſquare pillar by the hand. The uſe of it is to illuminate all tranſparent objects that are applied to the ſtage above.

Fig. 14.

Fig. 14. N° 1. is an auxiliary moveable ſtage; which by means of a pin *k* is placed in the hole *a* of the ſtage R, and can be moved in a horizontal direction over the whole field of the ſtage. In this ſtage, there are three circular holes with ſhouldered bottoms; a large one in the middle, and on each ſide a ſmall one, for the reception of the three following neceſſary articles: N° 2. a watch-glaſs to be placed in the large hole, to hold fluids containing animalcules, &c.; a circular piece of ivory, N° 3. one ſide of which is black, the other white, to ſupport opaque objects of different contraſted colours; and circular plane and concave glaſſes, N° 4. for extemporaneous tranſparent objects.—The ſame uſe is made of the other ſmall hole as of the large one, only in a leſſer degree, to receive ſmall concave glaſſes, plates, &c.

N° 5. is the ſilvered ſpeculum, called a *liberkhun*, which makes the ſingle opaque microſcope, by being ſcrewed to the ſlider *abcd* (fig. 13.) in room of the box of lenſes Q, and the body AE above it. The chief uſe of this is to view very ſmall objects ſtrongly illuminated near the compounded focus of the mirror T (fig. 13.). N° 6. is the forceps or pliers, for holding ſuch kind of objects, and by which they can be applied very readily to the focus of the lens in the liberkhun. They have a motion all ways by means of the ſpring ſocket *a*, the joint *b*, and the ſhank *c*: they are placed in the ſocket *c* of the fixed ſtage R (fig. 13.). N° 7. is a ſmall piece of ivory, to be placed upon the pointed end of the pliers: it is black upon one ſide, and white upon the other, to receive opaque objects.

N° 8. is a liberkhun of a larger ſize than that firſt mentioned, with a hole in its centre: this is ſcrewed into N° 9. the hole *a* of a braſs ring, faſtened to a long wire *b*; which moves up and down in the ſpring ſocket *b* of the ſtage R, in which it alſo moves ſideways; and thus, with the body AE above, forms an *aquatic compound microſcope* for ſhowing all ſorts of objects in water and other fluids placed under it in the watch-glaſs N° 2. on the ſtage.

N° 11. is a cone, with a proper aperture *a* to exclude ſuperfluous light, that would diſturb a critical obſervation of a curious object; it is placed on the under ſide of the fixed ſtage R.

N° 12. is what is uſually called a bug-box, conſiſting of a concave glaſs with a plane one ſcrewed over it; by means of which a bug, louſe, flea, &c. may be ſecured and viewed alive. It is to be placed on either of the ſtages R (fig. 13.), or N° 1. (fig. 14.).

N° 13. is the fiſh pan. In the long concave body *ab*, a fiſh may be ſo confined by the ribband *c*, that the tranſparent tail may be in part over the ſlit or hole at *a*. In this ſtate, it is placed on the ſtage R, with the pin *d* in the hole *c* of the ſtage, and moves freely and horizontally for viewing the circulation of the blood, &c.

N° 14. is the ſlider-holder that is placed on the ſtage R: it receives the ſliders and tubes when filled with tranſparent objects, to be viewed either by the compound or ſingle microſcope.

N° 15. repreſents the ivory ſlider, to hold the objects between the talcs as uſual.

N° 16. is a uſeful auxiliary ſlider framed in braſs. In this ſlider ſmall concave glaſſes are cemented; and a ſlip of plane glaſs ſlides over them; by which any ſmall living object, as mites, &c. may be confined without injury, and deliberately viewed.

N° 17. repreſents a ſet of glaſs tubes, three in number, one within another; they are uſeful for ſmall tadpoles, water newts, eels, &c. when the circulation of the blood is to be viewed. There is a ſmall hole at one end of each tube, that ſerves to admit the air; for when they are filled with water, the other end is ſtopped with a cork.

N° 18. is a ſmall ivory box, containing ſpare talcs and wires, to ſupply the ſliders with occaſionally.

N° 19. a braſs cell or button, containing a very ſmall lens, properly ſet between two ſmall plates of braſs, that it may be brought very near to the object when viewed therewith as a ſingle microſcope. This magnifier is ſcrewed into the ſame hole as the wheel of ſix magnifiers Q are (fig. 13.).

N° 20. is a lens, adapted to view and examine objects, by magnifying them ſufficiently, ſo as to be able to apply them to the microſcope for inſpection: on this account it is called the *explorator*.

The preceding are the chief articles of the apparatus: which, on account of their being ſomewhat different from what is applied to other microſcopes, we have been thus particular in deſcribing. In uſing the microſcope, and while viewing objects by either the ſingle or compound inſtrument, the focal diſtances of the magnifiers are made perfectly exact by turning of the pinion at the nut *w*, in one way or the other, very gently in the teeth of the rack-work at X (fig. 13.).

It is neceſſary that the centres of the object-lenſes or magnifiers, the ſtage, and the mirrors at bottom, ſhould all be in a right line in the axis of the microſcope, when opaque objects are to be viewed, that are placed upon the ivory piece N° 7. or the forceps N° 6. and all other ſuch ſort of objects which are placed in the centre of the ſtage R, or ſlider-holder N° 14: But when aquatic or living objects, which require a great ſpace to move in, are to be viewed, then the horizontal motion at *ef* (fig. 13.) is made uſe of, and the view may be extended laterally over the whole of the diameter of the object or field of view; and by putting the arm *abcd* forward or backward in its ſocket *ef*, the view is extended in the contrary direction

direction equally well; and in this manner the whole of the objects may be viewed without the leaſt diſturbance.

As the braſs arm *a b c d* may be brought to the height of three or four inches above the ſtage R; ſo, by means of the rack-work motion of the ſtage, a lens of a greater focal diſtance than the greateſt in the wheel Q may be occaſionally applied in place of the wheel, and thereby the larger kind of objects be viewed; the inſtrument becoming, in this caſe, what is called a *megalaſcope*.

In viewing moving living objects, or even fixed ones, when nice motions are requiſite, a rack-work and pinion is often applied to the arm *a b c d*: the arm is cut out with teeth; and the pinion, as ſhown at Y, is applied to work it. This acts but in one direction; and, in order to produce an equally neceſſary motion perpendicular to this, rack-work and pinion is applied tangent-wiſe to the ſtage, which is then jointed.

What has been related above reſpects the conſtruction of thoſe denominated *parlour* microſcopes, in contradiſtinction to thoſe which are portable: their dimenſions, however, have been conſiderably reduced by opticians, in order to render them fit for the pocket; and as they are for the moſt part conſtructed on nearly the ſame principles as thoſe which have been already deſcribed, what has been ſaid will ſufficiently inſtruct our readers in uſing any pocket microſcope whatever. Only it may be obſerved, that in thoſe reduced inſtruments, both the field of view and the magnifying power are proportionably diminiſhed.

We ſhall conclude the account of this ſort of microſcope with deſcriptions of a very portable pocket apparatus of microſcopic inſtruments, and of a new microſcopic pocket teleſcope, both invented by the late Mr B. Martin, and ſince made by moſt inſtrument-makers in London.

Fig. 15. The former is repreſented at fig. 15. It conſiſts of two parts, viz. the body *a b*, and the pedeſtal *i k*, which is joined by a ſcrew at the part between *b* and *i*. It conſiſts of three cylindric tubes, viz. (1.) the exterior tube, or caſe, *a b*; (2.) a middle tube *c b*; and (3.) the interior tube *f g*. The middle tube *c d* is the adjuſter; and is connected with the outer tube by the rack-work of teeth and pinion, as ſhown at *e*: by which means it is moved up and down at pleaſure through the ſmalleſt ſpace, and carries with it the internal tube *f g*. The interior tube *f g* receives on its lower part at *b* the ſeveral capſules or boxes 2, 3, 4, 5, (fig. 16.) which contain the object lenſes or magnifiers.

The method of *uſing* this compound microſcope in the perpendicular poſition, is as follows: The ſtage N° 1. is put within the exterior tube at *b*. Under the ſprings are applied the four ivory ſliders, which contain a variety of tranſparent objects; then move the interior tube *f g* up and down with the hand, till you diſcern the object in the ſlider, and there let it reſt. After this, turn the pinion at *e* very tenderly one way or the other, till you obtain a perfect view of the tranſparent objects properly illuminated, from a mirror contained in the pedeſtal or ſtand *i k*, ſuſpended upon, and moveable about, the points of two ſcrews (*l l*). Fig. 16. N° 6. (fig. 16.) repreſents a moveable ſtage, which is placed in the ſpring ſocket *m*. It contains a concave glaſs, for the reception of animalcules in fluids; and has the advantage of bringing any part into view by moving the handle at *n*. If living and moving objects are required to be ſhown, they muſt be confined in the concave, by putting a glaſs cover, N° 7. upon the ſtage; and then a ſmall ſpider, a louſe, a flea, bug, &c. may be ſeen, and the motion or circulation of the blood, &c. obſerved with ſurpriſing diſtinctneſs.

To view the circulation of the blood in the moſt eminent degree, it muſt be done by placing ſmall frogs, tadpoles, water-newts, fiſhes, &c. in a tube as repreſented N° 8. (fig. 17.); Fig. 17. which tube is placed in the holes *o* in the oppoſite ſides of the caſe *a b*, fig. 15. in the lower part.—N° 9. (fig. 16.) is a pair of pincers or pliers *d*, for holding any object; the other end of the ſteel wire is pointed to receive a piece of ivory *b*, with one end black, and the other white, on which you ſtick objects of different hue: this alſo, when uſed, is placed in the ſpring ſocket *m*.

To uſe this inſtrument as a compound opaque, you ſcrew off the body part *a b*, and ſcrew to it the handle *r* (fig. 16.); by this means you may hold the microſcope in a horizontal poſition, as ſhown in the figure. The ſilver diſh or ſpeculum (which is contained in the bottom or baſe *k*, fig. 15.), is then ſcrewed on at *b*. N° 9. is placed in the ſpring ſocket *m*, and adjuſted backward and forward in *m*, till the reflected light from the ſpeculum falls in a proper manner on the opaque object. Either of the 4 magnifiers, 2, 3, 4, 5, may be uſed, and brought to a proper focus, as before deſcribed by the tooth and pinion *e* (fig. 15.). If you take off the opaque apparatus, and apply the ſtage N° 1. (fig. 16.) with an ivory ſlider, and at the end *b* ſcrew in either of the two lenſes, N° 10. (which are diſtinguiſhed by the name of illuminators), the microſcope being held up to the light (and properly adjuſted), the whole field of view will be ſtrongly illuminated, and preſent a moſt pleaſing appearance of any tranſparent object. Theſe two convex lenſes are of different focuſes, and are to be uſed ſingly or together; N° 2. being the greateſt magnifier, will require the object to be ſtrongly illuminated, and of courſe both the lenſes muſt be uſed together. By candle-light, this method of viewing tranſparent objects will prove very entertaining; by ſcrewing the handle *r* into the part *s* of N° 10. it becomes a delightful hand megalaſcope for viewing flowers, foſſils, ſhells, &c.; and each lens, as before mentioned, having a different focus, produces two magnifying powers uſed ſingly, and when combined a third.

The manner of uſing this inſtrument as a ſingle microſcope (like Wilſon's) is repreſented in fig. 17. where the button or magnifier at each is to be ſcrewed off, and the circular piece N° 11. is ſcrewed in its place. This piece has a ſpring ſocket made to receive the ſlider-holder N° 12. N° 13. is a circular piece of braſs, with a long ſhank and ſpring, and is introduced through the outſide tube *a b* at *t*. N° 2, 3, 4, 5, are ſcrewed occaſionally in the centre of this piece, and uſed as ſingle lenſes with ivory ſliders, &c. N° 14. contains a lens of a great magnifying power, for viewing very minute objects: to render this inſtrument the moſt complete ſingle opaque microſcope, you have only to ſcrew into N° 13.

the ſilver ſpeculum N° 15. which has a ſmall lens ſet in its centre. The ſlider-holder N° 12. is taken out of N° 11. and the pincers or nippers *d b*, being detached from the other part of N° 9. are paſſed through the long ſpring ſocket N° 11. and ready to receive any opaque body in the pincers, or on the black and white piece of ivory. To the large ſcrew of N° 13. are applied the two lenſes N° 10. which make it the completeſt megalaſcope that can be deſired.

The handle *r* contains the four ivory ſliders with objects.

The ſhagreen caſe which contains this univerſal microſcope and its apparatus, is ſix inches long, three inches wide, two inches deep; and weighs together 16 ounces. "Thus (ſays Mr Martin) ſo ſmall, ſo light, ſo portable, and yet ſo univerſally complete, is this pocket microſcopic apparatus, that you find nothing material in the large three-pillared microſcope, the opaque microſcope, Wilſon's ſingle microſcope, and the aquatic microſcope, all together, which you have not in this; beſides ſome very conſiderable advantages in regard to the field of view, &c. which they have not (A)."

This inventive artiſt having contrived a conſtruction of the compound microſcope ſo ſmall as to admit of being packed in a common walking cane, thought next of introducing the ſame inſtrument into the inſide of what he called his *Pocket Three-braſs drawer Achromatic Teleſcope.* The ſame eye glaſſes that ſerve the purpoſe of a teleſcope, anſwer as the compound magnifier, for viewing tranſparent and opaque objects in a microſcope.

Fig. 18, 19, 20. Fig. 18, 19, 20, repreſent the teleſcope ſeparated by unſcrewing it at *m*, in order that the whole of the neceſſary parts in uſe may be exhibited. Fig. 19. repreſents the exterior tube, which is of mahogany, and its rims of braſs. It is detached from the reſt of the teleſcope, as not making any part of the microſcope. The braſs cover *k l*, that ſhuts up the object-glaſs of the teleſcope, is alſo the box which contains the two-wheel object frames, and a ſmall plain reflecting mirror.

In fig. 20. A is the cover taken off, by unſcrewing the top part: The mirror B is taken out; and alſo, by unſcrewing the bottom part, the two circular wheels, with the objects ſhown in C and D.

Fig. 18. is a repreſentation of the three internal braſs ſliding tubes of the teleſcope, which form the microſcopic part. The tubes are to be drawn out as ſhown in this figure; then, at the lower end of the large tube in the inſide, is to be pulled out a ſhort tube *b c*, that ſerves as a kind of ſtage to hold the wheels with objects, and ſupport the reflecting mirror. This tube is to be partly drawn out, and turned ſo that the circular hole that is pierced in it may coincide with a ſimilar hole that is cut in the exterior tube. This tube is repreſented as drawn out in the figure; and the mirror B placed therein, and the wheel with tranſparent objects. C (fig. 20.) repreſents the wheel with tranſparent objects, and D the wheel with opaque objects. They are both made of ivory; and turn round upon a centre braſs pin ſlit upon the top, which fits upon the edge of the tube; which tube is then to be puſhed up into the teleſcope tube, ſo that its lower end may reſt upon the upper edge of the wheel according to its view at *a* fig. 18.

In viewing the objects, the ſecond braſs tube of the teleſcope muſt be puſhed down, till its milled edge at top falls upon that of the exterior tube; taking care that the circular hole is duly placed to the exterior one. Theſe circular holes are not ſeen in fig. 18. being ſuppoſed in the oppoſite ſide, where the wheel is fixed. The adjuſtment for the focus is now only neceſſary; which is obtained by puſhing downwards or upwards the proper tube, till the object appear quite diſtinct. In viewing tranſparent objects, the inſtrument may be uſed in two poſitions; one vertical, when the light is to be reflected upon the object by the mirror; the other, by looking up directly againſt the light of a candle, common light, &c.; in which caſe the mirror muſt be taken away. In viewing opaque objects, the mirror is not uſed; but as much common light as poſſible muſt be admitted through the circular holes in the ſides of the tubes.

There is a ſpare hole in the tranſparent wheel, and alſo one in the opaque, to receive any occaſional object that is to be viewed. Any ſort of object whatſoever may be viewed, by only puſhing up the microſcope tube into its exterior, and bringing the firſt eye-tube to its focal diſtance from the object.

The braſs tubes are ſo contrived, that they ſtop when drawn out to the full length: ſo that by applying one hand to the outſide tube, and the other to the end of the ſmalleſt tube, the teleſcope at one pull may be drawn out; then any of the tubes (that next to the eye is beſt) may be puſhed in gradually, till the moſt diſtinct view of the object be obtained.

The tubes all ſlide through ſhort braſs ſpring tubes, any of which may be unſcrewed from the ends of the ſliding tubes by means of the milled edges which project above the tubes, taken from each other, and the ſprings ſet clear if required.

III. *Of* SOLAR *Microſcopes.*

This inſtrument, in its principle, is compoſed of a tube, a looking-glaſs or mirror, a convex lens, and Wilſon's ſingle microſcope before deſcribed. The ſun's rays being reflected through the tube by means of the mirror upon the object, the image or picture of the object is thrown diſtinctly and beautifully upon a ſcreen of white paper or a white linen ſheet, placed at a proper diſtance to receive the ſame; and may be magnified

---

(A) Notwithſtanding the properties that have been aſcribed to the above inſtrument, and the praiſes beſtowed upon it by ſome, which induced us to admit ſo minute a deſcription, we muſt appriſe our readers, that it has been omitted in Mr Adams's enumeration; and upon inquiry we learn, that it has fallen into neglect among the moſt judicious opticians, being found too imperfect to ſerve the purpoſes of ſcience, and too complicated for the uſe of perſons who ſeek only entertainment.

magnified to a ſize not to be conceived by thoſe who have not ſeen it: for the farther the ſcreen is removed, the larger will the object appear; inſomuch, that a louſe may thus be magnified to the length of five or ſix feet, or even a great deal more; though it is more diſtinct when not enlarged to above half that ſize.

The different forms in which the Solar Microſcope is conſtructed, are as follow.

Plate CCCXL. fig. 21. I. The old conſtruction is repreſented in fig. 21. A is a ſquare wooden frame, through which paſs two long ſcrews aſſiſted by a couple of nuts 1, 1. By theſe it is faſtened firmly to a window ſhutter, wherein a hole is made for its reception; the two nuts being let into the ſhutter, and made faſt thereto. A circular hole is made in the middle of this frame to receive the piece of wood B, of a circular figure; whoſe edge, that projects a little beyond the frame, compoſes a ſhallow groove 2, wherein runs a catgut 3; which, by twiſting round, and then croſſing over a braſs pulley 4, (the handle whereof 5, paſſes through the frame), affords an eaſy motion for turning round the circular piece of wood B, with all the parts affixed to it. C is a braſs tube, which, ſcrewing into the middle of the circular piece of wood, becomes a caſe for the uncovered braſs tube D to be drawn backwards or forwards in. E is a ſmaller tube, of about one inch in length, cemented to the end of the larger tube D. F is another braſs tube, made to ſlide over the above deſcribed tube E; and to the end of this the microſcope muſt be ſcrewed, when we come to uſe it. 5. A convex lens, whoſe focus is about 12 inches, deſigned to collect the ſun's rays, and throw them more ſtrongly upon the object. G is a looking-glaſs of an oblong figure, ſet in a wooden frame, faſtened by hinges in the circular piece of wood B, and turning about therewith by means of the above-mentioned catgut. H is a jointed wire, partly braſs and partly iron; the braſs part, whereof 6, which is flat, being faſtened to the mirror, and the iron part 7, which is round, paſſing through the wooden frame, enable the obſerver, by putting it backwards or forwards, to elevate or depreſs the mirror according to the ſun's altitude. There is a braſs ring at the end of the jointed wire 8, whereby to manage it with the greater eaſe. The extremities of the catgut are faſtened to a braſs pin, by turning of which it may be braced up, if at any time it becomes too ſlack.

When this microſcope is employed, the room muſt be rendered as dark as poſſible; for on the darkneſs of the room, and the brightneſs of the ſunſhine, depend the ſharpneſs and perfection of your image. Then putting the looking-glaſs G through the hole in your window ſhutter, faſten the ſquare frame A to the ſhutter by its two ſcrews and nuts 1, 1. This done, adjuſt your looking-glaſs to the elevation and ſituation of the ſun, by means of the jointed wire H, together with the catgut and pulley, 3, 4. For the firſt of theſe raiſing or lowering the glaſs, and the other inclining it to either ſide, there reſults a twofold motion, which may eaſily be ſo managed as to bring the glaſs to a right poſition, that is, to make it reflect the ſun's rays directly through the lens 5, upon the paper ſcreen, and form thereon a ſpot of light exactly round. But though the obtaining a perfect circular ſpot of light upon the ſcreen before you apply the microſcope, is a certain proof that your mirror is adjuſted right, that proof muſt not always be expected: for the ſun is ſo low in winter, that if it ſhine in a direct line againſt the window, it cannot then afford a ſpot of light exactly round; but if it be on either ſide, a round ſpot may be obtained, even in December. As ſoon as this appears, ſcrew the tube D into the braſs collar provided for it in the middle of your wood-work, taking care not to alter your looking-glaſs: then ſcrewing the magnifier you chooſe to employ to the end of your microſcope in the uſual manner, take away the lens at the other end thereof, and place a ſlider, containing the objects to be examined, between the thin braſs plates, as in the other ways of uſing the microſcope.

Things being thus prepared, ſcrew the body of the microſcope over the ſmall end E of the braſs tube F; which ſlip over the ſmall end E of the tube D, and pull out the ſaid tube D leſs or more as your object is capable of enduring the ſun's heat. Dead objects may be brought within about an inch of the focus of the convex lens 5; but the diſtance muſt be ſhortened for living creatures, or they will ſoon be killed.

If the light fall not exactly right, you may eaſily, by a gentle motion of the jointed wire and pulley, direct it through the axis of the microſcopic lens. The ſhort tube F, to which the microſcope is ſcrewed, renders it eaſy, by ſliding it backwards or forwards on the other tube E, to bring the objects to their focal diſtance; which will be known by the ſharpneſs and clearneſs of their appearance: they may alſo be turned round by the ſame means without being in the leaſt diſordered.

The magnifiers moſt uſeful in the ſolar microſcope are in general, the fourth, fifth, or ſixth. The ſcreen on which the repreſentations of the objects are thrown, is uſually compoſed of a ſheet of the largeſt elephant paper, ſtrained on a frame which ſlides up or down, or turns about at pleaſure on a round wooden pillar, after the manner of ſome fire ſcreens. Larger ſcreens may alſo be made of ſeveral ſheets of the ſame paper paſted together on cloth, and let down from the ceiling with a roller like a large map.

"This microſcope (ſays Mr Baker) is the moſt entertaining of any; and perhaps the moſt capable of making diſcoveries in objects that are not too opaque: as it ſhows them much larger than can be done any other way. There are alſo ſeveral conveniences attending it, which no other microſcope can have: for the weakeſt eyes may uſe it without the leaſt ſtraining or fatigue: numbers of people together may view any object at the ſame time; and by pointing to the particular parts thereof, and diſcourſing on what lies before them, may be able better to underſtand one another, and more likely to find out the truth, than in other microſcopes, where they muſt peep one after another, and perhaps ſee the object neither in the ſame light nor in the ſame poſition. Thoſe alſo, who have no ſkill in drawing, may, by this contrivance, eaſily ſketch out the exact figure of any object they have a mind to preſerve a picture of; ſince they need only faſten a paper on the ſcreen, and trace it out thereon either with a pen or pencil, as it appears before them. It is worth the while of thoſe who are deſirous of taking many draughts in this way, to get a frame, wherein a ſheet of paper may be put in or taken out at pleaſure; for if the paper be ſingle, the image of an object will be ſeen almoſt as plainly on the back as on the fore ſide; and, by ſtanding behind the ſcreen, the ſhade of the hand will not obſtruct the light in drawing, as it muſt in ſome degree when one ſtands before it." This conſtruction, however, has now become rather obſolete, and is ſuperſeded by the following.

Fig. 22.

II. *The improved Solar Microſcope, as uſed with the improved ſingle Microſcope, with teeth and pinion.* Fig. 22. repreſents the whole form of the *ſingle microſcope*; the parts of which are as follows: ABCD the external tube; GHIK the internal moveable one; QM part of another tube within the laſt, at one end of which is fixed a plate of braſs hollowed in the middle, for receiving the glaſs tubes: there is alſo a moveable flat plate, between which, and the fixed end of the ſecond tube, the ivory ſliders are to be placed. L, a part of the microſcope, containing a wire ſpiral ſpring, keeping the tube QM with its plates firm againſt the fixed part IK of the ſecond tube.

Plate cccxxxix.

EF is the ſmall rack-work of teeth and pinion, by which the tube IG is moved gradually to or from the end AB, for adjuſting the objects exactly to the focus of different lengths. NO is a braſs ſlider, with ſix magnifiers; any one of which may eaſily be placed before the object. It is known when either of the glaſſes is in the centre of the eye-hole, by a ſmall ſpring falling into a notch in the ſide of the ſlider, made againſt each of the glaſſes. Thoſe parts of the apparatus, fig. 14. marked N° 15, 16, 17, 18, 19, 20, 21, and 22. are made uſe of here to this microſcope. GH is a braſs cell, which holds an illuminating glaſs for converging the ſun's beams or the light of a candle ſtrongly upon the objects. The aperture of the glaſs is made greater or leſs, by two circular pieces of braſs, with holes of different ſizes, that are ſcrewed ſeparately over the ſaid lens. But at times objects appear beſt when the microſcope is held up to the common light only, without this glaſs. It is alſo taken away when the microſcope is applied to the apparatus now to be deſcribed.

Fig. 23.

Fig. 23. repreſents the apparatus, with the ſingle microſcope ſcrewed to it, which conſtitutes the *Solar Microſcope*. AB is the inner moveable tube, to which the ſingle microſcope is ſcrewed. CD is the external tube, containing a condenſing convex glaſs at the end D, and is ſcrewed into the plate EF, which is cut with teeth at its circumference, and moved by the pinion I, that is fixed with the plate GH. This plate is ſcrewed faſt againſt the window-ſhutter, or board fitted to a convenient window of a darkened room, when the inſtrument is uſed. KL is a long frame, fixed to the circular plate EF; containing a looking-glaſs or mirror for reflecting the ſolar rays through the lens in the body of the tube D. O is a braſs milled head, faſtened to a worm or endleſs ſcrew; which on the outſide turns a ſmall wheel, by which the reflecting mirror M is moved upwards and downwards.

In *uſing* this microſcope, the ſquare frame GH is firſt to be ſcrewed to the window ſhutter, and the room well darkened: which is beſt done by cutting a round hole of the ſize of the moveable plate EF, that carries the reflector, in the window-ſhutter or board; and, by means of two braſs nuts *aa*, let into the ſhutter to receive the ſcrews PP, when placed through the holes in the ſquare frame GH, at the two holes QQ: which will firmly faſten the microſcope to the ſhutter, and is eaſily taken away by only unſcrewing the ſcrews PP.

The white paper ſcreen, or white cloth, to receive the images, is to be placed ſeveral feet diſtant from the window: which will make the repreſentations the larger in proportion to the diſtance. The uſual diſtances are from 6 to 16 feet.

The frame KL, with its mirror M, is to be moved by turning the pinion I, one way or the other, till the beams of the ſun's light come through the hole into the room: then, by turning of the worm at O, the mirror muſt be raiſed or depreſſed till the rays become perfectly horizontal, and go ſtraight acroſs the room to the ſcreen. The tube CD, with its lens at D, is now to be ſcrewed into the hole of the circular plate EF: by this glaſs the rays will be converged to a focus; and from thence proceed diverging to the ſcreen, and there make a large circle of light. The ſingle microſcope, fig. 22. is to be ſcrewed on to the end AB (fig. 23.) of the inner tube; and the ſlider NO, with either of the lenſes marked 1, 2, 3, 4, 5, or 6, in the centre of the hole at the end AB. This will occaſion a circle of light upon the ſcreen much larger than before. The ſlider or glaſs-tube, with the objects to be viewed, is to be placed between the plates at IK againſt the ſmall magnifier, and moved at pleaſure. By ſhifting the tube AB in or out, you may place the object in ſuch a part of the condenſed rays as ſhall be ſufficient to illuminate it, and not ſcorch or burn it; which will generally require the glaſs to be about one inch diſtant from the focus. It now remains only to adjuſt the object, or to bring it ſo near to the magnifier that its image formed upon the ſcreen ſhall be the moſt diſtinct or perfect: and it is effected by gently turning the pinion F, fig. 22. a ſmall matter one way or the other. If the object be rather large in ſize, the leaſt magnifiers are generally uſed, and *vice verſa*.

N° 1. is the greateſt magnifier, and N° 6. the leaſt, in the braſs ſlider NO. But, if deſired, ſingle lenſes of greater magnifying powers are made: and they are applied, by being ſcrewed to the end AB, fig. 22. and the braſs ſlider NO is then taken away.

The ſame object may be variouſly magnified, by the lenſes ſeverally applied to it; and the degree of magnifying power is eaſily known by this rule: *As the diſtance of the object is to that of its image from the magnifier; ſo is the length or breadth of the object to that of the image.*

Inſtead of the braſs ſliders with the lenſes NO, there is ſometimes ſcrewed a lens of a large ſize, and longer focal diſtance: the inſtrument is then converted into a *megalaſcope*; and is adapted for viewing the larger kind of objects contained in large ſliders, ſuch as is repreſented at R. And, in the ſame manner, ſmall objects of entertainment, painted upon glaſs like the ſliders of a magic lanthorn, are much magnified, and repreſented upon the ſame ſcreen.

The ſolar microſcopes juſt deſcribed are capable only of magnifying tranſparent objects; for which purpoſe

poſe the laſt inſtrument is extremely well adapted. But as opaque objects form the moſt conſiderable part of the curious collections in the works of art as well as nature, a ſolar microſcope for this purpoſe was a long time wanted.—For ſeveral years previous to 1774, Mr Martin made ſeveral eſſays towards the conſtruction of ſuch an inſtrument; and at laſt completed one about the time juſt mentioned, which he named,

III. *The Opaque Solar Microſcope.* With this inſtrument (to uſe his own words) "all *opaque* objects, whether of the animal, vegetable, or mineral kingdom, may be exhibited in great perfection, in all their native beauty; the lights and ſhades, the prominences and cavities, and all the varieties of different hues, tints, and colours; heightened by reflection of the ſolar rays condenſed upon them.—*Tranſparent objects* are alſo ſhown with greater perfection than by the common ſolar microſcope."

Fig. 24. repreſents the ſolar opaque microſcope, mounted for exhibiting opaque objects.

Fig. 25. is the ſingle tooth and pinion microſcope, as before, which is uſed for ſhowing tranſparent objects; the cylindrical tube Y thereof being made to fit into the tube FE of the ſolar microſcope.

Fig. 24. ABCDEF, (fig. 24.) repreſents the body of the ſolar microſcope; one part thereof, ABCD, is conical; the other, CDEF, is cylindrical. The cylindrical part receives the tube G of the opaque box, or the tube Y of the ſingle microſcope. At the large end AB of the conical part, there is a lens to receive the rays from the mirror, and refract them towards the box HIKL. NOP is a braſs frame; which is fixed to the moveable circular plate *a b c*: in this frame there is a plane mirror, to reflect the ſolar rays on the aforementioned lens. This mirror may be moved into the moſt convenient poſition for reflecting the light, by means of the nuts Q and R. By the nut Q it may be moved from eaſt to weſt; and it may be elevated or depreſſed by the nut R. *d e*, Two ſcrews to faſten the microſcope to a window ſhutter. The box for opaque objects is repreſented at HIKL: it contains a plane mirror M, for reflecting the light which it receives from the large lens to the object, and thereby illuminating it; S is a ſcrew to adjuſt this mirror, or place it at a proper angle for reflecting the light. VX, two tubes of braſs, one ſliding within the other, the exterior one in the box HIKL; theſe carry the magnifying lenſes: the interior tube is ſometimes taken out, and the exterior one is then uſed by itſelf. Part of this tube may be ſeen in the plate within the box HIKL. At H there is a braſs plate, the back part of which is fixed to the hollow tube *h*, in which there is a ſpiral wire, which keeps the plate always bearing againſt the ſide H of the braſs box HIKL. The ſliders, with the opaque objects, paſs between this plate and the ſide of the box; to put them there, the plate is to be drawn back by means of the nut *g*: *i k* is a door to one ſide of the opaque box. The foregoing pieces conſtitute the ſeveral parts neceſſary for viewing opaque objects. We ſhall now proceed to deſcribe the ſingle microſcope, which is uſed for tranſparent objects: but in order to examine theſe, the box HIKL muſt be firſt removed, and in its place we muſt inſert the tube Y of the ſingle microſcope that we are now going to deſcribe.

Fig. 25. Fig. 25. repreſents a large tooth and pinion microſcope: at *m*, within the body of this microſcope, are two thin plates, that are to be ſeparated in order to let the ivory ſliders paſs between them; they are preſſed together by a ſpiral ſpring, which bears up the under plate, and forces it againſt the upper one.

The ſlider S (under fig. 24.), which contains the magnifiers, fits into the hole *n*; and any of the magnifiers may be placed before the object, by moving the aforeſaid ſlider: when the magnifier is at the centre of the hole P, a ſmall ſpring falls into one of the notches which is on the ſide of the ſlider.

Under the plate *m* are placed two lenſes, for enlarging the field of view on the ſcreen: the ſmaller of the two is fixed in a piece of braſs, and is neareſt the plate *m*; this is to be taken out when the magnifiers, N° 4, 5, or 6, are uſed, or when the megalaſcope lens T (fig. 24.) is uſed; but is to be replaced for N° 1, 2, 3.

This microſcope is adjuſted to the focus by turning the milled nut O.

To *uſe* the ſolar microſcope:—Make a round hole in the window ſhutter, a little larger than the circle *a b c*; paſs the mirror ONP through this hole, and apply the ſquare plate to the ſhutter; then mark with a pencil the places which correſpond to the two holes through which the ſcrew is to paſs; take away the microſcope, and bore two holes at the marked places, ſufficiently large to let the milled ſcrews *d e* paſs through them.

The ſcrews are to paſs from the outſide of the ſhutter, to go through it; and being then ſcrewed into their reſpective holes in the ſquare plate, they will, when ſcrewed home, hold it faſt againſt the inſide of the ſhutter, and thus ſupport the microſcope.

Screw the conical tube ABCD to the circle *a b c*, and then ſlide the tube G of the opaque box into the cylindrical part CDEF of the body, if opaque objects are to be examined; but if they be tranſparent objects you mean to ſhow, then place the tube Y within the tube CDEF.

The room is to be darkened as much as poſſible, that no light may enter but what paſſes through the body of the microſcope; for, on this circumſtance, together with the brightneſs of the ſunſhine, the perfection and diſtinctneſs of the image in a great meaſure depend.

When the microſcope is to be uſed for opaque objects, 1. Adjuſt the mirror NOP, ſo as to receive the ſolar rays, by means of the two finger ſcrews or nuts, QR; the firſt, Q, turns the mirror to the right or left; the ſecond, R, raiſes or depreſſes it: this you are to do till you have reflected the ſun's light through the lens at AB ſtrongly upon a ſcreen of white paper placed at ſome diſtance from the window, and formed thereon a round ſpot of light. An unexperienced obſerver will find it more convenient to obtain the light by forming this ſpot before he puts on either the opaque box or the tooth and pinion microſcope.

Now put in the *opaque* box, and place the object between the plates at H; open the door *i k*, and adjuſt the mirror M till you have illuminated the object ſtrongly. If you cannot effect this by the ſcrew S, you muſt move the ſcrews Q, R, in order to get the light reflected ſtrongly from the mirror NOP, or the mirror M, without which the latter cannot illuminate the object.

The object being ſtrongly illuminated, ſhut the door *i k*, and a diſtinct view of the object will ſoon be obtained on your ſcreen, by adjuſting the tubes VX, which is effected by moving them backwards or forwards.

A round ſpot of light cannot always be procured in northern latitudes, the altitude of the ſun being often too low; neither can it be obtained when the ſun is directly perpendicular to the front of the room.

As the ſun is continually changing its place, it will be neceſſary, in order to keep his rays full upon the object, to keep them continually directed through the axis of the inſtrument, by the two ſcrews Q and R.

To view *tranſparent* objects, remove the opaque box, and inſert the tube Y, fig. 25. in its place; put the ſlider S into its place at *n*, and the ſlider with the objects between the plates at *m*; then adjuſt the mirror NOP, as before directed by the ſcrews Q, R, ſo that the light may paſs through the object; regulate the focus of the magnifier by the ſcrew O. The moſt pleaſing magnifiers in uſe are the fourth and fifth.

The ſize of the object may be increaſed or diminiſhed, by altering the diſtance of the ſcreen from the microſcope: five or ſix feet is a convenient diſtance.

To examine tranſparent objects of a larger ſize, or to render the inſtrument what is uſually called a *megalaſcope*, take out the ſlider S from its place at *n*, and ſcrew the button T (fig. 24.) into the hole at P, fig. 25. and remove the glaſs which is under the plate at *m*, and regulate the light and focus agreeable to the foregoing directions.

N. B. At the end of the tube G there is a lens for increaſing the denſity of the rays, for the purpoſe of burning or melting any combuſtible or fuſible ſubſtance: this lens muſt be removed in moſt caſes, leſt the objects ſhould be burnt. The intenſity of the light is alſo varied by moving this tube backwards or forwards.

Apparatus of the Opaque Solar Microſcope.—The large ſquare plate and mirror; the body of the microſcope; the opaque box and its tube; the tooth and pinion microſcope; the ſlider with the magnifiers; the megalaſcope magnifier; the two ſcrews *d* and *e*; ſome ivory ſliders; ſome ſliders with opaque objects; a braſs frame, with a bottom of ſoft deal to ſtick any object on; a braſs cylinder K (fig. 31.), for confining opaque objects.

Plate CCCXLI.

IV. *The* CAMERA OBSCURA, *or* LUCERNAL, *Microſcope.*

The great facility with which objects can be repreſented on paper or a rough glaſs in the camera obſcura, and copies drawn from them by any perſon though unſkilled in drawing, evidently ſuggeſted the application of the microſcope to this inſtrument. The greateſt number of experiments that appear to have been made with this view, were by Mr Martin and Mr Adams; the former of whom frequently applied the microſcope to the portable camera, and with much effect and entertainment. But theſe inſtruments being found to anſwer only with the aſſiſtance of the ſun, Mr Adams directed his experiments to the conſtruction of an inſtrument of more extended utility, which could be equally employed in the day-time and by night. He accordingly ſucceeded ſo far as to produce, by *candle-light*, the images of objects refracted from a ſingle magnifier upon one or two large convex lenſes (of about five inches or upwards in diameter), at the end of a pyramidal ſhaped box, in a very pleaſing and magnified appearance, ſo as to give opaque objects as well as tranſparent ones the utmoſt diſtinctneſs of repreſentation; but ſtill the light of a candle or lamp was found generally inſufficient to throw the requiſite degree of illumination upon the objects. The invention of what is called *Argand's lamp*, within theſe few years offered a complete remedy for this defect, by the intenſity and ſteadineſs of its light. This did not eſcape Mr Adams (ſon of the former), who immediately applied it; and who had likewiſe ſo altered and improved his father's inſtrument, both in conſtruction and form, as to render it altogether a different one, and far more perfect and uſeful.

The advantages and properties of this excellently conceived inſtrument are numerous and important. "As the far greater part of the objects which ſurround us are opaque (ſays our author), and very few are ſufficiently tranſparent to be examined by the common microſcopes, an inſtrument that could be readily applied to the examination of opaque objects has always been a deſideratum. Even in the examination of tranſparent objects, many of the fine and more curious portions are loſt, and drowned, as it were, in the light which muſt be tranſmitted through them; while different parts of the ſame object appear only as dark lines or ſpots, becauſe they are ſo opaque as not to permit any light to paſs through them. Theſe difficulties, as well as many more, are obviated in the lucernal microſcope; by which opaque objects of various ſizes may be ſeen with eaſe and diſtinctneſs: the beautiful colours with which moſt of them are adorned, are rendered more brilliant, without changing in the leaſt the real tint of the colour; and the concave and convex parts retain alſo their proper form.—The facility with which all opaque objects are applied to this inſtrument, is another conſiderable advantage, and almoſt peculiar to itſelf; as the texture and configuration of the more tender parts are often hurt by previous preparation, every object may be examined by this inſtrument, firſt as opaque, and afterwards (if the texture will admit of it) as tranſparent.—The lucernal microſcope does not in the leaſt fatigue the eye; the object appears like nature itſelf, giving eaſe to the ſight and pleaſure to the mind: there is alſo, in the uſe of this inſtrument, no occaſion to ſhut the eye which is not directed to the object. A further advantage peculiar to this microſcope is, that by it the outlines of every object may be taken, even by thoſe who are not accuſtomed to draw; while thoſe who can draw well will receive great aſſiſtance, and execute their work with more acccuracy and in leſs time than they would otherwiſe have been able to have performed it. Tranſparent objects as well as opaque may be copied in the ſame manner. The inſtrument may be uſed at any time of the day, but the beſt effect is by night; in which reſpect it has a ſuperiority over the ſolar microſcope, as that inſtrument can only be uſed when the ſun ſhines.

Tranſparent objects may be examined with the lucernal microſcope in three or four different modes, from

from a blaze of light almoſt too great for the eye to bear, to that which is perfectly eaſy to it: And by the addition of a tin lanthorn to the apparatus, may be thrown on a ſcreen, and exhibited at one view to a large company, as by the ſolar microſcope.

We ſhall now proceed to the deſcription of the inſtrument and apparatus as given by Mr Adams.

Plate CCCXLI. fig. 26.

Fig. 26. repreſents the improved *Lucernal Microſcope*, mounted to view opaque objects. ABCD is a large mahogany pyramidal box, which forms the body of the microſcope; it is ſupported firmly on the braſs pillar FG, by means of the ſocket H and the curved piece IK.

LMN is a guide for the eye, in order to direct it in the axis of the lenſes; it conſiſts of two braſs tubes, one ſliding within the other, and a vertical flat piece, at the top of which is the hole for the eye. The outer tube is ſeen at MN, the vertical piece is repreſented at LM. The inner tube may be pulled out, or puſhed in, to adjuſt it to the focus of the glaſſes. The vertical piece may be raiſed or depreſſed, that the hole, through which the object is to be viewed, may coincide with the centre in the field of view; it is fixed by a milled ſcrew at M, which could not be ſhown in this figure.

At N is a dove-tailed piece of braſs, made to receive the dove-tail at the end of the tubes MN, by which it is affixed to the wooden box ABCDE. The tubes MN may be removed from this box occaſionally, for the convenience of packing it up in a leſs compaſs.

OP, a ſmall tube which carries the magnifiers.

O, one of the magnifiers; it is ſcrewed into the end of a tube, which ſlides within the tube P; the tube P may be unſcrewed occaſionally from the wooden body.

QRSTVX, a long ſquare bar, which paſſes through the ſockets YZ, and carries the ſtage or frame that holds the objects; this bar may be moved backward or forward, in order to adjuſt it to the focus by means of the pinion which is at *a*.

b, A handle furniſhed with an univerſal joint, for more conveniently turning the pinion. When the handle is removed, the nut (fig. 27.) may be uſed in its ſtead.

Fig. 27.

de, A braſs bar, to ſupport the curved piece KI, and keep the body AB firm and ſteady.

fghi, The ſtage for opaque objects: it fits upon the bar QRST by means of the ſocket *hi*, and is brought nearer to or removed farther from the magnifying lens by turning the pinion *a*: the objects are placed in the front ſide of the ſtage (which cannot be ſeen in this figure) between four ſmall braſs plates; the edges of two of theſe are ſeen at *kl*. The two upper pieces of braſs are moveable; they are fixed to a plate, which is acted on by a ſpiral ſpring, that preſſes them down, and confines the ſlider with the objects: this plate, and the two upper pieces of braſs, are lifted up by the ſmall nut *m*.

At the lower part of the ſtage, there is a ſemicircular lump of glaſs *n*, which is deſigned to receive the light from the lamp, fig. 29. and to collect and throw it on the concave mirror *o*, whence it is to be reflected on the object.

The upper part *fghs* (fig. 26.) of the opaque ſtage takes out, that the ſtage for tranſparent objects may be inſerted in its place.

Fig. 28.

Fig. 28. repreſents the ſtage for tranſparent objects; the two legs 5 and 6 fit into the top of the under part *rshi* of the ſtage for opaque objects; 7 is the part which confines or holds the ſliders, and through which they are to be moved; 9 and 10 a braſs tube, which contains the lenſes for condenſing the light, and throwing it upon the object; there is a ſecond tube within that, marked 9 and 10, which may be placed at different diſtances from the object by the pin 11.

When this ſtage is uſed as a ſingle microſcope, without any reference to the lucernal, the magnifiers or object lenſes, are to be ſcrewed into the hole 12, and to be adjuſted to a proper focus by the nut 13.

N. B. At the end AB (fig. 26.) of the wooden body there is a ſlider, which is repreſented as partly drawn out at A: when quite taken out, three grooves will be perceived; one of which contains a board that forms the end of the box; the next contains a frame with a grayed glaſs; and the third, or that fartheſt from the end AB, two large convex lenſes.

Fig. 29.

Fig. 29. repreſents one of Argand's lamps, which are the moſt ſuitable for microſcopic purpoſes, on account of the clearneſs, the intenſity, and the ſteadineſs of the light. The following account of the method of managing them, with other obſervations, is copied from an account given by Mr Parker with thoſe he ſells.

The principle on which the lamp acts, conſiſts in diſpoſing the wick in thin parts, ſo that the air may come into contact with all the burning fuel; by which means, together with an inercaſe of the current of air occaſioned by rarefaction in the glaſs tube, the whole of the fuel is converted into flame.

The wicks are circular; and, the more readily to regulate the quantity of light, are fixed on a braſs collar, with a wire handle, by means of which they are raiſed or depreſſed at pleaſure.

To fix the wick on, a wooden mandril is contrived, which is tapered at one end, and has a groove turned at the other.

The wick has a ſelvage at one end, which is to be put foremoſt on the mandril, and moved up to the groove; then putting the groove into the collar of the wick-holder, the wick is eaſily puſhed forward upon it.

The wick-holder and wick being put quite down in their place, the ſpare part of the wick ſhould, while dry, be ſet a-light, and ſuffered to burn to the edge of the tubes; this will leave it more even than by cutting, and, being black by burning, will be much eaſier lighted: for this reaſon, the black ſhould never be quite cut off.

The lamp ſhould be filled an hour or two before it is wanted, that the cotton may imbibe the oil and draw the better.

The lamps which have a reſervoir and valve, need no other direction for filling than to do it with a proper trimming pot, carefully obſerving when they are full; then pulling up the valve by the point, the reſervoir, being turned with the other hand, may be replaced without ſpilling a drop.

Thoſe lamps which fill in the front like a bird-fountain, muſt be reclined on the back to fill; and this ſhould be done gently, that the oil in the burner may return into the body when ſo placed and filled : if, by being too full, and oil appears above the guard, only move the lamp a little, and the oil will diſappear ; the lamp may then be placed erect, and the oil will flow to its proper level.

The oil muſt be of the ſpermaceti kind, commonly called chamber oil, which may generally be diſtinguiſhed by its paleneſs, tranſparency, and inoffenſive ſcent : all thoſe oils which are of a red and brown colour, and of an offenſive ſcent, ſhould be carefully avoided, as their glutinous parts clog the lamp, and the impurities in ſuch oil, not being inflammable, will accumulate and remain in the form of a cruſt on the wick. Seal oil is nearly as pale and ſweet as chamber oil ; but being of a heavy ſluggiſh quality, is not proper for lamps with fine wicks.

Whenever bad oil has been uſed, on changing it, the wick muſt alſo be changed ; becauſe, after having imbibed the coarſe particles in its capillary tubes, it will not draw up the fine oil.

To obtain the greateſt degree of light, the wick ſhould be trimmed exactly even, the flame will then be completely equal.

There will be a great advantage in keeping the lamp clean, eſpecially the burner and air tubes ; the neglect of cleanlineſs in lamps is too common : a candleſtick is generally cleaned every time it is uſed, ſo ſhould a lamp ; and if a candleſtick is not to be objected to becauſe it does not give light after the candle is exhauſted, ſo a lamp ſhould not be thought ill of, if it does not give light when it wants oil or cotton : but this laſt has often happened, becauſe the deficiency is leſs viſible.

The glaſs tubes are beſt cleaned with a piece of waſh leather.

If a fountain lamp is left partly filled with oil, it may be liable to overflow : this happens by the contraction of the air when cold, and its expanſion by the warmth of a room, the rays of the ſun, or the heat of the lamp when re-lighted : this accident may be effectually prevented by keeping the reſervoir filled, the oil not being ſubject to expanſion like air. On this account, thoſe with a common reſervoir are beſt adapted for microſcopic purpoſes.

To examine Opaque Objects, with the Lucernal Microſcope. To render the uſe of this inſtrument eaſy, it is uſually packed with as many of the parts together as poſſible : it occupies on this account rather more room, but is much leſs embarraſſing to the obſerver, who has only three parts to put on after it is taken out of its box, namely, the guide for the eye, the ſtage, and the tube with its magnifier.

But to be more particular : Take out the wooden ſlider A (fig. 26.), then lift out the cover and the gray glaſs, from their reſpective grooves under the ſlider A.

Put the end N of the guide for the eye LMN into its place, ſo that it may ſtand in the poſition which is repreſented in this figure.

Place the ſocket which is at the bottom of the opaque ſtage, on the bar QXT, ſo that the concave mirror *o* may be next the end DE of the wooden body.

Screw the tubes PO into the end DE. The magnifier you intend to uſe is to be ſcrewed on the end O of theſe tubes.

The handle G *b*, or the milled nut, fig. 27. muſt be placed on the ſquare end of the pinion *a*.

Place the lamp lighted before the glaſs lamp *n*, and the object you intend to examine between the ſpring plates of the ſtage ; and the inſtrument is ready for uſe.

In all microſcopes there are two circumſtances which muſt be particularly attended to : firſt, the modification of the light, or the proper quantity to illuminate the object ; ſecondly, the adjuſtment of the inſtrument to the focus of the glaſs and eye of the obſerver. In the uſe of the lucernal microſcope there is a third circumſtance, which is, the regulation of the guide for the eye.

1. To throw the light upon the object. The flame of the lamp is to be placed rather below the centre of the glaſs lump *n*, and as near it as poſſible ; the concave mirror *o* muſt be ſo inclined and turned as to receive the light from the glaſs lump, and reflect it thence upon the object ; the beſt ſituation of the concave mirror and the flame of the lamp depends on a combination of circumſtances, which a little practice will diſcover.

2. To regulate the guide for the eye, or to place the centre of the eye-piece L ſo that it may coincide with the focal point of the lenſes and the axis of viſion : Lengthen and ſhorten the tubes MN, by drawing out or puſhing in the inner tube, and raiſing or depreſſing the eye-piece ML, till you find the large lens (which is placed at the end AB of the wooden body) filled by an uniform field of light, without any priſmatic colours round the edge ; for till this piece is properly fixed, the circle of light will be very ſmall, and only occupy a part of the lens ; the eye muſt be kept at the centre of the eye-piece L, during the whole of the operation ; which may be rendered ſomewhat eaſier to the obſerver, on the firſt uſe of the inſtrument, if he hold a piece of white paper parallel to the large lens, removing it from or bringing it nearer to them till he find the place where a lucid circle, which he will perceive on the paper, is brighteſt and moſt diſtinct ; then he is to fix the centre of the eye-piece to coincide with that ſpot ; after which a very ſmall adjuſtment will ſet it perfectly right.

3. To adjuſt the lenſes to their focal diſtance. This is effected by turning the pinion *a*, the eye being at the ſame time at the eye-piece L. The gray glaſs is often placed before the large lenſes, while regulating the guide for the eye, and adjuſting for the focal diſtance.

If the obſerver, in the proceſs of his examination of an object, advance rapidly from a ſhallow to a deep magnifier, he will ſave himſelf ſome labour by pulling out the internal tube at O.

The upper part *f g r s* of the ſtage is to be raiſed or lowered occaſionally, in order to make the centre of the object coincide with the centre of the lens at O.

To delineate objects, the gray glaſs muſt be placed before the large lenſes ; the picture of the object will be formed on this glaſs, and the outline may be accurately taken by going over the picture with a pencil.

The

The opaque part may be uſed in the daytime without a lamp, provided the large lenſes at AB are ſcreened from the light.

To uſe the Lucernal Microſcope in the examination of Tranſparent Objects.—The inſtrument is to remain as before: the upper part *f g s* of the opaque ſtage muſt be removed, and the ſtage for tranſparent objects, repreſented at fig. 28. put in its place; the end 9 10 to be next the lamp.

Place the grayed glaſs in its groove at the end AB, and the objects in the ſlider-holder at the front of the ſtage; then tranſmit as ſtrong a light as you are able on the object, which you will eaſily do by raiſing or lowering the lamp.

The object will be beautifully depicted on the gray glaſs; it muſt be regulated to the focus of the magnifier, by turning the pinion *a*.

The object may be viewed either with or without the guide for the eye. A ſingle obſerver will ſee an object to the greateſt advantage by uſing this guide, which is to be adjuſted as we have deſcribed above. If two or three wiſh to examine the object at the ſame time, the guide for the eye muſt be laid aſide.

Take the large lens out of the groove, and receive the image on the gray glaſs; in this caſe, the guide for the eye is of no uſe: if the gray glaſs be taken away, the image of the object may be received on a paper ſcreen.

Take out the gray glaſs, replace the large lenſes, and uſe the guide for the eye; attend to the foregoing directions, and adjuſt the object to its proper focus. You will then ſee the object in a blaze of light almoſt too great for the eye, a circumſtance that will be found very uſeful in the examination of particular objects. The edges of the object in this mode will be ſomewhat coloured: but as it is only uſed in this full light for occaſional purpoſes, it has been thought better to leave this ſmall imperfection, than, by remedying it, to ſacrifice greater advantages; the more ſo, as this fault is eaſily corrected, a new and intereſting view of the object is obtained, by turning the inſtrument out of the direct rays of light, and permitting them to paſs through only in an oblique direction, by which the upper ſurface is in ſome degree illuminated, and the object is ſeen partly as opaque, partly as tranſparent. It has been already obſerved, that the tranſparent objects might be placed between the ſlider-holders of the ſtage for opaque objects, and then be examined as if opaque.

Some tranſparent objects appear to the greateſt advantage when the lens at 9 10 is taken away; as, by giving too great a quantity of light, it renders the edges leſs ſharp.

The variety of views which may be taken of every object by means of the improved lucernal microſcope, will be found to be of great uſe to an accurate obſerver: it will give him an opportunity of correcting or confirming his diſcoveries, and inveſtigating thoſe parts in one mode which are inviſible in another.

To throw the image of tranſparent objects on a ſcreen as in the ſolar microſcope.—It has been long a microſcopical deſideratum, to have an inſtrument by which the image of tranſparent objects might be thrown on a ſcreen, as in the common ſolar microſcope: and this not only becauſe the ſun is ſo uncertain in this climate, and the uſe of the ſolar microſcope requires confinement in the fineſt part of the day, when time ſeldom hangs heavy on the mind; but as it alſo affords an increaſe of pleaſure, by diſplaying its wonders to ſeveral perſons at the ſame inſtant, without the leaſt fatigue to the eye.

This purpoſe is now effectually anſwered, by affixing the tranſparent ſtage of the lucernal to a lanthorn, with one of Argand's lamps.—The lamp is placed within the lanthorn, and the end 9 10 of the tranſparent ſtage is ſcrewed into a female ſcrew, which is rivetted in the ſliding part of the front of the lanthorn; the magnifying lenſes are to be ſcrewed into the hole repreſented at 12, and they are adjuſted by turning the milled nut. The quantity of light is to be regulated by raiſing and lowering the ſliding-plate or the lamp.

Apparatus which uſually accompanies the improved Lucernal Microſcope.—The ſtage for opaque objects, with its ſemicircular lump of glaſs, and concave mirror. The ſtage for tranſparent objects, which fits on the upper part of the foregoing ſtage. The ſliding tube, to which the magnifiers are to be affixed: one end of theſe is to be ſcrewed on the end D of the wooden body; the magnifier in uſe is to be ſcrewed to the other end of the inner tube. Eight magnifying lenſes: theſe are ſo conſtructed that they may be combined together, and thus produce a very great variety of magnifying powers. A fiſh-pan, ſuch as is repreſented at I. A ſteel wire L, with a pair of nippers at one end, and a ſmall cylinder of ivory *l* at the other. A ſlider of braſs N, containing a flat glaſs ſlider, and a braſs ſlider into which are fitted ſome ſmall concave glaſſes. A pair of forceps. Six large and ſix ſmall ivory ſliders, with tranſparent objects. Fourteen wooden ſliders, with four opaque objects in each ſlider; and two ſpare ſliders. Some capillary tubes for viewing ſmall animalcula.

Ingenious men ſeldom content themſelves with an inſtrument under one form; hence ſuch a variety of microſcopes, hence many alterations in the Lucernal Microſcope. Mr Adams himſelf, we underſtand, has fitted up this laſt in a great many different ways; and it is reaſonable to think that no perſon was more likely to give it every improvement of which it is ſuſceptible. Of the alterations by other hands we ſhall only particularize one, made by Mr Jones of Holborn (B), whoſe deſcription is as follows:

A (fig. 30.) repreſents a portion of the top of the ma- Fig. 30.

(B) We truſt the reader will never conſider any paragraph wherein the name of an inſtrument-maker or other artiſt is inſerted, as a recommendation of thoſe artiſts by the editors of this work. In the courſe of a pretty extenſive correſpondence, they have been favoured with very liberal communications from various artiſts, for which they are greatly indebted to them: the inſerting their names in this work is therefore to be conſidered hogany box in which it packs, to preſerve it ſteady; it ſlides in a dove-tail groove withinſide, a ſimilar groove to which is cut in the top of the box A; ſo that when the inſtrument is to be uſed, it is ſlipt out of the box withinſide, and then ſlipt into the groove at top ready for uſe, almoſt inſtantly, as ſhown in the figure. The adjuſtment of the objects is at the ſtage E; for the right focal diſtance is readily and conveniently made by turning the long ſcrew-rod BB, which goes through the two pillars ſupporting the box, and works in the baſe of the braſs ſtage E; which baſe is alſo dove-tailed, ſo as to have a regular and ſteady motion in another braſs baſis that ſupports it. In this inſtrument, therefore, the pyramidical box does not move; but the ſtage part only, which, from its ſmall weight, moves in the moſt agreeable and ſteady manner. While obſerving the image of the object upon the glaſs through the ſight-hole at G, the object may be moved or changed by only turning the rack-work and pinion applied to the ſtage by means of the handle D, for that purpoſe. By this contrivance you have no occaſion to change your poſition during the view of the objects upon one of the ſliders. This motion changes the objects horizontally only; and as they are generally placed exactly in one line, it anſwers all the purpoſes for which this motion is intended very well. But it may ſometimes happen that the obſerver would wiſh to alter the vertical poſition of the object; to perform which there is another plain rod at F, that acts ſimply as a lever for this purpoſe, and moves the ſliding part of the ſtage E vertically either upwards or downwards.

Thus, without altering his poſition, the obſerver may inveſtigate all parts of the objects in the moſt ſatisfactory manner. Rack-work and pinion might be applied to the ſtage for the vertical motion alſo; but as it would materially enhance the expence, it is ſeldom applied. The braſs work at the handle of D contains a Hooke's univerſal joint.

The brilliancy of the images of the objects ſhown upon the large lenſes at the end of the box, being very frequently ſo great as to dazzle the eyes, Mr Jones applies a ſlight tinge of blue, green, and other coloured glaſs, to the ſight-hole at G, which ſoftens this glare, and caſts an agreeable hue upon the objects.

Deſcription of thoſe Parts of a Microſcopical Apparatus, common to moſt Inſtruments, which are delineated at fig. 31.

A and B repreſent the braſs cells which contain the magnifiers belonging to the different kinds of compound microſcopes. The magnifiers are ſometimes contained in a ſlider like that which is delineated at S (fig. 24.). The lenſes of A and B are confined by a ſmall cap; on unſcrewing this, the ſmall lens may be taken out and cleaned. The magnifiers A of the lucernal microſcope are ſo contrived, that any two of them may be ſcrewed together, by which means a conſiderable variety of magnifying powers is obtained.

To get at the lenſes in the ſlider S (fig. 24.) take out the two ſcrews which hold on the cover.

C repreſents the general form of the ſlider-holder. It conſiſts of a cylindrical tube, in which an inner tube is forced up by a ſpring. It is uſed to receive the ivory or any other ſlider, in which the tranſparent objects are placed; theſe are to be ſlid between the two upper plates: the hollow part in one of the plates is deſigned for the glaſs tubes.

D, the condenſing lens and its tube, which fits into the ſlider-holder C, and may be moved up and down in it. When this piece is puſhed up as far as it will go, it condenſes the light of a candle, which is reflected on it by the plain mirror of the compound microſcope, and ſpreads it uniformly over the object; in this caſe it is beſt adapted to the ſhalloweſt magnifiers. If the deeper lenſes are uſed, it ſhould be drawn down, or rather removed further from the object, that it may concentrate the light in a ſmall compaſs, and thus render it more denſe. The condenſing lens is ſometimes fitted up differently; but the principle being the ſame, it will be eaſy to apply it to uſe notwithſtanding ſome variations in the mechaniſm.

E, a braſs cone. It fixes under the ſlider-holder, and is uſed to leſſen occaſionally the quantity of light which comes from the mirror to any object.

F, a box with two flat glaſſes, which may be placed at different diſtances from each other in order to confine a ſmall living inſect.

G, a ſmall braſs box to hold the ſilver ſpeculum H.

H, a ſmall ſilver concave ſpeculum, deſigned to reflect the light from the mirror on opaque objects; it ſhould only be uſed with the ſhallow magnifiers. It is applied in different ways to the compound microſcope; ſometimes to a tube ſimilar to that repreſented at X, which ſlides on the lower part of the body; ſometimes it is ſcrewed into the ring of the piece Q; the pin of this generally fits into one of the holes in the ſtage. When this ſpeculum is uſed, the ſlider-holder ſhould be removed.

I, a fiſh-pan, whereon a ſmall fiſh may be faſtened, in order to view the circulation of the blood: its tail is to be ſpread acroſs the oblong hole at the ſmalleſt end, and tied faſt by means of the ribbon fixed thereto, by ſhoving the knob which is on the back of it through the ſlit made in the ſtage; the tail of the fiſh may be brought under the lens which is in uſe.

K, a cylindrical piece, intended for the ſolar opaque microſcope; by pulling back the ſpiral ſpring, ſmaller or larger objects may be confined in it.

k, A pair of triangular nippers for taking hold of and confining a large object.

L, a long ſteel wire, with a ſmall pair of pliers at one end and a ſteel point at the other: the wire ſlips backwards or forwards in a ſpring tube, which is affixed to a joint, at the bottom of which is a pin to fit one

---

as a grateful acknowledgment from the editors for favours conferred on them,—not as a teſtimonial of their opinion of the abilities of an individual, or as deſigned to inſinuate any preference over others in the ſame line, where ſuch preference has not been already beſtowed by the public.

one of the holes in the ſtage; this piece is uſed to confine ſmall objects.

l, A ſmall ivory cylinder that fits on the pointed end of the ſteel wire L; it is deſigned to receive opaque objects. Light-coloured ones are to be ſtuck on the dark ſide, and *vice verſa*.

M, a convex lens, which fits to the ſtage by means of the long pin adhering to it. This piece is deſigned to collect the light from the ſun or a candle, and to throw them on any object placed on the ſtage; but it is very little uſed at preſent.

N, a braſs ſlider, into which is fitted a flat piece of glaſs, and a braſs ſlider containing four ſmall glaſſes, one or two of them concave, the others flat; it is deſigned to confine ſmall living objects, and when uſed is to be placed between the two upper plates of the ſlider-holder.

O, a glaſs tube to receive a ſmall fiſh, &c.

P, repreſents one of the ivory ſliders, wherein objects are placed between two pieces of talc, and confined by a braſs ring.

Q, a piece to hold the ſpeculum H: this piece is generally fitted to the microſcope repreſented at fig. 12.

R, a pair of foreceps, to take up any occaſional object.

S, a camel's hair pencil to bruſh the duſt off the glaſſes; the upper part of the quill is ſcooped out, to take up a drop of any fluid, and place it on either of the glaſſes for examination.

T, an inſtrument for cutting thin tranſverſe ſections of wood. It conſiſts of a wooden baſe, which ſupports four braſs pillars; on the top of the pillars is placed a flat piece of braſs, near the middle of which there is a triangular hole.

A ſharp knife, which moves in a diagonal direction, is fixed on the upper ſide of the afore-mentioned plate, and in ſuch a manner that the edge always coincides with the ſurface thereof.

The knife is moved backwards and forwards by means of the handle *a*. The piece of wood is placed in the triangular trough which is under the braſs plate, and is to be kept ſteady therein by a milled ſcrew which is fitted to the trough; the wood is to be preſſed forward for cutting by the micrometer ſcrew *b*.

The pieces of wood ſhould be applied to this inſtrument immediately on being taken out of the ground, or elſe they ſhould be ſoaked for ſome time in water, to ſoften them ſo that they may not hurt the edge of the knife.

When the edge of the knife is brought in contact with the piece of wood, a ſmall quantity of ſpirits of wine ſhould be poured on the ſurface of the wood, to prevent its curling up; it will alſo make it adhere to the knife, from which it may be removed by preſſing a piece of blotting paper on it.

y, An appendage to the cutting engine, which is to be uſed inſtead of the micrometer ſcrew, being preferred to it by ſome. It is placed over the triangular hole, and kept flat down upon the ſurface of the braſs plate, while the piece of wood is preſſed againſt a circular piece of braſs which is on the under ſide of it. This circular piece of braſs is fixed to the ſcrew, by which its diſtance from the flat plate on which the knife moves may be regulated.

z, An ivory box, containing at one end ſpare talc for the ivory ſliders, and at the other ſpare rings for preſſing the talcs together and confining them to the ſlider.

Fluid microſcopes have been alſo propoſed; the firſt, it would appear, was ſuggeſted by Mr Grey. This was formed of water, and an account of it will be found in N° 221, 223, Phil. Tranſ. An improved microſcope, on a ſimilar principle, has been invented by Mr Brewſter, of which the following is a deſcription, taken from a note by the tranſlator of Haüy's Natural Philoſophy.

" A vertical bar (ſays Mr Gregory), is fixed upon a horizontal pedeſtal; and from the top of this bar proceeds a horizontal arm, which ſupports a circular caſe containing the lenſes; below this another horizontal arm ſlides up and down, capable of adjuſtment by means of a ſcrew, and carrying the uſual ſliders to hold the object which it is propoſed to examine; and upon the pedeſtal is fixed the frame of a mirror, which has both an inclined and a horizontal motion, in order to illuminate any object upon the ſlider. The upper circular caſe is hollow, and contains four or more plano-convex lenſes, which are conſtituted each of a drop of very pure and viſcid turpentine varniſh, taken up by the point of a piece of wood, and dropped upon a piece of very thin and well poliſhed glaſs. The lenſes thus formed may be made of any focal length by taking up a greater or a leſs quantity of fluid. The lower ſurface of the glaſs having been firſt ſmoked with a candle, the black pigment immediately below the lenſes is then to be removed, ſo that no light may paſs but through the lenſes. The piece of glaſs is then perforated at its centre, and ſurrounded by a toothed wheel, which, when the wheel is put in the upper circular caſe, may be turned by a common endleſs ſcrew, ſo that the fluid lenſes ſhall be brought ſeverally under an eye-aperture properly diſpoſed, and any object be ſucceſsfully examined with a variety of magnifying powers." Note, p. 365. See alſo Ferguſon's Lectures by Brewſter, vol. ii.

AFTER what has been related of microſcopes, they cannot be ſaid to be complete without the valuable addition of a *micrometer*; for the uſe and advantages of which, ſee the article MICROMETER.

HAVING preſented our readers with deſcriptions of the various microſcopes generally uſed, we think it our duty to point out to them thoſe which we conceive to be beſt calculated to anſwer the purpoſes of ſcience. The firſt which preſents itſelf to our mind is that of *Ellis*: It is better adapted than any other portable microſcope, to the purpoſe of general obſervation; ſimple in its conſtruction, and general in its application. To thoſe who prefer a double microſcope, we ſhould recommend that figured in Plate CCCXXXVIII. fig. 12. If opaque objects, as inſects, &c. be ſubjects of inveſtigation, the *Lucernal Microſcope* claims the preference; but if amuſement alone guides the choice, the *Solar Microſcope* muſt be fixed upon.

WE ſhall now proceed to explain ſome neceſſary particulars reſpecting the method of uſing microſcopes; after which, we ſhall ſubjoin an enumeration of the principal objects diſcovered or elucidated by their means. On this ſubject Mr Adams, in his *Eſſay on the Microſcope*, has been very copious; with a view, as he informs us, to remove the common complaint made by Mr Baker, "that many of thoſe who purchaſe microſcopes are ſo little acquainted with their general and extenſive uſefulneſs, and ſo much at a loſs for objects to examine by them, that after diverting their friends ſome few times with what they find in the ſliders which generally accompany the inſtrument, or perhaps with two or three common objects, the microſcope is laid aſide as of little further value: whereas no inſtrument has yet appeared in the world capable of affording ſo conſtant, various, and ſatisfactory an entertainment to the mind."

I. In uſing the microſcope, there are three things neceſſary to be conſidered. (1.) The preparation and adjuſtment of the inſtrument itſelf. (2.) The proper quantity of light, and the beſt method of directing it to the object. (3.) The method of preparing the objects, ſo that their texture may be properly underſtood.

1. With regard to the microſcope itſelf, the firſt thing neceſſary to be examined is, whether the glaſſes be clean or not: if they are not ſo, they muſt be wiped with a piece of ſoft leather, taking care not to ſoil them afterwards with the fingers; and, in replacing them, care muſt be taken not to place them in an oblique ſituation. We muſt likewiſe be careful not to let the breath fall upon the glaſſes, nor to hold that part of the body of the inſtrument where the glaſſes are placed with a warm hand; becauſe thus the moiſture expelled by the heat from the metal will condenſe upon the glaſs, and prevent the object from being diſtinctly ſeen. The object ſhould be brought as near the centre of the field of view as poſſible; for there only it will be exhibited in the greateſt perfection. The eye ſhould be moved up and down from the eye-glaſs, of a compound microſcope, till the ſituation is found where the largeſt field and moſt diſtinct view of the object are to be had: but every perſon ought to adjuſt the microſcope to his own eye, and not to depend upon the ſituation it was placed in by another. A ſmall magnifying power ſhould always be begun with; by which means the obſerver will beſt obtain an exact idea of the ſituation and connexion of the whole; and will of conſequence be leſs liable to form any erroneous opinion when the parts are viewed ſeparately by a lens of greater power. Objects ſhould alſo be examined firſt in their moſt natural poſition: for if this be not attended to, we ſhall be apt to form very inadequate ideas of the ſtructure of the whole, as well as of the connexion and uſe of the parts. A living animal ought to be as little hurt or diſcompoſed as poſſible.

From viewing an object properly, we may acquire a knowledge of its nature: but this cannot be done without an extenſive knowledge of the ſubject, much patience, and many experiments; as in a great number of caſes the images will reſemble each other, though derived from very different ſubſtances. Mr Baker therefore adviſes us not to form an opinion too ſuddenly after viewing a microſcopical object; nor to draw our inferences till after repeated experiments and examinations of the object in many different lights and poſitions; to paſs no judgment upon things extended by force, or contracted by dryneſs, or in any manner out of a natural ſtate, without making ſuitable allowances. The true colour of objects cannot be properly determined by very great magnifiers; for as the pores and interſtices of an object are enlarged according to the magnifying power of the glaſſes made uſe of, the component particles of its ſubſtance will appear ſeparated many thouſand times farther aſunder than they do to the naked eye: hence the reflection of the light from theſe particles will be very different, and exhibit different colours. It is likewiſe ſomewhat difficult to obſerve opaque objects; and as the apertures of the larger magnifiers are but ſmall, they are not proper for the purpoſe. If an object be ſo very opaque, that no light will paſs through it, as much as poſſible muſt be thrown upon the upper ſurface of it. Some conſideration is likewiſe neceſſary in forming a judgment of the motion of living creatures, or even of fluids, when ſeen through the microſcope; for as the moving body, and the ſpace wherein it moves, are magnified, the motion will alſo be increaſed.

2. On the management of the light depends in a great meaſure the diſtinctneſs of the viſion: and as, in order to have this in the greateſt perfection, we muſt adapt the quantity of light to the nature of the object and the focus of the magnifier, it is therefore neceſſary to view it in various degrees of light. In ſome objects, it is difficult to diſtinguiſh between a prominence and a depreſſion, a ſhadow or a black ſtain: or between a reflection of light and whiteneſs, which is particularly obſervable in the eye of the libellula and other flies: all of theſe appearing very different in one poſition from what they do in another. The brightneſs of an object likewiſe depends on the quantity of light, the diſtinctneſs of viſion, and on regulating the quantity to the object; for ſome will be in a manner loſt in a quantity of light ſcarcely ſufficient to render another viſible.

There are various ways in which a ſtrong light may be thrown upon objects; as by means of the ſun and a convex lens. For this purpoſe, the microſcope is to be placed about three feet from a ſouthern window; then take a deep convex lens, mounted on a ſemicircle and ſtand, ſo that its poſition may eaſily be varied: place this lens between the object and the window, ſo that it may collect a conſiderable number of ſolar rays, and refract them on the object or the mirror of the microſcope. If the light thus collected from the ſun be too powerful, it may be leſſened by placing a piece of oiled paper, or a piece of glaſs lightly grayed, between the object and lens. Thus a proper degree of light may be obtained, and diffuſed equally all over the ſurface of an object: a circumſtance which ought to be particularly attended to; for if the light be thrown irregularly upon it, no diſtinct view can be obtained. If we mean to make uſe of the ſolar light, it will be found convenient to darken the room, and to reflect the rays of the ſun on the above-mentioned lens by means of the mirror of a ſolar microſcope fixed to the window-ſhutter: for thus the obſerver will be enabled to preſerve the light on his ſubject, notwithſtanding the motion of the ſun. But by reaſon of this motion, and the variable ſtate of the atmoſphere, ſolar obſervations are rendered both tedious and inconvenient; whence it will be proper for the obſerver to be furniſhed with a large tin lanthorn, formed ſomething like the common magic lanthorn, capable of containing one of Argand's lamps. This, however, ought not to be of the fountain kind, leſt the rarefaction of the air in the lanthorn ſhould force the oil over. There ought to be an aperture in the front of the lanthorn, which may be moved up and down, and be capable of holding a lens; by which means a pleaſant and uniform as well as ſtrong light may eaſily be procured. The lamp ſhould likewiſe move on a rod, ſo that it may be eaſily raiſed or depreſſed. This lanthorn may likewiſe be uſed for many other purpoſes; as viewing of pictures, exhibiting microſcopic objects on a ſcreen, &c. A weak light, however, is beſt for viewing many tranſparent objects: among which we may reckon the prepared eyes of flies, as well as the animalcules in fluids. The quantity of light from a lamp or candle may be leſſened by removing the microſcope to a greater diſtance from them, or by diminiſhing the ſtrength of the light which falls upon the objects. This may very conveniently be done by pieces of black paper with circular apertures of different ſizes, and placing a larger or ſmaller one upon the reflecting mirror, as occaſion may require. There is an oblique ſituation of the mirrors, which makes likewiſe an oblique reflection of the light eaſily diſcovered by practice, (but for which no general rule can be given in theory); and which will exhibit an object more diſtinctly than any other poſition, ſhowing the ſurface, as well as thoſe parts through which the light is tranſmitted. The light of a lamp or candle is generally better for viewing microſcopic objects than day light; it being more eaſy to modify the former than the latter, and to throw it upon the objects with different degrees of denſity.

3. Swammerdam has excelled in the preparation of objects almoſt all other inveſtigators. Neither difficulty nor diſappointment could make him abandon the purſuit of any object until he had obtained a ſatisfactory idea of it. But unhappily the methods he uſed in preparing his objects for the microſcope are now entirely unknown. Boerhaave examined with the ſtricteſt attention all the letters and manuſcripts of Swammerdam which he could find; but his reſearches were far from being ſucceſsful. The following are all the particulars, which have thus come to the knowledge of the public.

For diſſecting *ſmall inſects*, Swammerdam had a braſs table made by S. Muſchenbroeck, to which were affixed two braſs arms moveable at pleaſure to any part of it. The upper part of theſe vertical arms was conſtructed in ſuch a manner as to have a ſlow vertical motion; by which means the operator could readily alter their height as he ſaw convenient. One of theſe arms was to hold the minute objects, and the other to apply the microſcope.

The lenſes of Swammerdam's microſcopes were of various ſizes as well as foci: but all of them the beſt that could be procured, both for the tranſparency of the glaſs and the fineneſs of the workmanſhip. His obſervations were always begun with the ſmalleſt magnifiers, from which he proceeded to the greateſt; but in the uſe of them, he was ſo exceedingly dexterous, that he made every obſervation ſubſervient to that which ſucceeded it, and all of them to the confirmation of each other, and to the completing of the deſcription. His chief art ſeems to have been in conſtructing ſciſſars of an exquiſite fineneſs, and making them very ſharp. Thus he was enabled to cut very minute objects to much more advantage than could be done by knives and lancets; for theſe, though ever ſo ſharp and fine, are apt to diſorder delicate ſubſtances by diſplacing ſome of the filaments, and drawing them after them as they paſs through the bodies; but the ſciſſars cut them all equally. The knives, lancets, and ſtyles he made uſe of in his diſſections, were ſo fine that he could not ſee to ſharpen them without the aſſiſtance of a magnifying glaſs; but with theſe he could diſſect the inteſtines of bees with the ſame accuracy that the beſt anatomiſts can do thoſe of large animals. He made uſe alſo of very ſmall glaſs tubes no thicker than a briſtle, and drawn to a very fine point at one end, but thicker at the other. Theſe were for the purpoſe of blowing up, and thus rendering viſible the ſmalleſt veſſels which could be diſcovered by the microſcope; to trace their courſes and comcomunications, or ſometimes to inject them with coloured liquors.

Swammerdam ſometimes made uſe of ſpirit of wine, water, or oil of turpentine, for ſuffocating the inſects he wiſhed to examine; and would preſerve them for a time in theſe liquids. Thus he kept the parts from putrefying, and gave them beſides ſuch additional ſtrength and firmneſs, as rendered the diſſections much more eaſy than they would otherwiſe have been. Having then divided the body tranſverſely with the ſciſſars, and made what obſervations he could without farther diſſection, he proceeded to extract the inteſtines carefully with very fine inſtruments, to waſh away the fat in the like careful manner; and thus to put the parts into ſuch a ſtate as would beſt expoſe them to view; but theſe operations are beſt performed while the inſects are in their nympha ſtate.

Sometimes the delicate viſcera of the inſects, after having been ſuffocated as above mentioned, were put into water: after which, having ſhaken them gently, he procured an opportunity of examining them, eſpecially the air veſſels, which laſt he could thus ſeparate entire from all the other parts, to the admiration of all who beheld them: as theſe veſſels cannot be diſtinctly ſeen in any other manner, or indeed in any way whatever, without injuring them. Frequently alſo he injected water with a ſyringe to cleanſe the parts thoroughly, after which he blew them up with air and dried them; thus rendering them durable, and fit for examination at a proper opportunity. Sometimes he made very important diſcoveries, by examining inſects which he had preſerved for ſeveral years in balſam. Other inſects he punctured with a very fine needle; and after ſqueezing out all their moiſture through the holes made in this manner, he filled them with air, by means of very ſlender glaſs tubes; then dried them in the ſhade; and laſtly, anointed them with oil of ſpike in which a little roſin had been diſſolved; and by which means they for a long time retained their proper forms. He was likewiſe in poſſeſſion of a ſingular ſecret, by which he could preſerve the limbs of inſects as limber and perſpicuous as ever they had been. He uſed to make a ſmall puncture or inciſion in the tails of worms;

worms; and after having with great caution ſqueezed out all the humours, as well as great part of the viſcera, he injected them with wax in ſuch a manner as to give them the appearance of living creatures in perfect health. He found that the fat of all inſects was entirely diſſolvable in oil of turpentine; by which means he was enabled plainly to diſcern the viſcera; though, after this diſſolution, it was neceſſary to cleanſe and waſh them frequently in clean water. In this manner he would frequently have ſpent whole days in the preparation of a ſingle caterpillar, and cleanſing it from its fat, in order to diſcover the true ſituation of the inſect's heart. He had a ſingular dexterity in ſtripping off the ſkins of caterpillars that were on the point of ſpinning their cones. This was done by letting them drop by their threads into ſcalding water, and then ſuddenly withdrawing them. Thus the epidermis peeled off very eaſily; and, when this was done, he put them into diſtilled vinegar and ſpirit of wine mixed together in equal proportions; which, by giving a due degree of firmneſs to the parts, gave him an opportunity of ſeparating them with very little trouble from the exuviæ, without any danger to the internal parts. Thus the nympha could be ſhown to be wrapped up in the caterpillar and the butterfly in the nympha; and there is little doubt that thoſe who look into the works of Swammerdam, will be amply recompenſed, whether they conſider the unexampled labour or the piety of the author.

M. Lyonet, an eminent naturaliſt, uſually drowned the inſects he deſigned to examine; by which means he was enabled to preſerve both the ſoftneſs and tranſparency of the parts. According to him, the inſect, if very ſmall, viz. one-tenth of an inch, or little more, in length, ſhould be diſſected on a glaſs ſomewhat concave. If it ſhould be ſuſpected that the inſect will putrefy by keeping for a few days, ſpirit of wine diluted with water muſt be ſubſtituted inſtead of pure water. The inſect muſt be ſuffered to dry; after which it may be faſtened by a piece of ſoft wax, and again covered with water.—Larger objects ſhould be placed in a trough of thin wood; and for this purpoſe the bottom of a common chip box will anſwer very well; only ſurrounding the edge of it with ſoft wax, to keep in the water or other fluid employed in preſerving the inſect. The body is then to be opened; and if the parts are ſoft like thoſe of a caterpillar, they ſhoud be turned back, and fixed to the trough by ſmall pins, which ought to be ſet by a ſmall pair of nippers. At the ſame time, the ſkin being ſtretched by another pair of finer forceps, the inſect muſt be put into water, and diſſected therein, occaſionally covering it with ſpirit of wine. Thus the ſubject will be preſerved in perfection, ſo that its parts may be gradually unfolded, no other change being perceived than that the ſoft elaſtic parts become ſtiff and opaque, while ſome others loſe their colour.

The following inſtruments were made uſe of by M. Lyonet in his diſſection of the *Chenille de Saule*. A pair of ſciſſars as ſmall as could be made, with long and fine arms: A pair of forceps, with their ends ſo nicely adjuſted, that they could eaſily lay hold of a ſpider's thread, or a grain of ſand: Two fine ſteel needles fixed in wooden handles, about two inches and three quarters in length; which were the moſt generally uſeful inſtruments he employed.

Dr Hooke, who likewiſe made many microſcopic obſervations, takes notice, that the common ant or piſmire is much more troubleſome to draw than other inſects, as it is extremely difficult to get the body in a quiet natural poſture. If its feet be fettered with wax or glue, while the animal remains alive, it ſo twiſts its body, that there is no poſſibility of gaining a proper view of it; and if it be killed before any obſervation is made, the ſhape is often ſpoiled before it can be examined. The bodies of many minute inſects, when their life is deſtroyed, inſtantly ſhrivel up; and this is obſervable even in plants as well as inſects, the ſurface of theſe ſmall bodies being affected by the leaſt change of air; which is particularly the caſe with the ant. If this creature, however, be dropped into rectified ſpirit of wine, it will inſtantly be killed; and when it is taken out, the ſpirit of wine evaporates, leaving the animal dry, and in its natural poſture, or at leaſt in ſuch a ſtate, that it may eaſily be placed in whatever poſture we pleaſe.

Parts of Inſects. The *wings*, in many inſects, are ſo tranſparent, that they require no previous preparation: but ſome of thoſe that are folded up under *elytra* or caſes, require a conſiderable ſhare of dexterity to unfold them; for theſe wings are naturally endowed with ſuch a ſpring, that they immediately fold themſelves again, unleſs care be taken to prevent them. The wing of the earwig, when expanded, is of a tolerable ſize, yet is folded up under a caſe not one-eighth part of its bulk; and the texture of this wing renders it difficult to be unfolded. This is done with the leaſt trouble immediately after the inſect is killed. Holding then the creature by the thorax, between the finger and the thumb, with a blunt pointed pin endeavour gently to open it, by ſpreading it over the forefinger, and at the ſame time gradually ſliding the thumb over it. When the wing is ſufficiently expanded, ſeparate it from the inſect by a ſharp knife or a pair of ſciſſars. The wing ſhould be preſſed for ſome time between the thumb and finger before it be removed; it ſhould then be placed between two pieces of paper, and again preſſed for at leaſt an hour; after which time, as there will be no danger of its folding up any more, it may be put between the talcs, and applied to the microſcope. Similar care is requiſite in diſplaying the wings of the notonecta and other water inſects, as well as moſt kinds of grylli.

The minute *ſcales* or *feathers*, which cover the wings of moths or butterflies, afford very beautiful objects for the microſcope. Thoſe from one part of the wing frequently differ in ſhape from ſuch as are taken from other parts; and near the thorax, ſhoulder, and on the fringes of the wings, we generally meet with hair inſtead of ſcales. The whole may be bruſhed off the wing, upon a piece of paper, by means of a camel's hair pencil; after which the hairs can be ſeparated with the aſſiſtance of a common magnifying glaſs.

It is likewiſe a matter of conſiderable difficulty to diſſect properly the *proboſcis* of inſects, ſuch as the gnat, tabanus, &c. and the experiment muſt be repeated a great number of times before the ſtructure and ſituation

tuation of the parts can be thoroughly inveſtigated, as the obſerver will frequently diſcover in one what he could not in another. The *collector of the bee*, which forms a very curious object, ought to be firſt carefully waſhed in ſpirit of turpentine ; by which means it will be freed from the unctuous matter adhering to it : when dry, it is again to be waſhed with a camel's hair pencil to diſengage and bring forward the ſmall hairs which form part of this microſcopic beauty. The beſt method of managing the *ſtings* of inſects, which are in danger of being broken by reaſon of their hardneſs, is to ſoak the caſe and the reſt of the apparatus for ſome time in ſpirit of wine or turpentine ; then lay them on a piece of paper, and with a blunt knife draw out the ſting, holding the ſheath with the nail of the finger or any blunt inſtrument ; but great care is neceſſary to preſerve the *feelers*, which when cleaned add much to the beauty of the object. The *beard* of the lepas anatifera is to be ſoaked in clean ſoft water, frequently bruſhing it while wet with a camel's hair pencil : after it is dried, the bruſhing muſt be repeated with a dry pencil to diſengage and ſeparate the hairs, which are apt to adhere together.

To view to advantage the *fat*, *brains*, and other ſimilar ſubſtances, Dr Hooke adviſes to render the ſurface ſmooth, by preſſing it between two plates of thin glaſs, by which means the matter will be rendered much thinner and more tranſparent : without this precaution, it appears confuſed, by reaſon of the parts lying too thick upon one another. For *muſcular fibres*, take a piece of the fleſh, thin and dry ; moiſten it with warm water, and after this is evaporated the veſſels will appear more plain and diſtinct ; and by repeated macerations they appear ſtill more ſo. The *exuviæ* of inſects afford a pleaſing object, and require but little preparation. If bent or curled up, they will become ſo relaxed by being kept a few hours in a moiſt atmoſphere, that you may eaſily extend them to their natural poſitions ; or the ſteam of warm water will anſwer the purpoſe very well.

The *eyes* of inſects in general form very curious and beautiful objects. Thoſe of the libellula and other flies, as well as of the lobſter, &c. muſt firſt be cleaned from the blood, &c. after which they ſhould be ſoaked in water for ſome days : one or two ſkins are then to be ſeparated from the eye, which would be otherwiſe too opaque and confuſed ; but ſome care is requiſite in this operation ; for if the ſkin be rendered too thin, it is impoſſible to form a proper idea of the organization of the part. In ſome ſubſtances, however, the organization is ſuch, that by altering the texture of the part, we deſtroy the objects which we wiſh to obſerve. Of this ſort are the nerves, tendons, muſcular fibres, many of which are viewed to moſt advantage when floating in ſome tranſparent fluid. Thus very few of the muſcular fibres can be diſcovered when we attempt to view them in the open air, though great numbers may be ſeen if they be placed in water or oil. By viewing the thread of a ligament in this manner, we find it compoſed of a vaſt number of ſmooth round threads lying cloſe together. Elaſtic objects ſhould be pulled or ſtretched out while they are under the microſcope, that the texture and nature of thoſe parts, the figure of which is altered by being thus pulled out, may be more fully diſcovered.

Other objects. To examine *bones* by the microſcope, they ſhould firſt be viewed as opaque objects ; but afterwards, by procuring thin ſlices of them, they may be viewed as tranſparent. The ſections ſhould be cut in all directions, and be well waſhed and cleaned ; and in ſome caſes maceration will be uſeful, or the bones may be heated red hot in a clear fire, and then taken out ; by which means the bony cells will appear more conſpicuous. The *pores of the ſkin* may be examined by cutting off a thin ſlice off the upper ſkin with a razor, and then a ſecond from the ſame place ; applying the latter to the microſcope. The lizard, guana, &c. have two ſkins, one very tranſparent, the other thicker and more opaque ; and, ſeparating theſe two, you obtain very beautiful objects.

To view the *ſcales of fiſh* to advantage, they ought to be ſoaked in water for a few days, and then carefully rubbed to clean them from the ſkin and dirt which may adhere to them. The ſcales of the eel are a great curioſity ; and the more ſo, as this creature was not known to have any ſcales till they were diſcovered by the microſcope. The method of diſcovering them is this. Take a piece of the ſkin of an eel from off its ſide, and ſpread it while moiſt on a piece of glaſs, that it may dry very ſmooth : when thus dried, the ſurface will appear all over dimpled or pitted by the ſcales, which lie under a ſort of cuticle or thin ſkin ; which may be raiſed with the ſharp point of a penknife, together with the ſcales, which will then eaſily ſlip out ; and thus we may procure as many as we pleaſe.

The *leaves* of many *trees*, as well as of ſome plants, when diſſected, form a very agreeable object. In order to diſſect them, take a few of the moſt perfect leaves you can find, and place them in a pan with clean water. Let them remain there three weeks, or a month, without changing the water : then take them up ; and if they feel very ſoft, and almoſt rotten, they are ſufficiently ſoaked. They muſt then be laid on a flat board, and holding them by the ſtalk, draw the edge of a knife over the upper ſide of the leaf, which will take off moſt of the ſkin. Then turn the leaf, and do the ſame with the under ſide ; and when the ſkin is taken off on both ſides, waſh out the pulpy matter, and the fibres will be exhibited in a very beautiful manner. The leaf may be ſlit into two parts, by ſplitting the ſtalk ; and the ſkins peeled from the fibres will alſo make a good object. This operation is beſt performed in the autumn ; the fibres of the leaves are much ſtronger at that ſeaſon, and leſs liable to be broken.—The internal ſtructure of ſhells may be obſerved by grinding them down on a hone : and all ores and minerals ſhould be carefully waſhed and bruſhed with a ſmall bruſh, to remove any ſordes that may adhere to them.

To view the *circulation of the blood*, we muſt obſerve living animals of the moſt tranſparent kind.—A ſmall eel is ſometimes uſed for this purpoſe ; in which caſe it muſt be cleanſed from the ſlime naturally adhering to it ; after which it may be put into a tube filled with water, where it can be viewed in a ſatisfactory manner. The tail of any other ſmall fiſh may be viewed in the ſame manner, or put upon a ſlip of flat glaſs, and thus laid before the microſcope. By filling the tube with water when an eel is made uſe of, we prevent in a great meaſure the ſlimineſs of the animal from ſoiling the glaſs.

The particles of the blood form a very curious object, and have been carefully viewed by different philoſophers; who, nevertheleſs, differ from one another very much in their accounts of them. The beſt method of viewing theſe is to take a ſmall drop of blood when warm, and ſpread it as thin as poſſible upon a flat piece of glaſs. By diluting it a little with warm water, ſome of the large globules will be ſeparated from the ſmaller, and many of them ſubdivided; or a ſmall drop of blood may be put into a capillary glaſs tube, and then placed before the microſcope. Mr Baker adviſes warm milk as proper to be mixed with the blood; but Mr Hewſon diluted the blood with its own ſerum: and by this method he could preſerve the ſmall particles entire, and view them diſtinctly; and thus he found that they were not globular, as had been imagined by other anatomiſts, but flat. Having ſhaken a piece of the craſſamentum of the blood in ſerum till the latter became a little coloured, he ſpread it with a ſoft hair pencil on a piece of thin glaſs, which he placed under the microſcope, in ſuch a manner as not to be quite horizontal, but rather higher at one end than the other. Thus the ſerum flows from the higher to the lower part; and, as it flows, ſome of the particles will be found to ſwim on their flat ſides, and will appear to have a dark ſpot in the middle; while others will turn over from one ſide to the other as they roll down the glaſs. Many cruel experiments have been tried in order to obſerve the circulation of the blood in living creatures, and an apparatus had been invented for viewing the circulation in the meſentery of a frog; but as this can anſwer no uſeful purpoſe, and will never be put in practice by perſons of humanity, we forbear to mention it.

II. Beſides the objects for the microſcope already mentioned, there are innumerable others, ſome hardly viſible, and others totally inviſible, to the naked eye; and which therefore, in a more peculiar ſenſe, are denominated

Microſcopic Animals. They are the animalcules or moving bodies in water, in which certain ſubſtances have been infuſed; and of which there are a great many different kinds. Theſe animalcula are ſometimes found in water which we would call *pure*, did not the microſcope diſcover its minute inhabitants; but not equally in all kinds of water, or even in all parts of the ſame kind of it. The ſurfaces of infuſions are generally covered with a ſcum which is eaſily broken, but acquires thickneſs by ſtanding. In this ſcum the greateſt number of animalcules are uſually found. Sometimes it is neceſſary to dilute the infuſions; but this ought always to be done with water, not only diſtilled, but viewed through a microſcope, leſt it ſhould alſo have animalcules in it, and thus prove a ſource of deception. It is, however, moſt proper to obſerve thoſe minute objects after the water is a little evaporated; the attention being leſs diverted by a few objects than when they appear in great number. One or two of the animalcules may be ſeparated from the reſt by placing a ſmall drop of water on the glaſs near that of the infuſion; join them together by making a ſmall connexion between them with a pin; and as ſoon as you perceive that an animalcule has entered the clear drop, cut off the connexion again.

Eels in paſte are obtained by boiling a little flour and water into the conſiſtence of bookbinders paſte; then expoſing it to the air in an open veſſel, and beating it frequently together to keep the ſurface from growing mouldy or hard. In a few days it will be found peopled with myriads of little animals viſible to the naked eye, which are the eels in queſtion. They may be preſerved for a whole year by keeping the paſte moiſtened with water; and while this is done, the motion of the animals will keep the ſurface from growing mouldy. Mr Baker directs a drop or two of vinegar to be put into the paſte now and then. When they are applied to the microſcope, the paſte muſt be diluted in a piece of water for them to ſwim in.

Numberleſs animalcules are obſerved by the microſcope in infuſions of pepper. To make an infuſion for this purpoſe, bruiſe as much common black pepper as will cover the bottom of an open jar, and lay it thereon about half an inch thick: pour as much ſoft water into the veſſel as will riſe about an inch above the pepper. Shake the whole well together: after which they muſt not be ſtirred, but be left expoſed to the air for a few days; in which time a thin pellicle will be formed on the ſurface, in which innumerable animals are to be obſerved by the microſcope.

The microſcopic animals are ſo different from thoſe of the larger kinds, that ſcarce any ſort of analogy ſeems to exiſt between them; and one would almoſt be tempted to think that they lived in conſequence of laws directly oppoſite to thoſe which preſerve ourſelves and other viſible animals in exiſtence. They have been ſyſtematically arranged by O. F. Muller; though it is by no means probable that all the different claſſes have yet been diſcovered. Such as have been obſerved, however, are by this author divided in the following manner:

I. *Such as have no external organs.*

1. Monas: Punctiforme. A mere point.
2. Proteus: Mutabilis. Mutable.
3. Volvox: Sphæricum. Spherical.
4. Enchelis: Cylindracea. Cylindrical.
5. Vibrio: Elongatum. Long.

* Membranaceous.

6. Cyclidium: Ovale. Oval.
7. Paramecium: Oblongum. Oblong.
8. Kolpoda: Sinuatum. Sinuous.
9. Gonium: Angulatum. With angles.
10. Burſaria. Hollow like a purſe.

II. *Thoſe that have external organs.*

* Naked, or not encloſed in a ſhell.

1. Cercaria: Caudatum. With a tail.
2. Trichoda: Crinitum. Hairy.
3. Kerona: Corniculatum. With horns.
4. Himantopus: Cirratum. Cirrated.
5. Leucophra: Ciliatum undique. Every part ciliated.
6. Vorticella: Ciliatum apice. The apex ciliated.

* Covered with a ſhell.

7. Brachionus: Ciliatum apice. The apex ciliated.

In the treatiſe on HELMINTHOLOGY under the fifth order of the claſs vermes, viz. *Infuſoria*, the genera here enumerated have already been noticed according to an arrangement ſomewhat different, and a few of the ſpecies have been deſcribed. For the ſake of thoſe who wiſh to proſecute microſcopical inquiries we ſhall introduce deſcriptions of a few more, and particularly thoſe whoſe habitats are known.

I. *Monas*.

This is by our author defined to be "an inviſible (to the naked eye), pellucid, ſimple, punctiform worm;" but of which, ſmall as it is, there are ſeveral ſpecies.

The *monas termo* or *gelatinoſa*, is a ſmall jelly-like point, which can be but imperfectly ſeen by the ſingle microſcope, and not at all by the compound one. In a full light they totally diſappear, by reaſon of their tranſparency. Some infuſions are ſo full of them that ſcarce the leaſt empty ſpace can be perceived; the water itſelf appearing compoſed of innumerable globular points, in which a motion may be perceived ſomewhat ſimilar to that which is obſerved when the ſun's rays ſhine on the water; the whole multitude of animals appearing in commotion like a hive of bees. This animal is very common in ditch-water, and in almoſt all infuſions either of animal or vegetable ſubſtances.

Monas atomus or *albida*; white monas with a variable point. This appears like a white point, which through a high magnifier appears ſomewhat egg-ſhaped. The ſmaller end is generally marked with a black point, the ſituation of which is variable; ſometimes it appears on the large end, and ſometimes there are two black ſpots in the middle. This ſpecies was found in ſea water, which had been kept through the whole winter, but was not very fetid. No other kind of animalcule was found in it.

II. *The Proteus*.

An inviſible, very ſimple, pellucid worm, of a variable form.

The *tenax*, running out into a fine point. This is a pellucid gelatinous body, ſtored with black molecules, and likewiſe changing its figure, but in a more regular order than the former. It firſt extends itſelf in a ſtraight line, the lower part terminating in a bright acute point. It appears to have no inteſtines; and when the globules are all collected in the upper part, it next draws the pointed end up toward the middle of the body, which aſſumes a round form. It goes through a number of different ſhapes, part of which are deſcribed under the article ANIMALCULE. It is found in ſome kinds of river water, and appears confined almoſt entirely to one place, only bending ſidewiſe.

III. *Volvox*.

An inviſible, very ſimple, pellucid, ſpherical worm.

The *punctum*; of a black colour, with a lucid point. This is a ſmall globule, with one hemiſphere opaque and black, the other having a cryſtalline appearance; and a vehement motion is obſerved in the black part. It moves as on an axis, frequently paſſing through the drop in this manner. Many are often ſeen joined together in their paſſage through the water; ſometimes moving as in a little whirlpool, and then ſeparating. They are found in great numbers on the ſurface of fetid ſea water.

The *globulus*, with the hinder part ſomewhat obſcure, ſometimes verges a little towards the oval in its ſhape, having a ſlow fluttering kind of motion, but more quick when diſturbed. The inteſtines are but juſt viſible. It is found in moſt vegetable infuſions, and is ten times larger than the monas lens.

The *lunula*, with lunular molecules, is a ſmall roundiſh tranſparent body, conſiſting of an innumerable multitude of homogeneous molecules of the ſhape of a creſcent, without any common margin. It moves continually in a twofold manner, viz. of the molecules among one another, and the whole maſs turning ſlowly round. It is found in marſhy places in the beginning of ſpring.

IV. *Enchelis*.

A ſimple, inviſible, cylindric worm.

The *viridis*, or green enchelis, has an obtuſe tail, the fore part terminating in an acute truncated angle; the inteſtines are obſcure and indiſtinct. It continually varies its motion, turning from right to left.

The *punctifera*, having the fore part obtuſe, the hinder part pointed. It is opaque, and of a green colour, with a ſmall pellucid ſpot in the fore part, in which two black points may be ſeen; and a kind of double band croſſes the middle of the body. The hinder part is pellucid and pointed, with an inciſion ſuppoſed to be the mouth, at the apex of the fore part. It is found in marſhes.

The *pupula*, with the fore part papillary, is found in dunghill water in November and December: it has a rotatory motion on a longitudinal axis, and moves in an oblique direction through the water. Both ends are obtuſe; and the hinder part is marked with a tranſparent circle, or circular aperture.

V. *Vibrio*.

A very ſimple, inviſible, round, and rather long worm.

The *lineola* is found in moſt vegetable infuſions in ſuch numbers, that it ſeems to fill up almoſt the whole of their ſubſtance. It is ſo ſmall, that with the beſt magnifiers we can diſcern little more than an obſcure tremulous motion among them. It is more ſlender than the monas terma.

The *ſerpens*, with obtuſe windings or flexures, is found in river water, but ſeldom. It is ſlender and gelatinous, reſembling a ſerpentine line, with an inteſtine down the middle.

The *ſpirillum* is exceedingly minute, and twiſted in a ſpiral form, which ſeems to be its natural ſhape as it never untwiſts itſelf, but moves forward in a ſtraight line, vibrating the hind and fore parts. It was found in 1782 in an infuſion of the ſonchus arvenſis.

The *vermiculus* has a milky appearance, with an obtuſe apex, and a languid undulatory motion, like that of the common worm. It is found in marſhy water in November,

November, but ſeldom. It is thought to be the animal mentioned by Leeuwenhoeck as found in the dung of the frog and ſpawn of the male libellula.

The *ſagitta*, with a ſetaceous tail, has a long and flexible body; broadeſt about the middle, and filled there alſo with gray molecules; the fore part being drawn out into a thin and tranſparent neck, and the upper end thick and black. It is found in ſalt water, and ſeems to move by contracting and extending its neck.

VI. *Cyclidium.*

A ſimple, inviſible, flat, pellucid, orbicular or oval worm.

The *bulla*, or orbicular bright cyclidium. This is found occaſionally in an infuſion of hay. It is very pellucid and white, but the edges ſomewhat darker than the reſt. It moves ſlowly, and in a ſemicircular direction.

The *millium* is very pellucid, and ſplendid like cryſtal; and of an elliptical figure, with a line through the whole length of it. The motion is ſwift, interrupted, and fluttering.

VII. *Paramæcium.*

An inviſible, membranaceous, flat, and pellucid worm.

The *chryſalis* is found in ſalt water, and differs very little from the former, only the ends are more obtuſe, and the margins are filled with black globules.

The *verſutum* is found in ditches, and has an oblong, green, and gelatinous body, filled with molecules; the lower part thicker than the other; and both ends obtuſe. It propagates by diviſion.

VIII. *Kolpoda.*

An inviſible, pellucid, flat, and crooked worm.

The *lamella* is very ſeldom met with. It reſembles a long, narrow, and pellucid membrane, with the hind part obtuſe, narrower, and curved towards the top. It has a vacillatory and very ſingular motion; going upon the ſharp edge, not on the flat ſide as is uſual with microſcopic animals.

The *gallinula* is found in fetid ſalt water; and has the apex ſomewhat bent, the belly oval, convex, and ſtriated.

The *roſtrum* is found, though ſeldom, in water where the lemna grows; and has a ſlow and horizontal motion. The fore part is bent into a kind of hook; the hind part obtuſe, and quite filled with black molecules.

The *triquetra* was found in ſalt water, and appears to conſiſt of two membranes; the upper ſide flattened, the lower convex, with the apex bent into a kind of ſhoulder.

The *aſſimilis* is found on the ſea-coaſt, and has an elliptic maſs in the middle, but is not folded like the former. The margin of the fore part is notched from the top to the middle; the lower part ſwells out, and contracts again into a ſmall point.

The *cucullulus* is found in an infuſion of the ſonchus arvenſis. It is very pellucid and cryſtalline, with ſeveral globules, and has an oblique inciſion a little below the apex.

The *ren*, or *craſſa*, is found in an infuſion of hay, commonly about 13 hours after the infuſion is made, and has a quick and vacillatory motion. Its body is yellow, thick, and ſomewhat opaque; curved a little in the middle, ſo that it reſembles a kidney; and full of molecules. When the water in which it ſwims is about to fail, it takes an oval form, is compreſſed, and at laſt burſts.

IX. *Gonium.*

An inviſible, ſimple, ſmooth, and angular worm.

The *pulvinatum* is found in dunghills; and appears like a little quadrangular membrane, plain on both ſides; but with a large magnifier it appears like a bolſter formed of three or four cylindric pillows ſunk here and there.

The *corrugatum* is found in various kinds of infuſions; and is ſomewhat of a ſquare ſhape, very ſmall, and in ſome poſitions appears as ſtreaked.

The *truncatum* is found chiefly in pure water, and then but ſeldom. It has a languid motion, and is much larger than the foregoing. The fore part is a ſtraight line, with which the ſides form obtuſe angles, the end of the ſides being united by a curved line. The internal molecules are of a dark green, and there are two little bright veſicles in the middle.

X. *Burſaria.*

A very ſimple, hollow, membranaceous worm.

The *truncatella* is viſible to the naked eye; white, oval, and truncated at the top, where there is a large aperture deſcending towards the baſe. Moſt of them have four or five yellow eggs, at the bottom. They move from left to right, and from right to left; aſcending to the ſurface in a ſtraight line, and ſometimes rolling about while they deſcend.

The *bullina* is pellucid and cryſtalline, having ſplendid globules of different ſizes ſwimming about with it. The under ſide is convex, the upper hollow, with the fore part forming a kind of lip.

The *hirundinella* has two ſmall projecting wings, which give it ſomewhat of the appearance of a bird: and it moves ſomething like a ſwallow. It is inviſible to the naked eye; but by the microſcope appears a pellucid hollow membrane.

The *duplella* was found among duckweed, and appears like a cryſtalline membrane folded up, without any viſible inteſtines except a ſmall congeries of points under one of the folds.

XI. *Cercaria.*

An inviſible tranſparent worm with a tail.

The *gyrinus* greatly reſembles the ſpermatic animalcules. It has a white gelatinous body; the fore part ſomewhat globular; the hind part round, long, and pointed. Sometimes it appears a little compreſſed on each ſide. When ſwimming it keeps its tail in continual vibration like a tadpole.

The *gibba* is found in the infuſions of hay and other vegetables;

vegetables; and is ſmall, opaque, gelatinous, white, and without any viſible inteſtines.

The *inquieta* is found in ſalt water, and is remarkable for changing the ſhape of its body: ſometimes it appears ſpherical, ſometimes like a long cylinder, and ſometimes oval. It is white and gelatinous, the tail filiform and flexible, the upper part vibrating violently. A pellucid globule may be obſerved at the baſe, and two very ſmall black points near the top.

The *turbo*, with a tail like a briſtle, is found among duckweed. It is of a talcy appearance, partly oval and partly ſpherical; and ſeems to be compoſed of two globular bodies, the lowermoſt of which is the ſmalleſt, and it has two little black points like eyes on the upper part. The tail is ſometimes ſtraight, ſometimes turned back on the body.

The *poduria* is found in November and December, in marſhy places covered with lemna. It is pellucid; and ſeems to conſiſt of a head, trunk, and tail: the head reſembles that of a herring; the trunk is ventricoſe and full of inteſtines, of a ſpiral form and black colour. The tail moſt commonly appears to be divided into two briſtles. The inteſtines are in a continual motion when the body moves, and by reaſon of their various ſhades make it appear very rough. There are likewiſe ſome hairs to be perceived. It turns round as upon an axis when it moves.

The *viridis* is found in the ſpring in ditches of ſtanding water; and in ſome of its ſtates has a conſiderable reſemblance to the laſt, but has a much greater power of changing its ſhape. It is naturally cylindrical, the lower end ſharp, and divided into two parts; but ſometimes contracts the head and tail ſo as to aſſume a ſpherical figure.

The *ſetifera* is found in ſalt water, but ſeldom. It is ſmall, the body rather opaque, and of a round figure. The upper part is bright, and ſmaller than the reſt: the trunk is more opaque; the tail ſharp, and near it a little row of ſhort hairs. It has a ſlow rotatory motion.

The *hirta* was likewiſe found in ſalt water. It is opaque and cylindrical; and when in motion, the body appears to be ſurrounded with rows of ſmall hairs ſeparated from each other.

The *pleuronectes* is found in water which has been kept for ſeveral months. It is membranaceous, roundiſh, and white, with two blackiſh points in the fore part, the hinder part being furniſhed with a ſlender ſharp tail. It has orbicular inteſtines of different ſizes in the middle; the larger of them bright. The motion is vacillatory; and in ſwimming it keeps one edge of the lateral membrane upwards, the other folded down.

The *trinos* is flat, pellucid, triangular, having each angle of the baſe or fore part bent down into two linear arms, the apex of the triangle prolonged into a tail. It is found in ſalt water.

XII. *Leucophra*.

An inviſible, pellucid, and ciliated worm.

The *mamilla* is of a dark colour, and filled with globular molecules; ſhort hairs are curved inwards; and it occaſionally projects and draws in a little white protuberance. It is pretty common in marſhy water.

The *vireſcens* is a large, pear-ſhaped, greeniſh-coloured animalcule, filled with opaque molecules, and covered with ſhort hairs; generally moving in a ſtraight line. It is found in ſalt water.

The *burſata* is found in ſalt water, and is ſimilar in many reſpects to the former. It is of a long oval ſhape, bulging in the middle, and filled with green molecules, everywhere ciliated except at the apex, which is truncated and ſhaped ſomewhat like a purſe; the hairs are ſometimes collected into little faſcicles.

The *poſthuma* is globular, and covered as it were with a pellucid net; is found in fetid ſalt water.

The *ſignata* is common in ſalt water in the months of November and December It is oblong and ſubdepreſſed, with a black margin filled with little molecules, but more particularly diſtinguiſhed by a curved line in the middle ſomewhat in the ſhape of the letter S; one end of which is ſometimes bent into the form of a ſmall ſpiral.

XIII. *Trichoda*.

An inviſible, pellucid, hairy worm.

The *gyrinus* is one of the ſmalleſt of this genus, and is found in ſalt water. It is ſmooth and free from hairs, except at the fore part, where there are a few.

The *nigra* was found in ſalt water, and has an opaque body; but when at reſt one ſide appears pellucid. When in violent motion, it ſeems entirely black.

The *pubes* is found in water where duckweed grows, chiefly in the month of December. It has a bunch above the hind part marked with black ſpots, depreſſed towards the top, a little folded, and ſomewhat convex on the under part. The apex is furniſhed with hairs, but they are ſeldom viſible till the creature is in the agonies of death, when it extends and moves them vehemently, and attempting as it were to draw in the very laſt drop of water.

The *patens* is found in ſalt water; and is of a long cylindrical ſhape, filled with molecules, the fore part bright and clear, with a long opening near the top which tapers to a point, and is beſet with hairs.

The *ſtriata* is found in the month of December in river water. It is a beautiful animalcule, of a fox colour. It is of an oblong ſhape, the lower end ſomewhat larger than the other. It has a ſet of ſtreaks running from one end to the other, and at the abdomen a double row of little eggs lying in a tranſverſe direction.

The *uvula* is found in the infuſion of hay and other vegetables. It is ſix times longer than broad, round, flexuous, of an equal ſize, the greater part filled with obſcure molecules; the fore part rather empty, with an alimentary canal and lucid globules near the middle. The margin of the fore part is covered with ſhort hairs.

The *linter* is found in an infuſion of old graſs. It is egg-ſhaped, oblong, with both extremities raiſed ſo that the bottom becomes convex, and the upper part depreſſed like a boat: it is of different ſhapes at different ages, and ſometimes has a rotatory motion.

The *paxillus* is found in ſalt water; and is long, full of gray molecules; the fore part truncated and hairy, and rather ſmaller than the other.

The *vermicularis* is found in river water; and is pellucid

Microſcope.

lucid in the fore part, with the hind part full of molecules.

The *melitæa* is found in ſalt water, but very rarely. It is oblong, ciliated, with a globular apex, a dilatable neck, and a kind of periſtaltic motion perceivable within it.

The *perillum* is frequently found in marſhes. It is cylindrical, pellucid, muſcular, and capable of being folded up. It appears double; the interior part full of molecules, with an orbicular muſcular appendage, which it can open and ſhut, and which forms the mouth. The external part is membranaceous, pellucid, dilated, and marked with tranſverſe ſtreaks; and it can protrude or draw in the orbicular membrane at pleaſure. Some have four articulations in the tail, others five; and it has two pairs of briſtles, one placed at the ſecond joint, the other at the laſt.

The *delphis* is found in river water. It is ſmooth, pellucid, having the fore part dilated into a ſemicircle, gradually decreaſing in breadth towards the tail. The front is hairy, the hairs ſtanding as rays from the ſemicircular edge: one of the edges is ſometimes contracted.

The *delphinus* is found in hay that has been infuſed for ſome months. It is pellucid, ſmooth, and egg-ſhaped; the hinder part terminating in a tail about half the length of the body, dilated at the upper end, truncated, and always bent upwards. It moves ſometimes on its belly and ſometimes on its ſide.

The *roſtrata* is found in water where duckweed has been kept. It is depreſſed, capable of changing its ſhape, yellow, with long ciliated hairs; it has four feet tapering to a point, one of them longer than the reſt. Both feet and hairs are within the margin. The ſhape of the body is generally triangular; the apex formed into an obtuſe beak, which the creature ſometimes draws in ſo that it appears quite round.

The *charon* was found in ſalt water. It is oval, and reſembles a boat as well in its motion as ſhape; the upper part is hollowed, the under part furrowed and convex; the ſtern round, with ſeveral hairs proceeding from it.

XIV. *Kerona.*

An inviſible worm with horns.

The *raſtellum* is found in river water. It has three rows of horns on the back, which occupy almoſt the whole of it.

The *cypris* is found in water covered with lemna. It is ſomewhat of a pear ſhape, compreſſed, with a broad and blunt fore part; the front furniſhed with hairs, or little vibrating points inſerted under the edge, ſhorter in the hind part, partly extended ſtraight, and partly bent down, having a retrograde motion.

The *calvitium* is found in the infuſion of vegetables. The body is broad and flat, both ſides obtuſe, filled with black molecules, and there is a black ſpot near the hinder part, where there are likewiſe a few ſhort briſtles.

The *puſtulata* is found in ſalt water. It is oval, convex; one edge of the hinder part ſinuated, both ends ſet with hairs, and ſome horns on the fore part.

Microſcope.

XV. *Himantopus.*

A pellucid, inviſible, and cirrated worm.

The *acarus* is lively, conical, ventricoſe, full of black molecules, with a bright and tranſparent fore part. The lower part of the apex has rows of long hairs on the under part ſet like rays. Four locks of long crooked hair or feet proceed from the belly, and it is continually moving theſe and other hairs in various directions.

The *ludio* is a lively diverting animalcule, ſmooth, pellucid, full of ſmall points, the fore part clubbed and a little bent, the hinder part narrow; the baſe obliquely truncated, and terminating in a tail ſtretched out tranſverſely. The top of the head and middle of the back are furniſhed with long and vibrating hairs; three moveable and flexible curls hang down from the ſide of the head at a diſtance from each other. When the creature is at reſt, its tail is curled; but when in motion, it is drawn tight and extended upwards.

The *ſannio* is found, though ſeldom, in water where the lemna grows. The cilia are longer than the hairs, and are continually vibrating: it has two moveable curls hanging on the ſide of the head.

The *charon* is found in ſea water, but rarely. It is oval, pellucid, and membranous, with longitudinal furrows and ſeveral bent diverging rows of hair below the middle, but none on the hinder part.

XVI. *Vorticella.*

A naked worm with rotatory cilia, capable of contracting and extending itſelf.

The *lunifera*, is found in ſalt water; has the fore part obtuſe, the baſe broad, and hollowed away like a creſcent, with a ſhort protuberance in the middle of the concave part: the fore part is ciliated.

The *burſata* is found in ſalt water, and is ventricoſe, crammed with molecules; the fore part truncated, and both ſides of it pellucid: there is a prominent papilla in the middle, which when the animalcule is at reſt appears notched, the edge of the aperture being ciliated; the hairs are capable of moving in various directions.

The *ſputarium* is found in October, with the leſſer lemna, and is one of the moſt ſingular of the microſcopic animalcules. When viewed ſidewiſe, it is ſometimes nearly cylindrical, only tapering a little towards the hinder part, and having a broad pellucid edge. Viewed from the top, it has ſometimes a broad face or diſk, furniſhed with radiating hairs, the under part contracted into a globular ſhape, of a dark green colour, and filled with ſmall grains.

The *multiformis* is found in ſalt water, and very much reſembles the former.

The *nigra* is found in Auguſt in meadows covered with water. It may be ſeen with the naked eye, appearing like a black point ſwimming on the ſurface. Through the microſcope it appears as a ſmall conical body, obtuſe and ventricoſe at one end, and acute at the other. When the extremities are extended, two ſmall white hooks become viſible, by the aſſiſtance of which

which it moves in the water, and it probably has a rotatory organ: it moves continually in a vacillating manner on the top of the water.

The *ocreata* is met with in rivers, though very ſeldom, and in ſhape ſomewhat reſembles the lower part of a boot. The apex of the upper part is truncated and ciliated, the heel pointed, and the foot round.

The *valga* is as broad as long, and the apex truncated and ciliated; both angles of the baſe projecting outwards, one ſomewhat like a wart, the other like a finger. It is found in marſhy waters.

The *papillaris* is likewiſe found in marſhes where the conſerva nitida grows. It is ventricoſe; the fore part truncated, with a papillary tail, and a beautiful papillary excreſcence on the ſide.

The *cratægaria* is found in the month of April, both in the mud and on the tail of the monoculus quadricornis. They are generally heaped together in a ſpherical form, and united to one common ſtalk. They are likewiſe often to be found without a pedicle, the body rather contracted, the aperture circular, and ſurrounded with a marked margin. It has two ſmall arms; and with a powerful magnifier a violent rotatory motion may be obſerved. Sometimes an individual will ſeparate from the community, and move in a kind of ſpiral line for a little time, and then go back to the reſt.

The *rotatoria* is the *wheel animal* deſcribed by Mr Baker; and of which an account is given under the article ANIMALCULE.

The *furcata* is commonly found in water, and has a cylindric body with a rotatory organ, conſiſting of a row of hairs at the apex: the tail is divided into two parts, turning a little inwards. When at reſt it joins the ſegments of the tail, but opens them when in motion.

The *citrina* is found in ſtagnant water; the head full of molecules, round, everywhere of an equal ſize, and very tranſparent. Both ſides of the orifice are ciliated, and each has a rotatory motion appearing ſometimes without and ſometimes within the edge of the mouth.

The *convallaria* is the ſame with the *bell-animal* mentioned by Mr Baker. See the article ANIMALCULE.

The *acinoſa* inhabits that whitiſh ſubſtance which often entirely covers plants, wood, ſhells, &c. When this ſubſtance is examined by a microſcope, it appears to be wholly compoſed of living animals of the polype kind. See POLYPE.

The *pyraria*.
The *anaſtatica*. } See the article POLYPE.
The *digitalis*.

XVII. *Brachionus*.

A contractile worm, covered with a ſhell, and furniſhed with rotatory cilia.

The *patella* is found in marſhy water in the wintertime. It is univalve, the ſhell oval, plain, cryſtalline, with the anterior part terminating in two acute points on both ſides, though the intervening ſpace is commonly filled up with the head of the animal. By theſe points it faſtens itſelf, and whirls about the body erect. The rotatory cilia are perceived with great difficulty.

To what has been already ſaid on this ſubject, under the article ANIMALCULE, we ſhall here add the following obſervations from Mr Adams.—"How many kinds of theſe inviſibles there may be (ſays he), is yet unknown; as they are diſcerned of all ſizes, from thoſe which are barely inviſible to the naked eye, to ſuch as reſiſt the force of the microſcope as the fixed ſtars do that of the teleſcope, and with the greateſt powers hitherto invented appear only as ſo many moving points. The ſmalleſt living creatures our inſtruments can ſhow, are thoſe which inhabit the waters; for though animalcula equally minute may fly in the air, or creep upon the earth, it is ſcarcely poſſible to get a view of them; but as water is tranſparent, by confining the creatures within it we can eaſily obſerve them by applying a drop of it to the glaſſes.

"Animalcules in general are obſerved to move in all directions with equal eaſe and rapidity, ſometimes obliquely, ſometimes ſtraight forward; ſometimes moving in a circular direction, or rolling upon one another, running backwards and forwards through the whole extent of the drop, as if diverting themſelves; at other times greedily attacking the little parcels of matter they meet with. Notwithſtanding their extreme minuteneſs, they know how to avoid obſtacles, or to prevent any interference with one another in their motions: ſometimes they will ſuddenly change the direction in which they move, and take an oppoſite one; and, by inclining the glaſs on which the drop of water is, as it can be made to move in any direction, ſo the animalcules appear to move as eaſily againſt the ſtream as with it. When the water begins to evaporate, they flock towards the place where the fluid is, and ſhow a great anxiety and uncommon agitation of the organs with which they draw in the water. Theſe motions grow languid as the water fails, and at laſt ceaſe altogether, without a poſſibility of renewal if they be left dry for a ſhort time. They ſuſtain a great degree of cold as well as inſects, and will periſh in much the ſame degree of heat that deſtroys inſects. Some animalcules are produced in water at the freezing point, and ſome inſects live in ſnow.—By mixing the leaſt drop of urine with the water in which they ſwim, they inſtantly fall into convulſions and die.

"The ſame rule ſeems to hold good in thoſe minute creatures, which is obſervable in the larger animals, viz. that the larger kinds are leſs numerous than ſuch as are ſmaller, while the ſmalleſt of all are found in ſuch multitudes, that there ſeem to be myriads for one of the others. They increaſe in ſize, like other animals, from their birth until they have attained their full growth; and when deprived of proper nouriſhment, they in like manner grow thin and periſh."

The modes of propagation among theſe animalcules are various, and the obſervation of them is extremely curious. Some multiply by a tranſverſe diviſion, as is obſerved under the article ANIMALCULE: and it is remarkable, that though in general they avoid one another, it is not uncommon, when one is nearly divided, to ſee another puſh itſelf upon the ſmall neck which joins the two bodies in order to accelerate the ſeparation.—Others, when about to multiply, fix themſelves to the bottom of the water; then becoming firſt oblong, and afterwards round, turn rapidly as on a centre, but perpetually varying the direction of their rotatory motion.

Microſcope.

motion. In a little time, two lines forming a croſs are perceived; after which the ſpherule divides into four, which grow, and are again divided as before. A third kind multiply by a longitudinal diviſion, which in ſome begins in the fore part, in others in the hind part; and from others a ſmall fragment detaches itſelf, which in a ſhort time aſſumes the ſhape of the parent animalcule. Laſtly, others propagate in the ſame manner as the more perfect animals.

In our obſervations under the article ANIMALCULE, we ſuggeſted ſome doubts whether all thoſe minute bodies which go under the name of *animalcules* really do enjoy animal life; or whether they are not in many caſes to be accounted only inanimate and exceedingly minute points of matter actuated by the internal motion of the fluid. This has alſo been the opinion of others: but to all hypotheſes of this kind Mr Adams makes the following reply: "From what has been ſaid, it clearly appears, that their motions are not purely mechanical, but are produced by an internal ſpontaneous principle; and that they muſt therefore be placed among the claſs of living animals, for they poſſeſs the ſtrongeſt marks and the moſt decided characters of animation; and, conſequently, that there is no foundation for the ſuppoſition of a chaotic and neutral kingdom, which can only have derived its origin from a very tranſient and ſuperficial view of theſe animalcules.—It may alſo be further obſerved, that as we ſee that the motions of the limbs, &c. of the larger animals, are produced by the mechanical conſtruction of the body, and the action of the ſoul thereon, and are forced by the ocular demonſtration which ariſes from anatomical diſſection to acknowledge this mechaniſm which is adapted to produce the various motions neceſſary to the animal; and as, when we have recourſe to the microſcope, we find thoſe pieces which had appeared to the naked eye as the primary mechanical cauſes of particular motions, to conſiſt themſelves of leſſer parts, which are the cauſes of motion, extenſion, &c. in the larger; when the ſtructure therefore can be traced no farther by the eye, or by the glaſſes, we have no right to conclude that the parts which are inviſible are not equally the ſubject of mechaniſm: for this would be only to aſſert, in other words, that a thing may exiſt becauſe we ſee and feel it, and have no exiſtence when it is not the object of our ſenſes.—The ſame train of reaſoning may be applied to microſcopic inſects and animalcula: we ſee them move; but becauſe the muſcles and members which occaſion theſe motions are inviſible, ſhall we infer that they have not muſcles, with organs appropriated to the motion of the whole and its parts? To ſay that they exiſt not becauſe we cannot perceive them, would not be a rational concluſion. Our ſenſes are indeed given us that we may comprehend ſome effects; but then we have alſo a mind, with reaſon, beſtowed upon us, that, from the things which we do perceive with our ſenſes, we may deduce the nature of thoſe cauſes and effects which are imperceptible to the corporeal eye."

Leaving theſe ſpeculations, however, we ſhall now proceed to give a particular

Explanation of the figures of the various animals, with their parts, ova, &c. repreſented in the plates.

Plate CCCXLII. fig. 32. 33.

Fig. 32. 33. repreſent the eggs of the phalæna neuſtria, as they are taken from the tree to which they adhere, and magnified by the microſcope. The ſtrong ground-work viſible in many places ſhows the gum by which they are faſtened together; and this connexion is ſtrengthened by a very tenacious ſubſtance interpoſed between the eggs, and filling up the vacant ſpaces. Fig. 34. ſhows a vertical ſection of the eggs, exhibiting their oval ſhape.—Fig. 35. is an horizontal ſection through the middle of the egg. Theſe eggs make a beautiful appearance through the microſcope. The ſmall figures *a*, *b*, *c*, repreſent the objects in their natural ſtate, without being magnified.

Microſcope.

Fig. 34.

Fig. 35.

Fig. 36.

Fig. 36. ſhows the larva of the *muſca chameleon*, an aquatic inſect. When viewed by the naked eye, it appears (as here repreſented) to be compoſed of twelve annular diviſions, ſeparating it into an head, thorax, and abdomen; but it is not eaſy to diſtinguiſh the two laſt parts from each other, as the inteſtines lie equally both in the thorax and abdomen. The tail is furniſhed with a fine crown or circle of hair *b*, diſpoſed in the form of a ring, and by this means it is ſupported on the ſurface of the water, the head and body hanging down towards the bottom, in which poſture it will ſometimes remain for a conſiderable time without any motion.—When it has a mind to ſink to the bottom, it cloſes the hairs of the ring, as in fig. 37. Thus an hollow ſpace is formed, including a ſmall bubble of air; by enlarging or diminiſhing which, it can riſe or ſink in the water at pleaſure. When the bubble eſcapes, the inſect can replace it from the pulmonary tubes, and ſometimes conſiderable quantities of air may be ſeen to eſcape from the tail of the worm into the common atmoſphere; which operation may eaſily be obſerved when the worm is placed in a glaſs of water, and affords an entertaining ſpectacle. The ſnout of this inſect is divided into three parts, of which that in the middle is immoveable; the other two, which grow from the ſides of the middle one, are moveable, and vibrate like the tongues of lizards or ſerpents. In theſe lateral parts lies moſt of the creature's ſtrength; for it walks upon them when out of the water, appearing to walk on its mouth, and to uſe it as the parrot does its beak to aſſiſt it in climbing.

Fig. 37.

Fig. 38.

The larva is ſhown, fig. 38. as it appears through a microſcope. It grows narrower towards the head, is largeſt about that part which we may call the thorax, converges all along the abdomen, and terminates at length in a ſharp tail ſurrounded with hairs, as has already been mentioned. The twelve annular diviſions are now extremely viſible, and are marked by numbers in the plate. The ſkin appears ſomewhat hard, and reſembling ſhagreen, being thick ſet with grains pretty equally diſtributed. It has nine holes, or ſpiracula, probably for the purpoſe of breathing, on each ſide; but it has none of theſe on the tail diviſion *a*, nor any eaſily viſible on the third from the head. In the latter, indeed, it has ſome very ſmall holes concealed under the ſkin, near the place where the embryo wings of the future fly are hid. "It is remarkable (ſays Mr Adams) that caterpillars, in general, have two rings without theſe ſpiracula, perhaps becauſe they change into flies with four wings, whereas this worm produces a fly with only two." The ſkin of the larva is adorned with oblong black furrows, ſpots of a light colour, and orbicular rings, from which there generally ſprings a hair; but only thoſe hairs which grow on the inſect's ſides are repreſented in the figure. There are alſo ſome larger hairs here and there, as at *c c*. The difference of colour, however, in this worm ariſes only from the quantity of grains in the ſame ſpace; for where they are in very great numbers, the furrows are darker, and paler where they are leſs plentiful.

The head *d* is divided into three parts, and covered with a ſkin which has hardly any diſcernible grains.—The eyes are rather protuberant, and lie near the ſnout; on which laſt are two ſmall horns at *i i*. It is crooked and ends in a ſharp point as at *f*. The legs are placed near the ſnout between the ſinuſes in which the eyes are fixed. Each of theſe legs conſiſts of three joints, the outermoſt of which is covered with ſtiff hairs like briſtles *g g*. From the next joint there ſprings a horny bone *h h*, uſed by the inſect as a kind of thumb: the joint is alſo compoſed of a black ſubſtance of an intermediate hardneſs between bone and horn; and the third joint is of the ſame nature. In order to diſtinguiſh theſe parts, thoſe that form the upper ſides of the mouth and eyes muſt be ſeparated by means of a ſmall knife; after which, by the aſſiſtance of the microſcope, we may perceive that the leg is articulated by ſome particular ligaments, with the portion of the inſect's mouth which anſwers to the lower jaw in the human frame. We may then alſo diſcern the muſcles which ſerve to move the legs, and draw them up into a cavity that lies between the ſnout and thoſe parts of the mouth which are near the horns *i i*. The inſect walks upon theſe legs, not only in the water, but on the land alſo. It likewiſe makes uſe of them in ſwimming, keeping its tail on the ſurface contiguous to the air, and hanging downward with the reſt of the body in the water. In this ſituation, the only perceptible motion it has is in its legs, which it moves in a moſt elegant manner, from whence it is reaſonable to conclude, that the moſt of this creature's ſtrength lies in its legs, as we have already obſerved.

The ſnout of this larva is black and hard; the back part quite ſolid, and ſomewhat of a globular form; the front *f* ſharp and hollow. Three membranaceous diviſions may be perceived on the back part; by means of which, and the muſcles contained in the ſnout, the creature can contract or expand it at pleaſure.

The extremity of the tail is ſurrounded with thirty hairs, and the ſides adorned with others that are ſmaller; and here and there the large hairs branch out into ſmaller ones, which may be reckoned ſingle hairs. All theſe have their roots in the outer ſkin, which in this place is covered with rough grains, as may be obſerved by cutting it off and holding it againſt the light upon a ſlip of glaſs. Thus alſo we find, that at the extremities of the hairs there are grains like thoſe on the ſkin; and in the middle of the tail there is a ſmall opening, within which are minute holes, by which the inſect takes in and lets out the air it breathes. Theſe hairs, however, are ſeldom diſpoſed in ſuch a regular order as is repreſented in fig. 38. unleſs when the inſect floats with the body in the water, and the tail with its hairs a little lower than the ſurface, in which caſe they are diſpoſed exactly in the order delineated in the plate. The leaſt motion of the tail downward produces a concavity in the water; and it then aſſumes the figure of a wine glaſs, wide at the top and narrow at the bottom. The tail anſwers the double purpoſe of ſwimming and breathing, and through it the inſect receives what is the principle of life and motion to all animals. By means of theſe hairs alſo it can ſtop its motion when ſwimming, and remain ſuſpended quietly without motion for any length of time. Its motions in ſwimming are very beautiful, eſpecially when it advances with its whole body floating on the ſurface of the water after filling itſelf with air by the tail.—To ſet out, it firſt bends the body to the right or left, and then contracts it in the form of the letter S, and again ſtretches it out in a ſtraight line: by thus contracting and then extending the body alternately, it moves on the ſurface of the water. It is very quiet, and is not diſturbed by handling.

Theſe creatures are commonly found in ſhallow ſtanding waters in the beginning of June: but ſome years much more plentifully than others. They crawl on the graſs and other plants which grow in ſuch waters, and are often met with in ditches floating on the ſurface of the water by means of their tail, the head and thorax at the ſame time hanging down; and in this poſture they turn over the clay and dirt with their ſnout and feet in ſearch of food, which is commonly a viſcous matter met with in ſmall ponds and ditches. It is very harmleſs, though its appearance would ſeem to indicate the contrary. It is moſt eaſily killed for diſſection by ſpirit of turpentine.

Fig. 39.

Fig. 39. ſhows in its natural ſize a beautiful inſect, deſcribed by Linnæus under the name of *Leucopſis dorſigera*, and which appears to be a kind of intermediate genus between a ſphex and a waſp. The antennæ are black and cylindrical, increaſing in thickneſs towards the extremity; the joint neareſt the head is yellow; the head and thorax are black, encompaſſed with a yellow line, and furniſhed with a croſs line of the ſame colour near the head. The ſcutellum is yellow, the abdomen black, with two yellow bands, and a deep ſpot of the ſame colour on each ſide between the bands. A deep poliſhed groove extends down the back from the thorax to the anus, into which the ſting turns and is depoſited, leaving the anus very circular; a yellow line runs on each ſide of the ſting.—The anus and whole body, when viewed with a ſmall magnifier, appear punctuated; but when theſe points are ſeen through a large magnifier, they appear hexagonal. Fig. 40. ſhows the inſect very much magnified. Fig. 41. gives a ſide view of it magnified in a ſmaller degree.

Fig. 40, 41.

Plate CCCXLIII. fig. 42.

Fig. 42. ſhows an inſect diſcovered by Mr John Adams of Edmonton, as he happened to be at an inn. It was firſt ſeen by ſome labouring people who were there at the time, by whom it was conjectured to be a louſe with unuſually long horns, a mite, &c. Mr Adams hearing the debate, procured the inſect; and having viewed it through a microſcope, it preſented the appearance exhibited in fig. 42. The inſect ſeems to be quite diſtinct from the phalangium cancroides of Linnæus. The latter has been deſcribed by ſeveral authors, but none of their deſcriptions agree with this. The abdomen of this inſect is more extended, the claws larger, and much more obtuſe; the body of the other being nearly orbicular, the claws ſlender, and almoſt terminating in a point, more tranſparent, and of a paler colour. Mr Marſham has one in

in his poſſeſſion not to be diſtinguiſhed from that repreſented in fig. 42. excepting only that it wants the break or dent in the claws, which is ſo conſpicuous in this. He found that inſect firmly fixed by its claws to the thigh of a large fly, which he caught on a flower in Eſſex in the firſt week of Auguſt, and from which he could not diſengage it without great difficulty, and tearing off the leg of the fly. This was done upon a piece of writing paper; and he was ſurpriſed to ſee the little creature ſpring forward a quarter of an inch, and again ſeize the thigh with its claws, ſo that he had great difficulty in diſengaging it. The natural ſize of this creature, which Mr Adams calls the *lobſter-inſect*, is exhibited at *a*.

Fig. 43.

Fig. 43. ſhows the inſect named by M. de Geer *Phyſapus*, on account of the bladders at its feet, (*Thrips phyſapus*, Lin.). This inſect is to be found in gleat plenty upon the flowers of dandelion, &c. in the ſpring and ſummer. It has four wings, two upper and two under ones (repreſented fig. 44.) but the two undermoſt are not to be perceived without great difficulty. They are very long; and fixed to the upper part of the breaſt, lying horizontally. Both of them are rather pointed towards the edges, and have a ſtrong nerve running round them, which is ſet with a hair fringe tufted at the extremity. The colour of theſe wings is whitiſh: the body of the inſect is black; the head ſmall, with two large reticular eyes. The antennæ are of an equal ſize throughout, and divided into ſix oval pieces, which are articulated together.—The extremities of the feet are furniſhed with a membranaceous and flexible bladder, which it can throw out or draw in at pleaſure. It preſſes this bladder againſt the ſubſtances on which it walks, and thus ſeems to fix itſelf to them; the bladder ſometimes appears concave towards the bottom, the concavity diminiſhing as it is leſs preſſed. The inſect is repreſented of its natural ſize at *b*.

Fig. 44.

Fig. 45.

Fig. 45. repreſents the *cimex ſtriatus* of Linnæus, remarkable for very bright and elegantly diſpoſed colours, though few in number. The head, proboſcis, and thorax, are black: the thorax ornamented with yellow ſpots; the middle one large, and occupying almoſt one-third of the poſterior part; the other two are on each ſide, and triangular. The ſcutellum has two yellow oblong ſpots, pointed at each end. The ground of the elytra is a bright yellow; ſpotted and ſtriped with black. The nerves are yellow; and there is a brilliant triangular ſpot of orange, which unites the cruſtaceous and membranaceous parts; the latter are brown, and clouded. It is found in the elm tree in June. It is repreſented of its natural ſize at *c*.

Fig. 46.

Fig. 46. ſhows the *chryſomela aſparagi* of Linnæus, ſo called from the larva of the inſect feeding upon that plant. It is a common inſect, and very beautiful. It is of an oblong figure, with black antennæ, compoſed of many joints, nearly oval. The head is a deep and bright blue; the thorax red and cylindrical: the elytra are blue, with a yellow margin, and having three ſpots of the ſame colour on each; one at the baſe, of an oblong form, and two united with the margin: the legs are black; but the under ſide of the belly is of the ſame blue colour with the elytra and head. This little animal, when viewed by the naked eye, ſcarcely appears to deſerve any notice; but when examined by the microſcope, is one of the moſt pleaſing opaque objects we have. It is found in June on the aſparagus after it has run to ſeed; and it is ſhown of its natural ſize at *d*. De Geer ſays that it is very ſcarce in Sweden.

Fig. 47.

Fig. 47. ſhows an inſect of a ſhape ſo remarkable, that naturaliſts have been at a loſs to determine the genus to which it belongs. In the Fauna Suecica, Linnæus makes it an *attelabus*: but in the laſt edition of the Syſtema Naturæ, it is ranged as a meloe, under the title of the *Meloe monoceros*; though of this alſo there ſeems to be ſome doubt. The true figure of it can only be diſcovered by a very good microſcope. The head is black, and appears to be hid or buried under the thorax, which projects forward like a horn: the antennæ are compoſed of many joints, and are of a dirty yellow colour, as well as the feet: the hinder part of the thorax is reddiſh, the fore part black.—The elytra are yellow, with a black longitudinal line down the ſuture; there is a band of the ſame colour near the apex, and alſo a black point near the baſe, the whole animal being curiouſly covered with hair. The natural ſize of it is ſhown at *e*. It was found in May. Geoffroy ſays that it lives upon umbelliferous plants.

Plate CCCXLIII. fig. 48—54.

Fig. 48.—54. exhibit the anatomy of the coſſus caterpillar, which lives on the willow. The egg from which it proceeds is attached to the trunk of the tree by a kind of viſcous juice, which ſoon becomes ſo hard that the rain cannot diſſolve it. The egg itſelf is very ſmall and ſpheroidical, and, when examined by the microſcope, appears to have broad waving furrows running through the whole length of it, which are again croſſed by cloſe ſtreaks, giving it the appearance of a wicker baſket. It is not exactly known what time they are hatched; but as the ſmall caterpillars appear in September, it is probable that the eggs are hatched ſome time in Auguſt. When ſmall, they are generally met with under the bark of the tree to which the eggs were affixed; and an aqueous moiſture, oozing from the hole through which they got under the bark, is frequently, though not always, a direction for finding them. Theſe caterpillars change their colour but very little, being nearly the ſame when young as when old. Like many others, they are capable of ſpinning as ſoon as they come from the egg. They alſo change their ſkin ſeveral times; but as it is almoſt impoſſible to rear them under a glaſs, ſo it is very difficult to know exactly how often this moulting takes place.—Mr Adams conjectures that it is more frequently than the generality of caterpillars do, ſome having been obſerved to change more than nine times.

The coſſus generally faſts for ſome days previous to the moulting; during which time the fleſhy and other interior parts of the head are detached from the old ſkull, and retire as it were within the neck. The new coverings ſoon grow on, but are at firſt very ſoft.—When the new ſkin and the other parts are formed, the old ſkin is to be opened, and all the members withdrawn from it; an operation naturally difficult, but which muſt be rendered more ſo from the ſoft and weak ſtate of the creature at that time. It is always much larger after each change.

From Mr Lyonet's experiments, it appears, that the coſſus generally paſſes at leaſt two winters, if not three, before it aſſumes the pupa ſtate. At the approach of winter, it forms a little caſe, the inſide of which is lined with ſilk, and the outſide covered with wood ground like very fine ſaw-duſt. During the whole ſeaſon it neither moves nor eats.

This caterpillar, at its firſt appearance, is not above one-twelfth of an inch long; but at laſt attains the length of two, and ſometimes of three inches. In the month of May it prepares for the pupa ſtate; the firſt care being to find a hole in the tree ſufficient to allow the moth to iſſue forth; and if this cannot be found, it makes one equal in ſize to the future pupa. It then begins to form of wood a caſe or cone; uniting the bits, which are very thin, together by ſilk, into the form of an ellipſoid, the outſide being formed of ſmall bits of wood joined together in all directions; taking care, however, that the pointed end of the caſe may always be oppoſite to the mouth of the hole: having finiſhed the outſide of the caſe, it lines the inſide with a ſilken tapeſtry of a cloſe texture in all its parts, except the pointed end, where the texture is looſer, in order to facilitate its eſcape at the proper time. The caterpillar then places itſelf in ſuch a poſture, that the head may always lie towards the opening of the hole in the tree or pointed end of its caſe. Thus it remains at reſt for ſome time: the colour of the ſkin firſt becomes pale, and afterwards brown; the interior parts of the head are detached from the ſkull; the legs withdraw themſelves from the exterior caſe; the body ſhortens; the poſterior part grows ſmall, while the anterior part ſwells ſo much, that the ſkin at laſt burſts; and, by a variety of motions, is puſhed down to the tail; and thus the pupa is exhibited, in which the parts of the future moth may be eaſily traced.—The covering of the pupa, though at firſt ſoft, humid, and white, ſoon dries and hardens, and becomes of a dark purple colour; the poſterior part is moveable; but not the fore part, which contains the rudiments of the head, legs, and wings. The fore-part of the pupa is furniſhed with two horns, one above and the other under the eyes. It has alſo ſeveral rows of points on its back. It remains for ſome weeks in the caſe; after which the moth begins to agitate itſelf, and the points are then of eſſential ſervice, by acting as a fulcrum, upon which it may reſt in its endeavours to proceed forward, and not ſlip back by its efforts for that purpoſe.

The moth generally continues its endeavours to open the caſe for a quarter of an hour; after which, by redoubled efforts, it enlarges the hole, and preſſes forward until it arrives at the edge, where it makes a full ſtop, leſt by advancing further it ſhould fall to the ground. After having in this manner repoſed itſelf for ſome time, it begins to diſengage itſelf entirely; and having reſted for ſome hours with its head upwards, it becomes fit for action. Mr Marſham ſays, that it generally puſhes one-third of the caſe out of the hole before it halts.

The body of the caterpillar is divided into twelve rings, marked 1, 2, 3, &c. as repreſented in fig. 48, 49, 50, 51. each of which is diſtinguiſhed from that which precedes, and that which follows, by a kind of neck or hollow; and, by forming boundaries to the rings, we make twelve other diviſions, likewiſe expreſſed in the figures; but to the firſt of theſe the word *ring* is affixed, and to the ſecond, *diviſion*. To facilitate the deſcription of this animal, M. Lyonet ſuppoſed a line to paſs down through the middle of the back, which he called the ſuperior line, becauſe it marked the moſt elevated part of the back of the caterpillar; and another, paſſing from the head down the belly to the tail, he called the inferior line.

All caterpillars have a ſmall organ, reſembling an elliptic ſpot, on the right and left of each ring, excepting the ſecond, third, and laſt; and by theſe we are furniſhed with a further ſubdiviſion of this caterpillar, viz. by lines paſſing through the ſpiracula, the one on the right ſide, the other on the left of the caterpillar. Theſe four lines, which divide the caterpillar longitudinally into four equal parts, mark each the place under the ſkin which is occupied by a conſiderable viſcus. Under the ſuperior line lies the heart, or rather thread of hearts; over the inferior line, the ſpinal marrow; and the two tracheal arteries follow the courſe of the lateral lines. At equal diſtances from the ſuperior and two lateral lines, we may ſuppoſe four intermediate lines. The two between the ſuperior and lateral lines are called the intermediate ſuperior; the two others oppoſite to them, and between the lateral and inferior lines, are called the intermediate inferior.

Fig. 48. and 49.

Fig. 48, 49. ſhow the muſcles of the caterpillar, arranged with the moſt wonderful ſymmetry and order, eſpecially when taken off by equal ſtrata on both ſides, which exhibits an aſtoniſhing and exact form and correſpondence in them. The figures ſhow the muſcles of two different caterpillars opened at the belly, and ſuppoſed to be joined together at the ſuperior lines. The muſcles of the back are marked by capitals; the gaſtric muſcles by Roman letters; the lateral ones by Greek characters. Thoſe marked *θ* are called, by M. Lyonet, dividing muſcles, on account of their ſituation.

The caterpillar was prepared for diſſection by being emptied, and the muſcles, nerves, &c. freed from the fat in the manner formerly directed: after which the following obſervations were made.

The muſcle A in the firſt ring is double; the anterior one being thick at top, and being apparently divided into different muſcles on the upper ſide, but without any appearance of this kind on the under ſide. One inſertion is at the ſkin of the neck towards the head; the other is a little above; and that of the ſecond muſcle A is a little below the firſt ſpiraculum, near which they are fixed to the ſkin.

The muſcle marked *α* is long and ſlender, fixed by its anterior extremity under the gaſtric muſcles *a* and *b* of the firſt ring, to the circumflex ſcale of the baſe of the lower lip. It communicates with the muſcle *c* of the ſecond ring, after having paſſed under ſome of the arteries, and introduced itſelf below the muſcle *θ*.

The muſcle *β* is ſo tender, that it is ſcarcely poſſible to open the belly of the caterpillar without breaking it. It is ſometimes double, and ſometimes triple.—Anteriorly it is fixed to the poſterior edge of the ſide of the parietal ſcale, the lower fixture being at the middle of the ring near the inferior line.

There are three muſcles marked *ξ*; the firſt affixed at one extremity near the lower edge of the upper part of the parietal ſcale; the other end divides itſelf into three or four tails, fixed to the ſkin of the caterpillar under the muſcle δ. The anterior part of the ſecond is fixed near the firſt; the anterior part of the third a little under the firſt and ſecond, at the ſkin of the neck under the muſcle A. Theſe two laſt paſſing over the cavity of the firſt pair of limbs, are fixed by ſeveral tails to the edge oppoſite to this cavity. In this ſubject there are two muſcles marked δ, but ſometimes there is only one anteriorly; they are fixed to the lower edge of the parietal ſcale, the other ends being inſerted in the firſt fold of the ſkin of the neck on the belly-ſide. Fig. 50. beſt repreſents the muſcles β and δ; as in that figure they do not appear injured by any unnatural connexion.

In the ſecond and four following rings we diſcern two large dorſal muſcles A and B. In the 7th, 9th, and 10th rings are three, A, B, and C; in the 11th are four, A, B, C, and D; and in the anterior part of the 12th ring are five, A, B, C, D, and E. All theſe ranges of muſcles, however, as well as the gaſtric muſcles *a*, *b*, *c*, *d*, appear at firſt ſight only as a ſingle muſcle, running nearly the whole length of the caterpillar; but when this is detached from the animal, it is found to conſiſt of ſo many diſtinct muſcles, each conſiſting only of the length of one of the rings, their extremities being fixed to the diviſion of each ring, excepting the middle muſcle *a*, which, at the 6th, 7th, 8th, and 9th rings, has its inſertions rather beyond the diviſion. Each row of muſcles appears as one, becauſe they are cloſely connected at top by ſome of the fibres which paſs from one ring to the other.

The muſcles A, which are 12 in number, gradually diminiſh in breadth to the lower part of the laſt ring: at the 8th and three following diviſions they communicate with the muſcles B, and at the 11th with D. In the lower part of the laſt ring, A is much broader than it was in the preceding ring; one extremity of it is contracted, and communicates with B; the lower inſertion being at the membrane I, which is the exterior ſkin of the fecal bag. The muſcles A and B, on the lower part of the laſt ring, cannot be ſeen until a large muſcle is removed, which on one ſide is fixed to the ſubdiviſion of the ring, and on the other to the fecal bag.

The right muſcles B, which are alſo 12 in number, begin at the ſecond ring, and grow larger from thence to the ſeventh. They are uſually narrower from thence to the 12th; the deficiency in width being ſupplied by the ſix muſcles C, which accompany it from the 7th to the ſubdiviſion of the 12th ring. The muſcles B and C communicate laterally with the 8th, 11th, and 12th diviſions. C is wanting at the ſubdiviſion of the 12th; its place being here ſupplied by B, which becomes broader at this part.

The firſt of the three floating muſcles V originates at the firſt ring, from whence it introduces itſelf under N, where it is fixed, and then ſubdivides, and hides itſelf under other parts. The ſecond begins at the ſecond diviſion, being fixed to the anterior extremity B of the ſecond ring; from thence directing itſelf towards the ſtomach; and, after communicating with the caſe of the *corpus craſſum*, it divides, and ſpreads into eight muſcles which run along the belly. The third begins at the third diviſion, originating partly at the ſkin, and partly at the junction of the muſcles B of the ſecond and third ring. It directs itſelf obliquely towards the belly, meeting it near the third ſpiraculum; and branching from thence, it forms the oblique muſcles of ſome of the viſcera.

The thin long muſcle θ, which is at the ſubdiviſion of the laſt ring, and covers the anterior inſertion of the muſcle (*a*) where the ring terminates, is ſingle. It begins at one extremity of the muſcle (*c*); at the fore part of the ring runs along the ſubdiviſion round the belly of the caterpillar, and finiſhes, on the other ſide, at the extremity of a ſimilar muſcle C.

Fig. 49. ſhows the dorſal muſcles of the coſſus. To view which in an advantageous manner, we muſt uſe the following mode of preparation.

1. All the dorſal muſcles, 35 in number, muſt be taken out, as well as the ſeven lateral ones already deſcribed.
2. All the ſtraight muſcles of the belly muſt be taken away, as well as the muſcular roots (*c*), and the ends of the gaſtric muſcles (*c*), which are at the third and fourth diviſions.
3. At the ſecond diviſion the muſcle θ muſt be removed; only the extremities being left to ſhow where it was inſerted.

The parts being thus prepared, we begin at the third ring; where there are found four dorſal muſcles C, D, E, and F. The firſt one C, is inſerted at the third diviſion, under the muſcles θ and α, where it communicates by means of ſome fibres with the muſcle *f* of the ſecond ring; proceeding from thence obliquely towards the intermediate ſuperior line, and is fixed at the fourth diviſion. As ſoon as C is retrenched, the muſcle D is ſeen; which grows wider from the anterior extremity: it lies in a contrary direction to the muſcle C, and is inſerted into the third and fourth diviſions. The muſcle E lies in the ſame direction as the middle C, but not ſo obliquely: the lower inſertion is at the fourth diviſion; the other at the third, immediately under C. The muſcle F is nearly parallel to D which joins it; the firſt inſertion is viſible, but the other is hid under the muſcles E and G at the fourth diviſion.

In the eight following rings, there are only two dorſal muſcles; and of theſe D is the only one that is completely ſeen. It is very large, and diminiſhes gradually in breadth from one ring to the other, till it comes to the laſt, ſending off branches in ſome places.—E is one of the ſtrait muſcles of the back; and is inſerted under the dividing muſcles θ, at the diviſions of its own ring.

On the anterior part of the 12th ring there are three dorſal muſcles, D, E, and F. D is ſimilar to that of the preceding ring, marked alſo D, only that it is no more than half the length; terminating at the ſubdiviſion of its own ring. E is of the ſame length, and differs from the muſcle E of the preceding ring only in its direction. F is parallel to E, and ſhorter than it; its anterior end does not reach the twelfth diviſion.

On the poſterior part there is only one dorſal muſcle, faſtened by ſome ſhort ones to the ſubdiviſion of the laſt ring, traverſing the muſcles α; and being fixed there as if deſigned to ſtrengthen them, and to vary their direction.—α Is a ſingle muſcle, of which the anterior inſertion is viſible, the other end being fixed to the bottom of the foot of the laſt leg; its uſe is to move the foot. The anterior part of the muſcle β branches into three or four heads, which croſs the ſuperior line obliquely, and are fixed to the ſkin a little above it. The other end is faſtened to the membrane T.

Fig. 50. 51. Fig. 50. and 51. ſhow the muſcles of the caterpillar when it is opened at the back. The preparation for this view is to diſengage the fat and other extraneous matter, as before directed.

The firſt ring has only two gaſtric muſcles (*c*) and (*d*): the former is broad, and has three or four little tails: the firſt fixture is at the baſe of the lower lip, from whence it deſcends obliquely, and is fixed between the inferior and lateral line. The ſmall muſcle (*d*) is faſtened on one ſide to the firſt ſpiraculum; on the other, a little lower, to the intermediate inferior and lateral line; and ſeems to be an antagoniſt to the muſcle P, which opens the ſpiracula. The poſterior fixture of δ is under the muſcle C, near the ſkin of the neck; β is fixed a little on the other ſide of C, at the middle of the ring.

In the ſecond ring there are three gaſtric muſcles, *g*, *h*, and *i*: *g* and *h* are fixed at the folds which terminate the ring; but only the anterior part of *i* is fixed there. The muſcle *h* is triple, and in one of the diviſions ſeparated into two parts; that marked *i* comes nearer the inferior line, and is fixed a little beyond the middle of the ring, where the correſponding muſcle of the oppoſite ſide is forked to receive it.

In the third ring, the muſcle *h*, which was triple in the foregoing ring, is only double here, that part which is neareſt the inferior line being broadeſt: it has three tails, of which only two are viſible in the figure. It is exactly ſimilar to that of the preceding ring; and is croſſed in the ſame manner by the muſcle from the oppoſite ſide of the ring.

Throughout the eight following rings, the muſcle *f* which runs through them all is very broad and ſtrong. The anterior part of it is fixed at the intermediate inferior line, on the fold of the firſt diviſion of the ring: the other part is fixed beyond the lower diviſion; with this difference, that at the 10th and 11th rings it is fixed at the laſt fold of its ring; whereas, in the others it paſſes over that ring, and is inſerted into the ſkin of the following one. In all theſe, the firſt extremity of the muſcle *g* is faſtened to the fold which ſeparates the ring from the preceding one, and is parallel to *f*, and placed at the ſide of it. The firſt ſix muſcles marked *g*, are forked; that of the fourth ring being more ſo than the reſt, nor does it unite till near its anterior inſertion. The longeſt tail lays hold of the following, and is inſerted near the inferior line; the other inſerts itſelf near the ſame line, at about the middle of its own ring; the two laſt do not branch out; but terminate at the diviſions, without reaching the following ring. The muſcle *h*, placed at the ſide of *f*, has nearly the ſame direction, and finiſhes at the folds of the ring.

The anterior part of the 12th ring has only one gaſtric muſcle, marked *e*: it is placed on the intermediate inferior line; and is inſerted at the folds of the upper diviſion, and at the ſubdiviſion of this ring. The lower part has a larger muſcle marked *c*, with ſeveral diviſions; one placed under *b*, with one extremity fixed near the lateral line, at the ſubdiviſion of its ring; the other to the fecal bag, a little lower than the muſcle *b*.

In fig. 51. all the gaſtric muſcles deſcribed in fig. 50. diſappear, as well as thoſe lateral and dorſal ones of which the letters are not to be found in this figure.

In the firſt ring are the gaſtric muſcles, *e*, *f*, *g*, which are beſt ſeen here: the firſt is narrow and long, paſſing under and croſſing *f*: one of its inſertions is at the lower line, the other at the lateral, between the ſpiraculum and neck: *f* is ſhort, broad, and nearly ſtraight, placed along the intermediate line; but between it and the lateral it paſſes under *e*, and is fixed to the fold of the ſkin which goes from the one bag to the other; the lower inſertion is near the ſecond diviſion. There are ſometimes three muſcles of thoſe marked *g*, and ſometimes four: the lower parts of them are fixed about the middle of the ring, and the anterior parts at the fold of the ſkin near the neck. The muſcles *i* and *h* are fixed to the ſame fold; the other end of *h* being fixed under the muſcle Π, near the ſpiraculum. Above the upper end of *f*, a muſcular body, *g*, may be ſeen. It is formed by the ſeparation of two floating muſcles.

The ſecond ring has ſix gaſtric muſcles, *k*, *l*, *m*, *n*, *o*, *p*. The firſt is a large oblique muſcle, with three or four diviſions placed at the anterior part of the ring: the head is fixed between the inferior line and its intermediate one, at the fold of the ſecond diviſion; from whence it croſſes the inferior line and its correſponding muſcle, terminating to the right and left of the line. I is a narrow muſcle, whoſe head is fixed to the fold of the ſecond diviſion; the tail of it lying under *n*, and faſtened to the edge of the ſkin that forms the cavity for the leg. The two muſcles marked *m* have the ſame obliquity, and are placed the one on the other; the head is inſerted in the ſkin under the muſcle β, and communicates by a number of fibres with the tail of the muſcle γ; the other end is fixed to the intermediate inferior line at the fold of the third diviſion. The large and broad muſcle *n*, covers the lower edge of the cavity of the limb, and the extremity of the tail of *l*. It is fixed firſt at the ſkin, near the intermediate line, from whence it goes in a perpendicular direction towards *m*, and introduces itſelf under *o* and *m*, where it is fixed. The muſcle *o* is narrow and bent, and covers the edge of the cavity of the leg for a little way; one end terminating there, and the other finiſhing at the third diviſion near *m*. That marked *p* is alſo bent: it runs near the anterior edge of the cavity of the leg; one end meets the head of *o*, the other end terminates at a raiſed fold near the inferior line. There is a triangular muſcle on the ſide of the lateral muſcle *o*, ſimilar to that marked *g* in the following ring; in this figure it is entirely concealed by the muſcle *m*.

The third ring has no muſcle ſimilar to *m*; that marked *k* differs only from that of the ſecond ring in being croſſed by the oppoſite muſcle. Thoſe marked *l*, *n*, *o*, *p*, are ſimilar to thoſe of the preceding one. The muſcle *q* is triangular; the baſe is faſtened to the laſt fold of the ring; on the lower ſide it is fixed to the muſcle *o*, the top to the ſkin at the edge of the cavity for the leg.

The eight following rings have the gaſtric muſcles, *i*, *k*, *l*, and *m*. The muſcle *i* is quite ſtraight, and placed at ſome diſtance from the inferior line: it is broad at the fourth ring, but diminiſhes gradually in breadth to the 11th. In the fourth it is united; but divides into two heads, which divaricate in the following rings. In the ſix next rings theſe heads are fixed nearly at the ſame place with *a* and *f*; and in the other two it terminates at the fold of the ring. The anterior inſertion of the firſt and laſt is at the fold where the ring begins; that of the ſix others is ſomewhat lower under the place where the muſcle *i* terminates. The lower part of the oblique muſcle *k* is inſerted in the ſkin near *i*; the upper part at the intermediate inferior muſcle upon the fold which ſeparates the following ring, but is wanting in the 11th. The muſcle *l* is large, and co-operates with M: in the opening and ſhutting the ſpiraculum, one of its fixtures is near the intermediate inferior line, at about the ſame height as *i*. The tail terminates a little below the ſpiraculum.

The twelfth ring has only the ſingle gaſtric muſcle *d*, which is a bundle of ſix, ſeven, or eight muſcles: the firſt fixture of theſe is at the ſubdiviſion of the ring near the inferior line: one or two croſs this, and at the ſame time the ſimilar muſcles of the oppoſite ſide. Their fixture is at the bottom of the foot; and their office is to aſſiſt the muſcle *a* in bringing back the foot, and to looſen the claw from what it lays hold of. One of the inſertions of this muſcle *a* is obſerved in this figure near *d*, the other near the ſubdiviſion of the ring.

Fig. 52, 53. Fig. 52. and 53. ſhow the organization of the head of the coſſus, though in a very imperfect manner, as M. Lyonet found it neceſſary to employ *twenty* figures to explain it fully. The head is repreſented as it appears when ſeparated from the fat, and diſengaged from the neck. HH are the two palpi. The truncated muſcles D belong to the lower lip, and aſſiſt moving it. K ſhows the two ganglions of the neck united. II are the two veſſels which aſſiſt in ſpinning the ſilk. L, the œſophagus. M, the two diſſolving veſſels. The Hebrew characters דבכא ſhow the continuation of the four cephalic arteries. In fig. 52. the ten abductor muſcles of the jaw are repreſented by SS, TT, VV, and Z. Four occipital muſcles are ſeen in fig. 53. under *e e* and *f f*. At *a k* is repreſented a nerve of the firſt pair belonging to the ganglion of the neck; *b* is a branch of this nerve.

Fig. 54. Fig. 54. exhibits the nerves as ſeen from the under part; but excepting in two or three nerves, which may be eaſily diſtinguiſhed, only one of each pair is drawn, in order to avoid confuſion. The nerves of the firſt ganglion of the neck are marked by capital letters, thoſe of the ganglion (a) of the head by Roman letters; the nerves of the ſmall ganglion by Greek characters. Thoſe of the frontal ganglion, except one, by numbers.

The muſcles of the coſſus have neither the colour nor form of thoſe of larger animals. In their natural ſtate they are ſoft, and of the conſiſtence of a jelly. Their colour is a grayiſh blue, which. with the ſilver-coloured appearance of the pulmonary veſſels, form a glorious ſpectacle After the caterpillar has been ſoaked for ſome time in ſpirit of wine, they loſe their elaſticity and tranſparency, becoming firm, opaque, and white, and the air-veſſels totally diſappear. The number of muſcles in a caterpillar is very great. The greateſt part of the head is compoſed of them, and there is a vaſt number about the œſophagus, inteſtines, &c.; the ſkin is, as it were, lined by different beds of them, placed the one under the other, and ranged with great ſymmetry. M. Lyonet has been able to diſtinguiſh 228 in the head, 1647 in the body, and 2066 in the inteſtinal tube, making in all 3941.

At firſt ſight the muſcles might be taken for tendons, as being of the ſame colour, and having nearly the ſame luſtre. They are generally flat, and of an equal ſize throughout; the middle ſeldom differing either in colour or ſize from either of the extremities. If they are ſeparated, however, by means of very fine needles, in a drop of ſome fluid, we find them compoſed not only of fibres, membranes, and air-veſſels, but likewiſe of nerves; and, from the drops of oil that may be ſeen floating on the fluid, they appear alſo to be furniſhed with many unctuous particles. Their ends are fixed to the ſkin, but the reſt of the muſcle is generally free and floating. Several of them branch out conſiderably; and the branches ſometimes extend ſo far, that it is not eaſy to diſcover whether they are diſtinct and ſeparate muſcles or parts of another. They are moderately ſtrong; and thoſe which have been ſoaked in ſpirit of wine, when examined by the microſcope, are found to be covered with a membrane which may be ſeparated from them; and they appear then to conſiſt of ſeveral parallel bands lying longitudinally along the muſcle, which, when divided by means of fine needles, appear to be compoſed of ſtill ſmaller bundles of fibres lying in the ſame direction; which, when examined by a powerful magnifier, and in a favourable light, appear twiſted like a ſmall cord. The muſcular fibres of the ſpider, which are much larger than thoſe of the caterpillar, conſiſt of two different ſubſtances, one ſoft and the other hard; the latter being twiſted round the former ſpirally, and thus giving it the twiſted appearance juſt mentioned.

There is nothing in the caterpillar ſimilar to the brain in man. We find indeed in the head of this inſect a part from which all the nerves ſeem to proceed; but this part is entirely unprotected, and ſo ſmall, that it does not occupy one-fifth part of the head; the ſurface is ſmooth, and has neither lobes nor any anfractuoſity like the human brain. But if we call this a brain in the caterpillar, we muſt ſay that it has *thirteen:* for there are twelve other ſuch parts following each other in a ſtraight line, all of them of the ſame ſubſtance with that in the head, and nearly of the ſame ſize; and from them, as well as from that in the head, the nerves are diſtributed through the body.

The ſpinal marrow in the coſſus goes along the belly; is very ſmall, forking out at intervals, nearly of the ſame thickneſs throughout, except at the ganglions, and is not encloſed in any caſe. It is by no means ſo tender as in man; but has a great degree of tenacity, and does not break without a conſiderable degree of tenſion. The ſubſtance of the ganglions differs from that of the ſpinal marrow, as no veſſels can be diſcovered in the latter; but the former

mer are full of very delicate ones. There are 94 principal nerves, which divide into inumerable ramifications.

The coſſus has two large tracheal arteries, creeping under the ſkin cloſe to the ſpiracula: one at the right and the other at the left ſide of the inſect, each of them communicating with the air by means of nine ſpiracula. They are nearly as long as the whole caterpillar; beginning at the firſt ſpiraculum, and extending ſomewhat farther than the laſt; ſome branches alſo extending quite to the extremity of the body. Round each ſpiraculum the trachea puſhes forth a great number of branches, which are again divided into ſmaller ones, and theſe further ſubdivided and ſpread through the whole body of the caterpillar. The tracheal artery, with all its numerous ramifications, are open elaſtic veſſels, which may be preſſed cloſe together, or drawn out conſiderably, but return immediately to their uſual ſize when the tenſion ceaſes. They are naturally of a ſilver colour, and make a beautiful appearance. This veſſel, with its principal branches, is compoſed of three coats, which may be ſeparated from one another. The outmoſt is a thick membrane furniſhed with a great variety of fibres, which deſcribe a vaſt number of circles round it, communicating with each other by numerous ſhoots. The ſecond is very thin and tranſparent, without any particular veſſel being diſtinguiſhable in it. The third is compoſed of ſcaly threads, generally of a ſpiral form; and ſo near each other as ſcarcely to leave any interval. They are curiouſly united with the membrane which occupies the intervals; and form a tube which is always open, notwithſtanding the flexure of the veſſel. There are alſo many other peculiarities in its ſtructure. The principal tracheal veſſels divide into 1326 different branches.

The heart of the coſſus is very different from that of larger animals, being almoſt as long as the animal itſelf. It lies immediately under the ſkin at the top of the back, entering the head, and terminating near the mouth. Towards the laſt rings of the body it is large and capacious, diminiſhing very much as it approaches the head, from the fourth to the twelfth diviſion. On both ſides, at each diviſion, it has an appendage, which partly covers the muſcles of the back, but which, growing narrower as it approaches the lateral line, it forms a number of irregular lozenge-ſhaped bodies.—This tube, however, ſeems to perform none of the functions of the heart in larger animals, as we find no veſſel opening into it which anſwers either to the aorta or vena cava. It is called the heart, becauſe it is generally filled with a kind of lymph, which naturaliſts have ſuppoſed to be the blood of the caterpillar; and becauſe in all caterpillars which have a tranſparent ſkin, we may perceive alternate regular contractions and dilatations along the ſuperior line, beginning at the eleventh ring, and proceeding from ring to ring, from the fourth; whence this veſſel is thought to be a ſtring or row of hearts. There are two white oblong bodies which join the heart near the eighth diviſion; and theſe have been called *reniform* bodies, from their having ſomewhat of the ſhape of a kidney.

The moſt conſiderable part of the whole caterpillar with regard to bulk is the corpus craſſum. It is the firſt and only ſubſtance that is ſeen on opening it. It forms a kind of ſheath which envelopes and covers all the entrails, and, introducing itſelf into the head, enters all the muſcles of the body, filling the greateſt part of the empty ſpaces in the caterpillar. It very much reſembles the configuration of the human brain, and is of a milk-white colour.

The œſophagus deſcends from the bottom of the mouth to about the fourth diviſion. The fore part, which is in the head, is fleſhy, narrow, and fixed by different muſcles to the cruſtaceous parts of it; the lower part, which paſſes into the body, is wider, and forms a kind of membranaceous bag, covered with very ſmall muſcles; near the ſtomach it is narrower, and, as it were, confined by a ſtrong nerve fixed to it at diſtant intervals. The ventricle begins a little above the fourth diviſion, where the œſophagus ends, and finiſhes at the tenth. It is about ſeven times as long as broad; and the anterior part, which is broadeſt, is generally folded. Theſe folds diminiſh with the bulk as it approaches the inteſtines; the ſurface is covered with a great number of aërial veſſels, and opens into a tube, which M. Lyonet calls the large inteſtine.—There are three of theſe large tubes, each of which differs ſo much from the reſt, as to require a particular name to diſtinguiſh it from them.

The two veſſels from which the coſſus ſpins its ſilk are often above three inches long, and are diſtinguiſhed into three parts; the anterior, intermediate, and poſterior. It has likewiſe two other veſſels, which are ſuppoſed to prepare and contain the liquor for diſſolving the wood on which it feeds.

Plate CCCXLIV. fig. 55.

Fig. 55. ſhows the wing of an earwig magnified; *a* repreſents it of the natural ſize. The wings of this inſect are ſo artificially folded up under ſhort caſes, that few people imagine they have any. Indeed, they very rarely make uſe of their wings. The caſes under which they are concealed are not more than a ſixth part of the ſize of one wing, though a ſmall part of the wing may be diſcovered, on a careful inſpection, projecting from under them. The upper part of the wing is cruſtaceous and opaque, but the under part is beautifully tranſparent. In putting up their wings, they firſt fold back the parts AB, and then ſhut up the ribs like a fan; the ſtrong muſcles uſed for this purpoſe being ſeen at the upper part of the figure. Some of the ribs are extended from the centre to the outer edge; others only from the edge about half way: but they are all united by a kind of band, at a ſmall but equal diſtance from the edge; the whole evidently contrived to ſtrengthen the wing, and facilitate its various motions. The inſect itſelf differs very little in appearance in its three different ſtates. De Geer aſſerts, that the female hatches eggs like a hen, and broods over her young ones as a hen does.

Fig. 56.

Fig. 56. repreſents a wing of the *hemerobius perla* magnified. It is an inſect which ſeldom lives more than two or three days.—The wings are nearly of a length, and exactly ſimilar to one another. They are compoſed of fine delicate nerves, regularly and elegantly diſpoſed as in the figure, beautifully adorned with hairs, and lightly tinged with green. The body is of a fine green colour; and its eyes appear like two burniſhed beads of gold, whence it has obtained the name of *golden eye*. This inſect lays its eggs on the leaves of the plum or the roſe tree; the eggs are of a white colour,

colour, and each of them fixed to a little pedicle or foot-ſtalk, by which means they ſtand off a little from the leaf, appearing like the fructification of ſome of the moſſes. The larva proceeding from theſe eggs reſembles that of the coccinella or lady-cow, but is much more handſome. Like that, it feeds upon aphides or pucerons, ſucking their blood, and forming itſelf a caſe with their dried bodies; in which it changes into the pupa ſtate, from whence they afterwards emerge in the form of a fly.

Fig. E, F, I, repreſent the duſt of a moth's wing magnified. This is of different figures in different moths. The natural ſize of theſe ſmall plumes is repreſented at H.

Fig. 57. Fig. 57. ſhows a part of the cornea of the libellula magnified. In ſome poſitions of the light, the ſides of the hexagons appear of a fine gold colour, and divided by three parallel lines. The natural ſize of the part magnified is ſhown at *b*.

Fig. 58. Fig. 58. ſhows the part *c* of a lobſter's cornea magnified.

Fig. 59. Fig. 59. ſhows one of the arms or horns of the lepas anatifera, or barnacle, magnified; its natural ſize being repreſented at *d*. Each horn conſiſts of ſeveral joints, and each joint is furniſhed on the concave ſide of the arm with long hairs. When viewed in the microſcope, the arms appear rather opaque; but they may be rendered tranſparent, and become a moſt beautiful object, by extracting out of the interior cavity a bundle of longitudinal fibres, which runs the whole length of the arm. Mr Needham thinks that the motion and uſe of theſe arms may illuſtrate the nature of the rotatory motion in the wheel-animal. In the midſt of the arms is an hollow trunk, conſiſting of a jointed hairy-tube, which encloſes a long round tongue that can be puſhed occaſionally out of the tube or ſheath, and retracted occaſionally. The mouth of the animal conſiſts of ſix laminæ, which go off with a bend, indented like a ſaw on the convex edge, and by their circular diſpoſition are ſo ranged, that the teeth, in the alternate elevation and depreſſion of each plate, act againſt whatever comes between them. The plates are placed together in ſuch a manner, that to the naked eye they form an aperture not much unlike the mouth of a contracted purſe.

Plate CCCXLV. fig. 60. Fig. 60. ſhows the apparatus of the *tabanus* or gadfly, by which it pierces the ſkin of horſes and oxen, in order to ſuck the blood. The whole is contained in a fleſhy caſe, not expreſſed in the figure. The feelers *a a* are of a ſpongy texture and gray coloured, covered with ſhort hairs. They are united to the head by a ſmall joint of the ſame ſubſtance. They defend the other parts of the apparatus, being laid upon it ſide by ſide whenever the animal ſtings, and thus preſerve it from external injury. The wound is made by the two lancets *b b* and B, which are of a delicate ſtructure, but very ſharp, formed like the diſſecting knife of an anatomiſt, growing gradually thicker to the back.—The two inſtruments *c c* and C, appear as if intended to enlarge the wound, by irritating the parts round it; for which they are jagged or toothed. They may alſo ſerve, from their hard and horny texture, to defend the tube *e* E, which is of a ſofter nature, and tubular to admit the blood, and convey it to the ſtomach. This part is totally encloſed in a line *d* D, which entirely covers it. Theſe parts are drawn ſeparately at B, C, D, E. De Geer obſerves, that only the females ſuck the blood of animals; and Reaumur informs us, that having made one, that had ſucked its fill, diſgorge itſelf, the blood it threw up appeared to him to be more than the whole body of the inſect could have contained. The natural ſize of this apparatus is ſhown at *f*.

Fig. 61. Fig. 61. ſhows a bit of the ſkin of a lump-fiſh (*cyclopterus*) magnified. When a good ſpecimen of this can be procured, it forms a moſt beautiful object. The tubercles exhibited in the figure probably ſecrete an unctuous juice.

Fig. 62. Fig. 62. ſhows the ſcale of a ſea perch found on the Engliſh coaſt; the natural ſize is exhibited at *h*.

Fig. 63. Fig. 63. the ſcale of an haddock magnified; its natural ſize as within the circle.

Fig. 64. Fig. 64. the ſcale of a parrot fiſh from the Weſt Indies magnified; *i* the natural ſize of it.

Fig. 65. Fig. 65. the ſcale of a kind of perch in the Weſt Indies magnified; *k* the natural ſize of the ſcale.

Fig. 66. Fig. 66. part of the ſkin of a ſole fiſh, as viewed through an opaque microſcope; the magnified part, in its real ſize, ſhown at *l*.

The ſcales of fiſhes afford a great variety of beautiful objects for the microſcope. Some are long; others round, ſquare, &c. varying conſiderably not only in different fiſhes, but even in different parts of the ſame fiſh. Leeuwenhoeck ſuppoſed them to conſiſt of an infinite number of ſmall ſcales or ſtrata, of which thoſe next to the body of the fiſh are the largeſt. When viewed by the microſcope, we find ſome of them ornamented with a prodigious number of concentric flutings, too near each other, and too fine, to be eaſily enumerated. Theſe flutings are frequently traverſed by others diverging from the centre of the ſcale, and generally proceeding from thence in a ſtraight line to the circumference.

For more full information concerning theſe and other microſcopical objects, the reader may conſult Mr Adams's *Eſſays on the Microſcope*, who has made the moſt valuable collection that has yet appeared on the ſubject. See alſo the articles ANIMALCULE, CRYSTALLIZATION, POLYPE, PLANTS, and WOOD, in the preſent work.

MIDAS, in fabulous hiſtory, a famous king of Phrygia, who having received Bacchus with great magnificence, that god, out of gratitude, offered to grant him whatever he ſhould aſk. Midas deſired that every thing he touched ſhould be changed into gold. Bacchus conſented; and Midas, with extreme pleaſure, everywhere found the effects of his touch. But he had ſoon reaſon to repent of his folly: for wanting to eat and drink, the aliments no ſooner entered his mouth than they were changed into gold. This obliged him to have recourſe to Bacchus again, to beſeech him to reſtore him to his former ſtate; on which the god ordered him to bathe in the river Pactolus, which from thenceforward had golden ſands. Some time after, being choſen judge between Pan and Apollo, he gave another inſtance of his folly and bad taſte, in preferring Pan's muſic to Apollo's; on which the latter being enraged, gave him a pair of aſſes ears. This Midas attempted to conceal from the knowledge of his ſubjects: but one of his ſervants ſaw the length of his ears, and being unable to keep the ſecret, yet afraid to reveal

MICROSCOPE. *PLATE CCCXXXVII.*

E. Mitchell sculp.t

His parents, who were in eaſy circumſtances, allowed him to follow that courſe in life his genius dictated. He began his ſtudies at the place of his nativity; but ſoon after removed to Bologna, where he obtained the degree of Doctor of Medicine, when he had but juſt reached the 16th year of his age. Here his peculiar taſte for anatomy found an able preceptor in Valſalva, who beſtowed on him the utmoſt attention; and ſuch was the progreſs he made under this excellent maſter, that at the age of 20 he himſelf taught anatomy with high reputation. Soon, however, the fame of his prelections, and the number of his pupils, excited the jealouſy of the public profeſſors, and gave riſe to invidious perſecutions. But his abilities and prudence gained him a complete triumph over his enemies; and all oppoſition to him was finally terminated from his being appointed by the ſenate of Bologna to fill a medical chair, which ſoon became vacant. But the duties of this office, although important, neither occupied the whole of his time, nor ſatisfied his anxious deſire to afford inſtruction. He ſtill continued to labour in ſecret on his favourite ſubject, and ſoon after communicated the fruits of theſe labours to the public in his *Adverſaria Anatomica*, the firſt of which was publiſhed in the year 1706, the ſecond and third in 1717, and the three others in 1719. The publication of this excellent work ſpread the fame of Morgagni far beyond the limits of the ſtate of Bologna. Such was his reputation, that the wiſe republic of Venice had no heſitation in making him an offer of the ſecond chair of the theory of medicine in the univerſity of Padua, then vacant by the death of M. Molinetti; and, to enſure his acceptance, they doubled the emoluments of that appointment. While he was in this department, he publiſhed his treatiſe, entitled *Nova Inſtitutionum medicarum idea*, which firſt appeared at Padua in the year 1712. From this work his former reputation ſuffered no diminution. And ſoon after he roſe, by different ſteps, to be firſt profeſſor of anatomy in that celebrated univerſity. Although Morgagni was thus finally ſettled at Padua, yet he gave evident proofs of his gratitude and attachment to Bologna, which he conſidered as his native country with reſpect to the ſciences. He exerted his utmoſt efforts in eſtabliſhing the academy of Bologna, of which he was one of the firſt aſſociates; and he enriched their publications with ſeveral valuable and curious papers. Soon after this, the Royal Societies of London and Paris received him among their number. Not long after the publication of his *Adverſaria Anatomica*, he began, much upon the ſame plan, his *Epiſtolæ Anatomicæ*, the firſt of which is dated at Padua in the beginning of April 1726. The works of Morgagni which have already been mentioned, are to be conſidered, in a great meaſure, as ſtrictly anatomical: but he was not more eminent as an anatomiſt, than as a learned and ſucceſsful phyſician. In the year 1760, when he was not far diſtant from the 80th year of his age, he publiſhed his large and valuable work *De cauſis et ſedibus morborum per anatomen indagatis*. This laſt and moſt important of all his productions will afford convincing evidence of his induſtry and abilities to lateſt poſterity. Beſides theſe works, he publiſhed, at different periods of his life, ſeveral miſcellaneous pieces, which were afterwards collected into one volume, and printed under his own eye at Padua, in the year 1765. It does not appear that he had in view any future publications; but he intended to have favoured the world with a complete edition of all his works, which would probably have been augmented with many new obſervations. In this he was engaged when, on the 5th of December 1771, after he had nearly arrived at the 90th year of his age, death put a period to his long and glorious career in the learned world.

MORGANA, or MORGAGNA, *Fata*. See FATA.

MORGES, a town of Swiſſerland in the canton of Berne, a place of ſome trade, and ſituated on the lake of Geneva, five miles from Lauſanne. E. Long. 6. 42. N. Lat. 46. 29.

MORGO, anciently *Amorgos*, an iſland in the Archipelago, which produces wine, oil, and corn. It is well cultivated, and the inhabitants are affable, and generally of the Greek church. The beſt parts belong to a monaſtery. The greateſt inconvenience in this iſland is the want of wood. It is 30 miles in circumference. E. Long. 26. 15. N. Lat. 36. 30.

MORIAH, one of the eminences of Jeruſalem; on which Abraham went to offer his ſon, and David wanted to build the temple, which was afterwards executed by Solomon: The threſhing floor of Araunah; originally narrow, ſo as ſcarce to contain the temple, but enlarged by means of ramparts; and ſurrounded with a triple wall, ſo as to add great ſtrength to the temple, (Joſephus). It may be conſidered as a part of Mount Sion, to which it was joined by a bridge and gallery, (*Id.*)

MORILLES, a kind of muſhroom, about the ſize of a walnut, pierced with holes like a honey-comb, and ſaid to be good for creating an appetite. It is often uſed in ſauces and ragouts.

MORINA, a genus of plants belonging to the diandria claſs; and in the natural method ranking under the 48th order, *Aggregatæ*. See BOTANY *Index*.

MORINORUM CASTELLUM, in *Ancient Geography*, ſimply Caſtellum (Antonine); ſituated on an eminence, with a ſpring of water on its top, in the territory of the Morini. Now *Mont Caſſel*, in Flanders.

MORINDA, a genus of plants belonging to the pentandria claſs, and in the natural method ranking under the 48th order, *Aggregatæ*. See BOTANY *Index*.

MORISON, ROBERT, phyſician and profeſſor of botany at Oxford, was born at Aberdeen in 1620, bred at the univerſity there, and taught philoſophy for ſome time in it; but having a ſtrong inclination to botany, made great progreſs in that ſcience. The civil wars obliged him to leave his country; which, however, he did not do till he had firſt ſignalized his zeal for the intereſt of the king, and his courage, in a battle fought between the inhabitants of Aberdeen and the Preſbyterian troops on the bridge of Aberdeen, in which he received a dangerous wound on the head. As ſoon as he was cured of it, he went into France; and fixing at Paris, he applied aſſiduouſly to botany and anatomy. He was introduced to the duke of Orleans, who gave him the direction of the royal gardens at Blois. He exerciſed the office till the death of that prince, and afterwards went over to England in 1660. Charles II. to whom the duke of Orleans had preſented him at Blois, ſent for him to London, and gave him the title

MICROSCOPE. *PLATE CCCXXXVIII.*

Fig. 8.

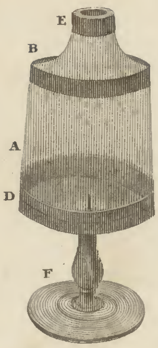


Fig. 9.

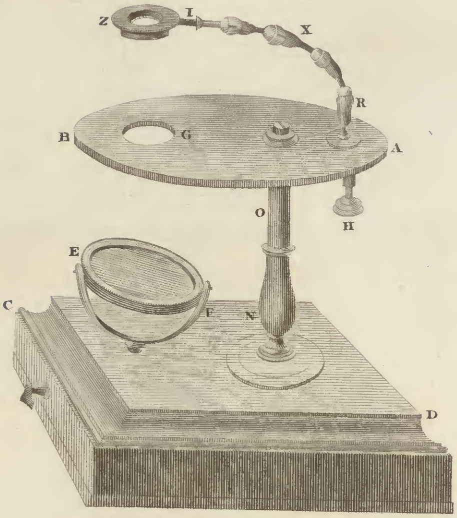


Fig. 10.

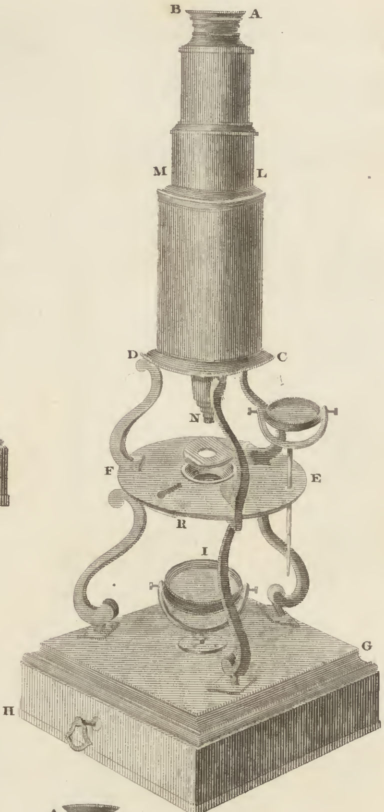


Fig. 11.

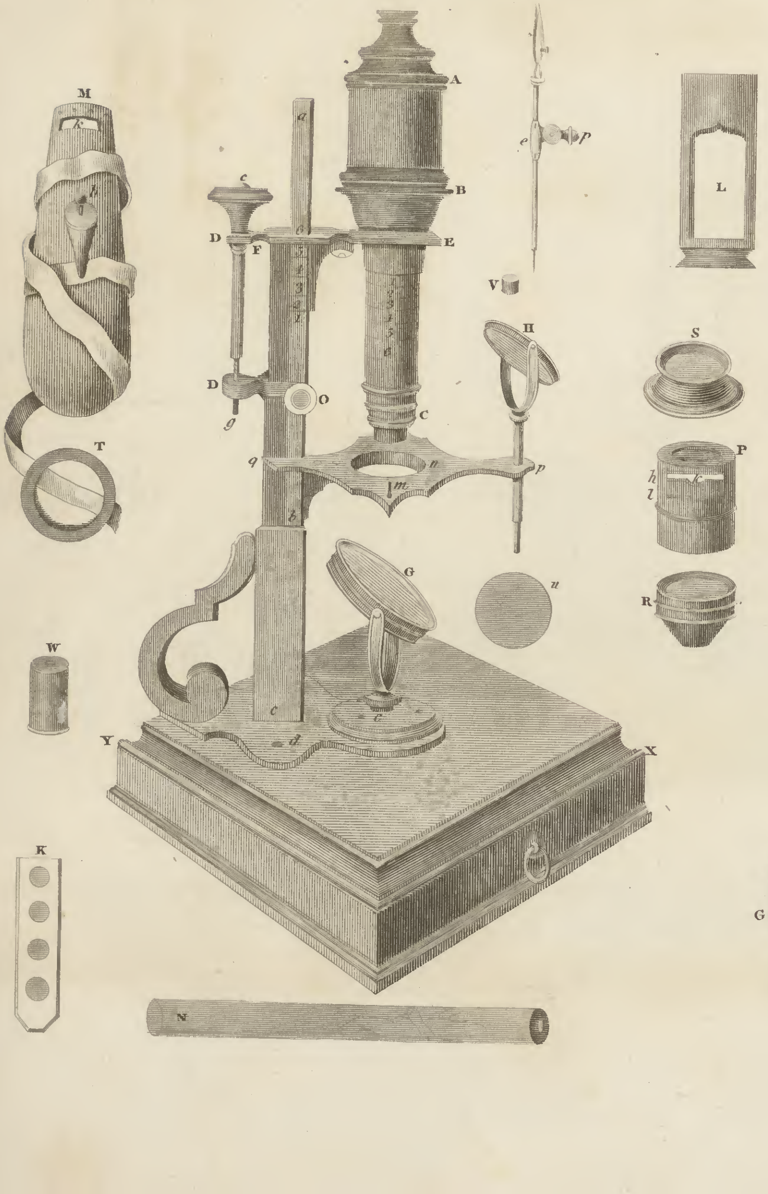
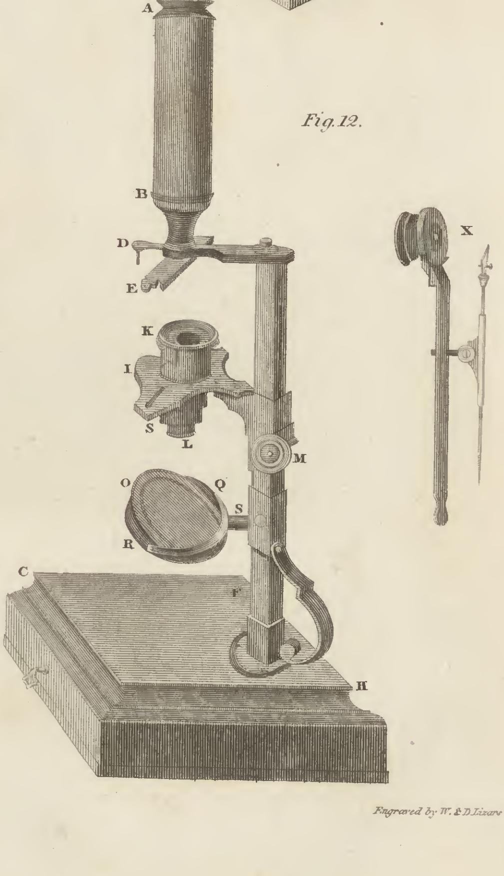


Fig. 12.



Engraved by W. & D. Lizars Edin.

MICROSCOPE. PLATE CCCXXXIX.

Fig. 13.

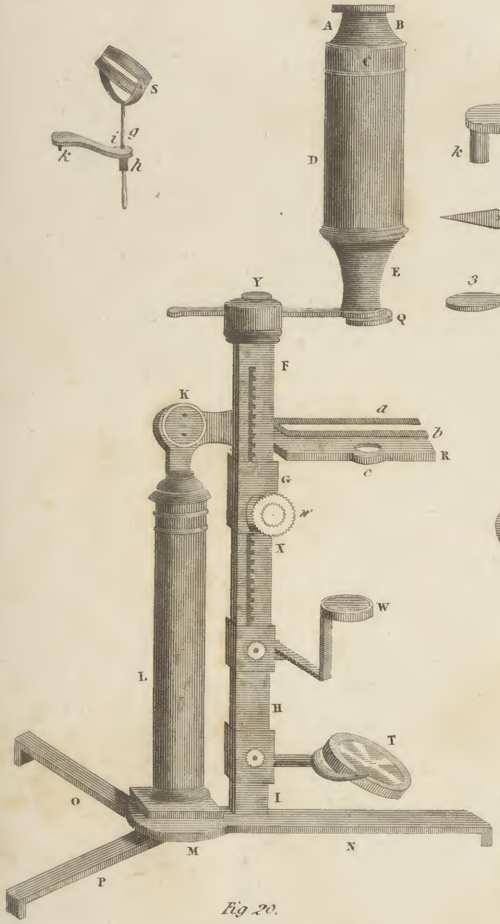


Fig. 14.

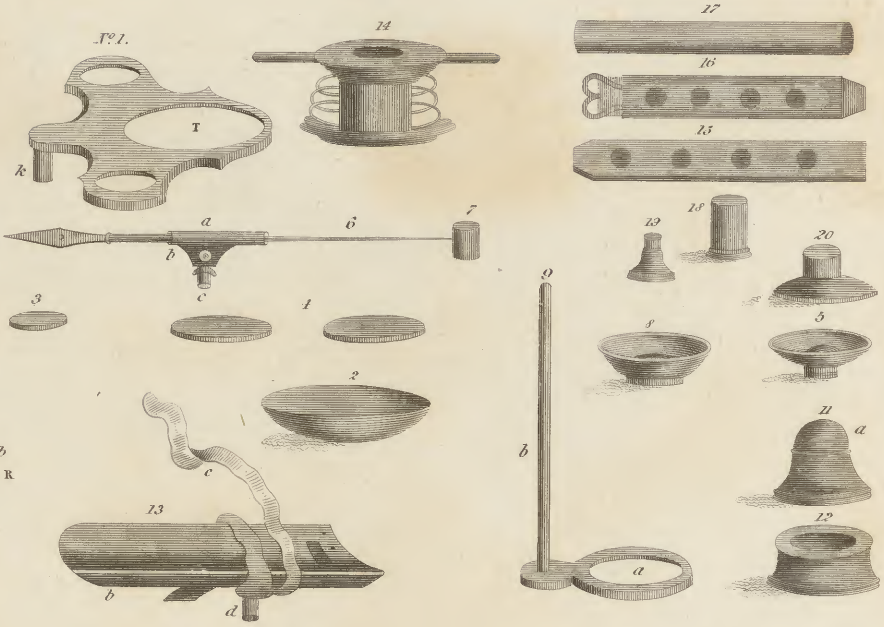


Fig. 16.

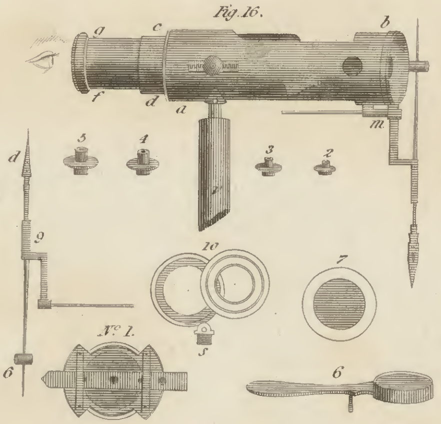


Fig. 17.

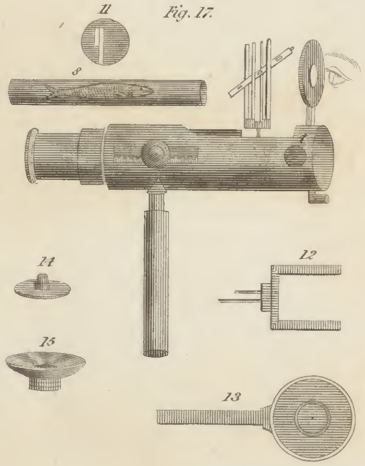


Fig. 20.

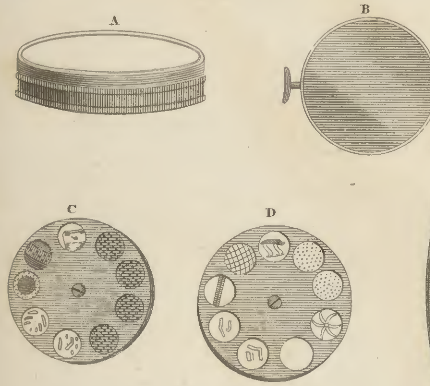


Fig. 19.

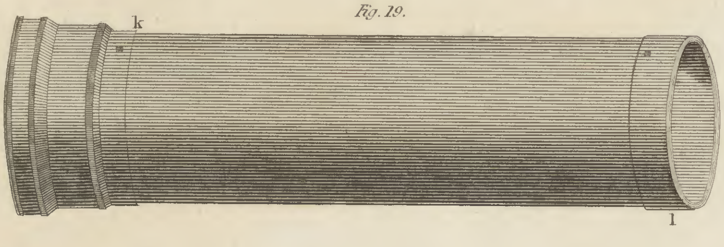


Fig. 15.

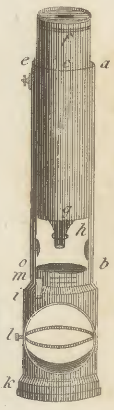
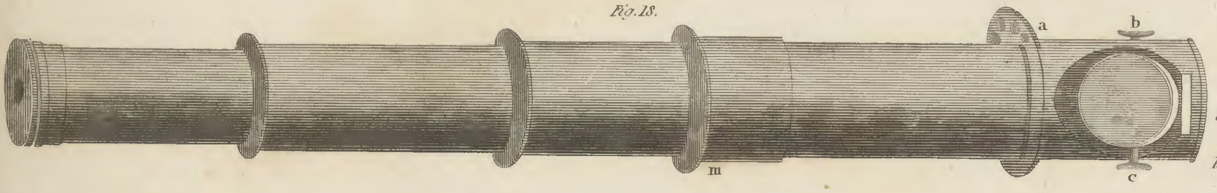


Fig. 18.



Engraved by W. & D. Lizars Edinburgh.

MICROSCOPE.

PLATE CCCXL.

Fig. 21.

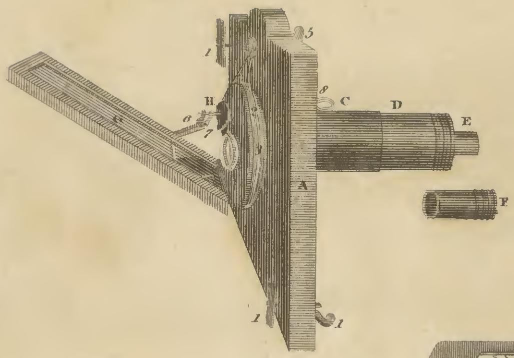


Fig. 25.

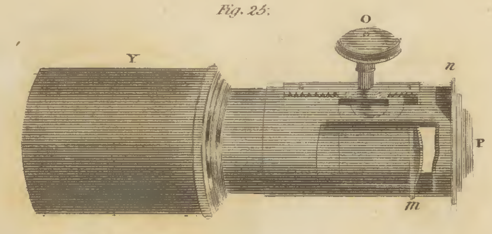
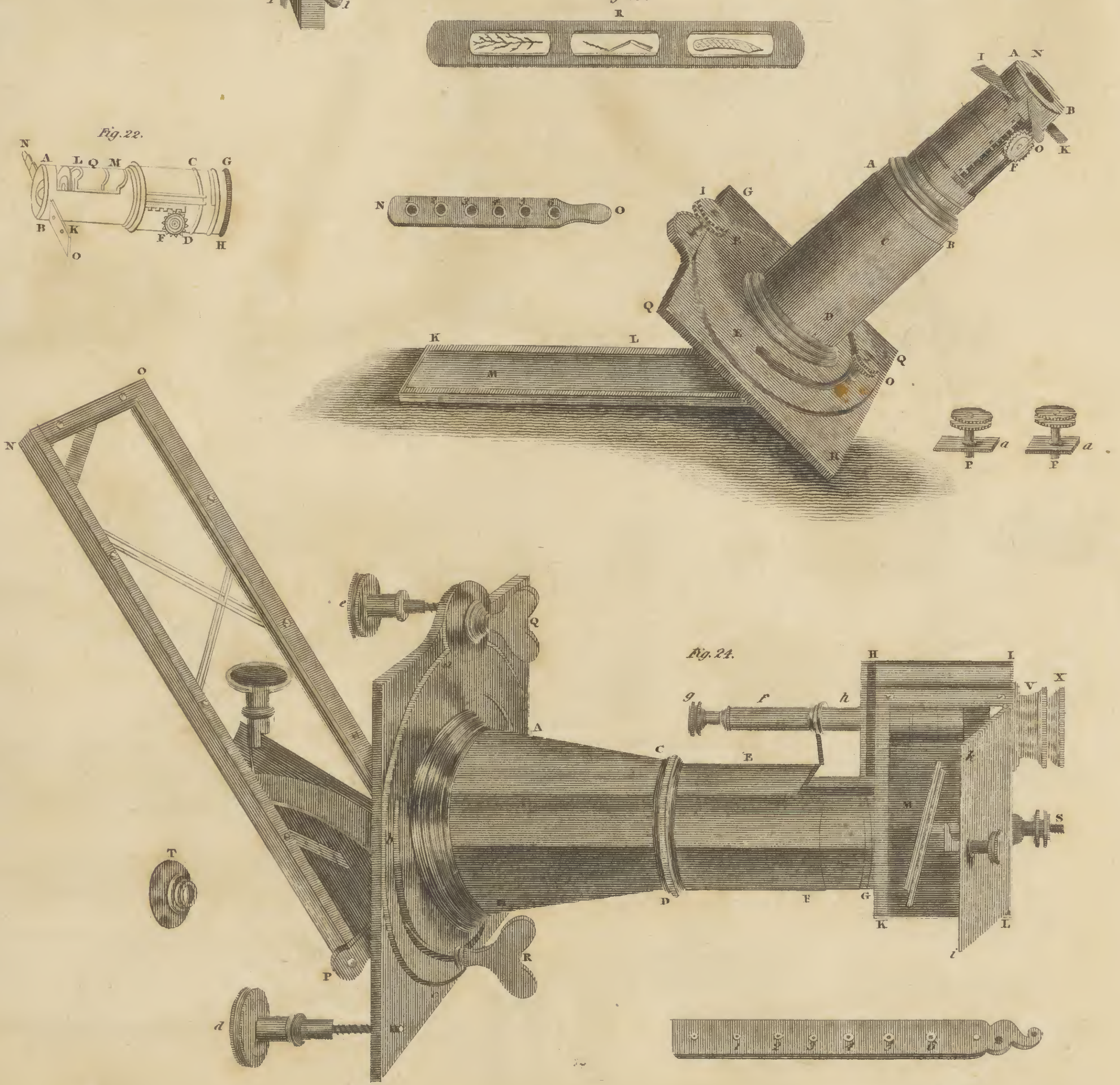


Fig. 23. *Fig. 22.* *Fig. 24.*



Engraved by W.&D. Lizars. Edin.

MICROSCOPE.

PLATE CCCXLI.

Fig. 26.

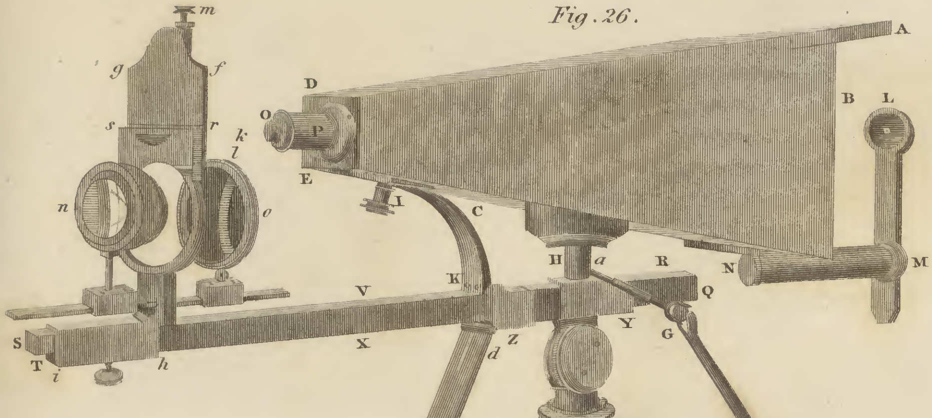
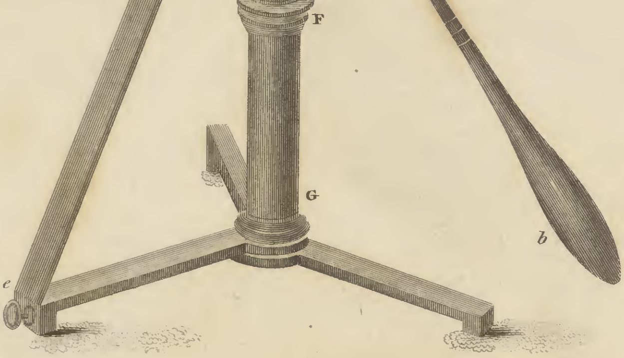



Fig. 29.

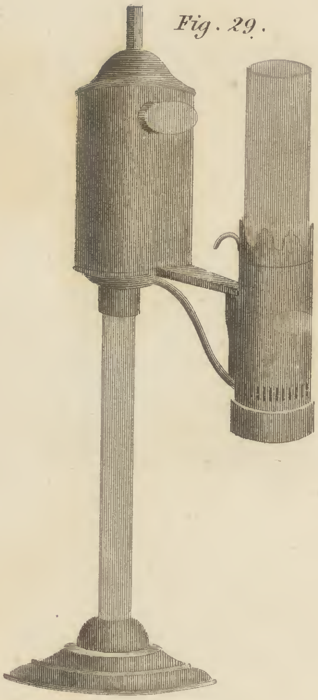


Fig. 27.

Fig. 28.

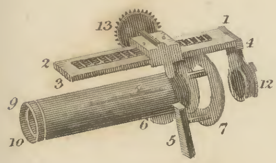


Fig. 30.

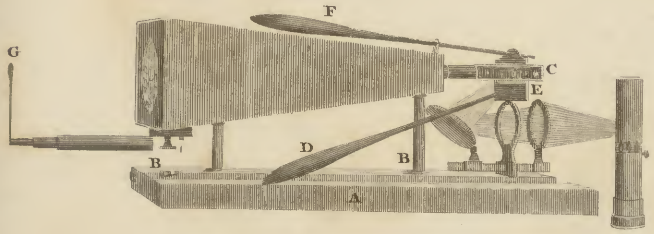
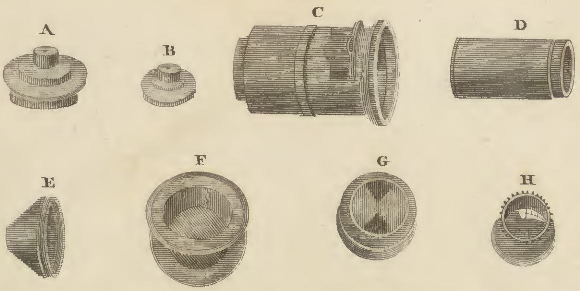
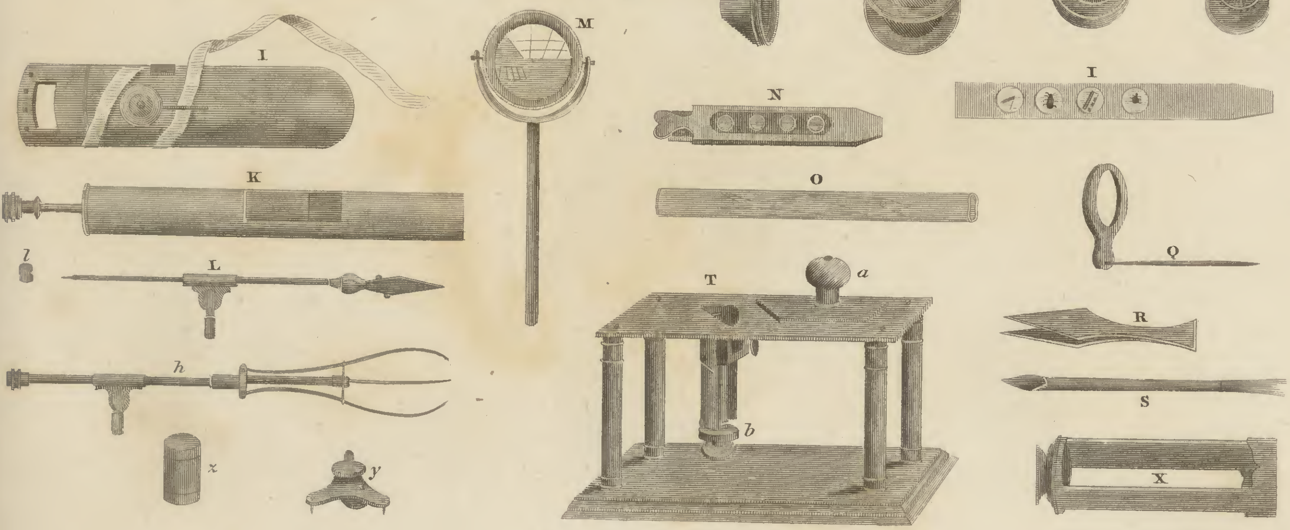


Fig. 31.



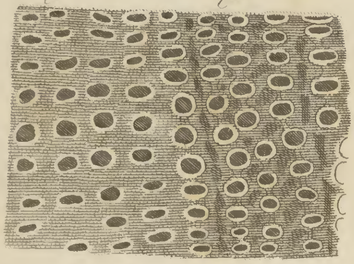


Engd. by W. & D. Lizars Edinr.

MICROSCOPIC *OBJECTS*. *PLATE CCCXLII.*

Fig. 32.

Fig. 33. *Fig. 32.*



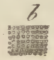


Fig. 35.

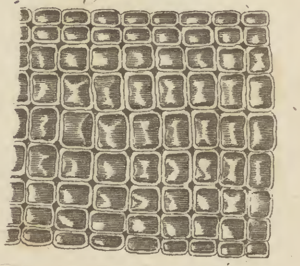


Fig. 36.

Fig. 37.

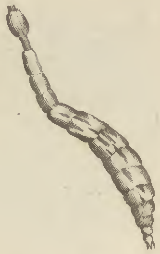


Fig. 39.

Fig. 40.

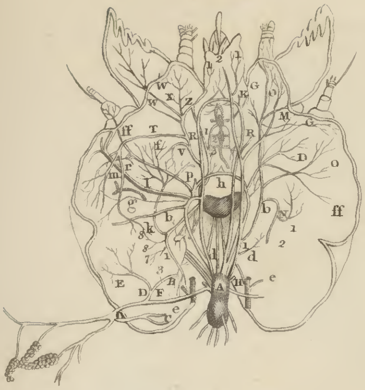
Fig. 41.

Fig. 34.

W. Archibald Sculp.^t

MICROSCOPIC OBJECTS. PLATE CCCXLIII.

Fig.54.



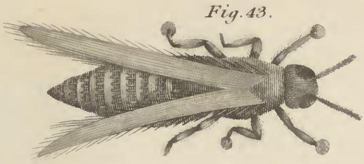


Fig.44.

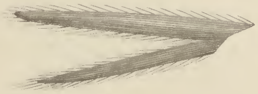


Fig.46.

Fig.53. *Fig.52.*

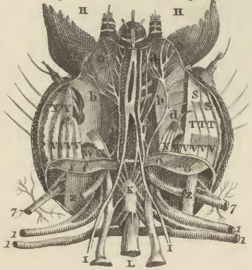


Fig.45.

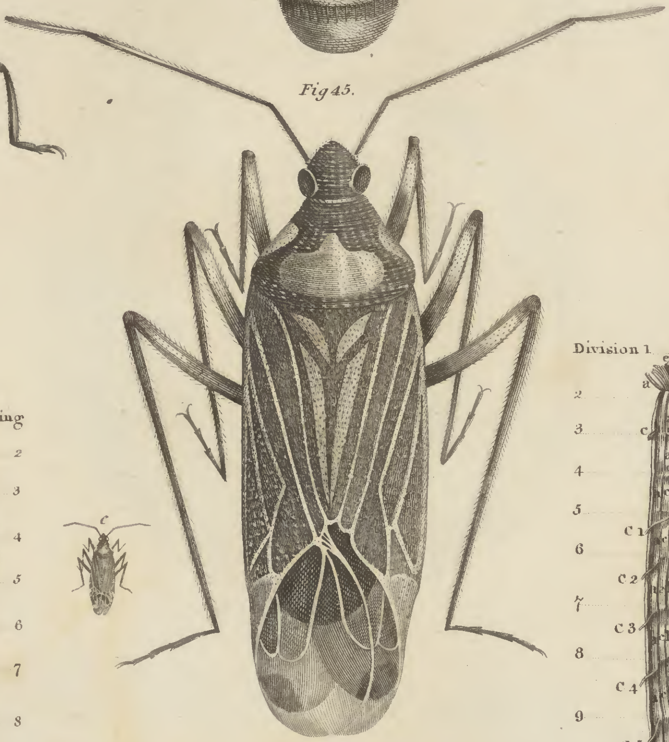


Fig.48. *Fig.49.*

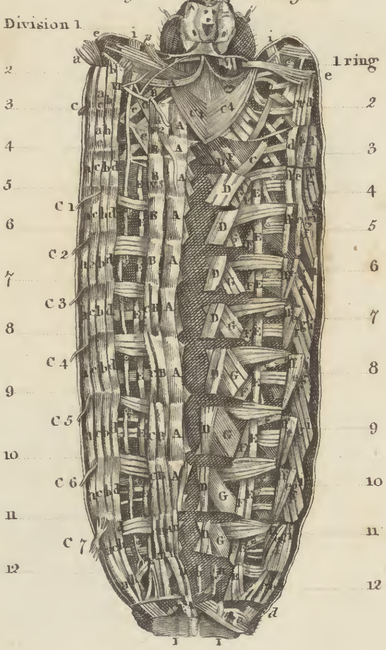


Fig.51. *Fig.50.*

Fig.47.

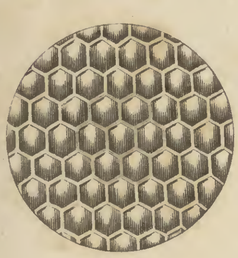
A.Wilson Sculp^t.

MICROSCOPIC OBJECTS. PLATE CCCXLIV.

Fig. 55.

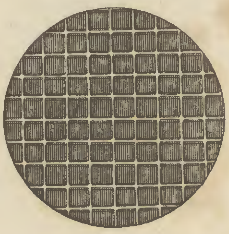
a

Fig. 57.



b

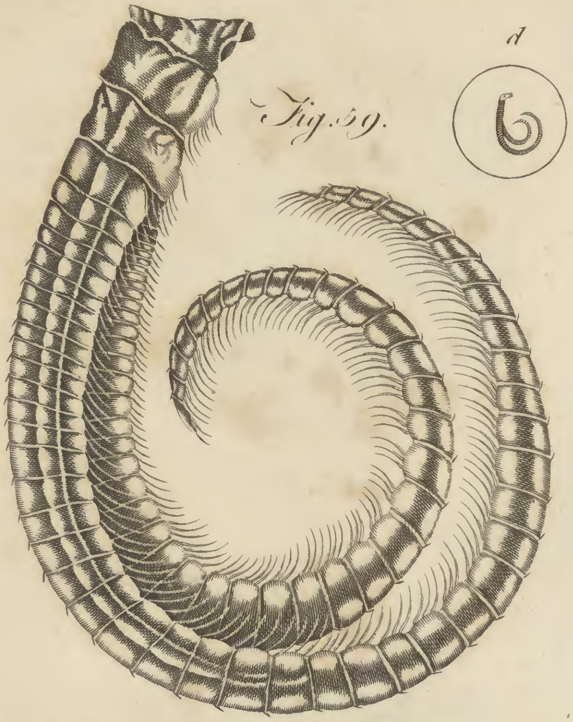
Fig. 58.



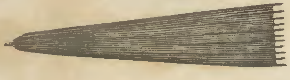
c

d

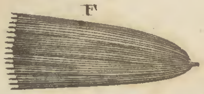
Fig. 59.



E



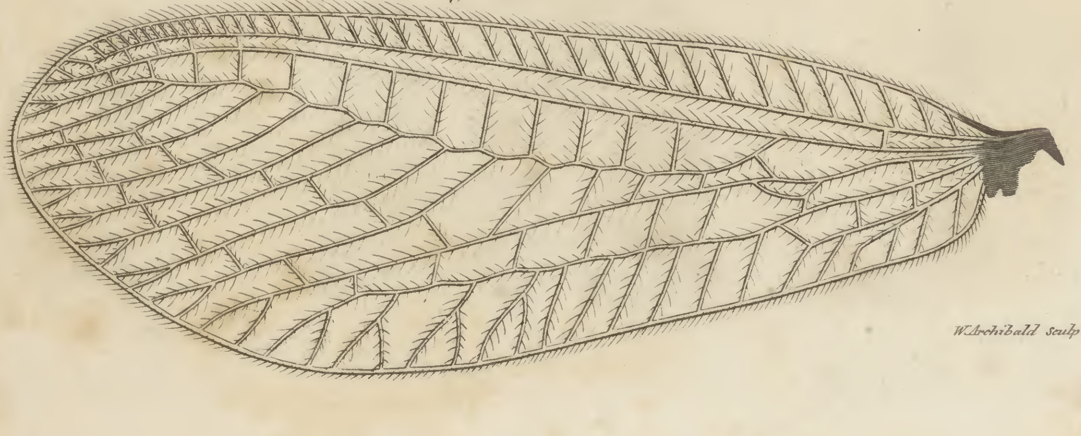
F



I

H

Fig. 56.



W. Archibald Sculp.t

MICROSCOPIC OBJECTS. PLATE CCCXLV.

Fig. 62.

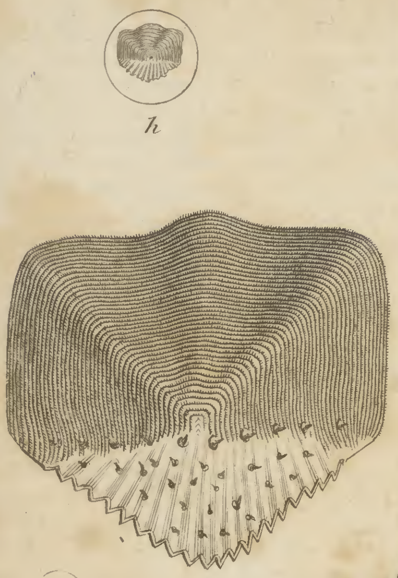


Fig. 65.

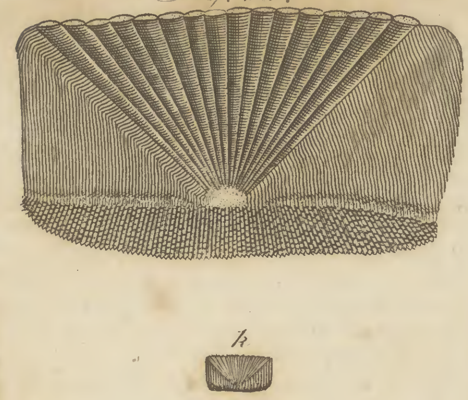


Fig. 64.

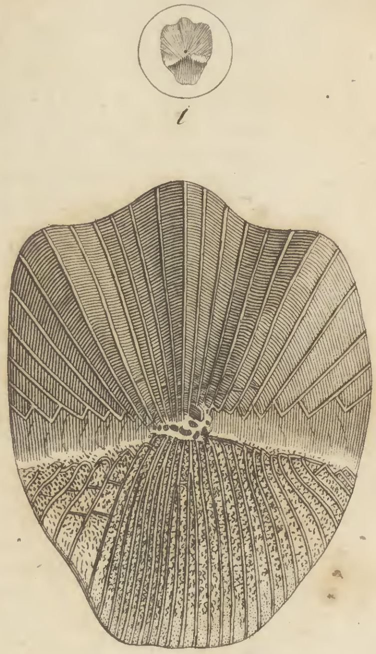


Fig. 61.

Fig. 63.

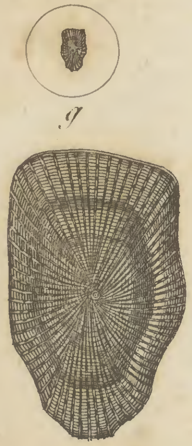
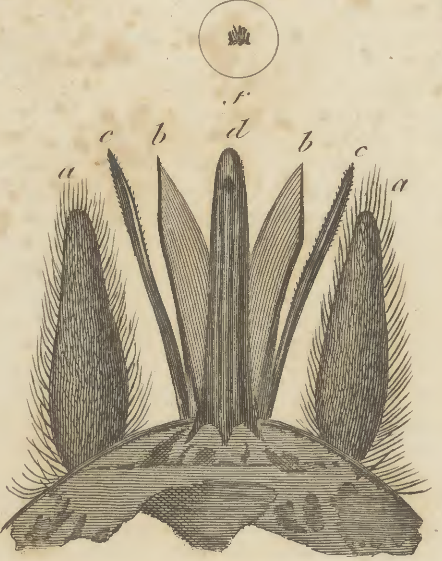


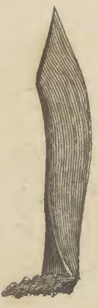
Fig. 66.

Fig. 60.



C

B



D

E

W. Archibald Sculp.t

veal it from apprehenſion of the king's reſentment, he opened a hole in the earth, and after he had whiſpered there that Midas had the ears of an aſs, he covered the place as before, as if he had buried his words in the ground. On that place, as the poets mention, grew a number of reeds, which when agitated by the wind uttered the ſame ſound that had been buried beneath, and publiſhed to the world that Midas had the ears of an aſs. Some explain the fable of the ears of Midas, by the ſuppoſition that he kept a number of informers and ſpies, who were continually employed in gathering every ſeditious word that might drop from the mouths of his ſubjects. Midas, according to Strabo, died of drinking bull's hot blood. This he did, as Plutarch mentions, to free himſelf from the numerous ill dreams which continually tormented him. Midas, according to ſome, was ſon of Cybele. He built a town which he called *Ancyræ*.

MIDAS, *Ear-ſhell*. See HALIOTIS, CONCHOLOGY *Index*.

MID-HEAVEN, the point of the ecliptic that culminates, or in which it cuts the meridian.

MIDDLEBURG, one of the Friendly iſlands in the South ſea. The iſland was firſt diſcovered by Taſman, a Dutch navigator, in January 1742-3; and is called by the natives *Ea-Oo-whe*: it is about 16 miles from north to ſouth, and in the wideſt part about 8 miles from eaſt to weſt. The ſkirts are chiefly laid out in plantations, the ſouth-weſt and north-weſt ſides eſpecially. The interior parts are but little cultivated, though very capable of it: but this neglect adds greatly to the beauty of the iſland; for here are agreeably diſperſed groves of cocoa-nuts and other trees, lawns covered with thick graſs, here and there plantations and paths leading to every part of the iſland, in ſuch beautiful diſorder, as greatly to enliven the proſpect. The hills are low; the air is delightful; but unfortunately water is denied to this charming ſpot. Yams, with other roots, bananas, and bread-fruit, are the principal articles of food; but the latter appeared to be ſcarce. Here is the pepper-tree, or *ava-ava*, with which they make an intoxicating liquor, in the ſame diſguſting manner as is practiſed in the Society iſlands. Here are ſeveral odoriferous trees and ſhrubs, particularly a ſpecies of the lemon tribe; and the botanical gentlemen met with various new ſpecies of plants. Here alſo are a few hogs and fowls.

There are no towns or villages; moſt of the houſes are built in plantations, which are laid out in different parts, with no other order than what convenience requires. They are neatly conſtructed, but are leſs roomy and convenient than thoſe in the Society iſles. The floors are a little raiſed, and covered with thick ſtrong mats. The ſame ſort of matting ſerves to encloſe them on the windward ſide, the others being open. They have little areas before moſt of them, which are planted round with trees or ornamental ſhrubs, whoſe fragrance perfumes the air. Their houſehold furniture conſiſts of a few wooden platters, cocoa-nut ſhells, and pillows made of wood, and ſhaped like four-footed ſtools or forms: their common clothing, with the addition of a mat, ſerves them for bedding.

The natives are of a clear mahogany or cheſnut brown, with black hair, in ſhort frizzled curls, which ſeems to be burnt at the tips; their beards are cut or ſhaven. The general ſtature of the men is equal to our middle ſize, from five feet three to five feet ten inches; the proportions of the body are very fine, and the *contours* of the limbs extremely elegant, though ſomething more muſcular than at Otaheite, which may be owing to a greater and more conſtant exertion of ſtrength in their agriculture and domeſtic economy. Their features are extremely mild and pleaſing; and differ from the old Otaheitan faces in being more oblong than round, the noſe ſharper, and the lips rather thinner. The women are, in general, a few inches ſhorter than the men, but not ſo ſmall as the lower claſs of women at the Society iſlands. The practice of puncturing the ſkin, and blacking it, which is called *tattowing*, is in full force among the men here, for their belly and loins are very ſtrongly marked in configurations more compounded than thoſe at Otaheite. The tendereſt parts of the body were not free from theſe punctures; the application of which, beſides being very painful, muſt be extremely dangerous on glandulous extremities.

The men in general go almoſt naked, having only a ſmall piece of cloth round the loins, but ſome wrap it in great abundance round them from their waiſt: this cloth is manufactured much like that at Otaheite, but overſpread with a ſtrong glue, which makes it ſtiff, and fit to reſiſt the wet. The women are likewiſe covered from the waiſt downwards: they often have looſe necklaces, conſiſting of ſeveral ſtrings of ſmall ſhells, ſeeds, teeth of fiſhes; and in the middle of all, the round *operculum*, or cover of a ſhell as large as a crown-piece. The men frequently wear a ſtring round their necks, from which a mother-of-pearl ſhell hangs down on the breaſt; both the ears of the women were perforated with two holes, and a cylinder cut out of tortoiſe-ſhell or bone was ſtuck through both the holes. The moſt remarkable circumſtance obſerved of this people was, that moſt of them wanted the little finger on one, and ſometimes on both hands: the difference of ſex or age did not exempt them from this amputation; for even among the few children that were ſeen running about naked, the greater part had already ſuffered ſuch loſs. This circumſtance was obſerved by Taſman. Another ſingularity which was obſerved to be very general among theſe people, was a round ſpot on each cheek-bone, which appeared to have been burnt or bliſtered. On ſome it ſeemed to have been recently made, on others it was covered with ſcurf, and many had only a ſlight mark of its former exiſtence: how, or for what purpoſe it was made, could not be learnt. The women here, in general, were reſerved; and turned, with diſguſt, from the immodeſt behaviour of ungovernable ſeamen: there were not, however, wanting ſome who appeared to be of eaſy virtue, and invited their lovers with laſcivious geſtures. The language ſpoken here is ſoft, and not unpleaſing; and whatever they ſaid was ſpoken in a kind of ſinging tone. Omai and Mahine, who were both paſſengers on board the ſhip, at firſt declared that the language was totally new and unintelligible to them; however, the affinity of ſeveral words being pointed out, they ſoon caught the particular modification of this dialect, and converſed much better with the natives than any on board the ſhips could have done, after a long intercourſe. They have the neat-

eſt

eſt ornaments imaginable, conſiſting of a number of little flat ſticks, about five inches long, of a yellow wood like box, firmly and elegantly connected together at the bottom by a tiſſue of the fibres of cocoa-nut, ſome of which were of their natural colour, and others dyed black; the ſame fibres were likewiſe uſed in the making of baſkets, the taſte of which was highly elegant, and varied into different forms and patterns. Their clubs are of a great variety of ſhapes, and many of them ſo ponderous as ſcarcely to be managed with one hand. The moſt common form was quadrangular, ſo as to make a rhomboid at the broad end, and gradually tapering into a round handle at the other. Far the greater part were carved all over in many chequered patterns, which ſeemed to have required a long ſpace of time, and incredible patience, to work up; as a ſharp ſtone, or a piece of coral, are the only tools made uſe of: the whole ſurface of the plain clubs was as highly poliſhed as if an European workman had made them with the beſt inſtruments. Beſides clubs, they have ſpears of the ſame wood, which were ſometimes plain ſharp-pointed ſticks, and ſometimes barbed with a ſting-ray's tail. They have likewiſe bows and arrows of a peculiar conſtruction: the bow, which is ſix feet long, is about the thickneſs of a little finger, and when ſlack forms a ſlight curve; its convex part is channelled with a ſingle deep groove, in which the bow-ſtring is lodged. The arrow is made of reed, near ſix feet long, and pointed with hard wood: when the bow is to be bent, inſtead of drawing it ſo as to increaſe the natural curvature, they draw it the contrary way, make it perfectly ſtraight, and then form the curve on the other ſide. Moſt of their canoes have outriggers, made of poles; and their workmanſhip is very admirable: two of theſe canoes are joined together with a ſurpriſing exactneſs, and the whole ſurface receives a very curious poliſh. Their paddles have ſhort broad blades, ſomething like thoſe at Otaheite, but more neatly wrought and of better wood.

They keep their dead above ground, after the manner of the Society iſlands; as a corpſe was ſeen depoſited on a low hut.

Here were ſeen ſeveral men and women afflicted with leprous diſeaſes, in ſome of whom the diſorder had riſen to a high degree of virulence: one man in particular had his back and ſhoulders covered with a large cancerous ulcer, which was perfectly livid within, and of a bright yellow all round the edges. A woman was likewiſe unfortunate enough to have her face deſtroyed by it in the moſt ſhocking manner; there was only a hole left in the place of her noſe; her cheek was ſwelled up, and continually oozing out a purulent matter; and her eyes ſeemed ready to fall out of her head, being bloody and ſore. Though theſe were ſome of the moſt miſerable objects that could poſſibly be ſeen, yet they ſeemed to be quite unconcerned about their misfortunes, and traded as briſkly as any of the reſt.

MIDDLEHAM, a town in the north riding of Yorkſhire, ſituated on the river Ure, 255 miles from London. It had once a caſtle, where was born Edward prince of Wales, only ſon of Richard III.; and is noted for a woollen manufactory and frequent horſe-races. Its market is on Monday; and fairs Nov. 6. and 7. The town ſtands on a riſing ground; and the caſtle, which was on the ſouth ſide, was formerly moated round by the help of a ſpring conveyed in pipes from the higher grounds.

MIDDLESEX, a county of England, which derives its name from its ſituation amidſt the three kingdoms of the Eaſt, Weſt, and South Saxons. It is bounded on the north by Hertfordſhire; on the ſouth by the river Thames, which divides it from Surry; on the weſt by the river Colne, which ſeparates it from Buckinghamſhire; and on the eaſt by the river Lea, which divides it from Eſſex. It extends about 23 miles in length, but hardly 14 in breadth, and is not more than 115 in circumference; but as it comprehends the two vaſt cities of London and Weſtminſter, which are ſituated in the ſouth-eaſt part of the county, it is by far the wealthieſt and moſt populous county in England. It is divided into 602 liberties, containing 200 pariſhes, beſides a vaſt number of chapels of eaſe, and 5 market towns, excluſive of the cities of London and Weſtminſter. The air is very pleaſant and healthy, to which a fine gravelly ſoil does not a little contribute. The ſoil produces plenty of corn, and the county abounds with fertile meadows and gardeners grounds. In a word, the greater part of the county is ſo prodigiouſly aſſiſted by the rich compoſt from London, that the whole of the cultivated part may be conſidered as a garden. The natural productions are cattle, corn, and fruit; but its manufactures are too many to be enumerated here, there being hardly a ſingle manufacture practiſed in Great Britain but what is alſo eſtabliſhed in this county.—Though London is the chief city, Brentford is the county town where the members of parliament are elected. It contains 77,712 houſes, inhabited by 130,742 families, containing 340,958 males, and 294,371 females, ſo that the whole amount of its population is 635,329 perſons.

MIDDLESEX is alſo the name of four different counties in the United States of America; one of them is in Maſſachuſſetts, another in Connecticut, a third in New Jerſey, and the fourth in Virginia.

MIDDLETON, DR CONYERS, a very celebrated Engliſh divine, the ſon of a clergyman in Yorkſhire, was born at Richmond in 1683. He diſtinguiſhed himſelf, while fellow of Trinity college, Cambridge, by his controverſy with Dr Bentley his maſter, relating to ſome mercenary conduct of the latter in that ſtation. He afterwards had a controverſy with the whole body of phyſicians, on the dignity of the medical profeſſion; concerning which he publiſhed *De medicorum apud veteres Romanos degentium conditione diſſertatio; qua, contra viros celeberrimos Jacobum Sponium et Richardum Meadium, ſervilem atque ignobilem eam fuiſſe oſtenditur:* and in the courſe of this diſpute much reſentment and many pamphlets appeared. Hitherto he had ſtood well with his clerical brethren; but he drew the reſentment of the church on him in 1729, by writing "A Letter from Rome, ſhowing an exact conformity between Popery and Paganiſm," &c.; as this letter, though politely written, yet attacked Popiſh miracles with a gaiety that appeared dangerous to the cauſe of miracles in general. Nor were his Objections to Dr Waterland's manner of vindicating Scripture againſt Tindal's "Chriſtianity as old as the Creation," looked on in a more favourable point of view. In 1741, came out his great work, "The hiſtory of the life of M. Tullius Cicero,"

"Cicero," 2 vols 4to: which is indeed a fine performance, and will probably be read as long as taſte and polite literature ſubſiſt among us: the author has nevertheleſs fallen into the common error of biographers, who often give panegyrics inſtead of hiſtory. In 1748, he publiſhed, "A free inquiry into the miraculous powers which are ſuppoſed to have ſubſiſted in the Chriſtian church from the earlieſt ages, through ſeveral ſucceſſive centuries." He was now attacked from all quarters; but before he took any notice of his antagoniſts, he ſupplied them with another ſubject, in "An examination of the Lord Biſhop of London's diſcourſes concerning the uſe and extent of prophecy," &c. Thus Dr Middleton continued to diſplay talents and learning, which are highly eſteemed by men of a free turn of mind, but by no means in a method calculated to invite promotion in the clerical line. He was in 1723 choſen principal librarian of the public library at Cambridge; and if he roſe not to dignities in the church, he was in eaſy circumſtances, which permitted him to aſſert a dignity of mind often forgotten in the career of preferment. He died in 1750, at Hilderſham in Cambridgeſhire, an eſtate of his own purchaſing; and in 1752, all his works, except the life of Cicero, were collected in 4 vols. 4to.

MIDDLEWICH, a town of Cheſhire, 167 miles from London. It ſtands near the conflux of the Croke and Dan, where are two ſalt water ſprings, from which are made great quantities of ſalt, the brine being ſaid to be ſo ſtrong as to produce a full fourth part ſalt. It is an ancient borough, governed by burgeſſes; and its pariſh extends into many adjacent townſhips. It has a ſpacious church. By means of inland navigation, it has communication with the rivers Merſey, Dee, Ribble, Ouſe, Trent, Darwent, Severn, Humber, Thames, Avon, &c.; which navigation, including its windings, extends above 500 miles, in the counties of Lincoln, Nottingham, York, Lancaſter, Weſtmoreland, Stafford, Warwick, Leiceſter, Oxford, Worceſter, &c. The river Wheelock, after a courſe of about 12 miles from Mowcop-hill, runs into the Dan a little above this town.

MIDHURST, a town of Suſſex, 52 miles from London, has been repreſented in parliament ever ſince the 4th of Edward II. It is a neat ſmall town, on a hill ſurrounded with others, having the river Arun at the bottom; and is a borough by preſcription, governed by a bailiff, choſen annually by a jury at a court-leet of the lord of the manor.

MIDIAN, or MADIAN, in *Ancient Geography*, a town on the ſouth ſide of Arabia Petræa, ſo called from one of the ſons of Abraham by Keturah.—Another *Midian*, near the Arnon and Æoplis, in ruins in Jerome's time. With the daughters of theſe Midianites the Iſraelites committed fornication, and were guilty of idolatry. A branch of the Midianites dwelt on the Arabian gulf, and were called *Kenites*: ſome of whom turned proſelytes, and dwelt with the Iſraelites in the land of Canaan.

MID-LOTHIAN. See LOTHIAN and EDINBURGHSHIRE.

MIDSHIP-FRAME, a name given to that timber, or combination of pieces formed into one timber, which determines the extreme breadth of the ſhip, as well as the figure and dimenſion of all the inferior timbers.

In the article *SHIP-Building*, the reader will find a full explanation of what is meant by a frame of timbers. He will alſo perceive the outlines of all the principal frames, with their gradual dimenſions, from the midſhip-frame, delineated in the plane of projection annexed to that article.

MIDSHIPMAN, a ſort of naval cadet, appointed by the captain of a ſhip of war, to ſecond the orders of the ſuperior officers, and aſſiſt in the neceſſary buſineſs of the veſſel, either aboard or aſhore.

The number of midſhipmen, like that of ſeveral other officers, is always in proportion to the ſize of the ſhip to which they belong. Thus a firſt-rate man of war has 24, and the inferior rates a ſuitable number in proportion. No perſon can be appointed lieutenant without having previouſly ſerved two years in the royal navy in this capacity, or in that of *mate*, beſides having been at leaſt four years in actual ſervice at ſea, either in merchant ſhips or in the royal navy.

Midſhipman is accordingly the ſtation in which a young volunteer is trained in the ſeveral exerciſes neceſſary to attain a ſufficient knowledge of the machinery, movements, and military operations of a ſhip, to qualify him for a ſea officer.

On his firſt entrance in a ſhip of war, every midſhipman has ſeveral diſadvantageous circumſtances to encounter. Theſe are partly occaſioned by the nature of the ſea ſervice; and partly by the miſtaken prejudices of people in general reſpecting naval diſcipline, and the genius of ſailors and their officers. No character, in their opinion, is more excellent than that of the common ſailor, whom they generally ſuppoſe to be treated with great ſeverity by his officers, drawing a compariſon between them not very advantageous to the latter. The midſhipman uſually comes aboard tinctured with theſe prejudices, eſpecially if his education has been amongſt the higher rank of people; and if the officers happen to anſwer his opinion, he conceives an early diſguſt to the ſervice, from a very partial and incompetent view of its operations. Blinded by theſe prepoſſeſſions, he is thrown off his guard, and very ſoon ſurpriſed to find, amongſt thoſe honeſt ſailors, a crew of abandoned miſcreants, ripe for any miſchief or villany. Perhaps, after a little obſervation, many of them will appear to him equally deſtitute of gratitude, ſhame, or juſtice, and only deterred from the commiſſion of any crimes by the terror of ſevere puniſhment. He will diſcover, that the pernicious example of a few of the vileſt in a ſhip of war is too often apt to poiſon the principles of the greateſt number, eſpecially if the reins of diſcipline are too much relaxed, ſo as to foſter that idleneſs and diſſipation, which engender ſloth, diſeaſes, and an utter profligacy of manners. If the midſhipman on many occaſions is obliged to mix with theſe, particularly in the exerciſes of extending or reducing the ſails in the tops, he ought reſolutely to guard againſt this contagion, with which the morals of his inferiors may be infected. He ſhould, however, avail himſelf of their knowledge, and acquire their expertneſs in managing and fixing the ſails and rigging, and never ſuffer himſelf to be excelled by an inferior. He will probably find a virtue in almoſt

Midſhipman.

every private ſailor, which is entirely unknown to many of his officers: that virtue is emulation, which is not indeed mentioned amongſt their qualities by the gentlemen of *terra firma*, by whom their characters are often copiouſly deſcribed with very little judgment. There is hardly a common tar who is not envious of ſuperior ſkill in his fellows, and jealous on all occaſions to be outdone in what he conſiders as a branch of his duty: nor is he more afraid of the dreadful conſequences of whiſtling in a ſtorm, than of being ſtigmatized with the opprobrious epithet of *lubber*. Fortified againſt this ſcandal, by a thorough knowledge of his buſineſs, the ſailor will ſometimes ſneer in private at the execution of orders which to him appear awkward, improper, or unlike a ſeaman. Nay, he will perhaps be malicious enough to ſuppreſs his own judgment, and, by a punctual obedience to command, execute whatever is to be performed in a manner which he knows to be improper, in order to expoſe the perſon commanding to diſgrace and ridicule. Little ſkilled in the method of the ſchools, he conſiders the officer who cons his leſſon by rote as very ill qualified for his ſtation, becauſe particular ſituations might render it neceſſary for the ſaid officer to aſſiſt at putting his own orders in practice. An ignorance in this practical knowledge will therefore neceſſarily be thought an unpardonable deficiency by thoſe who are to follow his directions. Hence the midſhipman who aſſociates with theſe ſailors in the tops, till he has acquired a competent ſkill in the ſervice of extending or reducing the ſails, &c. will be often entertained with a number of ſcurrilous jeſts, at the expence of his ſuperiors. Hence alſo he will learn, that a timely application to thoſe exerciſes can only prevent him from appearing in the ſame deſpicable point of view, which muſt certainly be a cruel mortification to a man of the ſmalleſt ſenſibility.

If the midſhipman is not employed in theſe ſervices, which are undoubtedly neceſſary to give him a clearer idea of the different parts of his occupation, a variety of other objects preſent themſelves to his attention. Without preſuming to dictate the ſtudies which are moſt eſſential to his improvement, we could wiſh to recommend ſuch as are moſt ſuitable to the bent of his inclination. Aſtronomy, geometry, and mechanics, which are in the firſt rank of ſcience, are the materials which form the ſkilful pilot and the ſuperior mariner. The theory of navigation is entirely derived from the two former, and all the machinery and movements of a ſhip are founded upon the latter. The action of the wind upon the ſails, and the reſiſtance of the water at the ſtem, naturally dictate an inquiry into the property of ſolids and fluids; and the ſtate of the ſhip, floating on the water, ſeems to direct his application to the ſtudy of hydroſtatics, and the effects of gravity. A proficiency in theſe branches of ſcience will equally enlarge his views, with regard to the operations of naval war, as directed by the efforts of powder and the knowledge of projectiles. The moſt effectual method to excite his application to thoſe ſtudies, is, perhaps, by looking round the navy, to obſerve the characters of individuals. By this inquiry he will probably diſcover, that the officer who is eminently ſkilled in the ſciences, will command univerſal reſpect and approbation; and that whoever is ſatisfied with the deſpicable ambition of ſhining the hero of an aſſembly, will be the object of univerſal contempt. The attention of the former will be engaged in thoſe ſtudies which are highly uſeful to himſelf in particular, and to the ſervice in general. The employment of the latter is to acquire thoſe ſuperficial accompliſhments that unbend the mind from every uſeful ſcience, emaſculate the judgment, and render the hero infinitely more dexterous at falling into his ſtation in the dance than in the line of battle.

Midſhipman, Midwife.

Unleſs the midſhipman has an unconquerable averſion to the acquiſition of thoſe qualifications which are ſo eſſential to his improvement, he will very rarely want opportunities of making a progreſs therein. Every ſtep he advances in thoſe meritorious employments will facilitate his acceſſion to the next in order. If the dunces, who are his officers or meſſmates, are rattling the dice, roaring bad verſes, hiſſing on the flute, or ſcraping diſcord from the fiddle, his attention to more noble ſtudies will ſweeten the hours of relaxation. He ſhould recollect, that no example from fools ought to influence his conduct, or ſeduce him from that laudable ambition which his honour and advantage are equally concerned to purſue.

MIDWIFE, one whoſe profeſſion is to deliver women in labour. See MIDWIFERY.

MIDWIFERY,

1 Definition. THE art of aſſiſting women in labour. In a more extended ſenſe, it is underſtood to comprehend alſo the treatment of the diſeaſes of women and children. In this work we ſhall conſider it in the former limited ſenſe, viz. as relating to the birth of the offspring of man.

2 *Hiſtory of Midwifery.*—It muſt be very obvious that this art muſt have been almoſt coeval with mankind: but in Europe it continued in a very rude ſtate till the 17th century; and even after phyſic and ſurgery had become diſtinct profeſſions, it remained almoſt totally uncultivated.

3 It is a curious fact, that in the empire of China the very reverſe of this has taken place. In that empire, according to the lateſt accounts, both phyſic and ſurgery are ſtill in a ſtate of the utmoſt degradation, even more ſo than among the ſavages of America; but for ſome hundred years, the art of midwifery has been practiſed by a ſet of men deſtined to the purpoſe by order of government. Theſe men, who hold in ſociety the ſame rank which lithotomiſts did in this country about the beginning of laſt century, are called in whenever a woman has been above a certain number of hours in labour, and employ a mechanical contrivance for-

for completing the delivery without injury to the infant. A certain number of ſuch individuals is allotted to each diſtrict of a certain population.

It is ſaid, that the Chineſe government was led to make this proviſion for alleviating the ſufferings of child-bearing women, in conſequence of a repreſentation, that annually many women died undelivered, and that in the majority of caſes the cauſe of obſtruction might have been removed by very ſimple mechanical expedients.

Both Sir George Staunton and Mr Barrow were ignorant of this fact; and the latter in particular expreſsly mentions, that there are no men-midwives in China. But the writer of this article had his information from a more authentic ſource than the works of gentlemen who were only a few months in that country, and were in a great meaſure treated as ſtate priſoners. He has it, through the medium of a friend, from a gentleman who reſided upwards of twenty years as ſurgeon to the Britiſh factory at Canton, and who had both the ability and the inclination to learn, during the courſe of ſo long a reſidence, all the cuſtoms and prejudices of the natives relating to the preſervation of human health.

4 Towards the end of the 17th century, the ſame cauſes which had ſo long before led to the cultivation of midwifery in China produced the ſame effect in Europe. The dangers to which women are ſometimes expoſed during labour excited the compaſſion of the benevolent; ſo that a conſiderable part of the firſt hoſpital which was eſtabliſhed for the reception of the indigent ſick, the Hotel Dieu of Paris was appropriated to lying-in women.

The opportunities of practice which that hoſpital afforded, directed the attention of medical men to the numerous accidents which happen during labour, and to the various diſeaſes which occur after delivery. Public teaching followed, and ſoon after the cuſtom of employing men in the practice of midwifery began.

From this period the art became rapidly improved; and it is now in many parts of Europe, and particularly in Great Britain, in as great a ſtate of perfection as phyſic or ſurgery.

5 In the year 1725, a profeſſorſhip of midwifery was eſtabliſhed in the univerſity of Edinburgh; and the town-council at the ſame time ordained, that no woman ſhould be allowed to practiſe midwifery within the liberties of the city, without having previouſly obtained a certificate from the profeſſor of her being properly qualified. This ſalutary regulation has fallen into deſuetude.

There can be no doubt that the improvement of the art of midwifery was chiefly in conſequence of medical men directing their attention to the ſubject; but the propriety of men being employed in ſuch a profeſſion is much queſtioned by many individuals of conſiderable reſpectability.

6 Dr John Gregory, in his Comparative View, p. 22. ſays, "every other animal brings forth its young without any aſſiſtance, but we think a midwife underſtands it better." Had this eminent philoſoper ſaid, "other animals content themſelves with the clothing which providence has beſtowed, but we think it neceſſary to cover our bodies with the workmanſhip of weavers," very few in this northern climate would have attended to the ſneer. His ſon, the preſent profeſſor, has improved upon the idea. He ſeems to ſuppoſe that women without any inſtruction, and of courſe without any knowledge of the ſubject, are capable of aſſiſting one another while in labour; and in the ſportiveneſs of his lively imagination, he compares men-midwives to that ſpecies of frog, in which, according to the allegation of Reaumur, the male draws out the ova from the female, or, to uſe the naturaliſt's words, "*accouche la femelle.*"

It appears to us that this queſtion, on which much declamation has been employed by the parties who have agitated it, may be brought within a very narrow compaſs. It may be aſſumed as a fact eſtabliſhed beyond the reach of controverſy, that ſometimes dangers and difficulties occur during labour (from cauſes to be explained in a ſubſequent part of this eſſay), which can be leſſened or removed by thoſe only who have an intimate knowledge of the ſtructure of the human body and of the practice of phyſic. On ſuch occaſions, it muſt be admitted, medical men alone can be uſeful. But as ſuch labours occur only in proportion of two or three in the hundred, the general practice might be confided to midwives, if they could be taught to manage ordinary caſes, and to foreſee and diſtinguiſh difficulties or dangers, ſo as to procure in ſufficient time additional aſſiſtance. It is on this point that the deciſion of the queſtion muſt depend. It conſiſts with the knowledge of the writer of this article, that women may be taught all this. But there are many who allege, that a little knowledge being a dangerous thing, midwives acquire a ſelf-ſufficiency which renders them averſe from calling in ſuperior aſſiſtance, and that, in conſequence, they often occaſion the moſt deplorable accidents both to mother and child. In England this is the popular opinion, ſo that there women are almoſt entirely excluded from the practice of midwifery. A ſimilar prejudice againſt midwives has, it is believed, begun in ſome parts of Scotland; but it is preſumed this will gradually ceaſe, when it is conſidered that, in general, the Scotch midwives are regularly inſtructed, and are at the ſame time both virtuous and induſtrious. If they attend ſtrictly to their duty, and invariably prefer their patients ſafety to their own feelings or ſuppoſed intereſt, they will deſervedly retain the public confidence. But if in caſes of difficulty or danger they truſt to their own exertions, or from intereſted motives decline the aſſiſtance of able practitioners, and if they interfere in the treatment of the diſeaſes of women and children, they will in a few years be excluded from practice.

7 *Diviſion of the ſubject.* In order to exhibit an accurate view of what relates to the birth of man, we ſhall conſider, in the firſt place, conception; ſecondly, the effects of impregnation; thirdly, the act of childbearing; and laſtly, the deviations from the ordinary courſe which ſometimes happen. Theſe topics will form the ſubjects of the following chapters.

Chap. I. *Of Conception.*

8 Three circumſtances are required for conception in the human race, viz. puberty; a healthy, vigorous, and natural ſtate of the parts ſubſervient to the operation in both ſexes; and ſucceſsful ſexual intercourſe.

1. The age of puberty in women differs conſiderably

Of Conception.

in different climates. In Europe it takes place commonly between the fourteenth and ſixteenth year. This important era is marked by certain changes both in the mind and body. The girl feels ſenſations to which ſhe had been formerly unaccuſtomed. She loſes a reliſh for her former amuſements, and even for her youthful companions. She ſeeks ſolitude, indulges in the depreſſing paſſions, and theſe are excited by the moſt apparently trifling cauſes. She feels occaſionally certain deſires which modeſty repreſſes; and it is by degrees only that ſhe regains her former tranquillity.

The changes in her body are even more ſtrongly marked than thoſe in her mind. Her breaſts aſſume that form which adds to the beauty of her perſon, and renders them fit for nouriſhing her infant; and every part of the genital ſyſtem is enlarged. A periodical diſcharge from the uterus renders the woman perfect.

9 In young men the ſame cauſes produce very different effects. The lad, about fifteen or ſixteen, feels a great increaſe of ſtrength; his features expand, his voice becomes rough, his ſtep firm, his body athletic; and he engages voluntarily in exerciſes which require an exertion of ſtrength and activity. The changes in his mind are as ſtrongly marked as thoſe in his body. He loſes that reſtleſs puerility which had diſtinguiſhed his early years, and becomes capable of attending ſteadily to one object. His behaviour to the fair ſex is ſuddenly altered. He no longer ſhews that contempt for women, which he had formerly betrayed. He is ſoftened, approaches them with deference, and experiences a degree of pleaſure in their company, for which he can ſcarcely account. In him too there is an important change in the condition of the genital organs.

10 2. Unleſs the parts which conſtitute peculiarity of ſex be in a healthy, vigorous, and natural ſtate, conception cannot take place.

In women, conception is prevented if the organs be too much relaxed; if there be obſtruction between the external and internal parts; if any preternatural diſcharge take place from the internal parts; if the menſtrual evacuation be not natural in every reſpect, and if the appendages of the uterus, called fallopian tubes, and ovaria, be not of the natural ſtructure.

In men, the ſame circumſtance happens if the organs be too much relaxed; if the orifice of the urethra be in an improper ſituation; if the urethra be diſeaſed; if the teſtes be not in a natural healthy ſtate; and if there be any defect in the erectores penis, which prevents the proper erection of that organ.

11 3. The ſexual intercourſe cannot be ſucceſsful unleſs ſomewhat neceſſary for conception be furniſhed by both ſexes. This conſiſts in the male of a fluid ſecreted by the teſtes; and in the female, of the detachment of a ſubſtance, ſuppoſed to reſemble a very minute veſicle ſituated in the ovarium, and called by phyſiologiſts ovum. Each ovarium contains a number of theſe veſicles. After every conception, certain marks of the detachment of the ovum remain in the reſpective ovarium.

When the circumſtances required for conception concur, a being is produced which generally reſembles both parents. This reſemblance is moſt ſtrikingly marked in the human ſubject, when one of the parents is an European, and the other an African. What is called a mulatto is produced.

Of Conception.

12 The human race poſſeſſes the power of propagation in common with all the other ſpecies of the animal kingdom, and alſo, it has been ſaid, with the vegetable kingdom.

As generation then, as it has been ſtyled, is common to two of the kingdoms of nature, it has been imagined by ingenious men, that this wonderful operation is regulated in both by a certain general law. But they have differed much in their account of this law. The queſtion at iſſue between the two parties is whether the embryos of animals be prepared by the ſexual intercourſe out of inorganic materials, or whether they pre-exiſt in the bodies of animals, and are only developed as it were by that intercourſe. The former of theſe opinions is called the doctrine of epigeneſis, the latter that of evolution.

Both doctrines have been maintained with much ingenuity by equally reſpectable authorities. Negative arguments have been adduced in favour of the one, poſitive in ſupport of the other, and it muſt be confeſſed that the balance between them ſeems nearly equal. The pre-exiſtence of ova in the oviparous animals appears a poſitive argument in favour of evolution; but the ſatirical remark of a late witty author, * that, were this theory true, every individual of the human race muſt have been lodged in the ovaria of our firſt parent, by affording a negative argument in favour of epigeneſis, reſtores the balance.

The various arguments advanced on each ſide by the oppoſite parties in this diſpute are ſo very numerous, that we cannot attempt to detail them in this work; and on a ſubject which has divided the opinions of ſo many able phyſiologiſts, it would be preſumption to decide peremptorily.

If generation be regarded as an animal operation, one is led to inquire whether the product be the reſult of the combined influence of both ſexes, or whether it be produced by either ſex alone.

13 The firſt opinion was generally adopted by phyſiologiſts, till about the end of the 17th century, when an accidental diſcovery convinced many that the embryo was produced by the male parent alone; and another diſcovery ſome years afterwards again overturned that opinion, and rendered it believed by not a few that the embyro is furniſhed excluſively by the female parent.

Several circumſtances concurred to render the firſt opinion probable; the ſtructure of the organs which conſtitute peculiarity of ſex in both parents, the circumſtances neceſſary for ſucceſsful impregnation, and the ſimilitude of children to both parents, appear very ſtrong arguments in its favour.

14 The ſecond theory, although firſt brought into vogue about the end of the 17th century by the diſcoveries of Leeuwenhoeck, had been formerly propoſed by the followers of Pythagoras. Their argument was analogy: the ſeed, ſaid they, is ſown in the earth, nouriſhed and evolved there; ſo the male ſemen is ſown in the uterus, and in the ſame manner nouriſhed and evolved.

Leeuwenhoeck's diſcovery ſeemed a more concluſive argument in favour of the theory than vague analogy. He

** Blumenbach.*

He obſerved innumerable animalcula in the ſeminal fluid of the males of many animals. Theſe he imagined to be embryos.

But as animalcula of apparently the ſame nature have been obſerved in many animal fluids beſides the ſemen maſculinum, the opinion of Leeuwenhoeck and the theory itſelf are overturned.

15 It was owing principally to the labours, induſtry, and ingenuity of Baron Haller, that the third theory, that of the pre-exiſting germ, became faſhionable.

His obſervations ſeem to contain a demonſtration of the fact.

Thoſe who have adopted this theory, imagine that the ſemen maſculinum poſſeſſes the power of ſtimulating the various parts of the pre-exiſting embryo. And hence they attribute the ſimilitude to both parents, and particularly the appearance of the hybrid productions, to that fluid nouriſhing certain parts, and new-arranging others. But if this were true, then the ſemen maſculinum of all animals ſhould poſſeſs the power of ſtimulating the germs of all female animals; and beſides, in each claſs of animals it ſhould poſſeſs certain ſpecific powers of giving a direction to the growth of parts. Experience, however, has not proved this to be the caſe, for the hybrid productions are very limited; and we may be permitted perhaps, without the imputation of arrogance in pretending to ſearch into the intentions of the Author of nature, to obſerve, that had the ſemen maſculinum been poſſeſſed of ſuch powers, the whole ſpecies of animals would have been ſoon confounded, and the whole animal kingdom would ſoon have returned to that chaos from which it has been allegorically ſaid it originated.

Yet we are reduced to the alternative of either rejecting the theory, or of believing that the ſemen does poſſeſs the powers alluded to. If we examine attentively the anatomical diſcovery on which this theory is built, we ſhall perhaps be inclined to believe that the foundation of the whole is very inſufficient; and hence to conclude that the great ſuperſtructure is in a very tottering condition. If it be poſſible that the attachment of the chick to the yolk of the egg ſhould be in conſequence of inoſculation, the theory muſt fall to the ground. Haller has endeavoured to obviate this objection, but not with his uſual judgment.

16 Two circumſtances, however, ſeem to ſhow that the attachment is really by inoſculation: 1. That veſſels are ſeen in the membrane of the yolk evidently containing blood before the heart of the chick begins to beat; yet theſe veſſels afterwards appear to depend on the vaſcular ſyſtem of the chick. And, 2. That in many animals, as in the human ſubject, the umbilical cord ſeems to be attached to the abdomen by inoſculation; for there is a circle round the root of the cord which reſembles a cicatrix, and within a few days after birth, the cord uniformly drops off at that very circle, whatever portion may have been retained after delivery.

17 There is one objection equally applicable to all the three theories, viz. the difficulty of explaining the ſteps of the proceſs. A variety of explanations have been offered by ingenious men. Spallanzani and Mr John Hunter lately, Haller and Bonnet formerly, have rendered themſelves conſpicuous on this ſubject. Spallanzani, in particular, appears to many to have produced, by his artificial impregnation, the moſt convincing proofs of the pre-exiſtence of the germ. But to what do his celebrated experiments amount? They ſhow, that in all animals it is neceſſary that the ſemen maſculinum ſhould be applied to the ſomewhat expelled by the female during the coitus, otherwiſe impregnation cannot take place. But was not this univerſally acknowledged before the abbé was born? In the unfortunate frogs who were the ſubjects of his experiments, the whole operation of generation was completed except the application of the male ſemen to the ſubſtances expelled by the female. Nature, by eſtabliſhing that the buſineſs ſhould be carried on in water, ſhows that the ſemen muſt be diluted, otherwiſe it cannot fecundate. The abbé only imitated nature. He left the queſtion in the ſtate in which he found it. His experiment on the bitch may appear more concluſive; but alas! it has never ſucceeded with any perſon but himſelf.

On the whole, ſince the proceſs of generation is ſo obſcure that no rational explanation of it has yet been offered, are we not entitled to conclude that the general theory which accounts moſt ſatisfactorily for the various phenomena which impregnation exhibits is the beſt; and conſequently, that the product of generation cannot pre-exiſt in the body of either parent excluſively?

CHAP. II. *Effects of Impregnation.* 18

In conſequence of impregnation, certain important changes take place in the uterine ſyſtem of the human ſubject. We ſhall conſider the natural changes only. On ſome occaſions, there are morbid changes; but we ſhall not notice them, except in ſo far as ſome of them ſerve to illuſtrate the nature of the uſual ones.

The firſt viſible change is on the ovarium. One of thoſe organs ſwells out at one point like a ſmall papilla, then burſts, and ſomewhat is diſcharged.

A ſubſtance is found in the ovarium after this, which is called *corpus luteum*. Rœderer has deſcribed very accurately its appearance a few hours after delivery. He ſays "corpus luteum locatur in rotundo apice. Totam ovarii craſſitiem occupat, immediatè pone ovarii membranam illa ſede tenuiorem locatum; ab ovario cum quo celluloſæ ope cohæret ſeparari ſine læſione poteſt; nulli peculiari ovarii rimæ reſpondet: neque canalis in illo excavatus, ſed totum ſolidum eſt. Luteus color eſt, ſubſtantia acinoſa, acinis admodum compactis et ad ſeſe preſſis ambitus rotundus. Poteſt aliquo modo, velut in glandulis ſuprarenalibus, duplex ſubſtantia diſtingui, corticalis et medullaris; quarum illa inæqualis craſſitici 1—2 lin. lutea comprehendit hanc medullarem albam, quæ tenuis et membrana quaſi calloſa, alium nucleum flavum includit caſſiorem *." It is very large ſoon after conception, and then gradually becomes ſmaller; but never totally diſappears. Rœderer obſerves, "poſt puerperium eo magis contrahi et indurari illa corpora videntur, quo remotior fit partus; qualia videlicet obſervantur in feminis quæ nuper partum non ediderunt. 19

"Lutea corpora quo ſerius à partu obſervantur cuncta glandulis ſuprarenalibus ſimilia eſſe videntur, duplice nempe ſubſtantia, exteriore corticali, ſolida ſeu flava lutea et nucleo fuſco.: velut etiam illæ glandulæ compreſſa ſunt †." In caſes where there is a plurality of children,

---

* *Roederer. Icones, Uteri Humani obſervat. illuſt.* p. 42.

† *Ibid.* p. 30.

Effects of Impregnation.

children, there is evidently a corpus luteum to each child. In ſome quadrupeds, as in the bitch or cat, the number of young in the uterus may be generally known by the correſponding corpora lutea in the ovaria.

20 The next change in the human uterine ſyſtem which deſerves notice is that in the fallopian tubes. They ſwell out towards the fimbriated extremity, and form a cavity which has been called antrum. Rœderer was the firſt who obſerved and accurately delineated this change.

He ſays, p. 14. loco citato, “ In hoc etiam utero antrum tubæ dextræ apparet, *c. f.* tab. i. not. 5. ubi quidem in utraque tuba adeſt, in hujus iconis utero ad ſolam tubam dextram antrum pertinet. Ad uterum feminæ octiduum puerperæ non longe a fimbria in iſtiuſmodi antrum tuba ſiniſtra prominet: dextra quidem ſine antro eſt, ſed verſus fimbriam ita flectitur ut ultima flexura dimidium pollicem ultra reliquam tubam efferatur. Tubæ feminæ quæ mox a maturo partu mortua eſt, et alterius tres dies puerperæ antris quidem carent, ſed multum verſus fimbrias dilatantur. An eſt facta conceptione iſta antra naſcuntur?

“ In uteri, tab. iv. ovario dextro luteum corpus latet in uteri feminæ octiduum puerperæ ovario ſiniſtro; in uteri, tab. i. ovario ſiniſtro.” He adds, “ ulteriori indagine iſta antra non indigna eſſe mihi videntur. Licebit forſan conjectare aliquid liquoris ex veſicula graaſiana in tubam lapſum et ad introitum morans illam dilatam.”

21 But the moſt aſtoniſhing changes are thoſe produced in the uterus itſelf. Its parietes ſeparate, a cavity is formed which becomes filled with a fluid, and the os uteri is cloſed up. The matter contained within the cavity ſoon aſſumes an organized form. It is ſaid that ſome time after conception, a ſmall veſicle is obſerved attached at one point to the internal ſurface of the uterus; that the reſt of the parietes is covered with a gelatinous fluid; and that the whole internal ſurface aſſumes a flocculent appearance. By degrees the veſicle, which is in fact the ovum containing the embryo, increaſes ſo much in ſize that it nearly fills the whole cavity in which it is contained, and then its ſtructure becomes the object of our ſenſes.

22 The increaſe of ſize in the uterus is very gradual. It is at firſt confined almoſt entirely to the fundus, and it proceeds ſo ſlowly that it does not leave the cavity of the pelvis till nearly the fourth month. The principal change in the cervix for the firſt five months is the complete cloſure of the orifice, which is effected by a gelatinous fluid: afterwards the cervix is gradually extended, and at laſt its form is obliterated, the whole uterus becoming like an oval pouch.

After the fifth month the increaſe of ſize in the uterus is very rapid. The fundus can be juſt felt above the pubes about the fifth month, but at the end of the ninth month it extends to the ſcrobiculus cordis.

Some authors have alleged that the changes in the cervix and in the ſituation of the fundus are ſo uniformly regular in every caſe, that by attending to them it is poſſible to aſcertain the exact period of impregnation. But in this reſpect they are much miſtaken; the changes being not only different in different women, but alſo in the ſame woman in different pregnancies.

The texture of the parietes of the uterus ſeems much altered after impregnation. It becomes ſpongy and fibrous. The fibres run in very different directions, and from their power and appearance are certainly muſcular. The blood-veſſels become much enlarged, but are ſtill in a tortuous direction. They are particularly large at one part of the uterus.

Effects of Impregnation.

The lymphatic veſſels, which in the unimpregnated uterus cannot be demonſtrated by anatomiſts, become, as well as the blood-veſſels, remarkably large.

23 The ovum is not often expelled entire till after the eighth or twelfth week after conception. It is ſhaped ſomewhat like an egg, and is about the latter period about four inches in length. When cut into, it is found to conſiſt of four layers or membranes, and to contain a fœtus ſurrounded by a certain quantity of water and connected to one part of the parietes (which is conſiderably thicker than the reſt) by a vaſcular cord.

24 The external membrane covers the whole ovum. It is thick, ſpongy, and very vaſcular, the veſſels evidently deriving their blood from the uterus; it has three perforations which correſpond with the openings of the os tincæ and fallopian tubes. It has been called *decidua*, *tunica filamentoſa*, &c. but its moſt ordinary appellation is ſpongy chorion.

25 The ſecond membrane proceeds from the edges of that part into which the vaſcular rope which connects the fœtus is attached. It was firſt pointed out to anatomiſts by Dr William Hunter, and called by him *decidua reflexa*. The name unfortunately records to poſterity the abſurd idea reſpecting its origin which was entertained by Dr Hunter. It is not ſo thick and ſpongy as the former membrane, nor ſo vaſcular. It lies looſely between the external membrane and that to be next deſcribed; but it appears only for a ſhort time, as it ſoon becomes blended with the others.

26 The third membrane is thin and tranſparent, but ſtrong. It is lined with the fourth membrane, and lies in the ſame ſituation with it. It contains no veſſels at this period of impregnation conveying red blood in the human ſubject, but in the cow the veſſels are very diſtinct at every period. This membrane however in the early period of impregnation is very vaſcular, and its veſſels are derived from the fœtus. The hiſtory of a caſe of morbid impregnation, where the fœtus was extra-uterine, detailed by Dr Clarke in the “ Tranſactions of a Society for the Improvement of Medical and Chirurgical Knowledge,” proves this circumſtance very clearly. He ſays, p. 220. “ a laceration was found to be in the fallopian tube about an inch and a half in length, each extremity of which was about an equal diſtance from the reſpective termination of the tube in the fimbriæ and in the uterus. The diſtenſion of the tube at this part was nearly of the ſize of a large walnut, forming a kind of pouch. More of the coagulated blood being removed from the lacerated part, the *ſhaggy veſſels of the chorion* immediately appeared, interſperſed with ſmall coagula, and lying in contact with the internal ſurface of the pouch formed by the fallopian tube; theſe being ſeparated, and the chorion divided, the amnios ſhewed itſelf, containing a fœtus perfectly formed of above ſix or ſeven weeks growth,” &c.

This membrane is called the true chorion.

27 The fourth membrane is even thinner and more tranſparent

Effects of Impregnation.

parent than the former. It lines the whole internal ſurface of the ovum, and together with the chorion is continued along the vaſcular cord which connects the ovum and fœtus. Between this membrane and the chorion, near the inſertion of the vaſcular cord, a ſmall white veſicle appears very diſtinct at this period; it was firſt deſcribed and delineated by Dr W. Hunter, and was called by him veſicula umbilicalis. At the full period of utero-geſtation it is no longer viſible, being then quite tranſparent.

The fœtus at this period is between two and three inches in length, and its external conformation is nearly complete.

The fluid contained in the ovum is in ſuch quantity as to prevent the fœtus from touching the parietes of the covering in which it is included. It is a clear watery fluid, of greater ſpecific gravity than water, and of a ſaltiſh taſte. When examined chemically it is found not coagulable by heat or alcohol, and to contain a proportion of ammoniacal and ſea ſalt. This fluid is called liquor amnii.

The connection of the parts thus enumerated with the uterus cannot be explained, unleſs the appearance of the ovum at the full period of geſtation be deſcribed.

28 The ovum then conſiſts of three membranes; a ſpongy vaſcular ſubſtance called placenta, to which the fœtus is connected by a vaſcular rope, and the liquor amnii.

The three membranes conſiſt of the ſpongy chorion, the true chorion, and the amnios.

The ſpongy chorion covers the whole. Its veſſels are numerous, and they can be filled by throwing hot wax into the veſſels of the uterus.

The true chorion and amnios are in the ſame ſituation as in the early months, being continued along the navel-ſtring. They are quite tranſparent, and contain no viſible veſſels of any deſcription.

The placenta is a large vaſcular ſpongy maſs, of various forms in different caſes, moſt generally approaching to a round one, placed on the outſide of the true chorion, between it and the ſpongy chorion. Its external ſurface is lobulated; its internal or that towards the fœtus is ſmooth, except from the riſing of the blood-veſſels.

It is not attached to the uterus at any regular place, being ſometimes at the cervix or ſide, but moſt generally about the fundus. On the one ſide it receives blood from the mother, and on the other from the child. Mr John Hunter was the firſt who clearly traced the inſertion of the blood-veſſels in the uterus into the placenta. He deſcribes it thus (D): "The late indefatigable Dr M'Kenzie, about the month of May 1754, when aſſiſtant to Dr Smellie, having procured the body of a pregnant woman who had died undelivered at the full term, had injected both the veins and arteries with particular ſucceſs; the veins being filled with yellow, the arteries with red.

"Having opened the abdomen, and expoſed the uterus, he made an inciſion into the fore part, quite through its ſubſtance, and came to ſomewhat having the appearance of an irregular maſs of injected matter, which afterwards proved to be the placenta. This appearance being new, he ſtopped, and greatly obliged me by deſiring my attendance to examine the parts, in which there appeared ſomething ſo uncommon.

Effects of Impregnation.

"I firſt raiſed, with great care, part of the uterus from the irregular maſs above mentioned; in doing which, I obſerved regular pieces of wax, paſſing obliquely between it and the uterus, which broke off, leaving part upon this maſs; and when they were attentively examined, towards the uterus, plainly appeared to be a continuation of the veins paſſing from it to this ſubſtance or placenta.

"I likewiſe perceived other veſſels, about the ſize of a crow quill, paſſing in the ſame manner, although not ſo obliquely: theſe alſo broke upon ſeparating the placenta and uterus, leaving a ſmall portion on the ſurface of the placenta; and, on examination, they were diſcovered to be continuations of the arteries of the uterus. My next ſtep was to trace theſe veſſels into the ſubſtance of what appeared placenta, which I firſt attempted in a vein; but that ſoon loſt the regularity of a veſſel, by terminating at once upon the ſurface of the placenta, in a very fine ſpongy ſubſtance, the interſtices of which were filled with the yellow injected matter. This termination being new, I repeated the ſame kind of examination on other veins, which always led me to the ſame terminations, never entering the ſubſtance of the placenta in the form of a veſſel. I next examined the arteries, and, tracing them in the ſame manner toward the placenta, found that they made a twiſt, or cloſe ſpiral turn upon themſelves, and then were loſt on its ſurface. On a more attentive view, I perceived that they terminated in the ſame way as the veins; for oppoſite to the mouth of the artery, the ſpongy ſubſtance of the placenta was readily obſerved, and was intermixed with the red injection.

"Upon cutting into the placenta, I diſcovered, in many places of its ſubſtance, yellow injection; in others red, and in many others theſe two colours mixed. This ſubſtance of the placenta, now filled with injection, had nothing of the vaſcular appearance, nor that of extravaſation, but had a regularity in its form, which ſhewed it to be a natural cellular ſtructure fitted for a reſervoir for blood.

"In ſome of the veſſels leading from the placenta to the uterus, I perceived that the red injection of the arteries (which had been firſt injected) had paſſed into them out of the ſubſtance of the placenta, mixing itſelf with the yellow injection. I alſo obſerved, that the ſpongy chorion, called the decidua by Dr Hunter, was very vaſcular, its veſſels coming from, and returning to, the uterus, being filled with the different coloured injections."

29 It appears then that the placenta has a cellular ſtructure, which receives blood from the arteries of the mother, and that there are veins by which that blood is returned, ſo that not a drop paſſes into the fœtus. Of this practitioners of midwifery have a very familiar proof. When the placenta is retained attached to the uterus, after the birth of the child, not a drop of blood paſſes from the umbilical cord, except what was contained in the ramifications of the fœtal veſſels when the child

---

(D) Obſervations on certain parts of the Animal Oeconomy, by John Hunter, p. 127.

child was ſeparated. Yet, if a ſmall portion of the edge of the placenta be detached, ſuch a quantity of blood eſcapes from the uterine veſſels of the mother, as ſometimes proves fatal to life: a circumſtance which clearly ſhews that the blood is ſtill conveyed into the cellular part of the placenta.

It has been ſaid, that the placenta on one ſide receives blood from the fœtus. In fact, the greateſt part of the placenta ſeems to be made up of ramifications of the fœtal veſſels. The internal iliacs of the fœtus are conveyed, through the vaſcular rope which connects the placenta and child, into the placenta: they then ramify into as many minute branches as the pulmonary arteries do in the lungs of the adult; they then terminate in various branches, which, uniting, form one large trunk that is conveyed along the vaſcular rope, and returns all the blood which had been diſtributed by the arteries.

As Mr Hunter remarks, "the arteries from the fœtus paſs out to a conſiderable length, under the name of the umbilical cord; and when they arrive at the placenta, ramify upon its ſurface, ſending into its ſubſtance branches which paſs through it, and divide into ſmaller and ſmaller, till at laſt they terminate in veins: theſe uniting, become larger and larger, and end in one which at laſt terminates in the proper circulation of the fœtus. This courſe of veſſels, and the blood's motion in them, is ſimilar to the courſe of the veſſels, and the motion of the blood, in other parts of the body *."

30 The fœtus, at the full period, weighs from between 6 and 7, to between 10 and 11 pounds, and meaſures from 18 to 22 inches. It is placed within the ovum in ſuch a manner as to occupy the leaſt poſſible ſpace. This poſition has been beautifully deſcribed by Harvey. "Infans in utero utplurimum reperitur, adductis ad abdomen genibus, flexis retroſum cruribus, pedibus decuſſatis, manibuſque ad caput ſublatis, quarum alteram circa tempora vel auriculas, alteram ad genam detinet, ubi maculæ albæ, tanquam confricationis veſtigia, in cute cernuntur: ſpina in orbem flectitur, caput ad genua incurvato collo propendet. Tali membrorum ſitu qualem in ſomno per quietem quærimus †."

31 The fœtus is diſtinguiſhed from the adult by a great many peculiarities in ſtructure: theſe the limits of this work do not permit us to enumerate. We ſhall therefore notice only one peculiarity, which diſtinguiſhes the fœtus not only from the adult, but even from the natus, viz. the diſtribution of the blood through its body.

It is well known, that, in the adult and in the natus, all the blood of the body, brought by the two cavæ into the anterior auricle of the heart, and from that into the correſponding ventricle, is diſtributed by the pulmonary artery over the whole ſubſtance of the lungs, by means of the moſt minute ramifications; from whence it is returned by the pulmonary veins into the poſterior auricle, and being then ſent into the poſterior ventricle, is, by its action, tranſmitted to every part of the body, through the aorta and its ramifications.

But in the fœtus the blood follows another courſe. All the blood of the fœtus is returned from the placenta by the umbilical vein, which, penetrating the abdomen, paſſes between the lobes of the liver, and thence at right angles divides into two branches nearly, by one of which, called *ductus venoſus*, a conſiderable quantity of blood is carried into the vena cava; by the other the remainder of the blood is ſent to the vena portarum; and, after having circulated through the liver, it too is brought by two ſhort venous trunks, the venæ cavæ hepaticæ, juſt above the diaphragm, into the vena cava. All the blood thus received into the vena cava, is carried to the anterior auricle; but a part only is tranſmitted to the correſponding ventricle, for by a particular apparatus, a quantity is at once ſent into the poſterior or left auricle. Anatomiſts have differed in opinion concerning the apparatus by which this is accompliſhed. As there is a ſmall oval hole of communication between the auricles of the fœtus, called foramen ovale, having a valve placed in ſuch a manner as to prevent any fluid from paſſing from the left into the right, but to admit it from the right into the left, it has been generally imagined that the blood paſſed through that opening. But the ſimultaneous action of the auricles in the natus ſeemed to contradict this opinion. A diſcovery made by Dr Wolfe of Peterſburgh appears to ſolve the riddle. He obſerved, that in the calf, before birth, the vena cava, at its entry into the heart, divides into two branches, by the one of which it ſends blood to the right, and by the other to the left auricle. It is probable that a ſimilar effect is produced in the human fœtus by a different ſtructure.

Of the blood ſent by the right ventricle into the pulmonary artery, a ſmall quantity only is carried to the lungs; for near the point at which that artery is divided into the two branches that go into the lobes of the lungs, a large branch is ſent off, which joining the aorta and pulmonary artery, carries a great proportion of the blood immediately into it. What is circulated through the lungs is conveyed by the pulmonary veins into the left auricle, &c.

All the blood thus received into the aorta is diſtributed through the ſeveral parts of the ſyſtem, and a large part of it is ſent out by the internal iliacs, which, paſſing out at the abdomen, conſtitute the umbilical arteries, and diſtribute the blood in the manner already mentioned over the placenta, from which it is returned by the veins.—The great difference then between the fœtus and natus in the circulation of the blood, conſiſts in the quantity diſtributed through the lungs.

32 To complete the deſcription of the ovum at the full period of geſtation, it only remains that we ſhould ſay ſomething on the vaſcular rope, which connects the placenta and fœtus, and on the liquor amnii.

This rope is called the funis umbilicalis. It terminates by one end at the placenta, and by the other at the centre of the abdomen of the fœtus. Its length and thickneſs differ materially in different caſes. It is longer in the human ſubject than in any other animal. It is found generally to be from eighteen to twenty-ſix inches in length, and in thickneſs about the ſize of the little finger. Externally it is formed of the chorion and amnios, together with cellular ſubſtance. Internally it is found to be compoſed of three blood-veſſels, and a quantity of gelatinous matter. The veſſels conſiſt of two arteries and one vein: the vein being as large as both arteries united. Theſe go in a ſpiral direction, and often form knots by their coils or twiſtings. A very ſmall artery and vein are likewiſe perceived to

---

* *J. Hunter*, loc. cit. p. 135.

† *Harvey Exercit. de Partu.*

go along the cord between the two layers of chorion and amnios, which cover it, into the veſicula umbilicalis. Theſe are called omphalo-meſenteric.

33 In quadrupeds, a canal, called urachus, is continued from the urinary bladder, along the umbilical cord, and communicates with a membrane, which, like this canal, does not exiſt in the human ſubject, called allantois. The urine of the young animal is collected in that membrane.

Some anatomiſts, as Albinus, have imagined, that the urachus and allantois do exiſt in the human ſubject. They were deceived by the appearance of the veſicula umbilicalis and omphalo-menſenteric veſſels.

The liquor amnii is never in ſuch proportion to the fœtus in the latter, as in the early periods of pregnancy. It is leſs pure too at that period, being often polluted with the ſtools of the fœtus. Except in this circumſtance, its chemical qualities are the ſame.

We ſhall now offer a few obſervations on the changes which have been deſcribed.

34 1. The cauſe of the increaſe of growth in the uterus is very obſcure. The acceſſion of fluids will account for the phenomenon; but a ſtrong objection occurs againſt conſidering that as the cauſe, i. e. that the uterus increaſes to a certain degree in ſize, even although the direction of fluids be to another part, as where the fœtus is extra-uterine. Boehmerus has marked this very accurately in a caſe of extra-uterine conception, which he has detailed (A). The developement of its fibres ſeems to prove, that the increaſe of ſize depends on a certain energy of the uterus itſelf; perhaps this may appear a very ambiguous mode of expreſſion, yet we can offer no other explanation of this curious phenomenon.

35 2. The great bulk of the uterus during the latter months, ſufficiently explains the cauſe of the various complaints which occur at that period. Van Doeveren has deſcribed this very accurately. He ſays, "uteri gravidi incrementum, adſcenſus è pelvis cavo, et immanis expanſio, innumeros excitat gravidarum morbos; primo quidem arctando abdomen et mechanicè comprimendo viſcera quæ in eo continentur, hepar, lienem, ventriculum, inteſtina, omentum, nec minus partes iis vicinas, nempe, renes, ureteres, aortam, venam cavam, arterias et venas iliacas, nervoſque è medulla ſpinali prodeuntes inferiores; accidit pectoris coarctatio, ſimileſque effectus inde excitati in corde, pulmonibus vaſiſque majoribus; ex quibus multiplici modo circulatio, digeſtio, chylificatio et reſpiratio læduntur, inque tota corporis œconomia, ejuſque functionibus ingentis, ſolent produci turbæ variaque vitia topica excitari, inter quæ, tenſiones, ſpaſmi, dolores, ſtupores, obturationes, obſtructiones, inflammationes, congeſtiones præ cæteris memorabiles ſunt; unde naſcitur magna ſeries morborum abdominis, pectoris, ipſiuſque capitis; nec non artuum inferiorum torpores, dolores, crampi, œdemata, eryſipelata, varices, hæmorrhagiæ, ulcera, labiorum vulvæ inflationes, variaque vitia partium genitalium, et alia multa pro diverſa partium compreſſarum aut diſtentarum actione, variis nominibus inſignienda (B)."

36 3. The origin of the membrane, which appears about the third month, called by Dr Hunter membrana decidua reflexa, has afforded matter of diſpute among phyſiologiſts. Dr Hunter imagined, that the decidua vera conſiſted of two layers, and that the ovum, enveloped in chorion and amnios, got ſomehow between theſe: but this is a very unſatisfactory opinion. The more probable opinion is, that the decidua vera and decidua reflexa are diſtinct membranes, although both formed in the ſame manner. If, as we have already ſtated, the uterus, ſoon after conception, be filled with a gelatinous fluid, and if the ovum be in contact with that organ at one point only, then it is probable that the veſſels of the internal ſurface of the uterus, by ſhooting into the fluid with which it is covered, will form one membrane, the decidua vera; while the veſſels on the external ſurface of the chorion, will ſhoot into the fluid with which the ovum muſt have been covered in its deſcent, and form another membrane, the decidua reflexa.

In proof that both membranes are formed in this way, it may be obſerved, that where the fœtus is extra-uterine, the uterus is lined with the decidua vera, and there is no decidua reflexa.—Boehmer is the firſt who demonſtrated this; and not Dr Hunter, as has been alleged. He ſays, "Quum vero uterus magnitudine gravido unius circiter menſis ſimilis videretur, eundem poſterius longitudinaliter, et ſuperius tranſverſaliter diſſecuimus, inque ejus cavo, intuitu haud impregnati ſatis magno, nihil præter tenacem et flaveſcentem mucum, mollemque poroſo-villoſam et valvuloſam quaſi turgeſcentem membranam undique uteri parietes et tubas inveſtentem, hinc inde inflammatam et eroſam, ſtructuram autem uteri ſatis compactam invenimus *."

37 4. The formation of the placenta is a curious ſubject of inquiry. That it depends principally on the fœtus, is proved by the appearances in extra-uterine conceptions. In the caſe of ventral conception, publiſhed by Mr Turnbull of London, this circumſtance is very clearly pointed out (C).

38 5. The origin of the liquor amnii has been explained very differently by different phyſiologiſts. Some imagine that it is furniſhed by the mother; others by the child. Baron Haller adopts the former opinion. "Ergo (he ſays) ab utero eſt, et à matre, ſiquidem à fœtu eſſe non poteſt. Non auſim experimentum producere, in quo crocus, quem mater ſumſerat, liquorem amnii tinxit †." But if this were the caſe, How could the liquor amnii exiſt when the fœtus is extra uterine? Yet it cannot be a ſecretion from the fœtus itſelf, becauſe

* Boehmer. loc. cit. p. 47.

† Halleri Phyſiologiæ Elementa, lib. xxix. ſect. 3. § 9.

(A) D. Philippi Boehmeri Obſervationum Anatomicarum variarum faſciculus notabilia circa uterum humanum continens, p. 52.

(B) Primæ lineæ de cognoſcendis mulierum morbis, in uſus academicos, ductæ à Gualth. van Doeveren, M. D. et Prof. p. 16.

(C) Vid. A Caſe of Extra-Uterine Geſtation of the ventral kind, by William Turnbull, A. M. F. M. S. Lond. 1791. Plate 1ſt.

cauſe it is in very large proportion when the fœtus is ſcarcely viſible. From what ſource then does it proceed? Moſt probably from the coats of the amnios.

39 6. Since from the ſituation of the fœtus it has no direct communication with the atmoſpheric air, two queſtions occur on the ſubject; firſt, whether it be neceſſary that the fœtus ſhould receive the vivifying ſomewhat which the natus receives from the atmoſphere. 2dly, If this be anſwered in the affirmative, by what means is this ſomewhat furniſhed?

1. On looking into the works of Nature, we find that there is a claſs of animals placed in a ſimilar ſituation with the fœtus, viz. the locomotive fiſhes. Theſe receive the vivifying ſomewhat furniſhed by the atmoſphere through the medium of the fluid in which they are immerſed; for their blood is always diſtributed by the ſmalleſt ramifications over a ſubſtance in conſtant contact with the water, before it return into the arterial ſyſtem to ſerve for the purpoſes of nutrition.

From analogy therefore it muſt be allowed, that the fœtus does receive, through ſome means or other, the vivifying principle of the atmoſphere.

40 2. By what means then is this furniſhed? Many circumſtances concur to prove that it is by means of the placenta. For,

1ſt, The ſtructure of the placenta reſembles much that of the lungs. It is cellular, and has the whole blood of the fœtus diſtributed in the ſmalleſt branches over its ſubſtance.

2dly, The blood returning from the placenta is ſent by the neareſt poſſible means to the left ſide of the heart. And, 3dly, Compreſſion of the umbilical cord to ſuch a degree as to interrupt the circulation through it, deſtroys the fœtus as ſoon as compreſſion of the trachea does the natus.

It appears therefore that the placenta ſerves to the fœtus the ſame purpoſe which lungs do to the natus.

41 The celebrated Haller has objected to this probable uſe of the placenta in the following words. "Non pauci etiam auctores ſecundis pulmonis officium tribuerunt, cum in vena umbilicali ſanguis ruber ſit et floridus, ſi cum ſanguinis ſodalis arteriæ comparetur. Id experimentum mea non confirmant. In pullo arteria fere coccinea, vena violacea eſt. In fœtu humano nunquam floridum ſanguinem vidi; neque intelligo ut placenta, in qua certiſſime nulla ſint aereæ mutabiles veſiculæ poſſit pulmonis munere fungi *."

42 But later obſervations have contradicted the aſſertions of Haller on this occaſion. In particular, Dr Jeffray profeſſor of anatomy in the univerſity of Glaſgow, in an inaugural diſſertation publiſhed here in the year 1786, relates an experiment made by him which is completely oppoſite to the opinion of Haller. "Puero "he ſays" in obſtetricatoris ſinu jacenti, funiculus tribus vinculis circumjectis, et ſimul in arctum tractis colligatus eſt; quo dein juxta umbilicum inciſo, in arteriis umbilicalibus et venis, inter duo vincula placentum proxime, ſanguinis copia interceptum eſt. Intercepti ſpatii vaſa, gelatinoſa funiculi parte cultro dempta, in conſpectum venerunt; et arteria, quæ ſanguinem jam ante in parte circumlatum, ad placentum perferebat, puncta eſt; quam prope arteriæ puncturam vena quoque umbilicalis ſimiliter puncta eſt. Quo facto ex vena ſanguis effluens, cum eo qui ex arteria effluebat facile comparari poterat. Ille, venoſi ſanguinis inſtar, nigricabat; hic, ſanguinis in adulta arteriis mox vivide florebat (D)."

43 7. The means by which the fœtus is nouriſhed have hitherto eſcaped the inveſtigation of phyſiologiſts. That the ſtomach and inteſtines do not ſerve this purpoſe is obvious from many concurrent teſtimonies; but particularly from theſe organs being on ſome occaſions entirely wanting, while other parts of the ſyſtem of the fœtus were complete. It is probable that the placenta ſupplies nouriſhment, as well as the vivifying principle of the air, to the fœtus in utero.

CHAP. III. *Natural Parturition.*

44 HUMAN parturition, where every thing is natural, is perhaps one of the moſt beautiful and intereſting operations in nature; for what can be more beautiful than a proceſs accompliſhed by the combined action of a number of powers admirably well adapted to the intended purpoſe? and what can be more intereſting than the continuation of our ſpecies which depends on the operation?

In treating of this ſubject, we ſhall firſt conſider the term of geſtation; 2dly, the phenomena of natural parturition; and, 3dly, the cauſes of thoſe phenomena.

SECT. I. *Term of Geſtation.*

45 The ancients imagined that although nine kalendar months be the moſt uſual period of human pregnancy, yet on ſome occaſions that period may be, and actually is, protracted even beyond ten kalendar months. Accordingly, it was laid down as a maxim in ancient juriſprudence, that children born within eleven months after the death of their ſuppoſed father ſhould be declared legitimate.

In modern times the queſtion has been often agitated, both among medical practitioners and among lawyers. Practitioners of midwifery however have had moſt frequent occaſion to inveſtigate this ſubject, and they have differed materially in their concluſions.

46 Rœderer ſays, "Hunc terminum, finem nempe trigeſimæ nonæ et nonnunquum quadrageſimæ hebdomadis partui maturo natura, uti accuratior obſervatio docet conſtituit, ultraque eum non facile differtur. Nihil hic valet energia ſeminis deficiens, morboſa vel debilis patris conſtitutio, matris diſpoſitio phthiſica, hectica, qua fœtus ſufficienti alimento privatur; nihil, ſtatus matris cachecticus, fluxus menſtruus tempore geſtationis contingens, diarrhœa aliuſve morbus; nihil nimia uteri amplitudo; nihil affectus matris vehementior, qualis triſtitia; nihil diæta matris extraordinaria, vel inedia; nihil fœtus debilitas et diſpoſitio morboſa; nihil plures fœtus in utero detenti.

"Tantum enim abeſt ut hæ cauſæ fœtus moram in utero retardent, ut potius accelerent. Viduæ quidem vanis hiſce ſpeciebus, illicitam venerem defendere atque hereditates aucupari, quin in eo medicos nimis credulos,

---

* *Haller.* loc. cit lib. xxix ſect. 3. § 37.

(D) Tentamen medicum inaugurale, quædam de placenta proponens, auctore Jacobo Jeffray, &c. Edinburgh 1786, p. 41.

dulos, vel lucri cupidos in ſuas partes trahere ſtudent, ſed mera hæc ſunt ludibria, prætereaque nihil (E)."

But many eminent teachers of midwifery believe that in ſome caſes human pregnancy is protracted for two or three weeks beyond the more common period.

47 Dr Hamilton eſpecially ſays, "In the human ſpecies nine kalendar months ſeem neceſſary for the perfection of the fœtus; that is, nearly thirty-nine weeks, or two hundred and ſeventy-three days from conception. The term does not, however, appear to be ſo arbitrarily eſtabliſhed, but that nature may tranſgreſs her uſual laws; and as many cirumſtances frequently concur to anticipate delivery, it certainly may in ſome inſtances be protracted. Individuals in the ſame claſs of quadrupeds, it is well known, vary in their periods of pregnancy. May we not, therefore, from analogy reaſonably infer, that women ſometimes exceed the more ordinary period? In ſeveral tolerably well atteſted caſes, the birth appears to have been protracted ſeveral weeks beyond the common term of delivery. If the character of the woman be unexceptionable, a favourable report may be given for the mother, though the child ſhould not be produced till nearly ten kalendar months after the abſence or ſudden death of her huſband †."

† *Outlines of Midwifery*, p. 192.

SECT. II. *Phenomena of Natural Labour.*

48 The ſufferings of a woman during labour having been compared to the fatigues of a perſon on a journey, the phenomena of labour have been divided into three ſtages. The firſt ſtage conſiſts of the opening of the mouth of the womb; the ſecond, of the actual paſſage of the child; and the third, of the ſeparation and expulſion of the ſecundines.

49 *Phenomena of the Firſt Stage.*—In moſt inſtances the bulk of the belly ſubſides for a day or two before labour begins; but the firſt evidence of the actual commencement of that proceſs is the occurrence of pains in the belly affecting the loins, and ſtriking down the thighs, occaſioning conſiderable irritation of the bladder and bowels. Theſe pains, &c. however, often take place during ſome hours of the night, for days, or even weeks, before true labour begins, and are then ſtyled ſpurious pains. It is not eaſy on many occaſions to diſtinguiſh true labour throes from ſpurious pains, unleſs the ſtate of the mouth of the womb be examined, ſo very nearly do they reſemble each other. But in general ſpurious pains recur at irregular intervals, and do not increaſe in force according to their duration; whereas true pains gradually recur at ſhorter intervals, and become more and more violent.

Spurious pains are ſometimes attended with an occurrence which was firſt publicly noticed and deſcribed by the preſent profeſſor of midwifery in the univerſity of Edinburgh (F), viz. the protruſion of the urinary bladder. This reſembles, to a ſuperficial obſerver, the bag formed by the membranes which incloſe the child, and in conſequence has repeatedly been burſt by the fingers of the operator. Incurable incontinence of urine, inflammation of the paſſages, &c. have followed this accident.

Protruſion of the urinary bladder may be readily diſtinguiſhed from that of the membranes which include the infant by two circumſtances. Firſt, the bag recedes completely during the interval of the pain; and ſecondly, when puſhed down, the finger cannot be paſſed round it at the fore part of the pelvis; it ſeems as if fixed to the pubis. True labour-pains ariſe from the contractions of the womb by which that organ is ſhortened and thickened; and, at the ſame time, its contents are forced through its orifice. When they become regular and forcing, they have the effect of opening the mouth of the womb, ſo that a practitioner can readily aſcertain the difference between them and ſpurious pains. The opening of the mouth of the womb, in moſt inſtances, is accompanied by the diſcharge of a ſlimy, bloody-like matter, termed ſhews; but in many women there is no ſuch circumſtance.

This proceſs is generally gradual, the pains increaſing in frequency and force; and eight, ten, or twelve hours, commonly elapſe before they complete the opening of the womb. In ſome caſes the dilatation takes place to a conſiderable extent before pains occur, ſo that a few pains accompliſh this ſtage. But theſe exceptions are not ſo frequent as thoſe of an oppoſite deſcription, where one or two complete days are required to open the womb, though the pains be unremitting.

In proportion as the firſt ſtage advances, the membranous bag containing the child is puſhed through the mouth of the womb, and forced gradually into the vagina. During the pain it is tenſe, and during the interval it becomes relaxed. When this happens, the head of the infant can be diſtinctly felt behind it. At laſt, the paſſages being ſufficiently opened, the pains having become ſtronger and more frequent, the membranes give way, and the water contained within them is diſcharged; which finiſhes the firſt ſtage. Shivering, vomiting, headach, thirſt, and pain in the back, take place in many inſtances during this ſtage.

50 *Phenomena of the Second Stage.*—Sometimes an interval of eaſe of ſome minutes duration ſucceeds the diſcharge of the waters. The pains then become much more violent and forcing, and the head, by the contractions of the uterus thus becoming more powerful, is puſhed through the brim of the pelvis into the vagina. For this purpoſe the vertex is forced foremoſt, and the brow is turned to one ſacro-iliac ſynchondroſis, ſo that the largeſt part of the head is applied to the wideſt part of the baſon; for as the head is oval, and the opening through which it is to paſs is of the ſame form, this is abſolutely neceſſary.

After the head is in the vagina, the pains ſtill continuing, the vertex is turned into the arch of the pubis, and the face into the hollow of the ſacrum, by which the largeſt part of the head is brought into the direction of the wideſt part at the outlet. All the ſoft parts are now protruded in the form of a tumour, a portion of the vertex is puſhed through the orifice of the vagina, and every pain advances the progreſs of the infant, till at laſt the head is expelled. An interval of a mi-

---

(E) Rœdereri Elementa Artis Obſtetricæ. Goettingæ, 1766. page 98.

(F) Select Caſes in Midwifery, by James Hamilton, M. D. 1795. page 16.

nute or two now enſues, after which another pain taking place, the face is turned to one thigh and the ſhoulders of the child being placed towards pubis and ſacrum, the whole of the body is born. During this proceſs the patient generally adds voluntary efforts to the contractions of the uterus.

This ſtage is in many inſtances extremely tedious; but after the woman has had one child, it often is completed within the time of ſix or eight pains.

51 *Phenomena of the Third Stage.*—Whenever the infant is born, if there be no other in the womb, the parietes of the abdomen become relaxed, and the womb can be perceived through them, contracted almoſt into the ſize of a child's head. An interval of eaſe of ſome minutes duration now elapſes, after which pains again recur, commonly attended with the diſcharge of ſome clots of blood, occaſioning a kind of gurgling noiſe, and the placenta and membranes are thrown off, and the womb remains quite contracted or nearly ſo, with a cavity ſcarcely capable of containing a hen's egg. In ſome caſes a ſingle pain accompliſhes this, and in others ſeveral pains are required; but, generally ſpeaking, this ſtage is completed within an hour after the birth of the child.

It ſometimes, however, happens that the natural efforts are inadequate to the expulſion of the ſecundines. The cauſes are, want of ſufficient contractile power in the uterus, irregular contraction of that organ, and indurated ſtate of the placenta itſelf.

From the above deſcription it is obvious that all the three ſtages of labour are completed by one ſimple power, viz. the contraction of the womb.

52 SECT. III. *Cauſes of the Phenomena of Labour.*

I. The firſt phenomenon which requires explanation is the action of the uterus. Why does that organ generally act at a certain period, after having remained in a quieſcent ſtate for ſo long a time?

This queſtion has puzzled phyſiologiſts ſtrangely. Some have attributed the circumſtance to a ſtimulus communicated by the fœtus: but their opinion is overturned by a well-known fact, that the ſame phenomena occur though the fœtus be dead. Others have imagined that the uterus is excited to act in conſequence of previous diſtenſion. But were this the caſe, women ſhould never have the uterus of a larger bulk in one pregnancy than in another; whereas, on the contrary, it is well known that women who have twins or triplets often have the womb diſtended to fully double the uſual ſize.

Phyſiologiſts as well as phyſicians have fallen into very great errors from referring complex phenomena to a ſingle cauſe. A variety of facts concur to prove, that in the preſent inſtance it is abſurd to impute the action of the uterus to any ſingle cauſe.

To what then ſhould we attribute it? To a variety of circumſtances.

1ſt, To the ſtructure of the uterus. From the appearance of that organ in its unimpregnated ſtate, it would ſeem that nature had laid up in ſtore a certain proportion of fibres to be developed during pregnancy. When theſe fibres are evolved, if the uterus be diſtended farther, the edges of the os tincæ muſt be ſeparated, in conſequence of which part of the uterine contents paſſing through it, the contraction of the uterus follows. A fact very familiar to practitioners of midwifery affords apparently a complete confirmation of this hypotheſis, viz. that in ſome women labour occurs as regularly and naturally, in the ſeventh or eighth month of geſtation, as in others it does at the end of the ninth, the cervix uteri having become quite obliterated.

2d, It is probable, however, that in ordinary caſes this ſtore of muſcular fibres is ſeldom entirely exhauſted, from the circumſtance of women having ſometimes twins or triplets; ſome other cauſe therefore muſt concur in exciting the action of the uterus. The contents of the uterus perhaps furniſh this cauſe.

In the latter months of geſtation, ſome parts of the fœtus come in contact with the parietes of the uterus, in conſequence of the decreaſe in proportion of the liquor amnii. This is principally the caſe with reſpect to the head, which preſſes on the cervix, and that part of the uterus, it is probable, is more irritable than any other; for we find that the entrance or exit of all hollow muſcular organs is more irritable than the other parts, as we ſee exemplified in the cardia of the ſtomach, and in the cervix of the urinary bladder.

3d, It is not improbable too, that the preſſure of the neighbouring parts contributes ſomewhat to induce the action of the uterus; for it is remarked by practitioners of midwifery, that women ſeldom arrive at the full period of geſtation in a firſt pregnancy, and the parietes of the abdomen yield with difficulty at firſt, as is obſerved in caſes of dropſy. Beſides all farmers know well, that in every ſucceeding pregnancy, cows exceed their former period of geſtation.

53 II. The next phenomenon worthy of notice is the manner in which the child's head enters the pelvis. Two circumſtances contribute towards this, firſt the connection of the head of the child with the neck; and 2dly, The form of the brim of the pelvis.

The firſt of theſe circumſtances has been accurately pointed out by Dr Oſborn. He ſays, "after the os uteri has been firſt opened by the membranes and contained waters, forming a wedge-like bag, the next operation and effect of the labour-pains or contractions of the uterus (for they are convertible terms) muſt be on the body of the child, *which being united to the baſis of the cranium at the great foramen and nearer the occiput than forehead*, the greater preſſure will be applied to the occiput, which being likewiſe ſmaller, and making leſs reſiſtance, will be the firſt part ſqueezed into the cavity of the pelvis (E)."

The latter circumſtance has been clearly explained by Profeſſor Saxtorph. He remarks, "cauſa hujus directionis capitis, concurrente toto mechaniſmo perfecti partus, potiſſimum hæret in pelvi. Nam agente utero in fœtum, in axi pelvis locatum, caput ejus hucuſque liberum, in humore amnii fluctuans, propter molam ſuam majorem in introitum ipſo pelvis magnam reſiſtentiam patitur à prominentia oſſis ſacri, quæ in poſteriori parte ſegmenti inferioris uteri ita impreſſa eſt, ut promontorii

---

(E) Eſſays on the Practice of Midwiſery, &c. by William Oſborn, M. D.

montorii inſtar fœtus frontem glabram, rotundam, unico puncto tantummodo illam tangentem et ſatis mobilem, blando motu ad latus dirigat, in ſpatium ei exactè reſpondens inter protuberantiam ipſam et marginem internum acutum ilii excavatum, quam ob rem, ſincipitis prævii ſutura ſagittalis cadit neceſſario in diametrum obliquum aperturæ ſuperioris pelvis (F)."

It is remarkable, that neither of theſe celebrated authors diſcovered that a combination of both the circumſtances juſt enumerated, is neceſſary to occaſion the phenomenon.

Two advantages reſult from this poſition of the head of the child ; for, 1ſt, The largeſt part of the head is applied to the wideſt part of the ſuperior aperture; and, 2dly, The head, when the occiput is forced foremoſt, occupies the leaſt poſſible ſpace.

54 III. The phenomenon which next ſtrikes us, is that change in the poſition of the head by which the face is turned into the hollow of the ſacrum.

Although the advantage, and even neceſſity, of this change in the poſition of the head, has been long known to practitioners; yet Dr Oſborn is, perhaps, the firſt author who has clearly explained the efficient cauſe of this. His remarks are theſe: " As it (viz. the head) deſcends obliquely through the pelvis, the preſſure of the two converging iſchia will not be exactly oppoſite to each other on the two parietal bones ; but one iſchium acting or preſſing on the part of that bone contiguous to the occiput, and the other on the oppoſite ſide next to the face, the head being made up of different bones, united by membranes, and forming various ſutures and fontanels, which permit the ſhape to be changed, and the volume to be leſſened, it neceſſarily follows, that the head, thus compreſſed, will take a ſhape nearly reſembling the cavity through which it paſſes ; and, as from the convergency of the iſchia, the cavity of the pelvis ſomewhat approaches the form of a cone, the child's head is moulded into that ſhape, the ſhape of all others beſt adapted to open the ſoft parts, and make its way through the os externum. This unequal preſſure of the two iſchia upon the head, will, in the firſt inſtance, direct the occiput, or apex of the cone, to turn under the arch of the pubis, where there is little or no reſiſtance ; while the preſſure of the other iſchium, in its further deſcent, will have the ſame effect on the other ſide, and direct or compel the face to turn into the hollow of the ſacrum *."

This change of poſition is productive of three advantages.

1ſt, The largeſt part of the head is again adapted to the wideſt part of the pelvis.

2dly, The ſmalleſt poſſible ſurface of the head is applied to the ſurface of the bones of the pubes. And,

3dly, As Dr Oſborn, in the paſſage quoted, very juſtly obſerves, the head is moulded into that ſhape which is beſt calculated to paſs without doing harm, through the ſoft parts.

55 IV. The phenomena which occur when the head paſſes through the external parts, are eaſily explained.

After the head has made that turn, by which the face is placed in the hollow of the ſacrum, the coccyx and perinæum reſiſt its further deſcent in that direction, and by forcing the nape of the neck againſt the inferior edge of the ſymphyſis pubis, every ſucceſſive pain contributes to make the occiput riſe up towards the abdomen, by which the chin leaves the top of the thorax, on which it had reſted during the preceding proceſs of delivery.

By this ſimple mechaniſm, the ſoft parts are gradually prepared for the paſſage of the child, while, at the ſame time, the ſhoulders are brought into the moſt favourable poſition for paſſing through the pelvis.

V. The phenomena of the third ſtage of labour obviouſly originate from the contraction of the uterus, 56 which both ſeparates and expels the ſecundines. Some authors have imagined that nature has provided for this purpoſe a particular apparatus, placed at the fundus uteri ; but as the placenta, when attached to the cervix uteri, is thrown off as readily as when it is attached to the fundus, it is very evident that theſe authors have been deceived by a ſeeming regularity of fibres, which is ſometimes obſerved.

Laſtly, The obſtacles which nature has oppoſed to 57 the paſſage of the child, occaſion all the difficulties of human parturition. Theſe obſtacles are formed by the ſituation and ſhape of the pelvis, and the ſtructure of the ſoft parts concerned in parturition.

The pelvis is ſituated in ſuch a direction, that its axis forms an obtuſe angle with that of the body ; conſequently, it is not placed perpendicularly, but obliquely to the horizon ; and hence nothing can paſs through it by the force of gravity.

The ſhape of the pelvis, too, is ſuch, that the head of the child cannot paſs through the outlet in the ſame direction in which it entered the brim ; and, from the ſtructure of the ſoft parts concerned in parturition, they yield with conſiderable difficulty.

By theſe means, the Author of our exiſtence has guarded againſt the effects of the erect poſture of the body, and has prevented the premature expulſion of the child and the ſudden laceration of the ſoft parts.

Sect. IV. *Treatment of Natural Labour.* 58

Firſt ſtage.—When this ſtage proceeds naturally and regularly, there is very little elſe to be done, after having aſcertained that labour has really begun, and that the child is in the ordinary poſition, than taking care that the bowels be open, and palliating any unpleaſant ſymptoms, ſuch as ſhivering or vomiting, &c. which may occur.

But if after the pains have become ſo regular as, by their continuance, to diſturb the ordinary functions of life, that is, moſt commonly, after they have been quite regular for twelve or fifteen hours; if this ſtage be not completed, it is neceſſary to interfere, and to endeavour, by art, to effect the dilatation. The reaſon for this rule is abundantly evident. If this ſtage of ſuffering be longer protracted, the ſtrength of the patient muſt be exhauſted by the long-continued exertion, and, of courſe, the remaining proceſs of labour cannot be completed. Hence the child may be loſt, or alarming diſcharges

---

[*] Dr Oſborn, loc. cit. p. 50.

(F) Diſſertatio inauguralis de Diverſo Partu, &c. Auctore Matthia Saxtorph. Hafniæ, 1771. p. 19.

diſcharges of blood may follow the birth of the infant.

This very obvious effect of the protraction, beyond certain limits, of the firſt ſtage of labour, was firſt publicly inſiſted on by the preſent profeſſor of midwifery in the univerſity of Edinburgh.

The means to be adopted for completing the dilatation, when that aſſiſtance becomes neceſſary, are veneſection or opiates, or ſupporting the os uteri, according to circumſtances.

When the reſiſtance to the opening of the womb ariſes from the premature diſcharge of the water, or from natural rigidity of the womb, copious blood-letting affords the adequate remedy. But if the patient be already reduced by previous diſeaſe, ſo that ſhe cannot ſafely be bled, an opiate, in the form of glyſter, ought to be adminiſtered.

And when, on the recurrence of every pain, the mouth of the womb is forced down upon the external paſſages before the child, its edges ought to be ſupported, *in ſitu*, by the fingers cautiouſly applied to each ſide.

59 *Second ſtage.*—When it is found that the head has begun fairly to enter the pelvis in the natural direction, no aſſiſtance is neceſſary till the perineal tumour be formed; and then ſuch ſupport muſt be given to the protruded parts as ſhall both relieve the diſtreſſing feelings of the patient, and, at the ſame time, prevent any laceration from happening. Of courſe, the preciſe manner of ſupporting the perinæum muſt be varied according to the circumſtances of the caſe. Inattention to this has very frequently occaſioned the moſt deplorable accidents.

After the head is born, it muſt be aſcertained whether there be any portion of the navel-ſtring round the neck of the infant, and if there be, it muſt be ſlackened or drawn over the head, otherwiſe the infant will be loſt.

If poſſible, time ſhould be allowed for the accommodation of the ſhoulders, and the expulſion of the body of the infant; and, at any rate, the utmoſt attention ſhould be paid to ſupporting the perinæum during that part of the proceſs.

60 *Third ſtage.*—When the child is born, and it is aſcertained that there is no other infant remaining in the womb, the patient ſhould be allowed to reſt for a little, unleſs pains again come on, by which the ſecundines are ſeparated. In that caſe, the cord is to be firmly graſped, and pulled gently, till the placenta be brought down to the external parts, when it is to be drawn out carefully, in ſuch a manner as to bring off at the ſame time the complete membranous bag.

Should pains not recur at the diſtance of an hour after the birth of the infant, it becomes neceſſary, for ſeveral reaſons, to introduce the hand into the womb to ſeparate and extract the ſecundines.

Firſt, If the cord were pulled by before the womb had contracted, or the after-birth had become ſeparated, the womb muſt inevitably be turned inſide out; an accident that has occaſionally happened.

Secondly, If a longer period than an hour were ſuffered to elapſe, the paſſages would become ſo much contracted, that the force required again to dilate them, would produce inflammation, with all its alarming conſequences.

Thirdly, If the after-birth were allowed to remain longer than an hour, exceſſive flooding might take place, which would ſoon prove fatal.

Fourthly, Were the patient to eſcape the danger of flooding, ſhe would incur that of putrefaction of the placenta, which is equally, though not ſo rapidly, productive of mortal event.

In thus introducing the hand to ſeparate the placenta, the two great cautions to be attended to, are to apply the fingers to the ſubſtance of the placenta, not to inſinuate them between its ſurface and that of the uterus, and to bring off only that portion of the placenta which can be ſeparated from the uterus without force.

When any alarming circumſtance happens after the birth of the infant, requiring the extraction of the placenta, the practitioner is not to delay for an hour, indeed not for a minute, giving the requiſite aſſiſtance.

Chap. IV. *Of the Deviations from Nature in Human Parturition.* 61

From the view thus given of human parturition, under the moſt favourable circumſtances, it muſt be obvious that many deviations from nature may occur.

Theſe deviations may proceed; firſt, from the propelling powers concerned in parturition; ſecondly, from the ſtate of the ſecundines; thirdly, from the ſtate of the child itſelf; or, fourthly, from the ſtate of the paſſages through which the child is forced. There may alſo be a combination of theſe cauſes. We ſhall conſider each of theſe cauſes of deviation in the order juſt enumerated. But as a minute inveſtigation of the ſubject would far exceed the neceſſary limits of this work, we ſhall treat each of theſe cauſes as ſhortly as poſſible, and notice only the moſt ſtriking circumſtances.

Sect. I. *Of the Deviations from Natural Labour, which proceed from the Propelling Powers.* 62

The propelling powers concerned in parturition conſiſt of voluntary and involuntary muſcular action. The diaphragm and abdominal muſcles furniſh the former, and the uterus the latter.

An exceſs or diminution of the action of thoſe powers muſt interrupt the ordinary progreſs of labour.

63 *a.* The violent action of the diaphragm and abdominal muſcles, if exerted at the beginning of labour, tends to exhauſt the patient and to retard delivery, and if induced when the head is within the vagina, may, provided proper precautions be not taken, lacerate the perinæum, and render the future life of the patient miſerable.

The action of theſe muſcles being quite voluntary, may be readily prevented by the patient ſubmitting to proper advice.

64 *b.* Impaired action of the diaphragm and abdominal muſcles, generally originates from the improper exertion of thoſe muſcles at the beginning of labour, or from paſſions of the mind. It always retards delivery, and conſequently protracts the ſufferings of the patient.

65 *c.* Violent action of the uterus at the beginning of labour, is frequently productive of much miſchief. It exhauſts the patient, and renders the ſubſequent proceſs of delivery exceedingly tedious and difficult. It alſo ſometimes occaſions an accident which generally proves almoſt immediately fatal, viz. rupture of the uterus.

This accident has been deſcribed by authors under the title of ſpontaneous rupture of the uterus. The laceration in the uterus in thoſe caſes is ſometimes tranſverſe and ſometimes longitudinal. When the accident happens from this cauſe, the laceration is moſt frequently in the cervix. The accident is preceded by excruciating pain, eſpecially during the action of the uterus, at one part, as in the loins or towards the pubes; and it is announced by a moſt agonizing increaſe of the pain ſucceeded by violent vomiting, the diſcharge of a little blood, a total ceſſation of the labour throes, very great irregularity and feebleneſs of the pulſe, cold ſweat, coldneſs of the extremities, difficulty of breathing, inability to lie in the horizontal poſture, and ſometimes delirium. Along with theſe ſymptoms, it often happens that the preſenting part of the child recedes entirely, and the limbs of the infant may be readily diſtinguiſhed through the parietes of the abdomen. But this circumſtance does not always take place, for ſometimes the head of the child is ſo firmly wedged within the pelvis, that it does not recede although the other parts be in the cavity of the abdomen.

The rupture of the uterus is generally fatal. A few caſes, however, are on record, where, by prudent management, the patient, even under ſuch dangerous circumſtances has been ſaved. Such are the caſes recorded by Dr Hamilton (H), by Dr Douglas (I), and Dr Hamilton, junior (K). But the injuries which muſt enſue from loſs of blood, acute pain, the preſence of the child in the cavity of the abdomen, and the probable protruſion and ſtrangulation of the inteſtines are ſuch, that it cannot be expected that many patients can ſurvive the accident.

The cauſe of violent action of the uterus at the beginning of labour, is obviouſly the premature diſcharge of the liquor amnii. By this circumſtance, the body of the child comes in contact with the parietes of the uterus, by which the action of that organ is immediately and violently excited. How much miſchief then may the raſh interference of an ignorant operator produce?

The cauſe of rupture of the uterus from its own violent action, is the reſiſtance to the paſſage of the child, either from undilated os uteri, or from deformities of the pelvis, or from wrong poſition of the child. Whenever, therefore, the rupture is threatened, means muſt be inſtantly adopted to remove the reſiſtance, or to ſuſpend the action of the uterus. The former is in general the more eaſily accompliſhed.

When the uterus has actually burſt, the only chance which can be afforded to the patient, is inſtant delivery; *per vias naturales*, where that is practicable; and where there is extreme narrowneſs of the pelvis, by an inciſion through the parietes of the abdomen. A caſe where this latter practice was ſucceſsfully had recourſe to occurred a few years ago in Lancaſhire.

Violent action of the uterus during the latter ſtage of labour, although not productive of the ſame dangers which enſue from it at the beginning, is by no means exempt from hazard; for if the ſoft parts be rigid or not ſufficiently relaxed, the woman may be miſerably torn.

The violent action of the uterus towards the termination of labour proceeds from ſome power of that organ itſelf, or from the ſtimulus communicated by the poſition of the child.

This circumſtance, however, is ſometimes beneficial; as, for inſtance, when the child is in an unfavourable poſition. Dr Denman was the firſt who diſcovered this effect of violent uterine action, and publiſhed it in the fifth volume of the London Medical Journal, page 64.

66 *d.* Impaired action of the uterus during the firſt ſtage of labour is in many inſtances productive of no other inconvenience than the protraction of labour; but if it exhauſts the ſtrength of the patient, it influences materially the ſubſequent proceſs, as already ſtated. When it occurs during the ſecond ſtage, it occaſions the moſt dangerous ſymptoms. Firſt, if the head of the child continue to preſs for a conſiderable time on the ſoft parts within the pelvis, theſe parts muſt neceſſarily from the impeded circulation become ſwelled, and conſequently the action of the uterus, though it ſhould return, would then be totally inſufficient for the expulſion of the child. This effect of the protraction of the ſecond ſtage was firſt pointed out to the public in Dr Hamilton's letters to Dr Oſborn. It merits moſt particular attention; not only as it is one of the moſt frequent cauſes of the loſs of the infant during labour, and of conſiderable danger to the parent, but alſo as it may be very readily prevented by an attentive practitioner. Previous to this ſwelling becoming ſo conſiderable as to impede the progreſs of the infant, there is a tenderneſs and heat, and dryneſs in the paſſage, which announces the actual commencement of the inflammation. Immediate delivery ought then to be had recourſe to.

Many diſagreeable ſymptoms alſo proceed from the ſame cauſe, ſuch as ſuppreſſion of urine, and violent cramps in the lower extremities.

When it is aſcertained, that, in conſequence of the deficiency of action of the uterus, the child is detained ſo long in the paſſage as to endanger the health or life of the mother, it becomes neceſſary to extract the infant by mechanical means. Two contrivances have been thought of for this purpoſe, viz. the vectis or lever, and the forceps.

67 Roonhuyſen, a Dutch practitioner, who flouriſhed about the beginning of the 18th century, contrived the vectis, and from the great ſucceſs which attended its uſe in his hands, an edict was iſſued by the ſtates-general, that no ſurgeon ſhould practiſe midwifery without

---

(H) Outlines of Midwifery, p. 348.

(I) Obſervations on the rupture of the gravidutenus, &c. by A. Douglas, M. D. &c. 8vo. London 1789.

(K) Select Caſes of Midwifery, p. 138.

Preternatural Parturition.

out being poſſeſſed of the Roonhuyſen ſecret, for the inſtrument was not publicly known. In the year 1756, however, the ſecret having been purchaſed by two liberal-minded phyſicians, Viſcher and Van de Poll, was publiſhed by them for the benefit of mankind. Since that time, the inſtrument has undergone a variety of alterations in its form; for a particular account of which, the reader is referred to Mulder's Hiſtoria Forcipis.

There can be no doubt that Roonhuyſen and his ſucceſſors employed the vectis as a lever of the firſt ſpecies, the head of the infant being the reſiſtance, the parts of the woman the fulcrum, and the hand of the operator forming the moving power. The injuries ariſing from this practice have been well explained by Dr Oſborn in his Eſſays on Laborious Labours. Although Dr Bland and Dr Denman ſtill recommend the ſame practice, there can be no doubt that whenever the uſe of the vectis proves ſucceſsful according to their directions, the fortunate termination is to be attributed to the action of the uterus being excited by the preſſure of the inſtrument; or, in other words, the delivery might have been completed without any mechanical interference at all. On the other hand, whenever the action of the uterus is either quite ſuſpended or much weakened, both mother and child ſuffer from the application of the vectis.

68 The late Dr Deaſe in altering the ſhape of the vectis, wiſhed to impreſs upon the profeſſion the neceſſity for changing the mode of employing it; and accordingly he called his inſtrument an *extractor*. This power, however, ſeems to be poſſeſſed in a ſuperior degree by Dr Lowder's inſtrument, of which a deſcription is contained in the eighth volume, ſecond decade, of Dr Duncan's Medical Commentaries, p. 400. As this inſtrument may be uſed with perfect ſafety, both to mother and child, and as in ſome caſes it is ſuperior to the forceps, we have repreſented its form in one of the plates, and now add the deſcription and an account of the manner of applying it from the work already referred to.

69 The inſtrument "conſiſts of a blade and handle (between which there is a hinge, that renders it portable), meaſuring in length $11\frac{1}{2}$ inches. Its length, before it be curved, is $12\frac{1}{2}$ inches. The curve begins about half an inch from the hinge. It deſcribes, reckoning an inch from its firſt curvature, as nearly as can be eſtimated, an arc of 87 degrees of a circle, the radius of which is four inches. The breadth of the blade, at the beginning of the curve, is half an inch, and is gradually increaſed, till within three quarters of an inch of the extremity, where it meaſures an inch and three-fourths. Its extremity is ſemicircular. Within $2\frac{1}{4}$ inches of the extremity there is an oval opening, meaſuring $2\frac{1}{4}$ inches in length, and $1\frac{1}{4}$ at its greateſt breadth. By this opening, the depth of the curve is conſiderably increaſed, without rendering the inſtrument inconvenient in its introduction."

70 "Let us ſuppoſe that it is found neceſſary to uſe Lowder's lever, when the head of the child has juſt begun to enter the cavity of the pelvis. The patient is to be placed in the ordinary poſition, on the left ſide, in bed. The occiput of the child is to be carefully diſtinguiſhed, and the curve of the inſtrument is to be applied, with all the neceſſary precautions, over it. The extremity of the blade ſhould be within a very little of the nape of the neck. To accompliſh this part of the operation with facility, it is neceſſary that the operator be well acquainted with the ſhape of the pelvis, and that he have accuſtomed himſelf to apply the inſtrument over a round ſubſtance.

Preternatural Part rition.

"When the inſtrument is applied in this manner, the operator will find, that he can exert very conſiderable power in drawing down, without preſſing on any other part than the occiput of the child. The mother cannot poſſibly feel the inſtrument; while, at the ſame time, the many points of the fœtal cranium, on which it reſts, prevent any injury whatever to the infant.

"If there be any pains, however ſlight they may be, the operator ſhould draw down only during the pain: in the intervals, a ſoft warm cloth ſhould be wrapped round the handle. If there be no pains, he muſt draw down from time to time, imitating, as nearly as he can, the natural efforts. It is aſtoniſhing, of what uſe even the moſt trifling pains are, on ſuch occaſions. Without pains, a long time is required before the head be made to advance in a perceptible degree (though, after it has advanced a little, it ſoon yields entirely); while, with them, the progreſs is often rapid.

"The operator ſhould continue to draw down in the ſame manner, till the head be completely in the cavity of the pelvis. Should any circumſtance, as dangerous uterine hæmorrhagy, or convulſions, require that the delivery be expeditiouſly finiſhed, after the head is brought into this poſition, the forceps muſt be applied; for it is in the power of the operator, by means of them, to accompliſh the extraction of the head within a very ſhort ſpace of time, or at leaſt, within a much ſhorter ſpace than would be required, were the uſe of Lowder's lever continued.

"But if there be no dangerous ſymptom, the operation may be completed by the firſt inſtrument, without any aſſiſtance from the forceps.

"For this purpoſe, the operator ſhould continue to draw down, by preſſing on the occiput, as already directed, until the face ſhall have turned into the hollow of the ſacrum. The direction of the inſtrument muſt then be changed. The reaſon of this is very obvious. After the face is in the hollow of the ſacrum, the occiput becomes engaged in the arch of the pubis, and riſes under it, while, at the ſame time, the chin leaves the top of the breaſt, on which it had reſted during the preceding proceſs of labour, and deſcribes a courſe equal to a full quarter of a circle, which is the conſequence of the occiput deſcribing a ſimilar courſe under the arch of the pubis. Were the practitioner then to continue to preſs in the ſame direction as he did while the head was paſſing through the brim, he would counteract this natural proceſs, and hence would retard delivery, and injure the parts againſt which he would neceſſarily preſs the child.

"The inſtrument muſt, therefore, be withdrawn from the occiput, and applied with the proper precautions over the chin, when the operator is to imitate the proceſs of nature, by diſengaging the chin from the breaſt, and making the occiput riſe under the arch of the pubis, while, with his left hand, he protects the perinæum from injury."

"From theſe obſervations it is obvious, that the inſtrument introduced into practice by Dr Lowder, affords exactly the aſſiſtance, in the firſt order of laborious labour, which is required; for it ſupplies the place of the propelling

propelling powers, or increaſes their efficacy, by acting on the body of the child, without injuring any part of the mother.

71 “ This property renders it of great uſe in certain caſes of deformed pelvis, viz. where the ſhort diameter of the brim is about three inches. In ſuch caſes, the long continued ſtrong action of the uterus, often eventually forces the head into the pelvis; but the ſtrength of the patient is in conſequence ſo much reduced, that after it has proceeded ſo far, the pains are entirely ſuſpended, and the delivery muſt neceſſarily be finiſhed by the uſe of mechanical expedients; but the child's life is commonly previouſly deſtroyed, by the compreſſion of the brain.

“ If, in ſuch caſes, it be poſſible to increaſe with ſafety the vis à tergo, the child would then be forced through the brim of the pelvis before the woman's ſtrength were exhauſted, and before its life were endangered; conſequently, many children, commonly doomed to inevitable deſtruction, would be preſerved.

“ Lowder's lever, I apprehend, poſſeſſes this power. It may be calculated, that, by its uſe, the efficacy of the labour throes is at leaſt doubled. Hence the child, in caſes of ſlight deformity of the pelvis, is forced through the oppoſing part within one half of the time which would be otherwiſe required; and this is accompliſhed without injury either to the mother or infant; for the inſtrument preſſes on no part of the former; and it reſts on ſuch parts of the latter, that no harm can poſſibly be done.

“ In face-caſes, too, where the interference of the practitioner is neceſſary (which, indeed, is a rare occurrence), this inſtrument may be employed with much advantage. The great aim ſhould be, to draw down the occiput.

“ As it appears, therefore, that Lowder's lever is applicable in many caſes where the forceps are inadmiſſible, and that its uſe is not productive of ſo much hazard to the mother as that of the forceps, it might perhaps be inferred, that the latter inſtrument may be baniſhed from practice, as unneceſſary and dangerous. Accordingly, many practitioners of midwifery have adopted an opinion of this kind; and, indeed, there are very few who do not employ one or other of theſe inſtruments excluſively.

“ But however deſirable it may be to leſſen the number of mechanical expedients, and to ſimplify practice, I apprehend, that many lives would be loſt if we poſſeſſed or employed no ſuch inſtrument as the forceps. As they have the property of a lever, delivery can in many caſes be accompliſhed much more expeditiouſly by them than by Dr Lowder's inſtrument. This ſeems to be the ſole advantage which they poſſeſs over it; and that is counterbalanced by ſeveral great diſadvantages. Many authors, indeed, have alleged, that the forceps have excluſively the power of diminiſhing the ſize of the fœtal cranium, by the preſſure of their blades, and hence have attributed a degree of pre-eminence to them, which in fact is not their due; for as the ſize of the child's head is, in natural caſes, diminiſhed as far as is neceſſary, by the contractions of the uterus forcing it forward through the bones of the pelvis, an increaſe of the vis à tergo will of courſe increaſe that diminution, if the ſhape of the paſſage require it. While Lowder's lever, therefore, poſſeſſes the power of compreſſing the cranium in common with the forceps, it has a decided ſuperiority over them in this, that it accompliſhes that end by ſimilar means with nature.

“ The great diſadvantages of the forceps are, that they are inapplicable when the child's head is ſituated high in the pelvis; that their application is often difficult to the operator, and painful to the patient; and that, as their centre of action is on the parts of the patient, they muſt injure her in proportion to the reſiſtance oppoſed to the delivery.

“ On the whole, then, in caſes of the firſt order of laborious labours, both inſtruments muſt be occaſionally had recourſe to. When the head is not completely within the cavity of the pelvis, Lowder's lever muſt be employed; and even when it is in that poſition, the ſame means may be uſed, if there be pains. But, when the labour throes are entirely ſuſpended, or when any circumſtance renders it neceſſary to terminate the delivery with expedition, the forceps ought to be employed in preference to every other inſtrument, if the head of the child be within their reach.”

72 The forceps are ſuppoſed to have been invented by Dr Hugh Chamberlain, who was phyſician to King Charles II.; but their form has been greatly altered ſince his time. The moſt approved form is that repreſented in the plate.

This inſtrument is only applicable in preſentations of the head; but it was formerly, by Dr Smellie and others, recommended in face caſes.

In order that this inſtrument be applicable, it is neceſſary that the head be completely, or nearly ſo, in the cavity of the pelvis; but ſometimes a lengthened pair is uſed for caſes where the head is ſituated high. The employment of long forceps, however, being extremely dangerous, is ſeldom juſtifiable; and therefore we ſhall limit our directions to the uſe of the common ſhort forceps.

73 There are three principal caſes in which that inſtrument may be had recourſe to, viz. 1. where the face is in the hollow of the ſacrum; 2. where the face is wedged under the pubis; and, 3. where it is on one ſide of the pelvis.

In whatever ſituation the head is, the inſtrument is to be applied over the ears, otherwiſe there could be no ſafe and ſecure hold. In the proceſs of extracting the child with this inſtrument too, it is to be obſerved, that the convex edge of the blades is to be brought along the hollow of the ſacrum.

The inſtrument being applied ſo cautiouſly over the ears of the infant that no part of the woman be injured by their introduction, the locking parts are to be brought together, and ſecured by a ligature; after which the operator, ſupporting carefully the perinæum with one hand, is to draw gently in a direction of from blade to blade during a pain, or now and then to imitate labour throes, while he at the ſame time favours the mechaniſm of labour by accommodating the child's head to the paſſage ſo as to make it take up the leaſt poſſible room. If this be done with ſuitable caution and gentleneſs, no part of the woman ſhould be injured, and the parts of the infant on which the inſtrument had reſted ſhould not even be marked. But as there can be no doubt, that in the proceſs of uſing the forceps, the parts of the woman are preſſed upon by the blades, if much force be exerted, or if due attention be not paid to the adaptation of the head of the infant to the apertures through which it is to be brought, the moſt dreadful effects reſult from the operation.

SECT. II. *Of the Deviations from Natural Labour, which proceed from the ſtate of the Secundines.*

74 The membranes which envelope the fœtus are in ſome caſes more tender, and in others more rigid, than in general they are found; circumſtances which have a conſiderable effect on the proceſs of parturition. Beſides this, the placenta is on ſome occaſions attached to the cervix or os uteri, by which not only is the order of labour interrupted, the placenta being expelled before the child, but alſo is the patient's life expoſed to much danger.

75 *a*. Where the membranes are too tender, the liquor amnii is diſcharged at the beginning of labour before the os tincæ be dilated, and then all the bad conſequences detailed under the article *b*, Sect. I. neceſſarily enſue.

b. Where the membranes are too rigid, the labour may be protracted to ſuch a period as ſhall injure the mother moſt materially, and at laſt, as the whole ovum may be expelled entire, the life of the child may be endangered.

After the os uteri is completely dilated, if the child included in the membranes do not advance into the cavity of the pelvis, the membranes ſhould be ruptured. But if it do, they ought not to be broken till they preſs on the external parts.

c. But the moſt alarming deviation from nature, which can proceed from the ſtate of the ſecundines, is that which originates from the attachment of the placenta over the cervix or os uteri. As there can be no doubt that the uterine veſſels dip into the ſubſtance of the placenta, and that they are lacerated when the placenta is ſeparated from its attachment, it is obvious that in ſuch a ſituation hæmorrhagy to a moſt dangerous extent muſt unavoidably enſue during the proceſs of the labour.

76 Mr Rigby of Norwich was the firſt Britiſh practitioner who publicly explained this cauſe of hæmorrhagy. In the firſt edition of his work; viz. that publiſhed in 1775, he expreſſes himſelf in the following words. "But from the uncertainty with which (as before obſerved) nature fixes the placenta to the uterus, it may happen to be ſo ſituated, that when the full term of pregnancy is arrived, and labour begins, a flooding *neceſſarily* accompanies it, and without the intervention of any of the above *accidental* circumſtances; that is, when it is fixed to that part of the womb which always dilates as labour advances, namely, the collum and os uteri, in which caſe it is very certain that the placenta cannot, as before deſcribed, remain ſecure till the expulſion of the child, but muſt of neceſſity be ſeparated from it, in proportion as the uterus opens, and by that means an hæmorrhage muſt *unavoidably* be produced.

"That floodings, which ariſe from theſe two different cauſes, which I will diſtinguiſh by the names of *accidental* and *unavoidable*, though they may appear exactly ſimilar in their firſt ſymptoms, ſhould terminate very differently, if left to nature, aſſiſted only by the palliative means before mentioned, cannot ſeem ſtrange; nor can it be a doubt, that of theſe two kinds of floodings, only one of them, namely, that which is produced by an accidental ſeparation of the placenta, can be relieved by the uſe of theſe palliatives; and that the other, in which the placenta is fixed to the os uteri, and the flooding is therefore *unavoidable*, cannot poſſibly be ſuppreſſed by any other method whatever than the timely removal of the contents of the womb; for ſuppoſing the diſcharge to be for a while reſtrained by bleeding, medicine, cool air, &c. it will inevitably return, when nature is ſo far recovered as again to bring on labour: in the firſt caſe, if the hæmorrhage have been checked by the uſe of the above means, it is not impoſſible but labour may come on, and the child be ſafely expelled by the natural pains before it returns; or if it ſhould return, it may not increaſe in quantity; as in this caſe very probably the ſeparated part of the placenta which occaſions the diſcharge remains nearly the ſame; whereas in the other caſe, in which the dilatation of the os uteri produces the ſeparation of the placenta, every return of pain muſt be a return of the bleeding, and it muſt become greater and greater as the uterus opens more and more, and the placenta is in proportion detached, till it increaſes to a degree that exhauſts the patient, and ſhe dies before nature has been able to expel the child. That ſuch muſt inevitably be the progreſs and event of floodings ariſing from ſuch a cauſe, if left to nature, is too obvious further to be inſiſted on.

"That this attachment of the placenta to the os uteri is much oftener a cauſe of floodings than authors and practitioners are aware of, I am from experience fully ſatisfied, and ſo far am I convinced of its frequent occurrence, that I am ready to believe that moſt, if not all of thoſe caſes which require turning the child are produced by this unfortunate original ſituation of it (L)."

77 No caſe in practice requires more deciſion and more attention than this. It muſt be obvious that no internal remedy can be of any avail in flooding from ſuch a cauſe, and that the life of the patient can be ſaved by immediate delivery alone, whenever conſiderable hæmorrhagy takes place. But it is to be recollected that the diſcharge in many inſtances threatens for days or even weeks before it becomes ſerious, and that for the ſake of the child, the patient ſhould be allowed to advance as near as her own ſafety will permit to the full period. Theſe threatenings may often be removed by aſtringent injections, per vaginam, while at the ſame time every means of moderating the circulation of the blood ſhould be ſuggeſted.

But whenever the diſcharge becomes profuſe, delivery by art is to be had recourſe to. The rule of Mr Rigby, and of ſome other eminent practitioners, "to watch from time to time the dilatability of the os uteri," and take advantage of that ſtate, ſounds well; but

---

(L) Eſſay on the Uterine Hæmorrhagy which precedes the delivery of the full-grown Fœtus, illuſtrated by caſes by Ed. Rigby, London 1775, p. 14. Vide alſo 3d edition 1784, ſame page.

Preternatural Parturition.

but if followed in practice, muſt either give ſuch a ſhock to the woman's conſtitution, as ſhall end in dropſy or maraſmus, or muſt prove immediately fatal. In all thoſe caſes the os uteri may be forced, and although it be not more open than barely to admit the introduction of the finger, it may in a very few minutes, if the operator have ſteadineſs and perſeverance, be rendered capable of allowing the hand to paſs.

If poſſible, the hand ſhould be carried forward at one ſide of the placenta, for if that part be torn (which it muſt be admitted is ſometimes inevitable) the infant muſt be deſtroyed. After the feet are brought down, the child is to be extracted as expeditiouſly as regard to its ſafety will permit, and the hand is then to be again paſſed into the uterus for the purpoſe not merely of detaching completely the ſecundines, but chiefly of ſecuring the contraction of that organ which is the great object of the delivery.

78 SECT. III. *Of the Deviations from Natural Labour, which proceed from the ſtate of the Child.*

The regular proceſs of parturition may be interrupted, in conſequence of the poſition and of the ſhape of the child.

79 1. *Poſition of the child.* The moſt natural poſition of the child, at the beginning of labour, is with the head placed at the brim of the pelvis, the face towards the ſacro-iliac ſynchondroſis of one ſide, and the occiput towards the groin of the oppoſite ſide. But there are many deviations from this natural poſition.

80 *a.* Although the head be applied to the brim of the pelvis, it may be forced with the ſinciput towards the promontory of the ſacrum, and the occiput towards the ſymphyſis pubis. In this ſituation the largeſt diameter of the head is oppoſed to the ſmalleſt of the pelvis, conſequently the head remains firmly fixed in that poſition, for as the ſinciput cannot advance a point beyond the promontory of the ſacrum, the occiput is forced juſt ſo much below the brim at the pubis as to wedge the head firmly between the ſacrum and pubis. By the long-continued preſſure the ſoft parts become much ſwelled, and at laſt the head is found ſo immoveably fixed, that it can neither be made to recede, nor can it advance in the ſame direction. This conſtitutes what has been ſtyled the *caput incuneatum*, or, as it is called by French practitioners, *la tête enclavèe.* This caſe moſt commonly is the effect of miſmanagement; for if a very little preſſure be made on the head when it preſents at the brim of the pelvis in this unfavourable poſition, the pains will readily force it into the paſſage in the proper direction.

When the locked head has actually taken place, the practice muſt be varied according to the circumſtances of the individual caſe; hence the long forceps, and ſometimes even the crotchet, are required. Turning is quite inadmiſſible, and the three-bladed forceps ſo ſtrenuouſly recommended by Dr Leake, in this caſe are totally inapplicable.

81 *b.* The long diameter of the head may alſo be applied to the ſhort diameter at the brim, in a different manner, viz. with the face towards the pubis, and the occiput to the baſe of the ſacrum. The obſtacles to the progreſs of the head are not in this caſe ſo great as in the former (*a*); for as the occiput is round, and its ſurface inconſiderable, while at the ſame time the promontory of the ſacrum is round, the labour throes, after ſome time, force the occiput either a little to one ſide, or at leaſt paſt the promontory. The caſe, however, is tedious, painful, and even dangerous to the patient; for as the face preſents a larger ſurface to the pubis than the occiput, it muſt require longer time to paſs, and as there are many inequalities on the face, the patient muſt ſuffer much pain from their preſſure, and from the ſame circumſtance muſt incur the hazard of having the urinary bladder or the urethra irreparably injured.

82 In this caſe Profeſſor Saxtorph remarks, "vel occiput primo deſcendit, quod cum accidit, frons ab oſſibus pubis ſuſtentata elevatur, mentumque pectori infantis imprimitur, urgentibus porro doloribus, verſus anum et perinæum, adagitur acuminatum occiput, et nullo modo ſub arcu oſſium pubis extorqueri poteſt inflexile ſinciput, hinc partus in exitu pelvis impoſſibilis redditur."

That this is a miſtake, the obſervation of other practitioners has ſufficiently demonſtrated; for it is well known that in ſuch caſes, after the perinæum has been much ſtretched the occiput is forced through the parts, and immediately ſlips back towards the anus, while the nape of the neck being applied to the anterior edge of the perinæum, moves on it as on an axis, ſo that the ſinciput and face emerge from under the ſymphyſis pubis, the chin leaving the top of the thorax in the ſame manner as if the face were ſituated naturally in the hollow of the ſacrum.

Although in this caſe the natural efforts moſt ordinarily complete the proceſs, yet in many inſtances the injury which threatens the urinary bladder renders the application of the forceps expedient.

83 *c.* Although the head may have entered the pelvis in the moſt natural poſition, yet it may not make thoſe changes in ſituation which are required to accommodate it to the outlet; for the face may turn under the ſymphyſis pubis inſtead of into the hollow of the ſacrum. When this happens the phenomena already deſcribed (*b*) take place.

84 *d.* It ſometimes happens, that inſtead of the ſmooth part of the cranium being forced firſt into the pelvis, the face preſents. In this caſe it may be ſituated in three poſitions, viz. with the chin to the ſacrum, or pubis, or ſide.

a a. The firſt caſe is eſteemed the moſt dangerous both for the mother and child. For the mother, becauſe the child in this poſition requires more room than the pelvis affords, conſequently the ſoft parts in contact with the chin and ſmooth part of the cranium are much compreſſed, and hence if the delivery be not ſpeedily accompliſhed, much injury to thoſe parts will enſue. As the chin too muſt paſs along a curved line formed by the ſacrum and coccyx, the obſtacles to delivery are very great; and even after the face has been forced ſo low as to preſs on the perinæum, that part is in much hazard of being torn by the violent diſtenſion which it undergoes. The delivery in ſuch caſes is very rarely accompliſhed naturally.

This ſpecies of labour is equally dangerous to the child as to the mother, not only on account of the long-continued preſſure on the brain, but alſo from the occiput being forced ſo ſtrongly on the ſuperior dorſal vertebra that the free return of the blood from the head is

Preternatural Partu rition.

interrupted, and hence apoplexy enſues; a circumſtance which is proved even by the appearance of children who in ſuch caſes are born alive, for the face of ſuch children is perfectly livid. Jacobs has pointed out theſe dangers pretty accurately. "Il eſt dangereux pour l'enfant, (he ſays), parce que la tête etant penchèe et portant ſur ſon cou, elle comprime les vaiſſeaux ſanguins au point que le ſang ne pouvant plus circuler, il meure d'une apoplexie pour peu que l'on tarde à l'extraire." *Ecole pratique des Accouchemens, par le Profeſſeur J. B. Jacobs. A Paris*, 1785. p. 366.

b b. The ſecond caſe, viz. where the chin is placed towards the pubis and the ſinciput to the ſacrum, is neither ſo dangerous for the mother nor child. For if by the force of the pains the face be puſhed ſo far forward that the chin becomes engaged within the arch of the pubis, then the inferior edge of the ſymphyſis pubis forms a fulcrum on which the inferior jaw moves, by which the ſinciput and occiput paſs readily and eaſily along the hollow of the ſacrum, their ſurface being well adapted to that of the ſacrum, and the ſeveral parts of the face paſs in ſucceſſion through the vulva.

cc. The third caſe, viz. where the chin is to one ſide, is ſtill more favourable than the ſecond; for the face paſſes readily through the oblique diameter of the pelvis till ſtopt by the tuberoſities of the iſchia, when the chin turns into the arch of the pubis, and then the ſame phenomena which occur in the ſecond caſe take place.

The cauſe moſt generally aſſigned for face-caſes is the ill directed exertion of the propelling powers. May it not alſo depend in many caſes on the original poſition of the fœtus?

When any extraordinary difficulty occurs in face-caſes, Lowder's lever is the inſtrument to which recourſe ought to be had. The forceps, as recommended by Smellie and others, being quite inſufficient to afford a ſafe and ſecure hold of the infant.

85 *e.* On ſome rare occaſions the ſide of the head preſents, ſo that one ear is in the centre of the pelvis. In ſuch a caſe, the ſtrongeſt contractions of the uterus cannot make the head enter the pelvis, and the woman would generally die undelivered were it not for the interference of art. Caſes of this kind are remarkably rare.

The hand of the operator muſt be carried up in ſuch caſes, and moderate preſſure muſt be made in ſuch a direction as ſhall allow the contractions of the uterus to puſh the ſmooth part of the cranium into the cavity of the pelvis.

86 *f.* The head of the child is not the part always applied to the pelvis; for ſometimes the head paſſes laſt. Whenever any other part than the head preſents, the labour is ſtyled by authors *preternatural.*

All preternatural labours have been divided into two orders. A. Preſentations of the inferior extremities; and B. Preſentations of the ſuperior extremities.

A. Preſentations of the lower extremities comprehend caſes where one or both feet, one or both knees, and the breech preſent.

87 *g.* Caſes where both feet preſent are more frequent than thoſe where one only preſents. It has been calculated that the feet preſent once in 105 caſes of labour.

Preternatural Parturition.

Some authors have divided labours of this kind into a great variety of ſpecies. There is, however, no neceſſity for ſuch diviſions, and they tend to miſlead and embarraſs practitioners. All the varieties may be reduced under three heads; for the toes muſt be either towards the ſide of the pelvis, or towards the ſacrum or pubes.

dd. Where the toes are towards the ſide of the pelvis, the child is generally placed in ſuch a manner that the abdomen, breaſt, and face paſs in ſucceſſion along the ſacro-iliac ſynchondroſis of that ſide. This is the moſt favourable ſituation in which the child under ſuch circumſtances can be placed; for the largeſt parts of its body paſs through the largeſt aperture of the pelvis.

In this caſe, then, the action of the uterus forcing forward the child, the feet are by degrees excluded through the external parts, the toes being ſituated between the point of the coccyx and the tuberoſity of the iſchium; the thighs follow, then the abdomen and thorax; but the farther progreſs of the child is for ſome time interrupted by the arms paſſing up along each ſide of the head, which add conſiderably to its bulk; at laſt, however, the repeated contractions of the uterus force the face into the hollow of the ſacrum, and then the nape of the neck turning on the inferior edge of the ſymphyſis pubis as on a pivot, the face is excluded, followed by the ſinciput and occiput.

Where the efforts of nature in this proceſs are ſolely truſted, the child, unleſs it be ſmall and the pelvis be very capacious, while the ſoft parts are much relaxed, is generally ſtill-born; for before the obſtacles to the delivery of the head be overcome, the long-continued compreſſion of the funis umbilicalis, by intercepting the courſe of the blood, proves fatal.

ee. Authors have generally conſidered that to be the moſt favourable poſition in which the feet can preſent, where the toes are towards the ſacrum. Roederer for example ſays, "pedum tunc digiti ſi oſſi ſacro obvertantur, fœtus abdomini incumbens recte ſitus eſt (L.)" But two diſadvantages attend this poſition: Firſt, the largeſt part of the child's body is forced through the ſmalleſt part of the outlet of the pelvis; and, 2dly, The longeſt diameter of the head is applied to the ſhorteſt diameter of the brim of the pelvis. In ſuch caſes, therefore, the patient commonly ſuffers much pain, and the child's life is deſtroyed.

ff. When the toes are turned to the pubes, it has been univerſally acknowledged, that the feet are in the worſt poſſible poſition. Indeed not only do the diſadvantages ſtated as reſulting from the laſt poſition (*ee*) equally take place in this one, but another cauſe of difficulty and danger is added, viz. that the face being applied to the pubes, the progreſs of the child muſt be impeded in no inconſiderable degree. Hence in ſuch a caſe the patient may be very much injured, and the child muſt be almoſt inevitably loſt.

The management of footling caſes was firſt explained, in as far as we know, in Dr Hamilton's Select Caſes in Midwifery, p. 89.

"It

(L) Roederer Elementa Artis Obſtetricæ, p. 249.

Preternatural Parturition.

88 " It is a curious circumſtance that the beſt mode of delivery in footling caſes has not yet been explicitly pointed out by any author. This muſt appear ſurpriſing when it is conſidered that ſuch preſentations frequently occur; that the life of the child depends upon the practice adopted; and that the management of every preternatural labour muſt be influenced by the rules applicable to footling caſes.

" When the feet preſent, the infant's ſituation relatively to the mother muſt be with its belly placed towards her back, her belly, her ſide, or ſome intermediate point. The firſt of thoſe poſitions has been generally conſidered as the moſt favourable, and the laſt as the reverſe. But a little reflection muſt convince every practitioner that the infant occupies the leaſt poſſible ſpace, when its belly is towards the ſide of the mother, or, to ſpeak more accurately, towards the ſacro-iliac ſynchondroſis; for then the largeſt part of its body is within the largeſt diameter of the pelvis at the brim, while in its progreſs through the pelvis, the breech is not forced through the ſhorteſt diameter at the outlet, viz. that between the tuberoſities of the iſchia.

" In every caſe therefore where the feet are brought down, the toes ſhould in the proceſs of extraction be turned into ſuch a poſition, that the belly, the breaſt, and the face, ſhall be made to paſs in ſucceſſion along the neareſt ſacro-iliac ſynchondroſis. After the arms are diſengaged, the face can be readily turned into the hollow of the ſacrum."

89 *h.* One foot may preſent in the ſame variety of directions as both feet. Where one foot preſents naturally, if the pains be regular and ſtrong, the caſe is attended with leſs pain to the mother and leſs danger to the child, than where under ſimilar circumſtances both feet preſent. It is leſs painful to the mother, becauſe the child is formed into the ſhape of a cone, and the apex paſſes firſt through the pelvis, by which the parts are gradually prepared, and not ſuddenly forced open; and it is leſs dangerous for the child, becauſe the one leg being folded along the belly and breaſt, the umbilical cord is protected from compreſſion.

From theſe circumſtances, a very erroneous inference has been deduced by ſome celebrated authors, viz. that in caſes where it is neceſſary to perform the operation ſtyled turning, the one foot ſhould be brought down in preference to both. But as on ſuch occaſions the operator cannot be aſſiſted by pains, it is obvious that he could not have a ſufficient hold of the child by a ſingle foot.

With the exceptions juſt ſtated, the phenomena where one foot preſents are the ſame with thoſe which occur in caſes where both feet are in the paſſage.

90 *i.* When the knees preſent, all the inconveniences of footling caſes take place, with this additional danger to the child, that if the legs be croſſed, one or both may be fractured before the knees be expelled.

The management of knee preſentations muſt depend on the advance which theſe parts may have at the time aſſiſtance is procured. If they be ſtill at the brim of the pelvis, the feet ſhould be hooked down. But if they be fairly within the cavity of the pelvis, or in the vagina, they muſt be allowed to protrude without the parts until the feet be expelled.

91 *k.* Breech caſes occur more frequently than footling ones. It has been calculated that they happen once in 52 caſes of labour.

Preternatural Parturition.

The breech may preſent in the ſame variety of poſitions as the feet, viz. with the belly of the child to the back, to the belly, or to the ſide of the mother. Certain advantages and diſadvantages attend each of thoſe poſitions.

When the belly is to the back of the mother, the thigh bones being ſtraight, paſs with difficulty along the curved line of the ſacrum; after that obſtacle is ſurmounted, the largeſt part of the child is applied to the ſmalleſt diameter at the brim of the pelvis; and after the body is delivered, the head is ſituated in ſuch a direction that it cannot enter the brim; for the ſinciput is oppoſite to the promontory of ſacrum and the occiput to the ſymphyſis pubis.

If the belly of the child be to the belly of the mother, then the thigh bones paſs very readily along the bones of the pubes, while the ſpine bending, accommodates itſelf admirably to the hollow of the ſacrum, conſequently at firſt the labour proceeds ſpeedily and ſafely; but after the breech has paſſed through the cavity of the pelvis, it is applied with its largeſt diameter to the ſhorteſt diameter at the outlet, and after it has at laſt overcome the reſiſtance occaſioned by that circumſtance, and the body is expelled, the face, being towards the ſymphyſis pubis, ſubjects the patient to all the pain, and the child to all the dangers, already enumerated *(ff)*.

When the belly of the child is placed towards the ſide of the mother in breech caſes, then the ſame advantages attend the ſituation which have been enumerated under the firſt footling caſe *(dd)*; for the largeſt part of the child is uniformly applied to the largeſt aperture of the pelvis. Beſides this, the child incurs leſs hazard in this poſition than where the feet originally preſent; for the legs being folded on the belly protect the funis umbilicalis from compreſſion.

Breech caſes, where the pains are powerful, are to be left entirely to nature, taking care to ſupport the perinæum, till the infant be expelled; the navel-ſtring is then to be taken off the ſtretch, and the child accommodated to the paſſage on the ſame principle as footling caſes.

When the pains prove inadequate to the expulſion of the breech, various methods have been recommended, ſuch as hooking the finger in the groin, firſt on the one ſide, and then on the other; employing a blunt hook for the ſame purpoſe; fixing a garter or piece of tape over one or both thighs, and applying the forceps.

The firſt of theſe methods are uſeful where there are ſlight pains, and the infant is not large. The ſecond and third methods are injurious both to the mother and child, for they add to the vis à tergo, without diminiſhing the reſiſtance. But the fourth method, that is, applying the forceps, is invariably both ſafe and ſucceſsful; becauſe, while it enables the practitioner to draw forward the child without any uterine action, it at the ſame time puts it in his power to accommodate it to the paſſage by turning it round in the proper direction.

92 B. The ſecond diviſion of preternatural labours, includes all caſes where any other part than the head or lower extremities preſents; ſuch as the neck, the arm or ſhoulder, the breaſt, the back, the belly, or the ſide.

Preternatural Parturition.

It is obvious, that a full grown child cannot poſſibly be expelled through the natural paſſages in ſuch poſitions, and conſequently, unleſs nature perform the operation firſt deſcribed by Dr Denman, both mother and child muſt be deſtroyed; for the unavailing contractions of the uterus will firſt operate in impeding the circulation of the child; and then by puſhing forward its body with great force on the ſoft parts of the mother, will induce ſuch a degree of pain and inflammation, that ſhe muſt at laſt ſink exhauſted.

93 The practice of turning, as it is called, that is, of bringing down the feet in caſes belonging to this diviſion of preternatural labours, originally ſuggeſted by Pierre Franco, but firſt properly eſtabliſhed by Ambroſe Parrè, has been the means of ſaving many valuable lives. Indeed the ſuperiority of this practice to that of making the head preſent under ſuch circumſtances muſt be very obvious; for after the operator has got hold of the infant's feet, he can complete the delivery without requiring the aſſiſtance of pains.

The dangers to be dreaded in performing the operation of turning are rupture of the uterus, or ſubſequent inflammation of the paſſages, and loſs of the child.

The firſt of theſe, is to be guarded againſt, by purſuing ſuch means as ſhall ſuſpend the labour-pains, and remove the uterine ſtricture, when the opportunity of turning before the diſcharge of the water which ſurrounds the infant has been loſt. Theſe are blood-letting and opiates in large doſes, ſingly or combined, according to circumſtances.

Great gentleneſs and caution, on the part of the operator, are indiſpenſably requiſite to prevent both rupture of the uterus and the ſubſequent inflammation of the paſſages. When it is added, that a perſeverance for ſeveral hours is ſometimes neceſſary for accompliſhing this operation, it muſt be obvious, that it demands in many inſtances a greater degree of patience, as well as dexterity, on the part of the operator, than moſt caſes of ſurgery.

The ſafety of the infant, can only be ſecured, by attending very accurately to the rules for the management of footling caſes.

94 Dr Denman, whoſe diſcovery of the ſpontaneous evolution has been already mentioned, at one time ſuppoſed that in the caſes under conſideration, the operation of turning might be diſpenſed with, and that the patient might be ſaved much hazard, and the practitioner great anxiety and trouble, by waiting for that change.

But although in the later editions of his valuable work (Introduction to Midwifery), he has relinquiſhed this idea, his obſervations on the management of preternatural labour of the ſecond order, are evidently influenced by his former opinion.

He ſays (vol. ii. p. 249.), "Yet the knowledge of this fact, however unqueſtionably proved, does not free us from the neceſſity and propriety of turning children preſenting with the ſuperior extremities, in every caſe in which that operation can be performed with ſafety to the mother or give us a better chance of ſaving the child. Under ſuch circumſtances, the inſtructions given by former writers, and the obſervations we have before made, muſt ſtill be conſidered as proper to guide our conduct. But when we are called to a patient with a preternatural labour, in which there is no room to hope for the preſervation of the child, or in which we are aſſured of its death, or when the operation of turning cannot be performed without violence and ſome danger to the mother, then the knowledge of this probability of a ſpontaneous evolution, will ſet our minds at eaſe, and diſengage us from the conſideration of making any haſty attempts to perform a hazardous operation, from which no poſſible good can be derived, except that of extracting a dead child, and which at all events might be effected by a method much more ſafe to the mother.

Preternatural Parturition.

"The time required for the ſpontaneous evolution of the child, and the facility with which it may be made, will depend upon a variety of circumſtances, but chiefly upon the ſize of the child, the aptitude of its poſition, the dimenſions of the pelvis, and the power exerted by the uterus. If the child be very large or much below the common ſize, the ſlower I believe will be the evolution, nor can it be made at all without a ſtrong action of the uterus. It is poſſible, therefore, when we have conducted ourſelves on the ground of expectation that the evolution would be made, that the pains may fall off or be unequal to the effect, and we may be diſappointed. It might then be apprehended, that the difficulty of extracting the child would be infinitely increaſed. But though the evolution was not perfected, I have not found this conſequence; for the child, though not expelled, has been brought into ſuch a ſtate that I could afterwards paſs my hand with eaſe, and bring down its feet, though in an attempt to do this at the beginning of the labour I had been foiled. In one caſe in which the evolution did not take place, I could not bring down the inferior extremities, but I had no difficulty in fixing an inſtrument upon the curved part of the body of the child, or in bringing it away with entire ſafety to the mother. It was before preſumed that the child was dead, and the ſole object was to free the mother from her danger; and with her ſafety no appearances of the child, however diſagreeable, are to be put in competition. In caſes of this kind another mode of practice has been recommended, that of ſeparating the head from the body with a blunt hook or other convenient ſafe inſtrument; but as I have never practiſed the method, I give the deſcription of it in a note."

There are two points in the above obſervations, in 95 which it appears that Dr Denman has erred. In the firſt place, in ſanctioning delay in having recourſe to the operation of turning where the ſuperior extremity preſents. In many ſuch caſes, if the pains be not ſpeedily ſuſpended, or the poſition of the child altered, the uterus would burſt; an accident which has repeatedly fallen under the obſervation of the writer of this article.

The ſecond error is, the ſuppoſition that, after it has been found by experience in any given caſe, that the ſpontaneous evolution is not to happen, it is eaſy to extract the child either by the feet or by ſome inſtrument. But it will be found in the majority of ſuch caſes, that the infant is impacted into ſo cloſe a body, while the parts are all in a ſtate of ſwelling and inflammation, that immenſe difficulty and great danger attend the attempt.

The following obſervations on this ſubject cannot be too ſtrongly impreſſed on the minds of, eſpecially young, practitioners.

"Several

“ Several years ago it was diſcovered by Dr Denman, that in preſentations, ſuch as that in the above caſe, the poſition of the child is ſometimes altered, and 96 its expulſion accompliſhed, by the natural contractions of the uterus. Although the doctor, with his uſual candour, has allowed, that this favourable event, under ſuch alarming circumſtances, is rather to be wiſhed than expected; yet he has offered it as his opinion, that if all interference of art were avoided, “ the woman would not, in this caſe, die undelivered.”

“ The preceding hiſtory, however, affords a melancholy contradiction to this opinion. The midwife, who attended from the beginning, did nothing to interrupt the natural proceſs, as far as could be learned. Her fatal error was having only looked on, and having neither given that aſſiſtance which was neceſſary, nor ſent for others who could do ſo.

“ The ſpontaneous evolution, as Dr Denman has called it, can only take place where the child lies in a particular ſituation, viz. where the action of the uterus cannot be exerted on the preſenting part, or where that part is ſo ſhaped that it cannot be wedged within the pelvis. A practitioner may, therefore, by a careful examination, be able to decide whether the evolution will happen or not. This obſervation is by no means a matter of ſpeculation, being, on the contrary, of much practical utility; for, if there be ſigns which indicate the event alluded to, it follows, as a conſequence, not only that the natural proceſs is not to be counteracted, but alſo, that it is to be aſſiſted. Two caſes occurred during one year, where the author of theſe remarks had an opportunity of prognoſticating and aſſiſting the evolution, in preſence of two gentlemen then attending the profeſſor of midwifery, as annual pupils.

“ That the uterus ſhould continue rigidly contracted on the body of the child, while the ſtrength of the woman was ſo much exhauſted that no pulſe could be felt, and that ſhe appeared ſinking very faſt, is a ſingular and an inſtructive fact. It will, it is to be hoped, teach practitioners the fallacy of the aſſertion, *that the longer the operation of turning is delayed, the more eaſily it will be accompliſhed.*

“ It may ſeem aſtoniſhing, that the body of the child could not be drawn down with the crotchet, ſince it was in a ſtate of great putridity: But when it is conſidered, that the long-continued action of the uterus had wedged it very ſtrongly within the pelvis, while, at the ſame time, the preſſure on the ſoft parts lining that cavity had ſwelled them much, the circumſtance will be readily underſtood (N).”

97 Authors have endeavoured to aſcertain the cauſes of preternatural labours; but little ſatiſfaction has been derived from their reſearches. It is probable, that ſome caſes depend on different cauſes from others. For example, in ſome women preternatural labour occurs more than once. Such caſes ſeem to depend on ſome peculiarity in the uterus or ovum. Again, it is well known to practitioners of midwifery, that, on ſome occaſions, where the child had been found to preſent naturally at the commencement of labour, the poſition is perceived to be preternatural after the firſt ſtage is completed (O). In theſe caſes, the change of poſition may perhaps be juſtly attributed to irregularity of action of the uterus. Beſides, there can be little doubt that ſome caſes of preternatural labours originate from the premature rupture of the membranes.

2. The bulk of the fœtus alſo occaſions conſiderable deviations from nature in labour; for it may be either too ſmall or too large. 98

l. The fœtus, at the full period of geſtation, is never of ſo ſmall a ſize as to occaſion any deviation from nature, unleſs it have been for ſome time dead. It is indeed, a very remarkable fact, that women often carry to the full time a fœtus which had died about the fifth or ſixth month.

In ſuch caſes, the child is ſometimes expelled ſo rapidly, the paſſages oppoſing little or no reſiſtance, that the uterus is ſuddenly emptied of its contents; and hence, from the irregularity of its contraction, the placenta is retained, or uterine hæmorrhagy takes place.

m. The patient, however, is expoſed to more dangers 99 from the increaſed than the diminiſhed bulk of the fœtus. The fœtus may exceed the ordinary ſize, either from a natural increaſe of bulk, or from monſtroſity, or from diſeaſe.

k k. It has been already ſtated that the fœtus at the full term of geſtation, generally weighs from ſeven to nine pounds; but on ſome rare occaſions it is found to exceed ten or twelve pounds, or even thirteen. Although, however, the proceſs of delivery is not ſo rapid where the child is ſo large, yet if no other circumſtance occurs to impede labour, it will be eventually terminated with ſafety both to mother and child in moſt caſes. Where indeed, under ſuch circumſtances, the patient has not formerly had a child, there is always reaſon to apprehend that the infant may be deſtroyed by apoplexy, or the mother may be very much bruiſed. In ſome caſes of this kind, it becomes neceſſary to open the head of the infant.

l l. When the child is monſtrous, from the redundancy of ſome large parts, as from two heads or two bodies, it is ſufficiently obvious that if the mother be at the full term of geſtation, the obſtacles to delivery will be inſurmountable by the natural powers. Fortunately, however, in by far the greateſt number of caſes of monſters of that kind, the action of the uterus is excited before the ordinary period.

m m. The moſt frequent diſeaſe of children, which proves an obſtacle to labour, is the enlargement of the head from hydrocephalus. On ſome occaſions the head is enlarged to an extraordinary ſize.

Sometimes too, the thorax or abdomen is diſtended 100 and enlarged by a watery fluid. Profeſſor Saxtorph has recorded the following example of an obſtacle to delivery from a very uncommon diſeaſe. “ D. 18. Sept. 1775. in domo obſtetricia regia, mox paritura admittebatur gravida. Inſtante partus principio dolores partus veri debito modo alternantes, ſed ſolita proportione vehementia, duratione et celeriori recurſu inſtigebant. Rite tendebatur

---

(N) Select Caſes in Midwifery, p. 110.

(O) Vide Denman's Introduction, vol. ii. p. 254.

Preternatural Parturition.

tendebatur orificium poſteriora verſus inclinans ; juſta erant capitis ſitus, directio et aquarum formatio ; pelvis parteſque molliores, viam partus conſtituentes, nullo laborabant vitio ; quibus omnibus acceſſit adhuc ſanus et robuſtus corporis ſeminei habitus, et partus aliquoties antea perpeſſi felix eventus, quæ indubie ominabantur incæptum hocce negotium partus feliciter quoque finiendum fore. In progreſſivo rite procedebat partus.

" In fine vero capite ſponte nato, truncus ſolita facilitate ſequi nolebat, quare obſtetrix in arte adhuc novitia conſtitutam domus obſtetricem expertem ſatis ſociam ſibi advocabat.

" Corpore fœtus ad latus revoluto, ut humeri in majore diametro aperturæ pelvis inferiori minorem facerent reſiſtentiam, brachiiſque eductis, junctis viribus truncum ad axin pelvis extrahere moliebantur ; attamen obſtabat abdomen nulla illarum vi ulterius cedens.

" In auxilium tunc accedens, qui domum iſto tempore artem addiſcendi gratia habitabat ſtudioſus, manum ſub abdomine prudenter intulit, quod tenſum atque complanatum ſine omni obſtaculo inveniebat ; ulterius vero manum protrudens pedes tetigit, interque crura tumorem ingentem tenſum fluidoque contento plenum reperiebat.

" Compreſſa hocce tumore, dum adſtantes omni vi truncum ſimul attrahebant, diſrumpebatur ſubito, inſigniſque aquæ copia effluxit ; ſuperato ſic obſtaculo, facillime extrahebatur fœtus, vitam per biduum trahens.

" Fœtus poſtea examinatus fæmellus erat, ingentem ſaccum inter femora gerens, qui ex elongatione integumentorum univerſalium corporis a tergo verſus anteriora ita protractorum, ut orificium ani ex facie anteriore corporis prope vulvam conſpiceretur, ortum habebat. In ipſo ſacco poſt effluxionem humoris, aquæ fere lib. iv. capiente, nihil præter hydatides parvas obſervatu dignum erat. Os ſacro vero, ad angulum rectum verſus poſteriora curvatum caudæ inſtar prominebat (L)."

101 SECT. III. *Of the Deviations from Natural Labour, which depend on the State of the Paſſages through which the Child is forced.*

The deviations from natural labour occaſioned by the ſtate of the paſſages, originate either from the ſoft parts, or the bones.

The obſtacles from the ſoft parts are tumours within the womb, thickening and induration of the neck and mouth of the womb, enlargement of the ovary, cicatrix in the vagina, collection of fæces within the rectum, ſwelling of the parts lining the pelvis, malformation and extreme rigidity of the external parts.

It is a curious fact, not only that conception ſometimes takes place when there is a tumour within the womb, but alſo that pregnancy goes on to the full period. When this has happened, the tumour has been puſhed down before the infant, and has filled up the paſſages.

If this obſtacle be aſcertained at an early period of the labour, which it muſt be if the practitioner be in any ordinary degree ſkilful and attentive, the tumour may be puſhed back, and the feet of the child may be brought down. In a caſe of this kind, where the writer of this article was called in after the tumour had become wedged within the pelvis, and the head had been opened, the delivery was accompliſhed with extreme difficulty, and the poor woman ſurvived only a few hours.

Preternatural Parturition.

The following ſingular caſe of an excreſcence on the os uteri, is ſtated by Dr Denman, vol. ii. p. 65.

102 " In June 1770, I was deſired to ſee a patient in the eighth month of her pregnancy, who in the preceding night had a profuſe hemorrhage. Her countenance ſhewed the effects of the great loſs of blood ſhe had ſuſtained ; and from the repreſentation of the caſe given me by the gentleman who was firſt called in, I concluded that the placenta was fixed over the os uteri. On examination I felt a very large fleſhy tumour at the extremity of the vagina, repreſenting and nearly equalling in ſize the placenta, which I judged it to be. Had this been the caſe, there could not be a doubt of the propriety and neceſſity of delivering the patient ſpeedily ; and with that intention I paſſed my finger round the tumour, to diſcover the ſtate of the os uteri. But this I could not find, and on a more accurate examination, I was convinced that this tumour was an excreſcence growing from the os uteri, with a very extended and broad baſis. I then concluded that the patient was not with child, notwithſtanding the diſtention of the abdomen, but that ſhe laboured under ſome diſeaſe which reſembled pregnancy, and that the hemorrhage was the conſequence of the diſeaſe. A motion which was very evidently perceived when I applied my hand to the abdomen, did not prevail with me to alter this opinion.

" It was of all others a caſe in which a conſultation was deſirable, both to decide upon the diſeaſe, and the meaſures which it might be neceſſary to purſue ; and ſeveral gentlemen of eminence were called in. That ſhe was actually pregnant, was afterwards proved to the ſatisfaction of every one ; and it was then concluded, that ſuch means ſhould be uſed as might prevent or leſſen the hemorrhage, and that we ſhould wait and ſee what efforts might be naturally made for accompliſhing the delivery.

" No very urgent ſymptom occurred till the latter end of July, when the hemorrhage returned in a very alarming way, and it was thought neceſſary that the patient ſhould be delivered. There was not a poſſibility of extirpating the tumour, and yet it was of ſuch a ſize, as to prevent the child from being born in any other way than by leſſening the head. This was performed ; but after many attempts to extract the child, the patient was ſo exhauſted, that it became neceſſary to leave her to her repoſe, and very ſoon after our leaving her, ſhe expired.

" We were permitted to examine the body. There was no appearance of diſeaſe in any of the abdominal viſcera, or on the external ſurface of the uterus, which was of its regular form ; and when a large oval piece was taken out of the anterior part, the child, which had

---

(L) Vide Societatis medicæ Haumenſis Collectanea, vol. ii. p. 23.

had no marks of putrefaction, was found in a natural poſition. An inciſion was made on each ſide of the cervix to the vagina, and then a large cauliflower excreſcence was found growing to the whole anterior part of the os uteri. The placenta adhered with its whole ſurface; ſo that the blood which ſhe had loſt muſt have been wholly diſcharged from the tumour (M)."

103 In two caſes, where a great thickening and induration of the neck and mouth of the womb, approaching to the nature of ſchirroſity, had taken place previous to conception, the natural action of the uterus, though after a very conſiderable time indeed, aſſiſted by copious blood-letting, eventually overcame the reſiſtance. One of the patients died ten months after, with all the ſymptoms of real cancer uteri. The other was reſtored to perfect health after lying in.

104 Dr Denman has recorded (vol. ii. p. 73.) two caſes, where the enlarged ovarium impeded the progreſs of the child. In the one caſe the head of the infant was opened, and the delivery completed by the crotchet; but the patient died at the diſtance of three weeks. In the other, a trocar was paſſed into the tumour, and a living child was born. The patient recovered from her lying-in; but died hectic at the end of ſix months. In ſuch caſes, the ovary may be puſhed back, if the circumſtance be diſcovered early enough.

105 Cicatrix of the vagina, in conſequence of former injury, may appear at firſt to impede the progreſs of the infant; but it will always be found to yield to the pains, if the ſtrength of the patient be ſupported, and proper means be adopted to counteract the effects of the long-continued labour throes. A caſe occurred ſome time ago to Dr Hamilton, where a ſubſtance, of the hardneſs of griſtle, as thick as an ordinary ſized finger, placed between the vagina and rectum, and apparently extending from the ramus of one iſchium to that of the other, preſented an unſurmountable obſtacles to the paſſage of the child. He was called in after an unſucceſsful attempt had been made to tear away the infant, and found the woman in a ſtate of extreme danger. He was informed, that five years before that period, ſhe had had a very ſevere tedious labour, followed by great inflammation and ſuppuration of the external parts. The indurated part was cut through without the patient making any complaint, and the child was very eaſily extracted; but ſhe ſurvived the delivery only two days. The relations would not permit the body to be opened.

106 A collection of fæces within the rectum has been known to occaſion ſuch reſiſtance to the paſſage of the child, that the woman has died undelivered. In general, however, it is in the power of an active practitioner to empty the gut at the beginning of labour. But if, from neglect, the head of the child be jammed in the pelvis, and immoveably wedged in conſequence of an accumulation of fæces, it then becomes neceſſary to open the head.

107 Perhaps the moſt frequent affection of the ſoft parts which impedes the proceſs of the infant is, ſwelling of the parts lining the pelvis. This circumſtance has been already hinted at. It can never happen where the practitioner is ordinarily attentive; for the tenderneſs, heat, and dryneſs of the paſſages, which precede the actual ſwelling, cannot be overlooked by one at all aware of the poſſibility of ſuch an event. When it has actually happened, nothing can ſave the mother but opening the head of the infant. After this moſt unpleaſant operation is completed, the extraction of the child is ſeldom a matter of much difficulty.

108 Malformation of the external parts in ſome caſes does not prevent conception. Two caſes have fallen within the knowledge of the writer of this article, where the woman had conceived though the orifice of the vagina had not been capable of permitting the introduction of even the little finger. And it conſiſts with his knowledge, that about thirty years ago a woman under ſimilar circumſtances, was brought into the Royal Infirmary of this place, and was delivered by the Cæſarean operation. She died within two days.

It is ſufficiently obvious that the ſafe practice under ſuch circumſtances is to enlarge the natural opening, by making an inciſion in the direction of the perinæum, taking care not to wound the ſphincter ani.

109 Extreme rigidity of the external parts is one of the moſt frequent cauſes of deviation which depends on the ſtate of the ſoft parts. It takes place, in a greater or leſs degree, in the greateſt number of women who lie in for the firſt time; and generally in all women who are conſiderably advanced in life before they have children.

It is ſeldom that the reſiſtance oppoſed by the external parts is ſo very great as to prove an invincible obſtacle to labour. But, on many occaſions, the long-continued preſſure of the child on thoſe parts produces the moſt diſagreeable conſequences, as inflammation of all theſe parts and of the bladder. Inflammation in thoſe parts is always dangerous, for there ſeems to be a remarkable tendency to gangrene. Caſes are on record where the whole parts have ſloughed off, and where the rectum, vagina, and bladder, have formed one canal. Perhaps death is much preferable to life under ſuch circumſtances.

Copious blood-letting, and the liberal uſe of ſome unctuous application, with time and patience, in general overcome the rigidity of the external parts. Placing the patient over the ſteams of hot water was formerly recommended in ſuch caſes, but this practice is now exploded.

110 B. Many deviations from natural labour occur from the ſtate of the bones of the pelvis, for they may be ſo much altered in ſhape as either to increaſe or diminiſh conſiderably the aperture of that part.

d. When the apertures of the pelvis are too large, the mother incurs much danger, and the child is not totally exempt from hazard.

aa. The danger incurred by the mother ariſes from there being no reſiſtance to the paſſage of the child, ſo that when the action of the uterus begins, the child may be puſhed by the force of the pains through the paſſage before the ſoft parts be dilated; hence the uterus may be ruptured, or the ſoft parts lacerated. If, on

---

(M) Were ſuch a caſe again to occur, there could be no doubt reſpecting the propriety of fixing a ligature round the neck of the tumour.

on the other hand, the external parts be ſoft and yielding, a conſiderable portion of the uterus may be excluded without the parts. There is a very wonderful hiſtory of a caſe of this kind alluded to by Saxtorph in the following words. “ Memorabilius adhuc exemplum eſt illud à cel. Wolfg. Mullnero allatum, ubi *totus uterus* una cum fœtu extra genitalia dilapſus, fœtuſque vivus extra pelvim verſione extractus fuit, matre poſt reductionem uteri ſuperſtite. Vide ejus *Bahrnehmung von einer ſamt dem Rinde ausgefallenen Debahrmutter, Nurnberg* 1771 (L.).

111 *bb.* The hazard which the child undergoes is that of being ſuddenly expelled, included within the entire ovum, ſo that it may be loſt before proper aſſiſtance can be afforded. Another danger is, that the membranes having given way, it may be daſhed with violence upon the floor on which the patient walks. Whenever from the great width of the hips, there is reaſon to ſuſpect that the pelvis is too large, the practitioner ſhould continue in conſtant attendance from the very commencement of labour, and ſhould carefully adopt the appropriate and obvious means to prevent the hazards juſt enumerated.

112 *c.* But deficiency of ſpace in the apertures of the pelvis occurs much more frequently than increaſe. The apertures of the pelvis may be diminiſhed from natural ſmall ſize or malformation of the bones, from exoſtoſis, or from altered ſhape in conſequence of mollities oſſium.

Caſes where the ſacrum and ilia are of an uncommon ſmall ſhape are not frequent. Narrowneſs of the baſe of the ſacrum is ſometimes met with; and in a few caſes it has been found that the apex of the ſacrum has approached too nearly to the anterior part of the pelvis, ſo as to diminiſh the apertures at the outlet.

113 Exoſtoſes ſeldom prove an obſtacle to delivery; but one exception to this rule fell under the obſervation of the writer of this article ſeveral years ago. The exoſtoſis extended along the whole extent of the ſymphyſis pubis, and was fully as thick as an ordinary ſized finger. The woman had been delivered previous to his being called in, but the exhauſtion which followed, (for ſhe had been allowed to continue five days and nights in conſtant hard labour) occaſioned her ſinking a very ſhort time after delivery. In this inſtance both mother and child were loſt from the ſelf-ſufficiency and ignorance of the midwife.

The deficiency may exiſt in the brim, the outlet, or the cavity ſingly or combined.

The brim is much more frequently affected by mollities oſſium than the outlet; and, as was long ago remarked by Levret, it generally happens, that when the brim is narrowed from this cauſe, the outlet is widened.

114 The brim may be diminiſhed in ſize by the projection of the promontory of the ſacrum, or by the flattening of the pubes, or by the approximation of the bones where the pubes and ilia unite, or by a combination of ſome of theſe circumſtances. The projection of the promontory of the ſacrum, however, is by far the moſt common. When this happens, the projection ſometimes renders one ſide of the pelvis wider than the other, and this conſtitutes what authors call the diſtorted pelvis. Sometimes, however, it leaves both ſides of an equal width, and this is called the deformed pelvis.

The deficiency in the brim produced by theſe cauſes is very various; moſt frequently ſlight, but ſometimes ſo great that there is not an inch between pubes and ſacrum.

115 The outlet may be diminiſhed by the approximation of the tuberoſities and rami of the iſchia, or by the apex of the ſacrum and coccyx projecting more than uſually forward, while they are at the ſame time hooked up.

116 When both the brim and outlet are diminiſhed in aperture, the cavity of the pelvis is generally affected alſo; but when the deficiency of ſpace is confined to either, the cavity is commonly more ſhallow than natural, by which both the reſiſtance and the danger are conſiderably leſſened. Melancholy are the caſes where the cavity is rendered deeper than uſual.

As the practice in caſes of extreme deficiency in the apertures of the pelvis is to be regulated by the degree of narrowneſs, it is a matter of the firſt importance to be able to aſcertain the dimenſions in any given caſe with tolerable preciſion.

117 For this purpoſe, inſtruments called pelvimetres have been invented. M. Coutuoli has propoſed one for internal uſe, and M. Baudelocque has recommended one for external application. But however plauſible in theory the uſe of ſuch contrivances may appear, it is now well known that no dependence can be placed upon them in actual practice, and therefore the hand of the operator muſt be had recourſe to for determining both the ſhape and the extent of the apertures of the pelvis, wherever there is any narrowneſs. The following directions for this purpoſe given by Dr Wallace Johnſon are extremely judicious.

118 “ On paſſing the finger along the vagina, if the coccyx, or any part of the ſacrum, be felt unuſually forwards or near at hand; or if the ſymphyſis, or any other part of the pubes, is found projecting rather inwards than outwards, it is evident that the pelvis is diſtorted. In which caſe, as well as in thoſe where it is not diſtorted, but only very ſmall, the principal part of the child's head (allowing the preſentation right) remains high, the vertex making only a little round tumor within the brim: ſo that when the os uteri is opened, and come a little forwards towards the pubes, the capacity of the pelvis may be found out by moving the end of the finger round that part of the head which has entered the upper ſtrait. This method is uſed by ſeveral practitioners in London. However, ſhould the finger not be long enough to effect it properly, as ſometimes is the caſe, there is then another method, which, being more certain, may be uſed, provided it be done with tenderneſs and caution, and when the orifices are ſo well opened as to admit of it with ſafety. But previous to it, the operator muſt be well acquainted with the dimenſions of his own hand, viz.

(L) Diſſertatio Inauguralis de Diverſo Partu, &c. Auctore Matth. Saxtorph. p. 46.

“ Firſt, The fingers of a middle-ſized hand (as we may ſuppoſe the operator's to be) being gathered together equally into the palm, and the thumb extended and applied cloſely along the ſecond or middle joint of the finger; the diſtance between the end of the thumb, and outer edge of the middle joint of the little finger, is uſually four inches.

“ Secondly, Whilſt they are in the above poſition, the diſtance from the thumb, at the root of the nail, in a ſtraight line to the outſide of the middle joint of the little finger, is full three inches and a half.

“ Thirdly, the fingers being ſtill in the ſame ſituation, and the thumb laid obliquely along the joints next the nails of the firſt two fingers, and bent down upon them; the diſtance between the outſide of the middle joint of the fore finger, and the outſide of that of the little finger is three inches and a quarter.

“ Fourthly, The hand being opened, and the tops of the four fingers being a little bent, ſo as to come nearly in a ſtraight line; their whole breadth, acroſs the joint next the nails, is two inches and a half.

“ Fifthly, When the firſt three fingers are thus bent, their breadth acroſs the ſame joint is two inches.

“ Sixthly, The breadth of the firſt two, acroſs the nail of the firſt finger, is one inch and a quarter.

“ And, ſeventhly, The fingers being gathered into a conical form, the thumb lying obliquely upon the palm of the hand with its point upon the firſt joint of the ring finger, reckoning downwards, will meaſure in thickneſs, between its back and the fore part of the thumb, two inches and two-eighths.

“ Now, as hands are extremely various, the operator ought always to know how much the ſize of his differeth from the above dimenſions; and this being rightly underſtood, the application may be made as follows:

“ The patient, being in the poſition as for natural delivery, and the operator's left hand being well anointed, and the fingers and thumb gathered into a cone, it muſt be gently paſſed into the vagina, and then through the os uteri, unleſs in this part there is ſtill a rigidity to forbid it; if ſo, the fingers only muſt be paſſed, their extremities formed into the fourth dimenſion, and then placed edgeways in the ſtrait; which being done, if the fore finger touch the angle of the ſacrum, and the little one the ſymphyſis of the pubes, the width is then manifeſtly no more than two inches and a half; a ſpace through which a mature child can neither paſs alive, nor be brought ſo by art, unleſs it happens to be preternaturally ſmall indeed.”

Three methods of practice have been adopted in caſes of ſuch narrowneſs of the pelvis as renders it impoſſible for the child to be protruded alive, viz. the operation of embryulcia or embryotomy, the Cæſarean ſection, and the diviſion of the ſymphyſis pubis.

119 I. *Embryotomy.* The caſes requiring this moſt ſhocking operation are thoſe where the infant cannot be extracted alive through the natural paſſages; while there is, nevertheleſs, ſuch ſpace that it may be torn away piece-meal without injury to the mother. Of courſe, in theſe caſes the life of the woman can be ſaved only at the expence of her infant.

But although authors and practitioners in modern times adopt in general this principle, they differ materially in their account of the preciſe caſes requiring the operation.

Dr Oſborn alleges, that, as the head of the infant at the full time of utero-geſtation cannot be diminiſhed to leſs than three inches between the parietal protuberances by the natural contractions of the uterus forcing it againſt the bones of the pelvis; wherever the aperture at the brim or outlet falls under three inches, the operator ought to proceed as ſoon as poſſible to open the head of the infant.

But on ſo very ſerious an operation as that by which one life is deſtroyed, it becomes a practitioner to adopt no rule which can be at all liable to error; and it is evident, that there are three very ſtrong objections to this precept of Dr Oſborn.

120 Firſt, It is impoſſible in any caſe at the beginning of labour, to aſcertain that the infant is at the full term of utero-geſtation; but it is well known, that a child at the age of between ſeven and eight months, if born alive, may be reared to maturity, and that ſuch a child is capable of being expelled without injury, through an aperture incapable of permitting the paſſage of a full grown fœtus.

Secondly, The heads of children, even at the full time, are ſometimes ſo ſmall and ſo yielding as to admit readily of their ſhort diameter being diminiſhed below three inches.

Thirdly, Every candid practitioner muſt allow, that it is quite impoſſible to aſcertain with geometrical accuracy the preciſe dimenſions of the pelvis; and conſequently what in any given caſe may appear to the operator to be leſs than three inches, may in fact be above theſe dimenſions.

For theſe reaſons, wherever the narrowneſs is not obviouſly very conſiderable, the prudent rule is to aſcertain the effect of the labour-throes, ſupporting the ſtrength of the patient, and palliating diſtreſſing ſymptoms. By adopting this rule, the practitioner will not only have the conſciouſneſs of not having deſtroyed life unneceſſarily, where he is eventually forced to open the head, by the conviction that it is too large to paſs unopened, but alſo the innate ſatisfaction of ſometimes ſaving a life, which under leſs cautious management muſt have been ſacrificed. Great care indeed is neceſſary in ſuch caſes not to be deceived in the eſtimate of the progreſs of the child, for the ſwelling of the ſcalp may miſlead a young practitioner.

121 There has been a variety of opinion too, reſpecting the loweſt dimenſions of the pelvis which permit the operation of embryulcia with ſafety to the mother; and it is ſurely unneceſſary to ſtate, that unleſs there be a moral probability of ſaving the life of the mother by this operation, it ought never to be had recourſe to.

Dr Kellie, of London (P), and Dr Oſborn (Q), have recorded ſome caſes where this operation was performed,

---

(P) Dr Wallace Johnſon.

(Q) Dr Oſborn's Eſſays.

although the narrowneſs was very great; and the latter gentleman, founding on a ſingle caſe, aſſumes the principle, that whenever there is a ſpace equal to an inch and a half between pubes and ſacrum, the operation of embryulcia is practicable. But a careful peruſal of the caſe alluded to (A) muſt ſatisfy any unprejudiced perſon that there muſt have been ſome miſtake, moſt probably, from the ſwelling of the ſoft parts lining the pelvis having added to the apparent narrowneſs, and having, after the head had been opened above 36 hours, ſubſided. And at any rate, ſince experience has now fully eſtabliſhed the fact, that the danger reſulting from this operation is always in proportion to the degree of reſiſtance, it may be concluded that the operation of embryulcia cannot prove ſafe to the mother, unleſs, firſt, there be an aperture equal to about two inches by four; and, ſecondly, the narrowneſs be chiefly, if not altogether, confined either to the brim or the outlet. When both brim and outlet are deficient, and the cavity is deeper than uſual, even although the ſeveral apertures be quite ſufficient to allow the diminiſhed head to be extracted, the injury that muſt accrue from the violent preſſure on all the parts within the pelvis would deter any prudent practitioner from hazarding ſuch an operation.

When it is determined to have recourſe to the operation of embryotomy, the inſtruments required are the perforator, the crotchet, and the embryotomy forceps delineated in the plate.

122 The operation is to conſiſt of two different proceſſes; firſt, the diminution of the head; and, ſecondly, the extraction of the mangled child. In many caſes the latter ſhould be performed immediately after the former is accompliſhed; but whenever the reſiſtance is very conſiderable, an interval ſhould be interpoſed between the two. The advantages reſulting from this practice were firſt publicly noticed by Dr Oſborn, though there can be little doubt that the practice itſelf was the effect of neceſſity. By waiting after the head has been opened, the woman's ſtrength will be reſtored, ſo that the aſſiſtance of the pains in the expulſion of the child may be obtained; the ſwelling of the ſoft parts will ſubſide, by which the reſiſtance may be greatly leſſened, as well as the danger of inflammation removed, and the child's body will become putrid, by which its extraction may be greatly facilitated.

123 In opening the head, which is to be done by means of the perforator, the two great points to be aimed at are to avoid injuring any part of the woman, and to make a ſufficiently large opening of the head. On the complete accompliſhment of the latter, the eventual ſucceſs of the operation muſt depend in all caſes of extreme deficiency of ſpace.

Should it be found expedient to delay the extraction of the infant after the head has been opened and its contents evacuated, the teguments are to be carefully brought over the ragged edges of the bones, ſo that in the event of labour throes recurring, there ſhall be no riſk of the parts within the pelvis being injured.

124 When it has been found proper to proceed to the extraction of the infant, the firſt thing to be attempted is to diminiſh the bulk of the cranium as much as poſſible. This may be done by means of the embryulcia forceps, delineated in the plates, and contrived it is believed by Dr Lyon of Liverpool. It is an inſtrument far ſuperior to the almiſdach of the Arabians, in uſe even within theſe fifty years among the practitioners of this iſland (B).

After the head has been ſufficiently reduced in bulk, the crotchet is to be fixed at firſt on the inſide of the cranium; and while two fingers of the left hand are to be kept conſtantly ſo applied that if the inſtrument ſhould ſlip in the proceſs of extraction, it ſhall be received on the fingers, and cannot poſſibly touch any part of the mother, the operator is to draw down with a ſuitable exertion of force, in ſuch a direction that the largeſt part of the head ſhall be brought through the wideſt part of the pelvis.

In ſome caſes, much time and very violent exertions are required to accompliſh the delivery; but, if the proper precautions to prevent any injury to the paſſages be adopted, and if at the ſame time the operator imitate nature by working only from time to time, and increaſe the force employed gradually as may be required, and perſevere patiently, notwithſtanding the reſiſtance, taking care to ſupport by nouriſhment and cordials the ſtrength of the woman, the delivery at laſt will be completed.

125 The dangers to be dreaded from this moſt ſhocking operation, are injuries of the paſſages, from the inſtrument's ſlipping through the embarraſſment of the practitioner; or violent inflammation of all the contents of the pelvis extending to the abdomen, in conſequence of the parts through which the child muſt be ſo forcibly extracted being ſeverely bruiſed. Accordingly, a greater number of women die from the effects of this operation than practitioners are willing to admit; and indeed, in every caſe of extreme deficiency of ſpace, where embryotomy is performed, the recovery is to be regarded as doubtful.

This operation is ſometimes had recourſe to in caſes where the forceps ſhould have been uſed had the child been alive. But ſuch caſes are very rare, becauſe the evidence of the infant in utero being dead, is ſeldom ſo complete as to juſtify the practitioner proceeding on the principle that it is ſo.

126 II. By the *Cæſarean ſection* is meant the extraction of the infant through the parietes of the abdomen by an inciſion into the uterus.

This bold operation was perhaps never performed by the ancients on the living ſubject, and certainly was firſt recommended to practitioners by M. Rouſſet in his *Traitè nouvelle de l'Hyſterotomie*, &c. 1581. Since that time it has been often performed on the continent, and about twenty times in Great Britain. The ſucceſs of this operation recorded in the early works has certainly been exaggerated; but it appears by an elaborate memoir by M. Baudelocque, tranſlated into Engliſh by

---

(A) Oſborn's Eſſay, p. 240.

(B) For an account of the ancient inſtruments employed in the practice of midwifery, ſee Sculteti Armament. Chir.

by Dr Hull of Mancheſter, that during the 50 years preceding 1802, the operation has been had recourſe to on the continent 95 times, and that 37 of theſe caſes proved ſucceſsful. In Great Britain, on the contrary, this operation has never yet ſucceeded, a circumſtance to be attributed partly to the delay which has always taken place after the neceſſity for ſuch an expedient had been determined, and hence the patient, at the time the operation was performed, muſt have been in a ſtate of exhauſtion; and partly, perhaps chiefly, to the previous very alarming ſtate of health of the ſubjects of the operation in this iſland. It is at any rate certain that all over the continent practitioners have leſs horror at performing the Cæſarean ſection than Britiſh practitioners have commonly ſhewn; and it is deemed neceſſary in caſes where the operation of embryulcia is preferred in this country, and where of courſe the women are not in ſuch a precarious ſtate of health as thoſe commonly are who have extreme narrowneſs of the pelvis.

127 In conſequence of the fatality of the Cæſarean ſection in Great Britain, ſeveral eminent practitioners have regarded it as unjuſtifiable. Dr Oſborn has rendered himſelf particularly conſpicuous on this ſubject, and uſes very ſtrong language in reprobation of it. His arguments are, its acknowledged fatality; the capability of completing the delivery by means of the crotchet, in caſes of ſuch deformity of the pelvis, that there is no more than one and a half inch between the pubis and ſacrum, or to one ſide of the projecting ſacrum; and the impoſſibility of impregnation taking place in caſes of greater deficiency of ſpace. We ſhall notice theſe arguments in their turn.

128 1ſt, *The acknowledged fatality of the operation.*—This relates only to the reſult of the operation in Great Britain; for, as already mentioned, a great proportion of the patients has been ſaved on the continent. But in inſiſting on this argument Dr Oſborn has overlooked that the object of the operation is to ſave, if poſſible, two lives, and at any rate one. Now if it can be ſatisfactorily proved, that on ſome occaſions the operation of embryotomy is abſolutely impracticable, it becomes the duty of the practitioner to ſave one life at leaſt; and it is well known that the Cæſarean operation is far leſs painful to the woman than that of embryotomy, even where that latter operation is eventually ſucceſsful. In ſuch caſes of extreme deformity, either an attempt ſhould be made to deliver the woman and ſave the child, or both muſt be allowed to periſh; for the operation of embryotomy, if attempted, muſt be regarded as wilful murder.

129 2dly, The *practicability* of tearing away the child in pieces by means of the perforation and crotchet, in caſes where there is no more than an inch and a half between the pubis and ſacrum, or to one ſide of the projecting ſacrum, is alleged by the doctor on the foundation of a ſingle caſe, that of Elizabeth Sherwood already referred to. But any perſon who ſhall take the trouble to have the aperture of Sherwood's pelvis, as ſtated by Dr Oſborn cut out in wood, and to compare this with the baſis of an infant's ſkull as much diminiſhed as poſſible by the crotchet (which is done in the courſe of his lectures by the profeſſor of midwifery in this univerſity), muſt be convinced, that there was ſome miſtake in the ſuppoſed dimenſions of that woman's pelvis. And it is quite obvious, that unleſs there be the ſpace already ſtated, viz. three and a half or four inches by two, it is unſafe to extract the mangled child through the natural paſſages.

130 3dly, The *allegation* that where there is a greater degree of narrowneſs of the pelvis than that which was ſuppoſed to have happened in the caſe of Sherwood, impregnation cannot take place, is quite inconſiſtent with facts. One of the moſt remarkable caſes of extreme deformity is that of Elizabeth Thompſon, on whom the Cæſarean operation was performed at Mancheſter in 1802. The deſcription as given by Dr Hull (G) is as follows: "The pelvis of this patient was not nearly ſo ſoft as has ſometimes been obſerved. It ſtill had a conſiderable degree of bony firmneſs. The oſſa innominata at their ſacro-iliac ſynchondroſes, and at the ſymphyſis pubis, before the pelvis was dried, admitted of a ſlight degree of motion.—The diſtance from the criſta of one os ilium to the other, at their moſt remote points, meaſures ten inches and a half.

"The alæ of both oſſa ilia are very much bent; and on the left ſide the curvature is ſo great, that it meaſures only two inches from the anterior and inferior ſpinous proceſs to the oppoſite poſterior point. The lumbar vertebræ project forwards or inwards, and make a conſiderable curve to the left ſide of the pelvis. The diſtance from the lower part of the ſecond lumbar vertebra to the anterior part of the ſpine of the os ilium, on the left ſide, is two inches. The diſtance from the loweſt part of the ſecond lumbar vertebra to the anterior part of the ſpine of the os ilium, on the right ſide, is five inches.

131 "*Superior aperture.* The conjugate or antero-poſterior diameter, from the ſymphyſis pubis to the upper edge of the laſt lumbar vertebra is one inch and a half.—This diameter is not taken from the os ſacrum, or its junction with the laſt lumbar vertebra, becauſe the point of their junction is ſo much ſunk into the pelvis, that the place it ſhould have occupied, is repreſented by the junction of the fourth and fifth lumbar vertebra. The tranverſe diameter meaſures four inches and five-eighths. It is taken from one ſacro-iliac ſymphyſis to the other. The diſtance of the point of this aperture, which is oppoſite to the anterior part of the right acetabulum, from the lumbar vertebra, is only half an inch. The diſtance from that part of this aperture, which correſponds with the poſterior part of the right acetabulum, to the os ſacrum is three-fourths of an inch. The diſtance of the point, correſponding with the anterior part of the left acetabulum, from the lumbar vertebra is five-eighths of an inch. The diſtance of the point of this aperture, oppoſite to the poſterior part of the left acetabulum, from the os ſacrum, is three-fourths of an inch. The diſtance of one os pubis from the other, in the points marked in the plate, is ſeven-eighths of an inch. The diſtance from the right ſacro-iliac ſymphyſis to the ſymphyſis pubis is three inches and three-fourths. The diſtance

---

(G) Obſervations on Mr Simmons's Detection, &c. p. 195.

Preternatural Parturition.

Preternatural Parturition.

ſtance from the right ſacro-iliac ſymphyſis to the left os pubis is three inches and three-eighths. The diſtance from the left ſacro-iliac ſymphyſis to the ſymphyſis pubis is three inches and five-eighths. The diſtance from the left ſacro-iliac ſymphyſis to the right os pubis is three inches and one-fourth. The largeſt circle, that can be formed in any part of the ſuperior aperture, does not exceed in diameter one inch.

132 " *Inferior aperture.* The diſtanc from one ramus oſſis iſchii to the other, where they are united with the rami oſſium pubis, meaſures only half an inch. The diſtance from the tuberoſity of one os iſchium to the other meaſures one inch and two-tenths. The conjugate or antero-poſterior diameter, taken from the ſymphyſis pubis to the point of the os coccygis is three inches.

" The angle, included by the rami of the oſſa pubis, is very acute, viz. an angle of about 20 degrees. The perpendicular height from the tubera of the oſſa iſchia to the inferior margin of the ſymphyſis pubis is two inches and a half. The perpendicular height of the ſymphyſis pubis is one inch and a half. The tuberoſity of the left os iſchium advances forwards, beyond that of the right, about ſix-tenths of an inch, and the whole of the rami oſſis pubis and iſchii on the left ſide projects beyond thoſe of the right. The perpendicular height of the os ſacrum and coccyx is two inches and one-fourth only, the os ſacrum being bent ſo as to form a very acute angle. The acetabula, at their neareſt points, are only three inches diſtant. The ſymphyſis pubis is much more prominent than natural. The upper margin of the ſmyphyſis pubis is ſituated as high as the bottom of the fourth lumbar vertebra."

It appears then, that Dr Oſborn's arguments are fallacious, and that caſes occur where the operation of embryotomy is neither ſafe nor practicable. Under ſuch circumſtances, the Cæſarean ſection muſt be had recourſe to; and it is therefore to be regarded as an operation of neceſſity, not one of choice. If this rule be adopted, the caſes requiring ſo formidable an expedient will happily be very ſeldom met with.

133 Mr Simmons of Mancheſter, obſerving that Dr Oſborn's third argument is untenable, has propoſed in the following words, another ſubſtitute for the Cæſarean operation.

" When a caſe ſhall ariſe in which the child cannot be delivered by the crotchet, from the brim of the pelvis being no more than one inch in diameter; I propoſe to combine the two operations, and to divide the ſymphyſis pubis to make way for the crotchet. Dr Oſborn has urged ſeveral objections againſt this propoſal, although he admits that the operation at the ſymphyſis is not ſo certainly fatal as the Cæſarean ſection. Weighty objections doubtleſs preſs againſt it; but whilſt there are no other means for preſerving life, bad as the chance is, it becomes a queſtion whether it be worth riſking; and, after maturely conſidering the caſe, ſhould an attempt for ſaving the life of the mother be judged expedient, as the laſt reſource it may be adopted.

" The ſpace gained has been differently ſtated at from three to eight or nine lines in the diameter;—the medium diſtance would probably be ſufficient to accompliſh the delivery by the crotchet.

" The objections urged againſt this mode of delivery, when the head is of the full ſize, will not apply to its reduced bulk; and it ſhould be remembered, that the ſymphyſis is formed of cartilage and ligament; ſo that whatever preſſure ſhall be made againſt the divided edges, will not be made againſt the ſharp angles of bone. That much injury may be done anteriorly will not be denied; but does the continued preſſure of the child's head never produce miſchief in other caſes? By the introduction of a female ſound for a guide, a cautious and ſteady operator will avoid wounding the urethra; and, as the baſe of the ſkull will probably be turned ſideways, it will ſuffer leſs in extraction than in other caſes of the crotchet; in which it muſt in general be injured from preſſure againſt the pubis. If the ſeparation, however, be carried beyond a certain length, laceration will probably enſue; and, ſhould this accident occur, I ſee no reaſon to apprehend more danger from it than follows the extraction of a large ſtone from the bladder through a ſmall opening, which will induce a lacerated wound, but which we know will not uncommonly heal. The ſacro-iliac ligaments would certainly not be injured by choice, but the conſequences, I believe, are not generally fatal; and, ſhould it be urged that great pain and lameneſs will afflict the patient for a long time after, a reply will readily occur, that life was at ſtake; and ſurely there are few who would not compound, for the proſpect of temporary pain and inconvenience, to have it preſerved to them.

" A ſpontaneous ſeparation ſometimes occurs, both there and at the pubis; and yet the patient has been again reſtored to health.

" I do not ſee, in other reſpects, in what this compound operation differs from the moſt difficult crotchet caſe—the Cæſarean ſection is certainly fatal to the mother in this country—the life of the child, it is agreed, ſhall not be put in competition with the parent's life—the ſection of the ſymphyſis is neither ſo formidable nor ſo fatal as the Cæſarean ſection—and the crotchet has been ſucceſsfully applied in dimenſions which will probably be thus acquired.

" Upon the whole, then, in that ſuppoſed caſe of diſtortion (which I hope will never happen) in which the mother muſt be doomed to death, from the impoſſibility of delivering the child by the crotchet, the compound operation I have recommended will furniſh a reſource, approved by reaſon and ſanctioned by experience; inaſmuch as the ſection of the ſymphyſis pubis has been made, and the crotchet has been uſed, though ſeparately, yet with ſafety. Such a caſe will be attended, unqueſtionably, with additional hazard; but it offers the only chance to the mother, to the preſervation of whoſe life our chief care ſhould be directed: and I hope that in future all trace of the Cæſarean operation will be baniſhed from profeſſional books; for it can never be juſtifiable during the parent's life, and ſtands recorded only to diſgrace the art."

134 He himſelf has afforded the moſt ſatisfactory evidence of the abſurdity of his own propoſal; for he had not publiſhed it many months when the very caſe he had deſcribed as ideal actually occurred in his neighbourhood, and he had the opportunity of making the experiment of his own plan. But he ſhrunk from it, and no wonder; for the woman was Elizabeth Thompſon, whoſe pelvis has juſt been deſcribed. It is unfortunate that Mr Simmons has not had the candour to confeſs his error, and to retract his opinions, more eſpecially ſince his reflections

flections againſt the Cæſarean operation, were couched in language peculiarly bitter and invective.

135 With reſpect to the mode of performing the Cæſarean ſection, there has been conſiderable variety of opinion. On theoretical principles, the external inciſion, viz. that through the parietes abdominis, ought to be in the direction of the linea alba, becauſe there is leſs chance of any conſiderable retraction of muſcular fibres, or of interfering with the inteſtines, than if it were made in any other direction. But the reſult of the practice ſeems at variance with the theory. According to the teſtimony of Baudelocque, of 35 operations, where the inciſion was made on the ſide of the abdomen, eighteen proved ſucceſsful; of thirty in the direction of the linea alba, ten only ſucceeded; and of eight in the manner recommended by Lauverjat, that is, by a tranſverſe inciſion between the recti muſcles and ſpina dorſi, three ſucceeded. But it may be remarked, that the event, in many of thoſe caſes, may have been influenced by a variety of circumſtances, totally independent of the line of direction of the external inciſion,

In whatever part of the abdomen the external inciſion be made, it ought to be extended to ſix inches; and, previous to cutting into the uterus, any active arterial branch, which may have been divided, muſt be ſecured; and the liquor amnii, if not already diſcharged, muſt be drawn off. The opening into the uterus need not be above five inches in length, and ſhould be made as much towards the fundus as poſſible. Means are to be employed to prevent the protruſion of the inteſtines at the time the uterus is emptied. Both fœtus and ſecundines are to be quickly extracted; after which, the hand is to be paſſed into the uterus, to clear out any coagula which may have formed within its cavity, to prevent the os tincæ being plugged up, and, at the ſame time, to promote the contraction of the uterus. The wound in the uterus is to be left to nature; but that of the parietes of the abdomen is to be carefully cloſed by means of the interrupted ſuture and adheſive ſtraps; and the whole belly is to be properly ſupported by a ſuitable bandage or waiſtcoat. In the after treatment of the patient, the great objects to be held in view, are to ſupport the ſtrength and moderate the degree of local inflammation.

136 III. *Diviſion of the ſymphyſis pubis.*—This was originally propoſed and performed by M. Sigault of Paris. His propoſal was made in 1768; but he had no opportunity of making the actual experiment till September 1777.—The ſucceſs of his firſt caſe was ſuch, that a medal was ſtruck to commemorate the event; and the operation was admired and recommended, with all the extravagance of French enthuſiaſm.

The operation conſiſts of the diviſion of the ſymphyſis pubis and ſeparation of the innominata. For this purpoſe, a catheter is to be introduced into the urethra, and, with a common ſcalpel, the articulation is to be cut through from the upper edge of the ſymphyſis, to within a quarter of an inch of the inferior edge. By ſeparating the thighs, the divided bones are forced aſunder. After this, the operator is either to turn the child, or to extract it by the forceps, according to the circumſtances of the caſe.

This expedient was propoſed as a ſubſtitute, both for the operation of embryulcia, and for the Cæſarean ſection, as it was alleged to be perfectly conſiſtent with the ſafety both of mother and child.

It is quite unneceſſary for us to offer any theoretical objections to this operation, becauſe we can now reaſon on the event of thirty-ſix caſes, which have been publiſhed.—But thoſe who may wiſh to inveſtigate this ſubject, may conſult Baudelocque, par 1994. and 2091. incluſive; and Dr Oſborn, p. 271. To that latter practitioner's profeſſional zeal and ability is chiefly to be aſcribed the total rejection of this operation in Great Britain.

137 Of the thirty-five ſubjects of the publiſhed caſes (for in one woman it was performed twice), fourteen women and eighteen children died.—Of the twenty-one women who ſurvived, nine had either had living children before the Sigaultian operation, or had ſuch at a ſubſequent period. Moſt of the remainder ſuffered much from the operation. Some had incurable incontinence of urine, others lameneſs, &c. But the moſt important fact is, that whenever the bones of the pelvis were ſeparated from each other above an inch (and no ſpace of any conſequence could be added to the brim, unleſs they were ſo), the ſacro-iliac ſynchondroſes were torn, and no woman ſurvived that accident.

Theſe facts have at laſt convinced foreign practitioners of the futility of this expedient; and, accordingly, for above ten years, it has not been performed on the continent by any practitioners of reſpectability.

138 When a woman, with a narrow pelvis, who has had the good fortune to recover after the operation of embryotomy, again falls with child, ſhe ſhould not incur the hazard of a repetition of ſo horrible an operation; but ought to have premature labour induced between the ſeventh and the eighth month. Under the direction of an intelligent practitioner this operation is eaſily performed; and, while it affords the only chance of ſaving the infant, which it is the duty of the mother and of the practitioner to attempt, it at the ſame time, by leſſening the reſiſtance, diminiſhes both the ſuffering and the riſk of the patient (N).

For a further account of the practice in caſes of extreme deformity of the pelvis, the reader is referred to Oſborn's Eſſays; Hamiltons Letters to Oſborn; Simmons's Reflections, and Hull's Detection of Simmons.

SECT. IV. *Of the Deviations from Natural Labour which happen from anomalous circumſtances.* 139

Certain circumſtances beſides thoſe already enumerated occaſion deviations in the proceſs of labour. Some of theſe reſpect the child, and others the woman.

140 *a*. The child's life is endangered if the navel-ſtring be ſo ſtrongly convoluted round its neck, that after the head is born the remainder cannot be expelled without the cord being drawn ſo tight as to interrupt the circulation through it. Dr Denman, vol. ii. p. 16. has ſtated this as a cauſe of protracted labour, and has adviſed

---

(N) See a paper on this ſubject, in the 18th volume of the Medical Facts and Obſervations, by Mr Barlow.

Preternatural Parturition

viſed certain modes of practice in conſequence. But if there be pains, there cannot be any material protraction of the labour from this cauſe.

All riſk of the infant may be prevented by ſlackening the cord, and waiting for the action of the uterus, if the operator find that he cannot draw the loop of cord which ſurrounds the child's neck eaſily over its head. But this in moſt caſes can be readily done.

141 *b.* The cord is ſometimes puſhed down before the preſenting part of the child.

If this happen before the membranes are burſt, the only certain method of ſaving the child is to perform the operation of turning as ſoon as the ſtate of the paſſages will permit.

When the cord is puſhed down along with ſome other part, as the head, after the waters are diſcharged, a variety of practice is required according to the circumſtances of the particular caſe; hence merely keeping the cord for a little time beyond the preſenting part by means of the fingers, or wrapping it up in a piece of ſoft rag, and puſhing it above the preſenting point, or the application of the forceps, are ſeverally found uſeful in different caſes.

142 *c.* Sometimes one or both arms of the child are forced down along with the head, where proper aſſiſtance is not had at the beginning of labour. If the pelvis be roomy, and the woman have formerly had children, the delivery may be at laſt completed by the natural powers, notwithſtanding this increaſed degree of reſiſtance. But in many caſes of this kind an experienced practitioner is not called in till the ſtrength of the woman be very much exhauſted, and then it becomes neceſſary to uſe the forceps, or even on ſome occaſions to have recourſe to the operation of embryulcia.

143 *d.* It is well known, that ſometimes there is more than one child in the womb. Inſtances where there are twins are not unfrequent; caſes of triplets are alleged to happen once in between three or four thouſand births; four at a birth have not occurred in this city for the laſt twenty-ſeven years; and there are only two, or at moſt three, well-authenticated caſes of five at a birth having happened within a hundred years in this iſland.

All the ſigns by which the exiſtence of more than one child in utero can be aſcertained, previous to the actual commencement of labour, are fallacious; and in general it is not till after the birth of one child that it can be determined that another remains in the womb; and, unleſs under very particular circumſtances, it is of no importance. The circumſtances alluded to are where different parts of both children are forced into the paſſage at the ſame time. Of this a very remarkable caſe is rcorded in the book of Geneſis, verſe 27. chap. xxxviii.

When the womb appears to remain bulky and hard after the birth of one child, there is reaſon to ſuppoſe that it contains a ſecond. But if there be any doubt on the ſubject, the practitioner has it in his power to aſcertain the point by examination. When there is no ſecond child in the uterus, the further the fingers are carried up within the paſſages, the more contracted do they feel; whereas, if there be a ſecond child, the more open are they found.

144 When it is aſcertained that another infant remains, the woman's belly ſhould be immediately compreſſed by means of a roller, in order to prevent faintiſhneſs from the ſudden relaxation of the parietes abdominis, and the portion of the navel-ſtring remaining attached to the after-birth of the firſt born ſhould be carefully ſecured, leſt the veſſels of the placenta anaſtomoſe.

Preternatural Parturition.

145 In regard to the ſubſequent treatment, there has been much variety of opinion among practitioners. Some have propoſed waiting till the action of the uterus expel the ſecond as it had done the firſt infant. Others urge ſtrongly the neceſſity for immediate delivery.

Againſt the former of theſe practices it is to be objected; firſt, that in ſome caſes, days or even weeks have been known to intervene between the birth of one child and the action of the uterus which expelled the ſecond. Secondly, that if this happen, the paſſages muſt become contracted and their ſubſequent dilatation may be productive of inflammatory ſymptoms. Thirdly, that during the time the uterine action is ſuſpended, internal hæmorrhagy may take place, and may deſtroy the patient. And, fourthly, the ſecond child may be ſuddenly forced down in ſuch a poſition, as may endanger its life, and at the ſame time occaſion great pain to the mother.

For theſe reaſons it is now an eſtabliſhed rule among judicious practitioners, to examine the ſituation of the ſecond infant, as ſoon as the patient ſhall have recovered from the ſhock of the birth of the firſt child; and, if its poſition be natural and the patient have not been exhauſted by the previous labour, and pains come on, to rupture the membranes, and allow the natural powers to complete the delivery. But if the infant preſent any other part than the head, or though the head do preſent, if the woman be exhauſted, or if there be no appearance of the return of pains within an hour after the birth of the firſt, then the hand is to be paſſed up to bring down the feet of the ſecond child, and the delivery is to be expedited. The extraction of the placentæ is to be conducted with great care, and every poſſible precaution is to be adopted againſt the occurrence of flooding, which is always to be dreaded as the conſequence of plurality of children.

The ſame principles apply to the management of triplets, &c.

146 *d.* Umbilical hernia, to which women are perhaps more ſubject than to any other ſpecies of rupture, may influence the labour materially.

If it be reducible, it diſappears after the fifth month of pregnancy; but immediately after the expulſion of the child it returns, and occaſions frightful faintings and floodings. This may be prevented by the ſimple expedient of having the belly compreſſed by a roller in ſuch a manner, that in proportion as the infant advances, the compreſſion may be increaſed.

Should it be irreducible, if the hernia be affected by the continuance of labour, as may be known by the colour, &c. the operation of turning muſt be had recourſe to.

147 *e.* Convulſions ſometimes happen during labour, and occaſion great danger both to the mother and the child. The woman is quite inſenſible during the fit, which conſiſts of violent convulſions of the muſcles which move the body, and of thoſe of the eyes, the face, and the lower jaw; it laſts in ſome caſes only a few ſeconds,

and

Preternatural Parturition.

and in others for ſeveral minutes. After the fit has ceaſed, it ſometimes happens that the patient remains in a comatoſe ſtate; in other caſes the ſenſibility returns.

The circumſtances which diſtinguiſh this diſeaſe from epilepſy were firſt ſtated explicitly by Dr Hamilton in the following words: "The old diſtinction between eclampſia and epilepſia has been rejected by Dr Cullen, without ſufficient reaſon. The convulſions that occur during pregnancy and labour, ſhould be diſtinguiſhed by the former name, for the diſeaſe is always an acute one, and it never, as far as my experience goes, lays the foundation for habitual epilepſy. To an inattentive practitioner, indeed, the phenomena appear ſimilar to thoſe of epilepſy; but, independent of its violence and fatality, there are many circumſtances peculiar to it. This has been remarked by ſeveral authors, particularly Dr Denman; but thoſe circumſtances have never been accurately pointed out in any publication which has fallen into my hands.

Dr Dun- an's An- als, vol. v. 319.

148

"The eclampſia, peculiar to pregnancy and labour, differs from epilepſy in the following reſpects.

"1. The ſymptoms which precede the attack are well marked, announcing to an experienced practitioner the approach of the diſeaſe.

"2. If the firſt fit do not prove fatal, and if no means of cure be attempted, it is within a few hours followed by other paroxyſms, provided delivery do not take place.

"3. After the paroxyſms, even where they have been very ſevere, the patient in many caſes continues quite ſenſible during the intervals, and the ſenſibility returns the moment the fit is off.

"4. What may appear ſtill more extraordinary is, that, in ſome caſes there is a remarkably increaſed ſuſceptibility of impreſſion of the external ſenſes; and this ſuperſenſation is not confined to patients in whom the convulſions are ſlight.

"5. The aura epileptica never occurs in the caſes alluded to.

"6. The pulſe is, in every caſe, affected in ſome degree during the remiſſions of the fits. It is ſlow, or oppreſſed, or intermitting, or frequent and rapid. But it is moſt commonly ſlow and oppreſſed, becoming fuller and more frequent after blood-letting.

149 The ſymptoms above hinted at as preceding the fits are, violent headach, or ſudden delirium, or violent tremors during the ſecond ſtage of labour. Impaired or depraved viſion commonly prove the immediate harbingers of the fit. The event of this occurrence is always precarious, for a ſingle fit may deſtroy the patient. Death happens in ſuch caſes in two ways; viz. either by rupture of ſame of the veſſels within the head, or by the rupture of the womb itſelf.

150 The cauſe of the diſeaſe is evidently an overload in the veſſels within the cranium, and this may be occaſioned from a variety of cauſes, as violent labour throes, paſſions of the mind, irritations in the primæ viæ, &c.

151 In caſes of ſo very alarming a nature, it is not wonderful that practitioners have differed much reſpecting the practice to be adopted. The following is what has been recommended by Dr Hamilton in the volume of Dr Duncan's annals already referred to.

"When fits have actually occurred during the latter months of pregnancy, the firſt remedy to be employed, after having adopted the ſuitable means for protecting the tongue, is blood letting, both general and topical. Opening the external jugular might anſwer both purpoſes, but the reſtleſsneſs of the patient in many caſes makes the ſurgeon or attendants dread this operation. A quantity of blood, therefore, adapted to the exigency of the caſe, is to be drawn from the arm, and either a branch of the temporal artery is to be divided, or ſeveral leeches are to be applied to the temples. After the bleeding, a powerful laxative glyſter ought to be exhibited. And if there be any evidence of diſordered primæ viæ, an emetic muſt, if poſſible, be given. The ſtate of the os uteri is then to be aſcertained; and if labour have not commenced, no attempts whatever are to be made to promote that proceſs. In ſome rare caſes, however, where the bulk of the gravid uterus is enormous, it may be neceſſary to remove a part of its contents; but ſuch caſes cannot happen once in a thouſand inſtances of the diſeaſe.

"Should the fits ſtill continue, the head muſt be ſhaved, and covered with a large bliſter; and if the oppreſſion or fulneſs, or hardneſs of the pulſe, be not removed, the blood-letting is to be repeated.

"As ſoon as the patient becomes capable of ſwallowing, the camphor, in doſes of ten grains, ought to be given every three or four hours. The moſt efficacious and palatable form in which this medicine can be preſcribed, is by ſuſpending it in boiling water, through the medium of alcohol, ſugar and magneſia. Its uſe muſt be perſevered in for ſeveral days, gradually leſſening the number of doſes.

"Where the eclampſia has been preceded by œdema, the digitalis may be employed with much ſucceſs.

"Convulſions during labour are to be treated upon the ſame principles, with theſe additional precautions, that delivery is to be accompliſhed by the moſt expeditious poſſible means, and that if the delivery be followed by uterine hæmorrhagy, the diſcharge is for ſome time to be rather encouraged than checked. I knew two inſtances of the fits, which had been ſuſpended for ſome hours, recurring, in conſequence of the flooding being ſtopped, and in both caſes the convulſions were removed, by allowing the diſcharge to return.

"When the ſymptoms that precede eclampſia, take place in the latter months of pregnancy, the moſt certain method of guarding againſt the threatening accident is, having recourſe to immediate blood-letting, and afterwards preſcribing camphor, attention to the ſtate of the bowels, and a ſpare diet.

"When the ſame ſymptoms occur during labour, a copious bleeding ſhould be inſtantly ordered, and the appropriate means of terminating the delivery ſhould be adopted with as much expedition as may be conſiſtent with the ſafety both of mother and child.

"In theſe conciſe practical ſuggeſtions, practitioners will obſerve circumſtances omitted, which have been recommended by gentlemen of deſerved profeſſional eminence, and novelties of practice propoſed, which I believe have not hitherto been explicitly adviſed. Some explanation, therefore, of the plan above recommended may perhaps be expected.

"The moſt obvious remedy apparently omitted is opium. This powerful medicine was not preſcribed, as far as we have reaſon to know, by the practitioners who lived at the end of the 17th and beginning of the 18th centuries. The firſt author who, in ſtrong terms, aſſerts the efficacy of opium in ſuch caſes, appears to be the tranſlator of Aſtruc's Midwifery (A); and his opinion has been adopted by Dr Denman (B), and by Dr Bland (C). But in every caſe of true eclampſia, during pregnancy or labour, opiates do irreparable miſchief, where a copious bleeding has not been premiſed; and even where that precaution has been attended to, they have been found uſeleſs, if not hurtful. Melancholy experience has completely eſtabliſhed in my mind this practical precept; and I conſider it to be a matter of very great moment, that it ſhould be univerſally known; for general practitioners, who are often firſt called to thoſe caſes where the fits happen during pregnancy, are extremely apt to preſcribe opium. I can ſolemnly declare, that no patient to whoſe aſſiſtance I have been called, who had taken a doſe of opium previous to my arrival, has recovered, and I have known that medicine given in almoſt every variety of doſe. My father, Dr A. Hamilton, of whoſe judgment and practical knowledge it does not become me to ſpeak in the terms they ſo juſtly merit, prevented my ever employing opium under ſuch circumſtances.

"A ſecond remedy extolled by Dr Denman, and now, after a fair trial, rejected in my practice, is vomiting. This ſeems to have been a very common preſcription in the time of Mauriceau, as he takes great pains to point out its hurtfulneſs in ſeveral parts of his works (D). Where there are unequivocal marks of diſordered ſtomach, an emetic may be preſcribed with advantage after blood-letting, but it ſhould be avoided under all other circumſtances.

"With regard to the warm-bath, which is a favourite remedy among foreign practitioners, and has been adviſed by ſeveral Britiſh authors, I have never had an opportunity of trying its effects. Upon theoretical principles I ſhould reject it; but my chief reaſon for never having directed its uſe, has been the impoſſibility, in ordinary caſes of practice, of commanding a warm-bath into which a woman in ſuch a ſituation could be put.

"Daſhing cold water by ſurpriſe upon the face is a practice ſuggeſted by Dr Denman, and on which he had much dependence at one period. Experience leſſened his hopes, and, many years ago, prevented my ever indulging any. I gave it ſeveral fair trials, (once or twice in public in the lying-in ward of the Royal Infirmary), and had even reaſon to be convinced, that it rather aggravated than diminiſhed the violence of the paroxyſms."

In addition to theſe obſervations it may be proper to remark, that a much larger quantity of blood ſhould be drawn in thoſe caſes than has commonly been done. Dr H. adviſes forty ounces to be taken at this firſt bleeding, and the ſame quantity to be again drawn within an hour, if the ſymptoms be not mitigated; and he talks with the utmoſt confidence of the utility of this practice.

152 *f.* Although the woman be delivered ſafely both of the child and afterbirth, ſhe may ſink very ſoon after in conſequence of internal flooding. This is to be ſuſpected if the patient ſuddenly complain of giddineſs or ſickneſs, or ſinging in the ears, or impaired viſion; or if ſhe become delirious, with a pallid face and cold limbs. The ſtate of the pulſe at the wriſt too ſhould lead a judicious practitioner to ſuſpect the exiſtence of internal flooding. Poſitive certainty of this accident may be obtained by feeling through the belly the condition of the uterus; or, more certainly ſtill, by feeling the ſtate of the vagina, for if its parietes approach, there is not much probability of there being any conſiderable internal hæmorrhagy; whereas, if it be found filled with coagulated blood, there is a certainty, that the womb too is diſtended from the ſame cauſe.

This accident is entirely owing to the womb not having contracted with ſufficient energy. It very often proves the cauſe of ſudden and unexpected death.

155 The boldeſt and apparently moſt violent meaſures are required to ſave the patient in many of thoſe caſes. The womb and vagina muſt be immediately emptied, and ſuch preſſure muſt be made on the inſide of the uterus with the hand, as ſhall force it into contraction. In ſome caſes cold water in great quantity muſt be daſhed from a height on the naked belly at the ſame time; and in the mean while the ſtrength of the patient muſt be ſupported with large doſes of opium. If there be vomiting, which is a frequent ſymptom in ſuch caſes, five grains of ſolid opium ſhould be given at firſt, and afterwards three grains every three or four hours, till the pulſe becomes ſteady and the ſtrength recruited, when the opiates are to to be withdrawn and leſſened by degrees. The writer of this article cannot avoid this opportunity of paying a juſt tribute of reſpect to the practical diſcernment of the able editor of the New London Medical Dictionary, who ſeems the firſt author who has mentioned this practice of giving large doſes of opium; a practice by which many valuable lives have been ſaved.

Concluſion.—In the preceding account of the deviations, which ſometimes happen in the proceſs of human parturition, although we have endeavoured to give a full view of the ſubject, we have not purſued the beaten tract. But as this article may rather be conſulted by many as a dictionary, than purſued regularly as a treatiſe, we ſhall add the ordinary arrangement of labours, with the reference to the numerical articles, under which the ſeveral varieties may be found.

Labours are divided into four claſſes; viz. natural, laborious, preternatural, and complex.

Natural labour comprehends all caſes where the head of the infant is forced foremoſt; and the whole proceſs is completed with ſafety, both to mother and child, within twenty-four hours from the commencement. It is deſcribed under articles 48. to 60.

Laborious

(A) The Art of Midwifery, &c. 8vo. London, printed for J. Nourſe 1767. Appendix, p. 295.

(B) Vol. ii. p. 418.

(C) Loco citato, page 136.

(D) Particularly in Aphoriſm 232. "L'émétique eſt pernicieux aux femmes groſſes, ou nouvellement accouchées, qui ſont ſurpriſes des convulſions." And Levret, page 451. of his L'Art des Accouchemens, ſays, in reference to that aphoriſm, "Cette ſentence eſt des mieux fondées, et elle doit être rigoureuſement obſervée dans tous ſes points."

Laborious labour is that where, although the head of the infant be forced foremoſt, the proceſs is protracted beyond twenty-four hours from the commencement. It is divided into three orders: Firſt, where the natural powers at laſt, after much ſuffering on the part of the mother, complete the delivery. See article 64.

Secondly, Where, although the action of the uterus be inadequate to the expulſion of the infant, it is practicable to extract the child through the natural paſſages, without injury either to it or to the mother. See articles 66. to 74. 82 and 84.

Thirdly, Where it is impoſſible to extract the child alive through the natural paſſages. See articles 80. and 99. to 133.

Preternatural labours comprehend all caſes where any other part of the child than the head is forced foremoſt; and conſiſt of two orders:

Firſt, Preſentations of the lower extremities, viz. footling caſes, article 87. Breech caſes, article 91. Caſes where one foot preſents, article 89. and knee-caſes, article 90.

Secondly, Preſentations of the ſuperior extremities or other parts than the head or lower extremities, articles 192. to 196.

Complex labours include all caſes where any other circumſtances than thoſe enumerated under the former three claſſes take place, viz.

Caſes where the pelvis is too large, articles 110. and 111.

Caſes where hæmorrhagy occurs at the beginning of labour, article 76. or at the concluſion of that proceſs, articles 152. and 153.

Caſes where there is more than one child, articles 143, 144, 145.

Caſes where the patient had previouſly been affected with umbilical herniæ, article 146.

Caſes where convulſions happen, articles 147, 148.

Caſes where the navel-ſtring is twiſted round the neck of the infant, article 140. or where it is forced down along with ſome part of the child, article 141.

And caſes of rupture of the uterus, article 65.

EXPLANATION OF THE PLATES.

Plate CCCXLVI.

Fig. 1. A front view of the uterus in the unimpregnated ſtate, *in ſitu*, ſuſpended in the vagina; the anterior parts of the oſſa iſchia, with the oſſa pubis, pudenda, perineum, and anus being removed, in order to ſhow the internal parts.

A, The laſt lumbar vertebra.
B, B, The oſſa ilia.
C, C, The acetabula.
D, D, The inferior and poſterior parts of the oſſa iſchia.
E, The part covering the extremity of the coccyx.
F, The inferior part of the rectum.
G, G, The vagina cut open longitudinally, and ſtretched on each ſide of the cervex uteri, in order to ſhow the manner in which the uterus is ſuſpended in it.
H, H, Part of the urinary bladder ſtretched on each ſide of the vagina and inferior part of the fundus uteri.
I, The cervix uteri.
K, The fundus uteri.
L, L, The fallopian tubes.
M, M, The ovaria.
N, N, The broad ligaments.
O, O, The ſuperior part of the rectum.

Fig. 2. A view of the internal parts as ſeen from the right groin, the pelvis having been divided vertically.

A, The loweſt vertebra of the loins.
B, C, The os ſacrum and coccyx with the integuments.
D, The left os ilium.
E, The inferior part of the os iſchium.
F, The os pubis of the ſame ſide.
G, The foramen magnum.
H, The acetabulum.
I, The inferior part of the rectum.
K. The os externum and vagina, the os uteri lying looſely in the latter.
L, The veſica urinaria.
M, N, The cervix and fundus uteri, with a view of the cavity of the uterus. The attachment of the vagina to the uterus, and the ſituation of the uterus when preſſed down by the inteſtines and bladder into the concave part of the os ſacrum, are likewiſe ſhown.
O, The broad ligament of the left ſide.
P, P, The left fallopian tube.
Q, The left ovarium.
R, R, The ſuperior part of the rectum and inferior part of the colon.

Fig. 3. Is a ſketch taken from Dr Hunter's magnificent plate, N° 6. of the gravid uterus. All the fore part of the uterus and ſecundines (which included the placenta) is removed. The navel ſtring is cut, tied, and turned to the left ſide over the edge of the womb. At the fundus the inveſting membranes are likewiſe turned over the edge of the womb, that they might be more apparent. The head of the child is lodged in the lower part of the womb, or in the cavity of the pelvis, and its body lies principally in the right ſide. Its poſition is diagonal or oblique, ſo that its poſterior parts are turned forwards, and to the right ſide of the mother, and its fore parts are directed backwards, and to the left ſide. Its right foot appears between its left thigh and leg. Every part is ſtated by Dr Hunter to have been repreſented juſt as it was found.

Fig. 4. A front view of the gravid uterus in the firſt ſtage of labour; the anterior parts are removed, but the membranes not being ruptured, form a large bag containing the fœtus and the liquor amnii.

A, A, The ſubſtance of the uterus.
B, B, C, C, D, D, E, E, The bones of the pelvis.
G, G, The vagina.
H, H, The os uteri dilated during a pain; with
I, The membranes containing the liquor amnii protruding through it.
K, The chorion.

L, The chorion diſſected off at the back of the uterus, to ſhow the head of the child through the amnios.

M, The placenta; the lobulated ſurface, or that which is attached to the uterus, being ſhown.

Plate CCCXLVII.

Fig. 1. Repreſents a well-formed pelvis.

A, A, The oſſa ilia, properly ſo called.

a, *a*, The iliac foſſæ.

b, *b*, The linea innominata, making part of the brim of the pelvis.

c, *c*, The criſta of the oſſa ilia.

e, *e*, Their ſuperior anterior ſpinous proceſſes.

B, B, The os iſchium.

f, *f*, Its tuberoſities.

h, *h*, Its branches.

C, C, The body of the os pubis.

i, *i*, The criſta pubis.

k, *k*, Its deſcending branch uniting with that of the iſchium.

l, The ſymphyſis pubis.

D, D, The os ſacrum.

m, *m*, Its baſe.

n, *n*, The ſacro-iliac ſynchondroſis.

o, Its internal ſurface called *hollow*.

p, Its apex to which the coccyx is joined.

E, The coccyx.

Fig. 2. Repreſents a vertical ſection of the pelvis.

A, The promontory of the ſacrum.

B, The point of the coccyx.

The diſtance from theſe two points marks the depth of the pelvis behind, which in the majority of caſes is ſix inches.

C, The ſpinous proceſs of the iſchium.

D, The tuberoſity of the iſchium.

E, The criſta pubis, the diſtance which two points marks the depth of the pelvis at the ſides, and is ordinarily about four inches.

F, The foramen thyroideum.

G, The ſurface by which the two oſſa pubis are joined to form the ſymphyſis pubis, and by which junction the depth of the pelvis at the front is reduced to about one and a half inch.

Fig. 3. Repreſents the brim of a well-formed pelvis.

A, B, The ſhort or conjugate diameter between pubis and ſacrum, which meaſures commonly a little leſs than four inches.

C, D, The long diameter in the ſkeleton, which, however, in the living ſubject, is rendered almoſt as ſhort as the former, in conſequence of the bellies of the pſoæ muſcles being lodged in the lower cavity of the tunica innominata.

E, F, The diagonal diameter in the ſkeleton, which, in fact, is the long diameter in the living body, and meaſures ſomewhat leſs than five inches.

Fig. 4. Repreſents the outlet of a well-formed pelvis.

A, B, The ſhort diameter, extending from one tuberoſity of the iſchium to the other, and meaſuring leſs than four inches.

C, D, The long diameter, extending from the lower edge of the ſymphyſis pubis to the point of the coccyx, and meaſuring nearly five inches.

Fig. 5. Repreſents the brim of a diſtorted pelvis.

Fig. 6. Repreſents the outlet of a deformed pelvis.

Plate CCCXLVIII.

Fig. 1. The fœtal heart.

a, The right ventricle.

b, The right auricle.

c, The left auricle.

d, Branches of the pulmonary veins of the right lobe of the lungs, thoſe of the left being cut off ſhort.

e, Arteries of the left lobe of the lungs.

f, The vena cava deſcendens.

g, The aorta deſcendens.

h, The trunk of the arteria pulmonalis.

i, The ductus arterioſus.

Fig. 2. Repreſents the firſt ſtage of natural labour, towards its termination.

A, The membranes of the ovum diſtending the cervix uteri, while the head of the child is juſt entering the brim of the pelvis.

B, B, The os uteri nearly dilated.

C, The vagina.

D, The orificium externum.

Fig. 3. Repreſents the ſecond ſtage of natural labour, when the head has deſcended into the cavity of the pelvis, while the face is ſtill towards the ſacro-iliac ſynchondroſis.

Fig. 4. Repreſents the ſecond ſtage of natural labour, after the head has advanced ſo far that the face is in the hollow of the ſacrum, and the vertex in the arch of the pubis.

Place CCCXLIX.

Fig. 1. A view of a deformed pelvis when the deficiency of ſpace is not very conſiderable.

Fig. 2. The child's ſkull.

a, The vertex, or poſterior fontanelle.

b, The anterior fontanelle.

Fig. 3. and 4. The common ſhort forceps, reduced to one-fourth of the natural ſize.

The inſtrument, when of the proper ſize, is in length 11 inches. The length of each handle is four inches and a half. If a ſtraight line be drawn through the plane ſurface of one handle, and be produced to the extremity of the inſtrument (which forms the axis of the handles when both are joined), the convex edge of the blade, at the greateſt diſtance from this line, is diſtant $1\frac{3}{8}$ inch; and the extreme diſtance of the point on the oppoſite edge is $\frac{13}{16}$ths of an inch. When both blades are joined their greateſt width is $2\frac{3}{4}$ inches. The right-hand blade has a hinge between the handle and blade, by which it is eaſily introduced, while the patient lies on the left ſide.

Fig. 5. and 6. Views of Lowder's lever; for a particular deſcription of which, ſee art. 69.

Fig. 7. Orme's perforator reduced to one-fourth the natural ſize.

Fig. 8. Embryotomy forceps, one-fourth the natural ſize.

Fig. 9. The crotchet, one-fourth the natural ſize.

Plate CCCL.

Fig. 1. Repreſents an ordinary ſized child forced againſt the brim of a deformed pelvis.

Fig. 2. Repreſents the child when the feet had preſented, turned into that direction by which its head is beſt

MIDWIFERY. PLATE CCCXLVI.

Fig. 1.

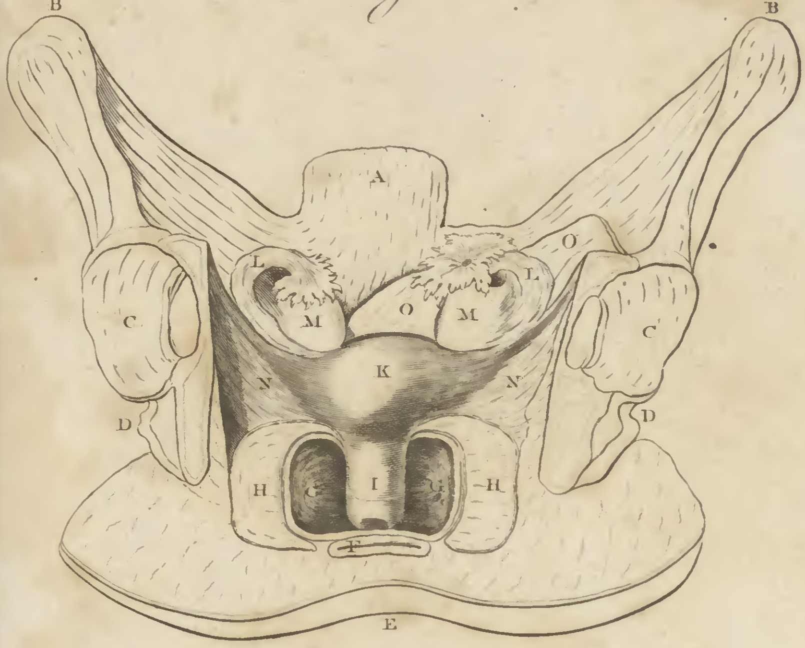


Fig. 2.

Fig. 3.

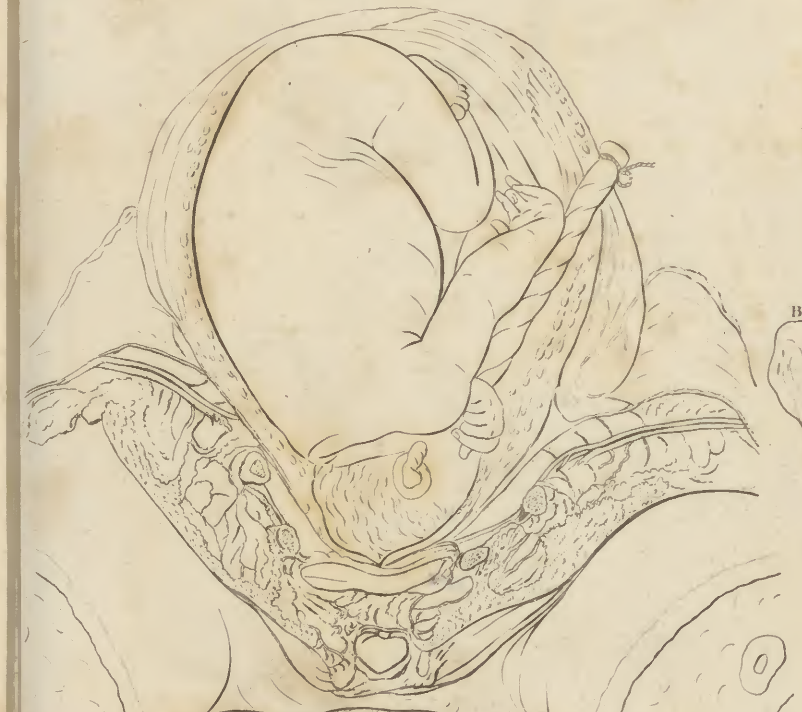
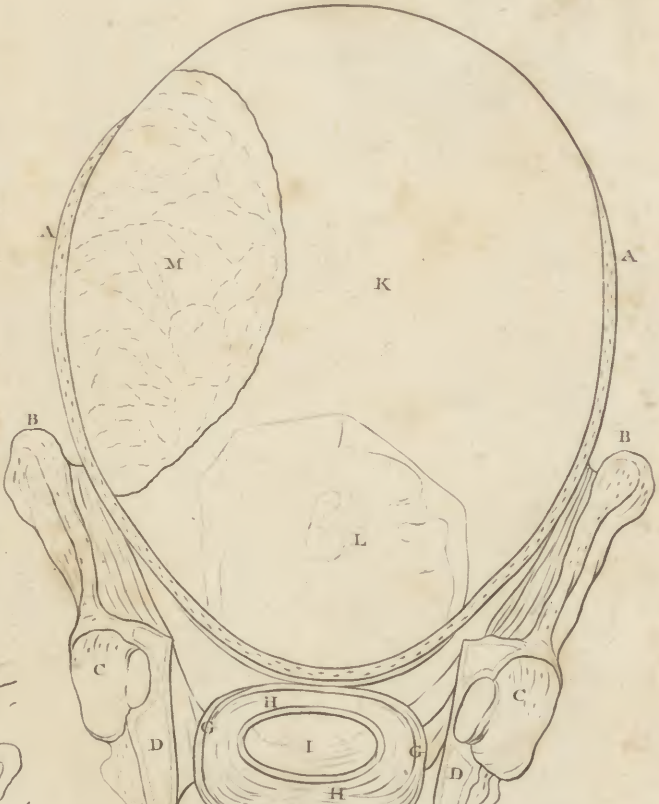


Fig. 4.



W. Archibald sculp.

MIDWIFERY.

PLATE CCCXLVII.

Fig. 1.

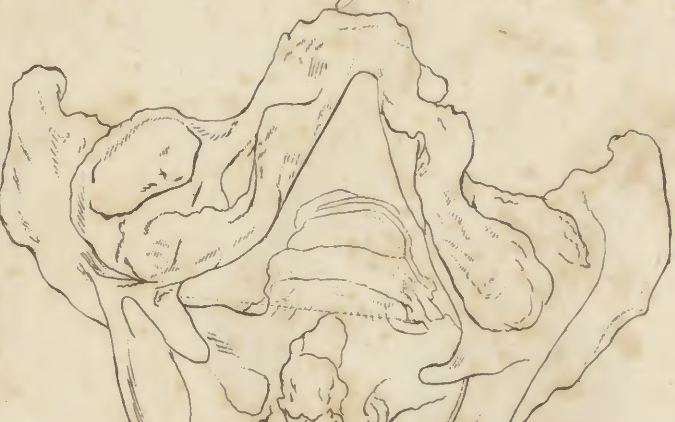
Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.



W. Archibald Sculp.t

MIDWIFERY. *PLATE CCCXLVIII.*

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

W. Archibald Sculp.

MIDWIFERY.

PLATE CCCXLIX.

Fig. 1.

Fig. 2.

Fig. 3.

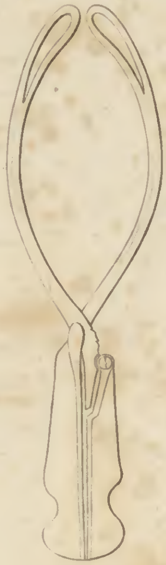


Fig. 4.

Fig. 9.

Fig. 7.

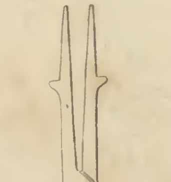


Fig. 8.

Fig. 5.

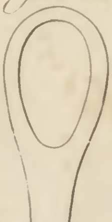


Fig. 6.

W. Archibald Sculp.ᵗ

Fig. 3.

Fig. 2.

Fig. 1.

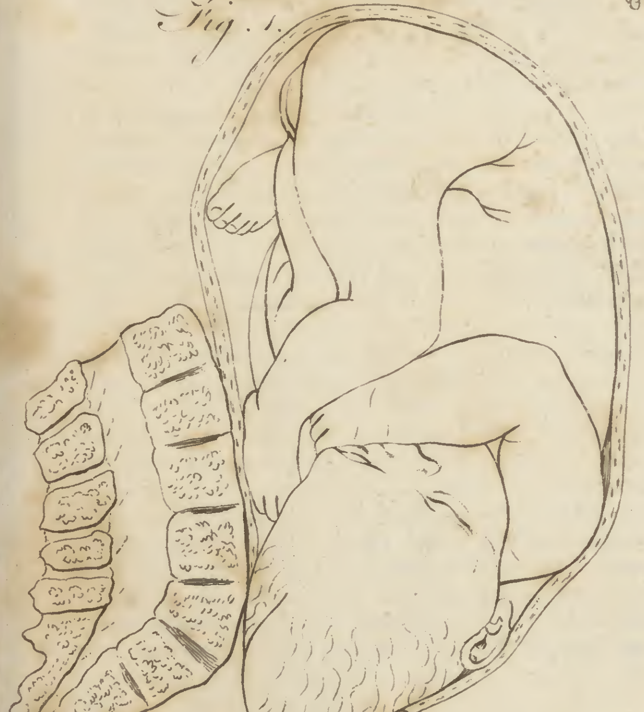


Fig. 4.

W. Archibald Sculp.t

beſt brought through the brim and cavity of the pelvis, viz. with the face towards the ſacro-iliac ſynchondroſis of one ſide.

Fig. 3. Repreſents the ordinary ſituation of the infant in breech preſentations; from which it is evident, that unleſs the infant be very ſmall, the natural action of the uterus cannot force it through the pelvis in this direction.

Fig. 4. Repreſents an arm preſentation, and communicates an idea of the difficulty of bringing down the feet, and turning the infant in that poſition.

Miedniki || Mieris.

MIEDNIKI, or MEDNIKI, or *Warmic*, a town of Samogitia, and the reſidence of the biſhop. It is 28 miles N. E. from Konigſberg, and 60 miles S. S. W. from Mittau.

MIEKOW, a town of Auſtrian Poland, in the palatinate of Cracow. The founder of this town is ſaid to have been Gripſius Jana, who built it after the model of Jeruſalem, when he returned from a pilgrimage to that city. It is 12 miles north from Cracow.

MIEL, JAN, called *Giovanni della Vite*, a moſt eminent painter, was born in Flanders in 1599. He was at firſt a diſciple of Gerard Seghers, in whoſe ſchool he made a diſtinguiſhed figure; but he quitted that artiſt, and went to Italy, to improve himſelf in deſign, and to obtain a more extenſive knowledge of the ſeveral branches of his art. At Rome he particularly ſtudied and copied the works of the Caracci and Corregio; and was admitted into the academy of Andrea Sacchi, where he gave ſuch evident proofs of extraordinary merit and genius, that he was invited by Andrea to aſſiſt him in a grand deſign which he had already begun. But Miel, through ſome diſguſt, rejected thoſe elevated ſubjects which at firſt had engaged his attention, refuſed the friendly propoſal of Sacchi, and choſe to imitate the ſtyle of Bamboccio, as having more of that nature which pleaſed his own imagination. His general ſubjects were huntings, carnivals, gypſies, beggars, paſtoral ſcenes, and converſations; of thoſe he compoſed his eaſel pictures, which are the fineſt of his performances. But he alſo painted hiſtory in a large ſize in freſco, and in oil; which, though they ſeem to want elevation of deſign, and a greater degree of grace in the heads, yet appear ſuperior to what might be expected from a painter of ſuch low ſubjects as he generally was fond of repreſenting. His pictures of huntings are particularly admired: the figures and animals of every ſpecies being deſigned with uncommon ſpirit, nature, and truth. The tranſparence of his colouring, and the clear tints of his ſkies, enliven his compoſitions; nor are his paintings in any degree inferior to thoſe of Bamboccio either in their force or luſtre. His large works are not ſo much to be commended for the goodneſs of the deſign as for the expreſſion and colouring; but it is in his ſmall pieces that the pencil of Miel appears in its greateſt delicacy and beauty. The ſingular merit of this maſter recommended him to the favour of Charles Emanuel duke of Savoy, who invited him to his court, where he appointed Miel his principal painter, and afterwards honoured him with the order of St Mauritius, and made him a preſent of a croſs ſet with diamonds of great value, as a particular mark of his eſteem. He died in 1664.

Mieris.

MIERIS, FRANCIS, the *Old*, a juſtly celebrated painter, was born at Leyden in 1635; and was at firſt placed under the direction of Abraham Toorne Vliet, one of the beſt deſigners of the Low Countries, and afterwards entered himſelf as a diſciple with Gerard Douw. In a ſhort time he far ſurpaſſed all his companions, and was by his maſter called the prince of his diſciples. His manner of painting ſilks, velvets, ſtuffs, or carpets, was ſo ſingular, that the different kinds and fabric of any of them might eaſily be diſtinguiſhed. His pictures are rarely to be ſeen, and as rarely to be ſold; and when they are, the purchaſe is extremely high, their intrinſic value being ſo inconteſtably great. Beſides portraits, his general ſubjects were converſations, perſons performing on muſical inſtruments, patients attended by the apothecary or doctor, chemiſts at work, mercers ſhops, and ſuch like; and the uſual valuation he ſet on his pictures was eſtimated at the rate of a ducat an hour. The fineſt portrait of this maſter's hand is that which he painted for the wife of Cornelius Plaats, which is ſaid to be ſtill preſerved in the family, although very great ſums have been offered for it. In the poſſeſſion of the ſame gentleman was another picture of Mieris, repreſenting a lady fainting, and a phyſician applying the remedies to relieve her. For that performance he was paid (at his uſual rate of a ducat an hour) ſo much money as amounted to fifteen hundred florins when the picture was finiſhed. The grand duke of Tuſcany wiſhed to purchaſe it, and offered three thouſand florins for it; but the offer was not accepted. However, that prince procured ſeveral of his pictures, and they are at this day an ornament to the Florentine collection. One of the moſt curious of them is a girl holding a candle in her hand, and it is accounted ineſtimable. This painter died in 1681.

MIERIS, *William*, called the *Young Mieris*, was ſon of the former, and born at Leyden in 1662. During the life of his father, he made a remarkable progreſs: but, by being deprived of his director when he was only arrived at the age of nineteen, he had recourſe to nature, as the moſt inſtructive guide; and by ſtudying with diligence and judgment to imitate her, he approached near to the merit of his father. At firſt he took his ſubjects from private life, in the manner of Francis; ſuch as tradeſmen in their ſhops, or a peaſant ſelling vegetables and fruit, and ſometimes a woman looking out at a window; all which he copied minutely after nature, nor did he paint a ſingle object without his model. As Mieris had obſerved the compoſitions of Gerard Laireſſe, and other great hiſtorical painters, with ſingular delight, he attempted to deſign ſubjects in that ſtyle; and began with the ſtory of Rinaldo ſleeping on the lap of Armida, ſurrounded with the Loves and Graces, the fore ground being enriched with plants and flowers; a work which added greatly to his fame, and was ſold for a very high price. This maſter alſo painted landſcapes and animals with equal truth and neatneſs; and modelled in clay and wax, in ſo ſharp and accurate a manner, that he might juſtly be ranked among the moſt eminent ſculptors. In the delicate finiſhing of his works, he imitated his father; as he likewiſe did in the luſtre, harmony, and truth, of his paintings, which makes them to be almoſt as highly prized; but they are not equal in reſpect of deſign, or of the ſtriking effect, nor is his touch ſo very exquiſite as that of the father. The works of the old Mieris are better compoſed, the figures are better grouped, and they have leſs confuſion; yet the younger Mieris is acknowledged to be an artiſt of extraordinary merit, although inferior to him, who had ſcarcely his equal. He died in 1747.

Mieris, *Francis*, called the *Young Francis*, was the ſon of William, and the grandſon of the celebrated Francis Mieris; and was born at Leyden in 1689. He learned the art of painting from his father, whoſe manner and ſtyle he always imitated; he choſe the ſame ſubjects, and endeavoured to reſemble him in his colouring and pencil. But with all his induſtry he proved far inferior to him: and moſt of thoſe pictures which at the public ſales are ſaid to be of the young Mieris, and many alſo in private collections aſcribed to the elder Francis, or William, are perhaps originally painted by this maſter, who was far inferior to both; or are only his copies after the works of thoſe excellent painters, as he ſpent abundance of his time in copying their performances.

MIEZA, in *Ancient Geography*, a town of Macedonia, which was anciently called *Strymonium*, ſituated near Stagira. Here, Plutarch informs us, the ſtone ſeats and ſhady walks of Ariſtotle were ſhown. Of this place was Peuceſtas, one of Alexander's generals, and therefore ſurnamed *Miezæus*, (Arrian).

MIGDOL, or Magdol, in *Ancient Geography*, a place in the Lower Egypt, on this ſide Pihahiroth, or between it and the Red ſea, towards its extremity. The term denotes a tower or fortreſs. It is probably the *Magdolum* of Herodotus, ſeeing the Septuagint render it by the ſame name.

MIGNARD, Nicholas, an ingenious French painter born at Troyes in 1628; but, ſettling at Avignon, is generally diſtinguiſhed from his brother Peter by the appellation of *Mignard of Avignon*. He was afterwards employed at court and at Paris, where he became rector of the royal academy of painting.

There is a great number of his hiſtorical pieces and portraits in the palace of the Thuilleries. He died in 1690.

Mignard, *Peter*, the brother of Nicholas, was born at Troyes in 1610; and acquired ſo much of the taſte of the Italian ſchool, as to be known by the name of the *Roman*. He was generally allowed to have a ſuperior genius to his brother Nicholas; and had the honour of painting the popes Alexander VII. and Urban VIII. beſides many of the nobility at Rome, and ſeveral of the Italian princes: his patron, Louis, ſat ten times to him for his portrait, and reſpected his talents ſo much as to ennoble him, make him his principal painter after the death of Le Brun, and appointed him director of the manufactories. He died in 1695, and many of his pieces are to be ſeen at St Cloud.

MIGNON, or Minjon, *Abraham*, a celebrated painter of flowers and ſtill life, was born at Francfort in 1639; and his father having been deprived of the greateſt part of his ſubſtance by a ſeries of loſſes in trade, left him in very neceſſitous circumſtances when he was only ſeven years of age. From that melancholy ſituation he was reſcued by the friendſhip of James Murel, a flower painter in that city; who took Mignon into his own houſe, and inſtructed him in the art, till he was 17 years old. Murel had often obſerved an uncommon genius in Mignon: he therefore took him along with him to Holland, where he placed him as a diſciple with David de Heem; and while he was under the direction of that maſter he laboured with inceſſant application to imitate the manner of De Heem, and ever afterwards adhered to it; only adding daily to his improvement, by ſtudying nature with a moſt exact and curious obſervation.—"When we conſider the paintings of Mignon, one is at a loſs (Mr Pilkington obſerves) whether more to admire the freſhneſs and beauty of his colouring, the truth in every part, the bloom on his objects, or the perfect reſemblance of nature viſible in all his performances. He always ſhows a beautiful choice in thoſe flowers and fruits from which his ſubjects are compoſed: and he groups them with uncommon elegance. His touch is exquiſitely neat, though apparently eaſy and unlaboured; and he was fond of introducing inſects among the fruits and flowers, wonderfully finiſhed, ſo that even the drops of dew appear as round and as tranſlucent as nature itſelf." He had the good fortune to be highly paid for his works in his lifetime; and he certainly would have been accounted the beſt in his profeſſion even to this day, if John Van Huyſum had not appeared. Weyerman, who had ſeen many admired pictures of Mignon, mentions one of a moſt capital kind. The ſubject of it is a cat, which had thrown down a pot of flowers, and they lie ſcattered on a marble table. That picture is in every reſpect ſo wonderfully natural, that the ſpectator can ſcarce perſuade himſelf that the water which is ſpilled from the veſſel is not really running down from the marble. This picture is diſtinguiſhed by the title of *Mignon's Cat*. This painter died in 1679, aged only 40.

MIGRATION, the paſſage or a removal of a thing out of one place into another.

1 Migrati generall believed

MIGRATION of Birds.—It has been generally believed, that many different kinds of birds annually paſs from one country to another, and ſpend the ſummer or the winter where it is moſt agreeable to them; and that even the birds of our own iſland will ſeek the moſt diſtant ſouthern regions of Africa, when directed by a peculiar inſtinct to leave their own country. It has long been an opinion pretty generally received, that ſwallows reſide during the winter ſeaſon in the warm ſouthern regions; and Mr Adanſon particularly relates his having ſeen them at Senegal when they were obliged to leave this country. But beſides the ſwallow, Mr Pennant enumerates many other birds which migrate from Britain at different times of the year, and are then to be found in other countries; after which they again leave theſe countries, and return to Britain. The reaſon of theſe migrations he ſuppoſes to be a defect of food at certain ſeaſons of the year, or the want of a ſecure aſylum from the perſecution of man during the time of courtſhip, incubation, and nutrition. The following is his liſt of the migrating ſpecies.

2 Birds th migrate

1. *Crows*. Of this genus, the hooded crow migrates regularly with the woodcock. It inhabits North Britain the whole year: a few are ſaid annually to breed on

Migration.

on Dartmoor, in Devonſhire. It breeds alſo in Sweden and Auſtria: in ſome of the Swediſh provinces it only ſhifts its quarters, in others it reſides throughout the year. Our author is at a loſs for the ſummer retreat of thoſe which viſit us in ſuch numbers in winter, and quit our country in the ſpring; and for the reaſon why a bird, whoſe food is ſuch that it may be found at all ſeaſons in this country, ſhould leave us.

2. *Cuckoo.* Diſappears early in autumn; the retreat of this and the following bird is quite unknown to us.

3. *Wryneck.* Is a bird that leaves us in the winter. If its diet be ants alone, as ſeveral aſſert, the cauſe of its migration is very evident. This bird diſappears before winter, and reviſits us in the ſpring a little earlier than the cuckoo.

4. *Hoopoe.* Comes to England but by accident; Mr Pennant once indeed heard of a pair that attempted to make their neſt in a meadow at Selborne, Hampſhire, but were frighted away by the curioſity of people. It breeds in Germany.

5. *Grous.* The whole tribe, except the quail, lives here all the year round: that bird either leaves us, or elſe retires towards the ſea coaſts.

6. *Pigeons.* Some few of the ring doves breed here; but the multitude that appears in the winter is ſo diſproportioned to what continue here the whole year, as to make it certain that the greateſt part quit the country in the ſpring. It is moſt probable they go to Sweden to breed, and return from thence in autumn; as Mr Ekmark informs us they entirely quit that country before winter. Multitudes of the common wild pigeons alſo make the northern retreat, and viſit us in winter; not but numbers breed in the high cliffs in all parts of this iſland. The turtle alſo probably leaves us in the winter, at leaſt changes its place, removing to the ſouthern counties.

7. *Stare.* Breeds here. Poſſibly ſeveral remove to other countries for that purpoſe, ſince the produce of thoſe that continue here ſeems unequal to the clouds of them that appear in winter. It is not unlikely that many migrate into Sweden, where Mr Berger obſerves they return in ſpring.

8. *Thruſhes.* The fieldfare and the redwing breed and paſs their ſummers in Norway and other cold countries; their food is berries, which abounding in our kingdoms, tempts them here in the winter. Theſe two and the Royſton crow are the only land birds that regularly and conſtantly migrate into England, and do not breed here. The hawfinch and croſsbill come here at ſuch uncertain times as not to deſerve the name of birds of paſſage.

9. *Chatterer.* The chatterer appears annually about Edinburgh in flocks during winter; and feeds on the berries of the mountain aſh. In South Britain it is an accidental viſitant.

10. *Groſbeaks.* The groſbeak and croſsbill come here but ſeldom; they bread in Auſtria. The pine groſbeak probably breeds in the foreſts of the Highlands of Scotland.

11. *Buntings.* All the genus inhabits England throughout the year; except the greater brambling, which is forced here from the north in very ſevere ſeaſons.

12. *Finches.* All continue in ſome parts of theſe kingdoms, except the fiſkin, which is an irregular viſitant, ſaid to come from Ruſſia. The linnets ſhift their quarters, breeding in one part of this iſland, and remove with their young to others. All finches feed on the ſeeds of plants.

13. *Larks*, *fly-catchers*, *wagtails*, and *warblers.* All of theſe feed on inſects and worms; yet only part of them quit theſe kingdoms; though the reaſon of migration is the ſame to all. The nightingale, black-cap, fly-catcher, willow-wren, wheat-ear, and white-throat, leave us before winter, while the ſmall and delicate golden-creſted wren braves our ſevereſt froſts. The migrants of this genus continue longeſt in Great Britain in the ſouthern counties, the winter in thoſe parts being later than in thoſe of the north; Mr Stillingfleet having obſerved ſeveral wheat-ears in the iſle of Purbeck on the 18th of November. As theſe birds are incapable of very diſtant flights, Spain, or the ſouth of France, is probably their winter aſylum.

14. *Swallows and goatſucker.* Every ſpecies diſappears at the approach of winter.

WATER-FOWL.

3 Water-fowl.

Of the vaſt variety of water-fowl that frequent Great Britain, it is amazing to reflect how few are known to breed here: the cauſe that principally urges them to leave this country, ſeems to be not merely the want of food, but the deſire of a ſecure retreat. Our country is too populous for birds ſo ſhy and timid as the bulk of theſe are: when great part of our iſland was a mere waſte, a tract of woods and fen, doubtleſs many ſpecies of birds (which at this time migrate) remained in ſecurity throughout the year.—Egrets, a ſpecies of heron now ſcarcely known in this iſland, were in former times in prodigious plenty; and the crane, that has totally forſaken this country, bred familiarly in our marſhes: their place of incubation, as well as of all other cloven-footed water-fowl (the heron excepted), being on the ground, and expoſed to every one. As rural economy increaſed in this country, theſe animals were more and more diſturbed; at length, by a ſeries of alarms, they were neceſſitated to ſeek, during the ſummer, ſome lonely ſafe habitation.

On the contrary, thoſe that build or lay in the almoſt inacceſſible rocks that impend over the Britiſh ſeas, breed there ſtill in vaſt numbers, having little to fear from the approach of mankind: the only diſturbance they meet with in general being from the deſperate attempts of ſome few to get their eggs.

CLOVEN-FOOTED WATER-FOWL.

15. *Herons.* The white heron is an uncommon bird, and viſits us at uncertain ſeaſons; the common kind and the bittern never leave us.

16. *Curlews.* The curlew breeds ſometimes on our mountains: but, conſidering the vaſt flights that appear in winter, it is probable that the greater part retire to other countries: the whimbrel breeds on the Grampian hills, in the neighbourhood of Invercauld.

17. *Snipes.* The woodcock breeds in the moiſt woods of Sweden, and other cold countries. Some ſnipes breed here, but the greateſt part retire elſewhere: as do every other ſpecies of this genus.

18. *Sandpipers.* The lapwing continues here the whole year: the ruff breeds here, but retires in winter; the

the redſhank and ſandpiper breed in this country, and reſide here. All the others abſent themſelves during ſummer.

19. *Plovers and oyſter-catcher.* The long-legged plover and ſanderling viſit us only in winter; the dottrel appears in ſpring and in autumn; yet, what is very ſingular, we do not find it breeds in South Britain. The oyſter catcher lives with us the whole year. The Norfolk plover and ſea-lark breed in England. The green plover breeds on the mountains of the north of England, and on the Grampian hills.

We muſt here remark, that every ſpecies of the genera of curlews, woodcocks, ſandpipers, and plovers, that forſakes us in the ſpring, retires to Sweden, Poland, Pruſſia, Norway, and Lapland, to breed: as ſoon as the young can fly, they return to us again, becauſe the froſts which ſet in early in thoſe countries totally deprive them of the means of ſubſiſting; as the dryneſs and hardneſs of the ground, in general, during our ſummer, prevent them from penetrating the earth with their bills, in ſearch of worms, which are the natural food of theſe birds. Mr Ekmark ſpeaks thus of the retreat of the whole tribe of cloven-footed water-fowl out of his country (Sweden) at the approach of winter; and Mr Klein gives much the ſame account of thoſe of Poland and Pruſſia.

20. *Rails and gallinules.* Every ſpecies of theſe two genera continues with us the whole year; the land-rail excepted, which is not ſeen here in winter. It likewiſe continues in Ireland only during the ſummer months, when they are very numerous, as Mr Smith tells us in the Hiſtory of Waterford, p. 336. Great numbers appear in Angleſea the latter end of May; it is ſuppoſed that they paſs over from Ireland, the paſſage between the two iſlands being but ſmall. As we have inſtances of theſe birds lighting on ſhips in the Channel and the bay of Biſcay, we may conjecture their winter quarters to be in Spain.

Finned-footed Water Birds.

21. *Phalaropes.* Viſit us but ſeldom; their breeding place is Lapland, and other arctic regions.

22. *Grebes.* The great creſted grebe, the black and white grebe, and little grebe, breed with us, and never migrate; the others viſit us accidentally, and breed in Lapland.

Web-footed Birds.

23. *Avoſet.* Breed near Foſsdike in Lincolnſhire, but quit their quarters in winter. They are then ſhot in different parts of the kingdom, which they viſit, not regularly, but accidentally.

24. *Auks and guillemots.* The great auk or pinguin ſometimes breeds in St Kilda. The auk, the guillemot, and puffin, inhabit moſt of the maritime cliffs of Great Britain, in amazing nombers, during ſummer. The black guillemot breeds in the Baſs iſle, and in St Kilda, and ſometimes in Llandidno rocks. We are at a loſs for the breeding place of the other ſpecies; neither can we be very certain of the winter reſidence of any of them, excepting of the leſſer guillemot and black billed auk, which, during winter, viſit in vaſt flocks the frith of Forth.

25. *Divers.* Theſe chiefly breed in the lakes of Sweden and Lapland, and in ſome countries near the pole; but ſome of the red throated divers, the northern and the imber, may breed in the north of Scotland and its iſles.

26. *Terns.* Every ſpecies breeds here; but leaves us in the winter.

27. *Petrels.* The fulmar breeds in the iſle of St Kilda, and continues there the whole year except September and part of October: the ſhearwater viſits the iſle of Man in April; breeds there; and, leaving it in Auguſt or the beginning of September, diſperſes over all parts of the Atlantic ocean. The ſtormfinch is ſeen at all diſtances from land on the ſame vaſt watery tract; nor is ever found near the ſhore except by ſome very rare accident, unleſs in the breeding ſeaſon. Mr Pennant found it on ſome little rocky iſles off the north of Skye. It alſo breeds in St Kilda. He alſo ſuſpects that it neſtles on the Blaſquet iſles off Kerry, and that it is the gourder of Mr Smith.

28. *Merganſers.* This whole genus is mentioned among the birds that fill the Lapland lakes during ſummer. Mr Pennant has ſeen the young of the red-breaſted in the north of Scotland: a few of theſe, and perhaps of the gooſanders, may breed there.

29. *Ducks.* Of the numerous ſpecies that form this genus, we know of few that breed here: The ſwan and gooſe, the ſhield duck, the eider duck, a few ſhovelers, garganies, and teals, and a very ſmall portion of the wild ducks.

The reſt contribute to form that amazing multitude of water-fowl that annually repair from moſt parts of Europe to the woods and lakes of Lapland and other arctic regions, there to perform the functions of incubation and nutrition in full ſecurity. They and their young quit their retreat in September, and diſperſe themſelves over Europe. With us they make their appearance the beginning of October; circulate firſt round our ſhores; and, when compelled by ſevere froſt, betake themſelves to our lakes and rivers. Of the web-footed fowl there are ſome of hardier conſtitutions than others: theſe endure the ordinary winters of the more northern countries; but when the cold reigns there with more than common rigour, they repair for ſhelter to theſe kingdoms: this regulates the appearance of ſome of the diver kind, as alſo of the wild ſwans, the ſwallow-tailed ſhield duck, and the different ſorts of gooſanders which then viſit our coaſts. Barenta found the barnacles with their neſts in great numbers in Nova Zembla. (*Collect. Voy. Dutch Eaſt India Company*, 8vo, 1703, p. 19.). Cluſius, in his *Exot.* 368. alſo obſerves, that the Dutch diſcovered them on the rocks of that country and in Waygate ſtraits. They, as well as the other ſpecies of wild geeſe, go very far north to breed, as appears from the hiſtories of Greenland and Spitzbergen, by Egede and Crantz. Theſe birds ſeem to make Iceland a reſting place, as Horrebow obſerves: few continue there to breed, but only viſit that iſland in the ſpring, and after a ſhort ſtay retire ſtill further north.

30. *Corvorants.* The corvorant and ſhag breed on moſt of our high rocks: the garnet in ſome of the Scotch iſles and on the coaſt of Kerry: the two firſt continue on our ſhores the whole year. The garnet diſperſes itſelf all round the ſeas of Great Britain, in purſuit of the herring and pilchard, and even as far as the Tagus to prey on the ſardina.

But

Migration.

Few breed in this country.

But of the numerous ſpecies of fowl here enumerated, it may be obſerved how very few intruſt themſelves to us in the breeding ſeaſon, and what a diſtant flight they make to perform the firſt great dictate of nature.

There ſeems to be ſcarcely any but what we have traced to Lapland, a country of lakes, rivers, ſwamps, and alps, covered with thick and gloomy foreſts, that afford ſhelter during ſummer to theſe fowls, which in winter diſperſe over the greateſt part of Europe. In thoſe arctic regions, by reaſon of the thickneſs of the woods, the ground remains moiſt and penetrable to the woodcocks, and other ſlender-billed fowl: and for the web-footed birds, the waters afford larvæ innumerable of the tormenting gnat. The days there are long; and the beautiful meteorous nights indulge them with every opportunity of collecting ſo minute a food: whilſt mankind is very ſparingly ſcattered over that vaſt northern waſte.

Why then ſhould Linnæus, the great explorer of theſe rude deſerts, be amazed at the myriads of water-fowl that migrated with him out of Lapland? which exceeded in multitude the army of Xerxes; covering, for eight whole days and nights, the ſurface of the river Calix! His partial obſervation as a botaniſt, would confine their food to the vegetable kingdom, almoſt denied to the Lapland waters; inattentive to a more plenteous table of inſect food, which the all-bountiful Creator had ſpread for them in the wilderneſs. It may be remarked, that the lakes of mountainous rocky countries in general are deſtitute of plants: few or none are ſeen on thoſe of Switzerland; and Linnæus makes the ſame obſervation in reſpect to thoſe of Lapland; having, during his whole tour, diſcovered only a ſingle ſpecimen of a *lemma triſulca*, or "ivy-leaved duck's meat," *Flora Lap.* N° 470.; a few of the *ſcirpus lacuſtris*, or "bulruſh," N° 18.; the *alopecurus geniculatus*, or "flote foxtail-graſs," N° 38.; and the *ranunculus aquatilis*, N° 234.; which are all he enumerates in his *Prolegomena* to that excellent performance.

rguments
gainſt mi-
ration.

We ſhall afterwards ſtate the principal arguments for and againſt the migration of ſwallows; but here we ſhall give a ſhort abſtract of the arguments uſed by the Hon. Daines Barrington againſt the migration of birds in general, from a paper publiſhed by him in the 62d volume of the Philoſophical Tranſactions. This gentleman denies that any well-atteſted inſtances can be produced of this ſuppoſed migration; which, he thinks, if there were any ſuch periodical flight, could not poſſibly have eſcaped the frequent obſervation of ſeamen. It has indeed been aſſerted that birds of paſſage become inviſible in their flight, becauſe they riſe too high in the air to be perceived, and becauſe they chooſe the night for their paſſage. The author, however, expreſſes his doubts "whether any bird was ever ſeen to riſe to a greater height than perhaps twice that of St Paul's croſs;" and he further endeavours to ſhow, that the extent of ſome of theſe ſuppoſed migrations (from the northern parts of Europe, for inſtance, to the line) is too great to be accounted for, by having recourſe to the argument founded on a nocturnal paſſage.

The author next recites, in a chronological order, all the inſtances that he has been able to collect, of birds having been actually ſeen by mariners when they were croſſing a large extent of ſea; and he endeavours to ſhow that no ſtreſs can be laid on the few caſual obſervations of this kind that have been produced in ſupport of the doctrine of a regular and periodical migration.

Mr Barrington afterwards proceeds to invalidate M. Adanſon's celebrated obſervation with reſpect to the migration of the ſwallow in particular, and which has been conſidered by many as perfectly deciſive of the preſent queſtion. He endeavours to ſhow that the four ſwallows which that naturaliſt caught, on their ſettling upon his ſhip, on the 6th of October, at about the diſtance of 50 leagues from the coaſt of Senegal, and which he ſuppoſes to have been then proceeding from Europe to paſs the winter in Africa, could not be true European ſwallows; or, if they were, could not have been on their return from Europe to Africa. His objections are founded principally on ſome proofs which he produces of M. Adanſon's want of accuracy on this ſubject, which has led him, in the preſent inſtance, to miſtake two African ſpecies of the ſwallow tribe, deſcribed and engraved by Briſſon, for European ſwallows, to which they bear a general reſemblance; or granting even that they were European ſwallows, he contends that they were flitting from the Cape de Verd iſlands to the coaſt of Africa; "to which ſhort flight, however, they were unequal, and accordingly fell into the ſailors hands."—We ſhall here only add, in oppoſition to the remarks of Mr Barrington, the following obſervations of the Rev. Mr White * in a letter to Mr Pennant on this ſubject.

6
Arguments in ſupport of it.

"We muſt not (ſays he) deny migration in general; becauſe migration certainly does ſubſiſt in ſome places, as my brother in Andaluſia has fully informed me. Of the motions of theſe birds he has ocular demonſtration, for many weeks together, both ſpring and fall: during which periods myriads of the ſwallow kind traverſe the Straits from north to ſouth, and from ſouth to north, according to the ſeaſon. And theſe vaſt migrations conſiſt not only of hirundines, but of bee-birds, hoopoes, oro pendolos, or golden thruſhes, &c. &c. and alſo of many of our ſoft-billed ſummer birds of paſſage; and moreover of birds which never leave us, ſuch as all the various ſorts of hawks and kites. Old Belon, 200 years ago, gives a curious account of the incredible armies of hawks and kites which he ſaw in the ſpring time traverſing the Thracian Boſphorus from Aſia to Europe. Beſides the above mentioned, he remarks that the proceſſion is ſwelled by whole troops of eagles and vultures.

"Now it is no wonder that birds reſiding in Africa ſhould retreat before the ſun as it advances, and retire to milder regions, and eſpecially birds of prey, whoſe blood being heated with hot animal food, are more impatient of a ſultry climate: but then I cannot help wondering why kites and hawks, and ſuch hardy birds as are known to defy all the ſeverity of England, and even of Sweden and all northern Europe, ſhould want to migrate from the ſouth of Europe, and be diſſatisfied with the winters of Andaluſia.

"It does not appear to me that much ſtreſs may be laid on the difficulty and hazard that birds muſt run in their migrations, by reaſon of vaſt oceans, croſs winds, &c.; becauſe, if we reflect, a bird may travel from England to the equator without launching out and ex-

---

* *Natural Hiſtory of Selborne*, letter ix. p. 189.

poſing itſelf to boundleſs ſeas, and that by croſſing the water at Dover and again at Gibraltar. And I with the more confidence advance this obvious remark, becauſe my brother has always found that ſome of his birds, and particularly the ſwallow kind, are very ſparing of their pains in croſſing the Mediterranean: for when arrived at Gibraltar, they do not,

> ———"rang'd in figure, wedge their way,
> ————————"and ſet forth
> "Their airy caravan high over ſeas
> "Flying, and over lands with mutual wing
> "Eaſing their flight." MILTON.

but ſcout and hurry along in little detached parties of ſix or ſeven in a company; and ſweeping low, juſt over the ſurface of the land and water, direct their courſe to the oppoſite continent at the narroweſt paſſage they can find. They uſually ſlope acroſs the bay to the ſouth-weſt, and ſo paſs over oppoſite to Tangier, which it ſeems is the narroweſt ſpace.

"In former letters we have conſidered whether it was probable that woodcocks in moon-ſhiny nights croſs the German ocean from Scandinavia. As a proof that birds of leſs ſpeed may paſs that ſea, conſiderable as it is, I ſhall relate the following incident, which, though mentioned to have happened ſo many years ago, was ſtrictly matter of fact:—As ſome people were ſhooting in the pariſh of Trotton, in the county of Suſſex, they killed a duck in that dreadful winter 1708-9, with a ſilver collar about its neck (I have read a like anecdote of a ſwan), on which were engraven the arms of the king of Denmark. This anecdote the rector of Trotton at that time has often told to a near relation of mine; and, to the beſt of my remembrance, the collar was in the poſſeſſion of the rector.

"At preſent I do not know any body near the ſea ſide that will take the trouble to remark at what time of the moon woodcocks firſt come. One thing I uſed to obſerve when I was a ſportſman, that there were times in which woodcocks were ſo ſluggiſh and ſleepy that they would drop again when fluſhed juſt before the ſpaniels, nay juſt at the muzzle of a gun that had been fired at them: whether this ſtrange lazineſs was the effect of a recent fatiguing journey, I ſhall not preſume to ſay.

"Nightingales not only never reach Northumberland and Scotland, but alſo, as I have been always told, Devonſhire and Cornwall. In thoſe two laſt counties we cannot attribute the failure of them to the want of warmth: the defect in the weſt is rather a preſumptive argument that theſe birds come over to us from the continent at the narroweſt paſſage, and do not ſtroll ſo far weſtward."

7
Queſtion, What becomes of ſwallows in winter?

Upon the ſubject of the migration of the ſwallow there are three opinions. Some ſay that it migrates to a warmer climate; ſome, that it retires to hollow trees and caverns, where it lies in a torpid ſtate; and others have affirmed, that it lies in the ſame ſtate in the bottom of lakes and under the ice. The firſt opinion is ſupported by Marſigli, Ray, Willoughby, Cateſby, Reaumur, Adanſon, Buffon, &c. The firſt and ſecond opinion are both adopted by Pennant and White. The third is ſanctioned by Schæffer, Hevelius, Derham, Klein, Ellis, Linnæus, Kalm: and the ſecond and third have been ſtrongly defended by the honourable Daines Barrington.

Though we cannot help giving a preference to that opinion which appears the moſt probable, yet we do not think that any one of them is eſtabliſhed upon ſuch evidence as ſo curious a ſubject requires, and as the advanced ſtate of natural hiſtory would lead us to expect. We ſhall therefore ſtate the arguments upon which each opinion is founded as fairly and diſtinctly as we can, and as often as poſſible in the very words of their reſpective advocates. By doing ſo, we ſhall place the whole ſubject before the eyes of our readers, who will thus have an opportunity of examining it attentively, and of making ſuch obſervations and experiments as may lead to the truth.

8
Firſt opinion ſtated, that they migrate to warm climates.

Thoſe who aſſert that the ſwallow migrates to a warmer country in winter, argue in this manner: That many birds migrate, is a fact fully proved by the obſervations of natural hiſtorians. Is it not more probable, therefore, that ſwallows, which diſappear regularly every ſeaſon, retire to ſome other country, than that they lie in a ſtate of torpor in caverns or lakes? But this opinion does not reſt on probability, it is founded on facts.

We often ſee them collected in great flocks on churches, rocks, and trees, about the time when they annually diſappear. The direction of their flight has been obſerved to be ſouthward. Mr White, the ingenious hiſtorian of Selborne, travelling near the coaſt of the Britiſh Channel one morning early, ſaw a flock of ſwallows take their departure. At the beginning of his journey he was environed with a thick fog; but on a large wild heath the miſt began to break, and diſcovered to him numberleſs ſwallows, cluſtered on the ſtanding buſhes, as if they had rooſted there: as ſoon as the ſun burſt out, they were inſtantly on wing, and with an eaſy and placid flight proceeded towards the ſea. After this he ſaw no more flocks, only now and then a ſtraggler.

Natural Hiſtory of Selborne, p. 64.

Mr Laſkey of Exeter obſerved attentively the direction which a flock of ſwallows took in the autumn of 1793. On the 22d of Sept. about ſeven o'clock in the morning, the wind being eaſterly, accompanied with a cold drizzling rain, Mr Laſkey's houſe was entirely covered with houſe-ſwallows. At intervals large flocks arrived and joined the main body, and at their arrival an unuſual chirping commenced. The appearance of the whole company was ſo lethargic, that he found it an eaſy matter to catch a conſiderable number of them, which he kept in a room all that day. By heating the room they all revived: he opened four of them, and found their ſtomachs quite full. The main body occupied the houſe top all day, except for two hours. About half an hour after nine in the morning of the 23d, there was a great commotion, with very loud chirping, and within a few minutes after, the whole multitude took their flight, in a direct ſouth-eaſt direction, having aſcended to a great height in the atmoſphere. He let go the birds which he had caught, at certain intervals till four o'clock, and they all flew toward the ſame quarter.

Gent. Mag. for 1796.

Not only has the direction of their flight been obſerved, but they have alſo been found on their paſſage at a great diſtance from land. Mr Adanſon informs us, that about 50 leagues from the coaſt of Senegal four ſwallows ſettled upon the ſhip on the 6th of October;

that

that theſe birds were taken; and that he knew them to be European ſwallows, which, he conjectures, were returning to the coaſt of Africa. Sir Charles Wager's authority may alſo be appealed to: "Returning home (ſays he) in the ſpring of the year, as I came into ſoundings in our channel, a great flock of ſwallows came and ſettled on all my rigging; every rope was covered, they hung on one another like a ſwarm of bees; the decks and carving were filled with them. They ſeemed almoſt famiſhed and ſpent, and were only feathers and bones; but, being recruited with a night's reſt, took their flight in the morning." This vaſt fatigue proves that their journey muſt have been very great, conſidering the amazing ſwiftneſs of theſe birds: in all probability they had croſſed the Atlantic ocean, and were returning from the ſhores of Senegal, or other parts of Africa; ſo that this account from that moſt able and honeſt ſeaman, confirms the later information of Mr Adanſon.

Philoſophical Tranſactions, vol. liii.

Mr Kalm, who is an advocate for the opinion that ſwallows lie immerſed in lakes during winter, acknowledges that in croſſing the Atlantic from Europe a ſwallow lighted on the ſhip on the 2d September, when it had paſſed only two-thirds of the ocean. Since, therefore, ſwallows have been ſeen aſſembled in great flocks in autumn flying off in company towards ſouthern climes, ſince they have been found both in their paſſage from Europe and returning again, can there be any doubt of their annual migration?—Mr Barrington's objections to this opinion have been noticed above in N° 5.

Kalm's Voyage, vol. i. p. 24.

9
Second opinion, that ſome lie in caverns in a torpid ſtate.

The ſecond notion (ſays Mr Pennant) has great antiquity on its ſide. Ariſtotle and Pliny give it as their belief, that ſwallows do not remove very far from their ſummer habitation, but winter in the hollows of rocks, and during that time loſe their feathers. The former part of their opinion has been adopted by ſeveral ingenious men; and of late ſeveral proofs have been brought of ſome ſpecies, at leaſt, having been diſcovered in a torpid ſtate. Mr Collinſon favoured us with the evidence of three gentlemen, eye-witneſſes to numbers of ſand martins being drawn out of a cliff on the Rhine, in the month of March 1762. And the honourable Daines Barrington communicated to us the following fact, on the authority of Lord Belhaven, That numbers of ſwallows have been found in old dry walls and in ſand-hills near his Lordſhip's ſeat in Eaſt Lothian; not once only, but from year to year; and that when they were expoſed to the warmth of a fire, they revived. We have alſo heard of the ſame annual diſcoveries near Morpeth in Northumberland, but cannot ſpeak of them with the ſame aſſurance as the two former: neither in the two laſt inſtances are we certain of the particular ſpecies.

Pennant's British Zoology, vol. ii. p. 250.

"Other witneſſes crowd on us to prove the reſidence of thoſe birds in a torpid ſtate during the ſevere ſeaſon. Firſt, In the chalky cliffs of Suſſex; as was ſeen on the fall of a great fragment ſome years ago. Secondly, In a decayed hollow tree that was cut down, near Dolgelli, in Merionethſhire. Thirdly, In a cliff near Whitby, Yorkſhire; where, on digging out a fox, whole buſhels of ſwallows were found in a torpid condition. And, laſtly, The reverend Mr Conway of Sychton, Flintſhire, was ſo obliging as to communicate the following fact: A few years ago, on looking down an old lead-mine in that county, he obſerved numbers of ſwallows clinging to the timbers of the ſhaft, ſeemingly aſleep; and on flinging ſome gravel on them, they juſt moved, but never attempted to fly or change their place: this was between All Saints and Chriſtmas.

"Theſe are doubtleſs the lurking places of the later hatches, or of thoſe young birds which are incapable of diſtant migrations. There they continue inſenſible and rigid; but like flies may ſometimes be reanimated by an unſeaſonable hot day in the midſt of winter: for very near Chriſtmas a few appeared on the moulding of a window of Merton college, Oxford, in a remarkably warm nook, which prematurely ſet their blood in motion, having the ſame effect as laying them before a fire at the ſame time of year. Others have been known to make this premature appearance; but as ſoon as the cold natural to the ſeaſon returns, they withdraw again to their former retreats.

"The above are circumſtances we cannot but aſſent to, though ſeemingly contradictory to the common courſe of nature in regard to other birds. We muſt, therefore, divide our belief relating to theſe two ſo different opinions; and conclude, that one part of the ſwallow tribe migrate, and that others have their winter quarters near home. If it ſhould be demanded, why ſwallows alone are found in a torpid ſtate, and not the other many ſpecies of ſoft-billed birds, which likewiſe diſappear about the ſame time? reaſons might be aſſigned."

10
Third opinion, that ſome lie immerſed in water.

The third opinion we ſhall ſtate and ſupport in the words of Mr Kalm. "Natural hiſtory (ſays he), as all other hiſtories, depends not always upon the intrinſic degree of probability, but upon facts founded on the teſtimony of people of noted veracity.—Swallows are ſeldom ſeen ſinking down into water; ſwallows have not ſuch organs as frogs or lizards, which are torpid during winter; *ergo*, ſwallows live not, and cannot live, under water.—This way of arguing, I believe, would carry us, in a great many caſes too far: for though it is not clear to every one, it may however be true; and lizards and frogs are animals of a claſs widely different from that of birds, and muſt therefore of courſe have a different ſtructure; hence it is they are claſſed ſeparately. The bear and marmot are in winter in a torpid ſtate, and have, however, not ſuch organs as lizards and frogs; and nobody doubts of their being, during ſome time, in the moſt rigid climates, in a torpid ſtate: for the Alpine nations hunt the marmots frequently by digging their holes up; and find them ſo torpid, that they cut their throats, without their reviving or giving the leaſt ſign of life during the operation; but when the torpid marmot is brought into a warm room, and placed before the fire, it revives from its lethargy. The queſtion muſt therefore be decided by facts; nor are theſe wanting here. Dr Wallerius, the celebrated Swediſh chemiſt, informs us, That he has ſeen, more than once, ſwallows aſſembling on a reed, till they were all immerſed and went to the bottom; this being preceded by a dirge of a quarter of an hour's length. He atteſts likewiſe, that he had ſeen a ſwallow caught during winter out of a lake with a net, drawn, as is common in northern countries, under the ice; this bird was brought into a warm room, revived, fluttered about, and ſoon after died.

"Mr Klein applied to many farmers-general of the king of Pruſſia's domains, who had great lakes in their diſtricts, the fiſhery in them being a part of the revenue. In winter the fiſhery thereon is the moſt conſiderable under the ice, with nets ſpreading more than 200 or 300 fathoms, and they are often wound by ſcrews and engines on account of their weight. All the people that were queſtioned made affidavits upon oath before the magiſtrates. Firſt, The mother of the counteſs Lehndorf ſaid, that ſhe had ſeen a bundle of ſwallows brought from the Friſhe-Haff (a lake communicating with the Baltic at Pillaw), which, when brought into a moderately warm room, revived and fluttered about. Secondly, Count Schilcben gave an inſtrument on ſtamped paper, importing, that by fiſhing on the lake belonging to his eſtate of Gerdauen in winter, he ſaw ſeveral ſwallows caught in the net, one of which he took up in his hand, brought it into a warm room, where it lay about an hour, when it began to ſtir, and half an hour after, it flew about in the room. Thirdly, Farmer-general (Amtman) Witkouſki made affidavit, that, in the year 1740, three ſwallows were brought up with the net in the great pond at Didlacken; in the year 1741, he got two ſwallows from another part of the pond, and took them home (they being all caught in his preſence); after an hour's ſpace they revived all in a warm room, fluttered about, and died in three hours after. Fourthly, Amtman Bonke ſays, that having had the eſtate of Kleſkow in farm, he had ſeen nine ſwallows brought up in the net from under the ice, all which he took into a warm room, where he diſtinctly obſerved how they gradually revived; but a few hours after they all died. Another time his people got likewiſe ſome ſwallows in a net, but he ordered them to be again thrown into the water. Fifthly, Andrew Rutta, a maſter fiſherman at Oletſko, made affidavit, in 1747, that 22 years ago, two ſwallows were taken up by him in a net, under the ice, and, being brought into a warm room, they flew about. Sixthly, Jacob Koſiulo, a maſter fiſherman at Stradauen made affidavit, that, in 1736, he brought up in winter, in a net, from under the ice of the lake at Raſki, a ſeemingly dead ſwallow, which revived in half an hour's time in a warm room; and he ſaw, in a quarter of an hour after, the bird grow weaker, and ſoon after dying. Seventhly, I can reckon myſelf (ſays our author) among the eye-witneſſes of this paradox of natural hiſtory. In the year 1735, being a little boy, I ſaw ſeveral ſwallows brought in winter by the fiſhermen from the river Viſtula to my father's houſe; where two of them were brought into a warm room, revived, and flew about. I ſaw them ſeveral times ſettling on the warm ſtove (which the northern nations have in their rooms); and I recollect well, that the ſame forenoon they died, and I had them, when dead, in my hand. In the year 1754, after the death of my uncle Godefroy Wolf, captain in the Poliſh regiment of foot guards, being myſelf one of his heirs, I adminiſtered for my co-heirs ſeveral eſtates called the *Staroſty of Diſchau*, in Poliſh Pruſſia, which my late uncle farmed under the king. In January, the lake of Lybſhaw, belonging to theſe eſtates, being covered with ice, I ordered the fiſhermen to fiſh therein, and in my preſence ſeveral ſwallows were taken, which the fiſhermen threw in again; but one I took up myſelf, brought it home, which was five miles from thence, and it revived, but died about an hour after its reviving.

"Theſe are facts atteſted by people of the higheſt quality, by ſome in public offices, and by others who, though of a low rank, however, made theſe affidavits upon oath. It is impoſſible to ſuppoſe indiſcriminately that they were prompted, by views of intereſt, to aſſert as a fact a thing which had no truth in it. It is therefore highly probable, or rather inconteſtably true, that ſwallows retire in the northern countries, during winter, into the water, and ſtay there in a torpid ſtate till the return of warmth revives them again in ſpring. The queſtion therefore, I believe, ought for the future to be thus ſtated: The ſwallows in Spain, Italy, France, and perhaps ſome from England, remove to warmer climates; ſome Engliſh ones, and ſome in Germany and other mild countries, retire into clefts and holes in rocks, and remain there in a torpid ſtate. In the colder northern countries the ſwallows immerſe in the ſea, in lakes, and rivers; and remain in a torpid ſtate, under ice, during winter. There are ſtill ſome objections to this latter aſſertion, which we muſt remove. It is ſaid, Why do not rapacious fiſh, and aquatic quadrupeds and birds, devour theſe ſwallows? The anſwer is obvious, ſwallows chooſe only ſuch places in the water for their winter retreat as are near reeds and ruſhes; ſo that ſinking down there between them and their roots, they are by them ſecured againſt the rapacioufneſs of their enemies. But others object, Why are not theſe birds caught in ſuch freſh waters as are continually haraſſed by nets? I believe the ſame anſwer which has been made to the firſt objection will ſerve for this likewiſe. Fiſhermen take care to keep off with their nets from places filled with reeds and ruſhes, for fear of entangling and tearing their net; and thus the ſituation of ſwallows under water, is the reaſon that they are ſeldom diſturbed in their ſilent winter retreats. What confirms this opinion ſtill more is, that ſwallows were never caught in Pruſſia according to the above-mentioned affidavits, but with thoſe parts of the net which paſſed near to the reeds and ruſhes; and ſometimes the ſwallows were yet faſtened with their feet to a reed, when they were drawn up by the net. As to the argument taken from their being ſo long under water without corruption, I believe there is a real difference between animals ſuffocated in water and animals being torpid therein. We have examples of things being a long time under water; to which we may add the intenſe cold of theſe northern regions, which preſerves them. Who would have thought that ſnails and polypes might be diſſected, and could reproduce the parts ſevered from their bodies, if it was not a fact? Natural hiſtory ought to be ſtudied as a collection of facts, not as the hiſtory of our gueſſes or opinions. Nature varies in an infinite manner; and Providence has diverſified the inſtinct of animals and their economy, and adapted it to the various ſeaſons and climates."

With Mr Kalm's concluding obſervations we heartily concur. Natural hiſtory ought to be ſtudied as a collection of facts; and it was from this very notion that we have ſtated the above-mentioned opinions ſo fully, and brought together the facts which the beſt advocates for each opinion have judged moſt proper for ſupporting

11
This queſtion ought to be determined, not by reaſoning, but by experiment.

Migration.

ſupporting them. We are ſenſible of the great improbability of the third opinion, and know that many arguments have been uſed to prove its abſurdity: ſuch as theſe, The ſwallow is lighter than water, and therefore cannot ſink; if it moults at all, it muſt moult under water during its torpid ſtate, which is very improbable; there is no inſtance of land animals living ſo long under water without reſpiration. Many other arguments of the ſame ſort have been advanced, and certainly afford a ſhort way of deciding the queſtion; but unleſs they were ſufficient to prove the immerſion of ſwallows a phyſical impoſſibility, they are of no force when oppoſed to the evidence of teſtimony, if there be no cauſe to ſuſpect the witneſſes of inaccuracy or deſign. The true way to refute ſuch an opinion is by accurate obſervation and experiment. We have not heard of any accurate inquiries being made by philoſophers in thoſe northern countries where ſwallows are ſaid to paſs the winter under water. The count de Buffon, indeed, ſhut up ſome ſwallows in an ice-houſe by way of experiment, which died in a few days; but as he does not tell us what precautions he took to make the experiment ſucceed, it is not entitled to any attention.

Mr John Hunter made a very judicious experiment on the banks of the Thames, which is deſcribed by a correſpondent in the Gentleman's Magazine, who aſſerts that he had it from Mr Hunter himſelf.

tle- 's Ma- ne, 1796.

One year in the month of September, he prepared a room, with every accommodation and convenience which he could contrive, to ſerve as a dormitory for ſwallows, if they were diſpoſed to ſleep in winter. He placed in the centre a large tub of water with twigs and reeds, &c. which reached to the bottom. In the corners of the room he contrived artificial caverns and holes, into which they might retire; and he laid on the floor, or ſuſpended in the air, different lengths of old wooden pipes, which had formerly been employed in conveying water through the ſtreets, &c.

12 Hun- r expe- nt in- ous;

When the receptacle was rendered as complete as poſſible, he then engaged ſome watermen to take by night a large quantity of the ſwallows that hang upon the reeds in the Thames about the time of their departure. They brought him, in a hamper, a conſiderable number; and had ſo nicely hit the time of their capture, that on the very day following there were none to be ſeen.

He put the ſwallows into the room ſo prepared, where they continued to fly about, and occaſionally perch on the twigs, &c. But not one ever retired into the water, the caverns, holes, or wooden pipes, or ſhewed the leaſt diſpoſition to grow torpid, &c. In this ſituation he let them remain till they all died but one. This appearing to retain ſome vigour, was ſet at liberty; when it mounted out of ſight, and flew away. All the birds lay dead ſcattered about the room; but not one was found aſleep or torpid, or had, if the correſpondent remembers, ſo much as crept into any of the receptacles he had ſo provided.

3 ot ve re- to ern tes.

This experiment was ingenious, and certainly does render the doctrine of immerſion much more improbable; but it is not deciſive; for it may ſtill be urged by the advocates for that doctrine, as Mr Kalm has done, that it may only be in the colder countries where ſwallows retire into the water. We formerly ſaid that none of the three opinions is ſupported by ſuch evidence as to ſatisfy the mind completely. Opinions reſpecting events which happen every year ought to be confirmed by a great number of obſervations, and not by a few inſtances diveſted of almoſt all their concomitant circumſtances. Can no better proofs be brought to prove the migration of ſwallows than thoſe of Adanſon and Sir Charles Wager, or the circumſtances mentioned by Mr White and Mr Laſkey reſpecting their diſappearing? We ought not merely to know that ſome ſwallows have taken a ſoutherly flight in autumn, that ſome have been found at a great diſtance from land in the ſpring, or in harveſt; but we ought to know to what countries they actually retire. Before we can reſt ſatisfied, too, that it is a general fact that ſwallows remain in a torpid ſtate during winter, either in caverns or in the bottom of lakes, &c. we muſt have more proofs; we muſt know what ſpecies of ſwallows they are ſaid to be, in what countries this event takes place, and ſeveral other circumſtances of the ſame kind.

14 Many things yet remain to be done in order to determine this point.

We cannot help being of opinion that much remains to be done in order properly to aſcertain what becomes of the ſwallows in Europe during winter. It would be neceſſary, in the firſt place, to know accurately what are the countries in which ſwallows are found. 2. Do they remain viſible the whole year? or, if they diſappear, at what ſeaſon does this happen, and when do they appear again? 3. Do they ever appear while a ſtrong north wind blows, or do they only come in great numbers with a ſouth wind? We will endeavour to anſwer ſome of theſe queſtions in part; but muſt regret, that all the information on this ſubject which we have been able to cull from the beſt writers in natural hiſtory is very ſcanty; and we merely give it by way of ſpecimen, hoping that future obſervations will render it more complete.

15 A few important facts ſtated.

There are five ſpecies which viſit Britain during the ſummer months; the common or chimney ſwallow, the martin, ſand martin, ſwift, and goat-ſucker. 1. The chimney ſwallow frequents almoſt every part of the old continent; being known (ſays Dr Latham) from Norway to the Cape of Good Hope on the one ſide, and from Kamtſchatka to India and Japan on the other. It is alſo found in all parts of North America, and in ſeveral of the Weſt Indian iſlands. In Europe it diſappears during the winter months. It appears generally a little after the vernal equinox; but rather earlier in the ſouthern, and later in the northern latitudes. It adheres to the uſual ſeaſons with much regularity; for though the months of February and March ſhould be uncommonly mild, and April and May remarkably cold, it never deviates from its ordinary time. In the cold ſpring of 1740 ſome appeared in France before the inſects on which they feed had become numerous enough to ſupport them, and great numbers died †. In the mild and even warm ſpring of 1774 they appeared no earlier than uſual. They remain in ſome warm countries the whole year. Kolben aſſures us that this is the caſe at the Cape of Good Hope; but (he ſays) they are more numerous in winter. Some birds of this ſpecies live, during winter, even in Europe; for example on the coaſt of Genoa, where they ſpend the night in the open country on the orange ſhrubs.

† *Buffon's Natural Hiſtory of Birds*, vol. vi. p. 527.

2. The

2. The *martins* are alſo widely diffuſed through the old continent; but the countries where they reſide or viſit have not been marked by naturaliſts with much attention. 3. The *ſand martins* are found in every part of Europe, and frequently ſpend the winter in Malta ‡. Two birds of this ſpecies were ſeen in Perigord in France, on the 27th December 1775, when there was a ſoutherly wind, attended with a little rain ||. 4. The *ſwift* viſits the whole continent of Europe; has alſo been obſerved at the Cape of Good Hope, and in Carolina in North America. 5. The *goat-ſuckers* are not very common birds, yet are widely ſcattered. They are found in every country between Sweden and Africa: they are found alſo in India. In April the ſouth-weſt wind brings them to Malta, and in autumn they repaſs in great numbers.

‡ *Ibid.* 527.

|| *Ibid.* 484.

Tranſactions of the Linnæan Society, vol. i.

Mr Markwick of Catsfield, near Battle in Suſſex, has drawn up an accurate table, expreſſing the day of the month on which the birds, commonly called *migratory*, appeared in ſpring, and diſappeared in autumn, for 16 years, from 1768 to 1783 incluſive. The obſervations were made at Catsfield. From this table we ſhall extract the dates for five years, and add the very few obſervations which we have been able to collect reſpecting the time when the ſwallow appears and diſappears in other countries.

	Firſt ſeen.	*Laſt ſeen.*
	1779.	
Chimney Swallow	April 14.	October 29.
Martins	14.	15.
Sand Martin	May 7.	
Swift	9.	
	1780.	
Chimney Swallow		November 3.
Martins	April 29.	3.
Sand Martin	8.	September 8.
Swift	May 6.	8.
	1781.	
Chimney Swallow	April 8.	October 15.
Martins	May 12.	September 7.
Sand Martin	April 26.	September 1.
Swift	May 12.	1.
	1782.	
Chimney Swallow	April 22.	September 1.
Martins	26.	November 2.
Sand Martin	May 15.	Auguſt 28.
Swift	18.	28.
	1783.	
Chimney Swallow	April 13.	November 6.
Martins	May 1.	6.
Sand Martin	July 25.	September 1.
Swift	May 13.	November 6.

	Chim. Swal,	Swifts.	Martins.	S. Mart.
		Appear about		
In Burgundy †			Ap. 9.	Ap. 12.
In Selborne, Hampſhire ‡	Ap. 4.	Ap. 24.	Ap. 30.	
In South Zele, Devonſhire ‡	25.	May 1.	May 15.	
In Blackburn, Lancaſhire ‡	29.	Ap. 28.		
In Upſal in Sweden §			May 9.	

† *Buffon*, ibid.

‡ *White's Natural Hiſtory of Selborne.*

§ *Buffon*, ibid.

Were tables of the ſame kind made in every different country, particularly within the torrid zone, it would be eaſy to determine the queſtion which we have been conſidering. To many, perhaps, it may not appear a matter of ſuch importance as to be worth the labour. We acknowledge it to be rather a curious than an important inquiry; yet it is one which muſt be highly gratifying to every mind that can admire the wiſdom of the Great Architect of nature. The inſtinct of the ſwallow is indeed wonderful: it appears among us juſt at the time when inſects become numerous; and it continues with us during the hot weather, in order to prevent them from multiplying too much. It diſappears when theſe inſects are no longer troubleſome. It is never found in ſolitude; it is the friend of man, and always takes up its reſidence with us, that it may protect our houſes and our ſtreets from being annoyed with ſwarms of flies.

MIGRATION of Fiſhes. See CLUPEA.

ST MIGUEL, one of the Azore iſlands, ſituated in W. Long. 22. 45. N. Lat. 38. 10. This iſland appears to be entirely volcanic. The beſt account we have of it hath been publiſhed in the 68th volume of the Philoſophical Tranſactions by Mr Francis Maſſon. According to him, the productions differ greatly from thoſe of Madeira, inſomuch that none of the trees of the latter are found here, except the faya: it has a nearer affinity to Europe than Africa. The mountains are covered with the erica vulgaris, and an elegant evergreen ſhrub very like a phillyrea, which gives them a moſt beautiful appearance.

It is one of the principal and moſt fertile of the Azorian iſlands, lying nearly eaſt and weſt. Its length is about 18 or 20 leagues; its breadth unequal, not exceeding five leagues, and in ſome places not more than two. It contains about 80,000 inhabitants.

Its capital, the city of Ponta del Guda, which contains about 12,000 inhabitants, is ſituated on the ſouth ſide of the iſland, on a fine fertile plain country, pretty regularly built; the ſtreets ſtraight, and of a good breadth. It is ſupplied with good water, which is brought about the diſtance of three leagues from the neighbouring mountains. The churches and other religious edifices are elegant and well built for ſuch an iſland. There is a large convent of Franciſcan friars and one of the order of St Auguſtine, four convents for profeſſed nuns, and three Ricolhimentos for young women and widows who are not profeſſed. The veſſels anchor in an open road; but it is not dangerous, as no wind can prevent their going to ſea in caſe of ſtormy weather.

The country round the city is plain for ſeveral miles, well cultivated, and laid out with good taſte into ſpacious fields, which are ſown with wheat, barley, Indian corn, pulſe, &c. and commonly produce annually two crops; for as ſoon as one is taken off, another is immediately ſown in its place. The ſoil is remarkably gentle and eaſy to work, being for the moſt part compoſed of pulverized pumice ſtone. There are in the plains a number of pleaſant country ſeats, with orchards of orange trees, which are eſteemed the beſt in Europe.

The ſecond town is Ribeira Grande, ſituated on the north ſide of the iſland, containing about as many inhabitants as the city; a large convent of Franciſcan friars, and one of nuns. It gives title to a count, called the *Conde Ribeira Grande*, who firſt inſtituted linen and woollen manufactories in the iſland.

The third town is Villa Franca, on the ſouth ſide of the iſland, about ſix leagues eaſt of Ponta del Guda. It

It has a convent of Franciſcan friars and one of nuns, which contains about 300. Here, about half a mile from the ſhore, lies a ſmall iſland (Ilhao), which is hollow in the middle, and contains a fine baſon with only one entrance into it, fit to hold 50 ſail of veſſels ſecure from all weather; at preſent it wants cleaning out, as the winter rain waſhes down great quantities of earth into it, which has greatly diminiſhed its depth. But veſſels frequently anchor between this iſland and the main.

Beſides theſe towns are ſeveral ſmaller, viz. Alagao, Agoa de Pao, Brelanha, Fanaes de Ajuda, and a number of hamlets, called *lugars* or *places*.

About four leagues north-eaſt from Villa Franca, lies a place called the Furnas, being a round deep valley in the middle of the eaſt part of the iſland, ſurrounded with high mountains, which, though ſteep, may be eaſily aſcended on horſeback by two roads. The valley is about five or ſix leagues in circuit. The face of the mountains, which are very ſteep, is entirely covered with beautiful evergreens, viz. myrtles, laurels, a large ſpecies of bilberry called *uva de ſerra*, &c. and numberleſs rivulets of the pureſt water run down their ſides. The valley below is well cultivated, producing wheat, Indian corn, flax, &c. The fields are planted round with a beautiful ſort of poplars, which grow into pyramidal forms, and by their careleſs irregular diſpoſition, together with the multitude of rivulets, which run in all directions through the valley, a number of boiling fountains throwing up clouds of ſteam, a fine lake in the ſouth-weſt part about two leagues round, compoſe a proſpect the fineſt that can be imagined. In the bottom of the valley the roads are ſmooth and eaſy, there being no rocks, but a fine pulverized pumice ſtone that the earth is compoſed of.

There are numerous hot fountains in different parts of the valley, and alſo on the ſides of the mountains: but the moſt remarkable is that called the *chaldeira*, ſituated in the eaſtern part of the valley, on a ſmall eminence by the ſide of a river, on which is a baſon about 30 feet diameter, where the water continually boils with prodigious fury. A few yards diſtant from it is a cavern in the ſide of the bank, in which the water boils in a dreadful manner, throwing out a thick, muddy, unctuous water, ſeveral yards from its mouth with a hideous noiſe. In the middle of the river are ſeveral places where the water boils up ſo hot, that a perſon cannot dip his finger into it without being ſcalded; alſo along its banks are ſeveral apertures, out of which the ſteam riſes to a conſiderable height, ſo hot that there is no approaching it with one's hand: in other places, a perſon would think that 100 ſmiths bellows were blowing altogether, and ſulphureous ſteams iſſuing out in thouſands of places; ſo that native ſulphur is found in every chink, and the ground covered with it like hoar froſt; even the buſhes that happen to lie near theſe places are covered with pure brimſtone, condenſing from the ſteam that iſſues out of the ground, which in many places is covered over with a ſubſtance like burnt alum. In theſe ſmall caverns from which the ſteam iſſues, the people often boil their yams.

Near theſe boiling fountains are ſeveral mineral ſprings; two in particular, whoſe waters have a very ſtrong quality, of an acid taſte, and bitter to the tongue.

About half a mile to the weſtward, and cloſe by the river ſide, are ſeveral hot ſprings, which are uſed by ſick people with great ſucceſs. Alſo, on the ſide of a hill weſt of St Anne's church, are many others, with three bathing houſes, which are moſt commonly uſed. Theſe waters are very warm, although not boiling hot; but at the ſame place iſſue ſeveral ſtreams of cold mineral water, by which they are tempered, according to every one's liking.

About a mile ſouth of this place, and over a low ridge of hills, lies a fine lake about two leagues in circumference, and very deep, the water thick, and of a greeniſh colour. At the north end is a plain piece of ground, where the ſulphureous ſteams iſſue out in many places, attended with a ſurpriſing blowing noiſe. Our author could obſerve ſtrong ſprings in the lake, but could not determine whether they were hot or cold: this lake ſeems to have no viſible evacuation. The other ſprings immediately form a conſiderable river, called *Ribeira Quente*, which runs a courſe about two or three leagues, through a deep rent in the mountains, on each ſide of which are ſeveral places where the ſmoke iſſues out. It diſcharges itſelf into the ſea on the ſouth ſide, near which are ſome places where the water boils up at ſome diſtance in the ſea.

This wonderful place had been taken little notice of until very lately: ſo little curioſity had the gentlemen of the iſland, that ſcarcely any of them had ſeen it, until of late ſome perſons, afflicted with very virulent diſorders, were perſuaded to try its waters, and found immediate relief from them. Since that time it has become more and more frequented; ſeveral perſons who had loſt the uſe of their limbs by the dead palſy have been cured; and alſo others who were troubled with eruptions on their bodies.

A clergyman, who was greatly afflicted with the gout, tried the ſaid waters, and was in a ſhort time perfectly cured, and has had no return of it ſince. When Mr Maſſon was there, ſeveral old gentlemen, who were quite worn out with the ſaid diſorder, were uſing the waters, and had received incredible benefit from them; in particular, an old gentleman about 60 years of age, who had been tormented with that diſorder more than 20 years, and often confined to his bed for ſix months together: he had uſed theſe waters for about three weeks, had quite recovered the uſe of his limbs, and walked about in the greateſt ſpirits imaginable. A friar alſo who had been troubled with the ſaid diſorder about 12 years and reduced to a cripple, by uſing them a ſhort time was quite well, and went a-hunting every day.

There are ſeveral other hot ſprings in the iſland, particularly at Ribeira Grande; but they do not poſſeſs the ſame virtues, at leaſt not in ſo great a degree.

The eaſt and weſt part of the iſland riſes into high mountains; but the middle is low, interſperſed with round conic hills, all of which have very recent marks of fire; all the parts below the ſurface conſiſting of melted lava lying very hollow.

Moſt of the mountains to the weſtward have their tops hollowed out like a punch bowl, and contain water. Near the weſt end is an immenſe deep valley like the Furnas, called the *Sete Cidades*. This valley is ſurrounded with very abrupt mountains, about ſeven or eight leagues round; in the bottom is a deep lake of water about three leagues in circuit, furniſhed with great numbers of water fowls. This water has no mineral quality; neither are there any hot ſprings in the valley. All theſe mountains are compoſed of a white crumbly pumice ſtone, which is ſo looſe, that if a perſon thruſt a ſtick into the banks, whole waggon loads of it will tumble down. The inhabitants of the iſland relate a ſtory, that he who firſt diſcovered it obſerved an extraordinary high peak near the weſt end; but the ſecond time he viſited it, no ſuch peak was to be ſeen, which he ſuppoſed muſt have certainly ſunk; but, however improbable this ſtory may be, at ſome period or other it muſt have certainly been the caſe.

MILAN, or the duchy of the Milaneſe, a country of Italy, bounded on the weſt by Savoy, Piedmont, and Montferrat; by Switzerland on the north; by the territories of Venice, the duchies of Mantua, Parma, and Placentia on the eaſt; and by the territories of Genoa on the ſouth. It is 150 miles long, and 78 broad.

Anciently this duchy, containing the north part of the old Liguria, was called *Inſubria*, from its inhabitants the *Inſubres;* who were conquered by the Romans, as theſe were by the Goths; who in their turn were ſubdued by the Lombards. Didier, the laſt king of the Lombards, was taken priſoner by Charlemagne, who put an end to the Longobardic empire, and appointed governors of Milan. Theſe governors being at a diſtance from their maſters, ſoon began to aſſume an independency, which brought a dreadful calamity on the country; for, in 1152, the capital itſelf was levelled with the ground by the emperor Frederic Barbaroſſa, who committed great devaſtations otherwiſe throughout the duchy. Under this emperor lived one Galvian, a nobleman who was deſcended from Otho a Milaneſe. Galvian, along with William prince of Montferrat, ſerved in the cruſade, when Godfrey of Boulogne took Jeruſalem: he killed in ſingle combat the Saracen general, whom he ſtripped of his helmet, which was adorned with the image of a ſerpent ſwallowing a youth; and this ever afterwards was the badge of that family. His grandſon Galvian, having oppoſed the emperor, was taken priſoner, and carried in irons into Germany, from whence he made his eſcape, and returning to Milan, died in the ſervice of his country. From him deſcended another Otho, at the time that Otho IV. was emperor of Germany, and who ſoon diſtinguiſhed himſelf by the accompliſhments both of his mind and body. When he grew up, he was received into the family of Cardinal Octavian Ubaldini at Rome. This prelate, who was himſelf aſpiring at the popedom, was in a ſhort time greatly taken with the addreſs and accompliſhments of young Otho and predicted his future greatneſs. In the mean time, one Torreſs, or Torriano, a Milaneſe nobleman of unbounded ambition, was attempting to make himſelf maſter of Milan. The popular faction had ſome time before been caballing againſt the nobility; and at laſt, Torriano putting himſelf at their head, expelled the biſhop, and put to death or baniſhed all the nobility; by which means the popular government was fully eſtabliſhed; and Torriano, under this pretence, ruled every thing as he pleaſed. He was, however, ſoon oppoſed by one Franciſco Sepri, who formed a great party, pretending to deliver the city from Torriano's haughtineſs and cruelty. But while the two parties were collecting their forces againſt each other, Cardinal Ubaldini was projecting the deſtruction of both, by means of his favourite Otho. This prelate had for ſome time borne an implacable hatred to Torriano, becauſe he had been by him prevented from carrying out of the treaſury of St Ambroſe's church at Milan, a carbuncle or jewel of great value, which he pretended to reſerve for adorning the papal tiara; for which reaſon he now determined to oppoſe his ambition.

Ubaldini began with naming Otho archbiſhop of Milan; which, as the pope's legate, he had a right to do. This nomination was confirmed by Pope Urban IV.; and the party of the nobility having now got a head from the pope himſelf, began to gather ſtrength. Otho in the mean time employed himſelf in collecting troops; and had no ſooner procured a ſhow of an army, than he advanced towards Lago Maggiore, and took poſſeſſion of Arona, a ſtrong poſt near that lake: but Torriano, marching immediately againſt him with all his troops, obliged him to abandon the place, and leave his party to make the beſt terms they could with the conqueror. This was followed by the deſtruction of the caſtles of Arona, Anghiari, and Brebia: ſoon after which Torriano died, and was ſucceeded by his brother Philip, who had ſufficient intereſt to get himſelf elected podeſta, or prætor of Milan, for ten years. During his lifetime, however, the party of the nobility increaſed conſiderably under Otho, notwithſtanding the check they had received. Philip died in 1265, having loſt ground conſiderably in the affections of the people, though he obtained a great reputation for his courage and conduct. His ſucceſſor Napi rendered himſelf terrible to the nobility whom he proſcribed, and put to death as often as he could get them into his power. He proceeded ſuch lengths, and acted with ſuch fury againſt that unfortunate party, that Pope Clement IV. who had ſucceeded Urban, at laſt interdicted Milan, and excommunicated Napi and all his party. By this Napi began to loſe his popularity, and the public diſaffection towards him was much heightened by the natural cruelty of his temper. But in the mean time, the party of the nobility was in the utmoſt diſtreſs. Otho himſelf and his friends, having ſpent all their ſubſtance, wandered about from place to place; the pope not being in a capacity of giving them any aſſiſtance. Otho, however, was not diſcouraged by his bad ſucceſs, but found means ſtill to keep up the ſpirits of his party, who now choſe for their general Squarcini Burii, a man of great eminence and courage, whoſe daughter was married to Matthew Viſconti, afterwards called *Matthew the Great*. At the ſame time they renewed their confederacy with the marquis of Montferrat, who was ſon-in-law to the king of Spain. The marquis agreed to this confederacy chiefly with a view to become maſter of the Milaneſe.

The nobility now again began to make head; and having collected an army, which was joined by 600

Spaniſh cavalry and a body of foot, gained ſome advantages. But in the mean time Napi, having gathered together a ſuperior army, ſuddenly attacked Otho and Burri, and defeated them. After this diſaſter Otho applied to the pope; from whom, however, he did not obtain the aſſiſtance he deſired; and in the mean time Napi invited the emperor Rodolph into Italy, with the promiſe of being crowned at Milan. This invitation was accepted of with great readineſs by Rodolph; who conſtituted Napi his governor and vicar-general in Lombardy, ſending to him at the ſame time a fine body of German horſe, the command of which was given to Caſſoni, Napi's nephew. On this Otho again applied to the pope (Gregory X.); but he was ſo far from granting him any aſſiſtance, that he is ſaid to have entered into a ſcheme of aſſaſſinating him privately; but Otho eſcaped the danger, and in 1276 began to recover his affairs. The reaſon of Pope Gregory's enmity to him was, that he and his party were thought to be Gibelines, and were oppoſed by great numbers of the nobility themſelves; but after that pope's death, the Milaneſe exiles being united under one head, ſoon became formidable. They now choſe for their general Godfrey count of Languſio, a noble Pavian, and an inveterate enemy of the Torriano family. This nobleman being rich and powerful, enliſted many German and other mercenaries, at whoſe head he marched towards the Lago Maggiore. All the towns in that country opened their gates to him, through the intereſt of the Viſconti family, who reſided in theſe parts. But this ſucceſs ſoon met with a ſevere check in an unfortunate engagement, wherein Godfrey was defeated and taken priſoner; after which he and 34 nobles had their heads ſtruck off, and ſent from the field of battle piled up in a common waggon.

This defeat greatly affected Otho; but having in a ſhort time recovered himſelf, he again attacked his enemies, and defeated them; but, ſuffering his troops to grow remiſs after their victory, the fugitives rallied, and entirely defeated him. The next year, however, Otho had better ſucceſs, and totally defeated and took priſoner Napi himſelf. After this victory Caſſoni was obliged to abandon Milan to his competitor, who kept poſſeſſion of it till his death, which happened in 1295, in the 87th year of his age.

Otho was ſucceeded by Matthew Viſconti above mentioned; and Milan continued in ſubjection to that family without any very memorable occurrence till the year 1378, when, by the death of Galeazzo II. his brother Barnabo became ſovereign of Milan. He was of a brave and active diſpoſition; but exceſſively profuſe in his expences, as his brother Galeazzo had alſo been; and to procure money to ſupply his extravagancies, was obliged to oppreſs his ſubjects. Galeazzo had engaged in an enterpriſe againſt Bologna, and the ſiege of it was continued by Barnabo. It laſted for nine years; and during this time is ſaid to have coſt 300 millions of gold, a prodigious ſum in thoſe days, near 40 millions ſterling, the loweſt gold coin being in value ſomewhat more than half-a-crown Engliſh. Both the brothers were exceſſively fond of building. Barnabo erected a bridge over the Adda, conſiſting of three ſtories; the loweſt for chariots and heavy carriages, the middle for horſes, and the uppermoſt for foot paſſengers. He built alſo another bridge which was carried over houſes without touching them. To accompliſh theſe, and many other expenſive ſchemes, he became one of the greateſt tyrants imaginable, and every day produced freſh inſtances of his rapacity and cruelty. He inſtituted a chamber of inquiry, for puniſhing all thoſe who had for five years before been guilty of killing boars, or even of eating them at the table of another. They who could not redeem themſelves by money were hanged, and above 100 wretches periſhed in that manner. Thoſe who had any thing to loſe were ſtripped of all their ſubſtance, and obliged to labour at the fortifications and other public works. He obliged his ſubjects to maintain a great many hunting dogs, and each diſtrict was taxed a certain number. The overſeers of his dogs were at the ſame time the inſtruments of his rapacity. When the dogs were poor and ſlender, the owners were always fined; but when the dogs were fat, the owners were alſo fined for ſuffering them to live without exerciſe.

The extravagant behaviour of Barnabo ſoon rendered public affairs ready for a revolution, which was at laſt accompliſhed by his nephew John Galeazzo. He affected a ſolitary life, void of ambition, and even inclining to devotion; but at the ſame time took care to have his uncle's court filled with ſpies, who gave him information of all that paſſed. He reduced his table and manner of living, pretending that he took theſe ſteps as preparatives to a retirement from the world, which was ſoon to take place, after he had paid a religious vow. In ſhort, he acted his part ſo well, that even Barnabo, though abundantly cautious, had no ſuſpicion of his having any deſigns againſt him; and ſo entirely did he conceal his ambition, that he ſeveral times made application to his uncle for his intereſt to procure him a quiet retreat as ſoon as his religious vows were performed. One of theſe was to pay a viſit to the church of the bleſſed Virgin upon Mount Varezzio. This was to be done with ſo much ſecrecy that all kinds of eye witneſſes were to be excluded; and it was with difficulty that Barnabo himſelf and two of his ſons were allowed to accompany our devotee. But, in the mean time, the hypocritical Galeazzo had ſoldiers advancing from all quarters; ſo that Barnabo and his ſons were immediately ſeized, and the houſes of thoſe who had ſided with them given up to be plundered. The booty in plate, money, and all kinds of rich furniture, was immenſe. The miniſters of the late government were dragged from their hiding places, and put to death; and at laſt the citadel itſelf fell into the hands of Galeazzo, who found in it an immenſe ſum of money. Barnabo was carried priſoner to Tritici, a caſtle of his own building, where he had the happineſs to find one perſon ſtill faithful to him. This was his miſtreſs, named *Dominia Porra*; who, when he was abandoned by all the world, ſhut herſelf up a voluntary priſoner in his chamber, and remained with him as long as he lived, which was only ſeven months after his degradation.

John Galeazzo was the firſt who took upon him the title of the *Duke of Milan*, and was a prince of great policy and no leſs ambition. He made war with the Florentines, became maſter of Piſa and Bologna, and entirely defeated the emperor in 1401, ſo that he entertained hopes of becoming maſter of all Lombardy, and cutting off all poſſibility of invading it either from

France or Germany; but his deſigns were fruſtrated by death, which happened in 1402, in the 55th year of his age. After his deceaſe the Milaneſe government fell into the moſt violent diſtractions, ſo that it could not be ſupported, even in time of peace, without an army of 20,000 foot and as many horſe. In the year 1421, however, Philip duke of Milan became maſter of Genoa; but though he gained great advantages in all parts of Italy, the different ſtates ſtill found means to counterbalance his ſucceſſes, and prevent him from enſlaving them: ſo that Milan never became the capital of any extenſive empire; and in 1437 Genoa revolted, and was never afterwards reduced.

Philip died in 1448, and by his death the male line of the Viſconti family was at an end. The next lawful heir was Valentina his ſiſter, who had married the duke of Orleans, ſon to Charles V. of France. By the contract of that marriage, the lawful progeny of it was to ſucceed to the duchy of Milan in failure of the heirs male of the Viſconti family; but this ſucceſſion was diſputed by Sforza, who had married Philip's natural daughter. It is certain, however, that the rightful ſucceſſion was veſted in the houſe of Orleans and the kings of France; and therefore though the Sforza family got poſſeſſion of the duchy for the preſent, Louis XII. afterwards put in his claim, being a grandſon to John Galeazzo. For ſome time he was ſucceſsful; but the French behaved in ſuch an inſolent manner, that they were driven out of the Milaneſe by the Swiſs and Maximilian Sforza. The Swiſs and Milaneſe were in their turn expelled by Francis I. who obliged the Sforza family to relinquiſh the government for a penſion of 30,000 ducats a-year. Francis Sforza, the ſon of Maximilian, however, being aſſiſted by the emperor and the pope, regained the poſſeſſion of the Milaneſe about the year 1521; and, eight years after, the French king, by the treaty of Cambray, gave up his claim on the duchy.

But, in fact, the emperors of Germany ſeem to have had the faireſt title to the Milaneſe in right of their being for a long time ſovereigns of Italy. On the death of Francis Sforza, therefore, in the year 1536, the emperor Charles V. declared the Milaneſe to be an imperial fief, and granted the inveſtiture of it to his ſon Philip II. king of Spain. In his family it continued till the year 1706, when the French and Spaniards were driven out by the Imperialiſts, and the emperor again took poſſeſſion of it as a fief. It was confirmed to his houſe by the treaty of Baden in 1714, by the quadruple alliance in 1718, and by the treaty of Aix-la-Chapelle in 1748.

The duchy of Milan is one of the fineſt provinces in Italy. It is bounded on the ſouth by the Apennine mountains, and the territory of Genoa; on the north by Switzerland; on the eaſt by the Venetian territories, and the duchies of Mantua, Parma, and Placentia; and on the weſt by Savoy, Piedmont, and Montferrat; extending from north to ſouth about 100 miles, and from eaſt to weſt about 108. It is well watered by the Teſſino, the Seſia, the Adda, the Po, the Oglio, the Lombro, Serio, &c. and alſo by ſeveral canals and lakes. Of the latter, the Lago Maggiore is between 30 and 40 miles in length, and in ſome places ſix or ſeven miles broad. In it lie the *Boromean iſlands*, as they are called, viz. Iſola Bella and Iſola Madre, the beauty of which almoſt exceeds imagination: art and nature ſeem to have vied with one another in embelliſhing them. In each of them is a palace with delicious gardens, belonging to the Boromean family. The water of the lake is clear and of a greeniſh colour, and abounds with fiſh. The hills with which it is ſurrounded preſent a moſt charming landſcape, being planted with vines and cheſnut trees, interſperſed with ſummer houſes. There is a canal running from it towards Switzerland, with which the city of Milan has a communication. It was anciently called *Lacus Verbanus*. The Lago de Como, which was called by the Latin poets *Lacus Larius*, but had its modern name from the city near which it lies, extends itſelf about 30 miles northward from Como, but its greateſt breadth is not above five miles. From the Lago Maggiore iſſues the Teſſino; and from that of Como the Adda. Of the other lakes, that of Lugano and Guarda are the chief: that of Guarda was anciently called *Benacus*.

The trade and manufactures of this duchy conſiſt principally in ſilk ſtuffs, ſtockings, gloves, and handkerchiefs, linen and woollen cloth, hardware, curious works of cryſtal, agate, hyacinths, and other gems; but their exports are uſually far ſhort of their imports.

As to the revenue of the duchy, it muſt without doubt be very conſiderable. It is ſaid to have amounted to 2,000,000 of dollars while the duchy was in the hands of the Spaniards.

In the year 1767, the Auſtrian government of Milan publiſhed a law, by which all the rights which the pope or the biſhops had till then exerciſed over eccleſiaſtics, either with regard to their effects or perſons, was transferred to a council eſtabliſhed for that purpoſe at Milan. By the ſame edict, all eccleſiaſtics were obliged to ſell the eſtates which they had become poſſeſſed of ſince the year 1722; and no ſubject, whether eccleſiaſtic or ſecular, was to go to Rome to ſolicit any favour, except letters of indulgence, without the conſent of the ſaid council.

This duchy was ſubdued by the French in the year 1796, when it was regarded as a conſtituent part of the Ciſalpine republic. When hoſtilities recommenced in 1799, it was again taken by the allies, but afterwards reconquered by the army of Dijon under Bonaparte, who entered the metropolis on the 2d of June 1800. It now forms part of the kingdom of Italy.

Milan, the capital of the duchy of that name, in Latin *Mediolanum*, is a very large city, and has a wall and rampart round it, with a citadel; yet is thought to be incapable of making any great reſiſtance. The gardens within the city take up a great deal of ground. In the citadel is a foundery for cannon, and an arſenal furniſhed with arms for 12,000 men. The governor of it is quite independent of the governor general of the Milaneſe, who reſides in the city, in a large but old and ill-contrived palace. The yearly income of the governor of Milan is ſaid to be 200,000 guilders. The council belonging to the city is compoſed of a preſident and 60 doctors of law, who are all nobles, and independent of the governor general. Milan hath experienced a great variety of fortune, having been ſubject ſometimes to the French, ſometimes to the Spaniards, and ſometimes to the Germans, A great number of perſons of rank and fortune live in it, eſpecially during the winter. The ladies in France are not allowed more liberty than thoſe of this city: even the auſterities of the monaſtic life are ſo far mitigated here, that gentlemen have not only the liberty of talking with the nuns, and of rallying and laughing at the grate, but alſo of joining with them in concerts of muſic, and of ſpending whole afternoons in their company. The place where the *beau monde* take the air, either in their coaches or on foot, is the rampart betwixt the Porta Orientale and the Porta Toſa, where it is ſtraight and broad, and extremely pleaſant, being planted with white mulberry trees, and commanding a proſpect on one ſide of the open country, and on the other of the gardens and vineyards between the ramparts and the city. Milan, which is ſaid to have been built by the Gauls about 200 years after the foundation of Rome, contains a great number of ſtately edifices, as churches, convents, palaces, and hoſpitals. The cathedral is a vaſt pile, all of marble; and though ſomething has been doing for near 400 years towards the outward or inward ornament thereof, it is not yet finiſhed. Of the great number of ſtatues about it, that of St Bartholomew, juſt flead alive, with his ſkin hanging over his ſhoulders; and of Adam and Eve, over the main portal, are the fineſt. The pillars ſupporting the roof of the church are all of marble, and the windows finely painted. This church contains a treaſure of great value, particularly a ſhrine of rock cryſtal, in which the body of St Charles Borromæo is depoſited. The other churches moſt worthy a ſtranger's notice are thoſe of St Alexander, St Jerome, St Giovanni di Caſarotti della Paſſione, that of the Jeſuits, and of St Ambroſe, in which lie the bodies of the ſaint and of the kings Pepin and Bernard. In the Ambroſian college, founded by Frederic Borromæo, 16 profeſſors teach gratis. In the ſame college is alſo an academy of painting, with a muſeum, and a library containing about 45,000 printed books and manuſcripts; among the laſt of which is a tranſlation of Joſephus's Hiſtory of the Jews, done by Rufinus about 1200 years ago, and written on the bark of a tree; St Ambroſe's works on vellum, finely illuminated; the orations of Gregory Nazianzen, and the works of Virgil, in folio, with Petrarch's notes. In the muſeum are Leonardi da Vinci's mathematical and mechanical drawings, in 12 large volumes. The ſeminary for ſciences, the college of the nobles, the Helvetian college, and the mathematical academy, are noble foundations, and ſtately buildings. Of the hoſpitals, the moſt remarkable are the Lazaretto, and that called the *great hoſpital;* the latter of which receives ſick perſons, foundlings, and lunatics, and has ſix ſmaller hoſpitals depending on it, with a revenue of 100,000 rix dollars.

The number of the inhabitants of this city is ſaid to be about 250,000. It has been 40 times beſieged, taken 20 times, and four times almoſt entirely demoliſhed; yet it hath always recovered itſelf. It is ſaid that gunpowder is ſold here only by one perſon, and in one place. The court of inquiſition is held in the Dominican convent, near the church of Madonna della Gratia. The houſes of entertainment, and the ordinaries here, are repreſented as very indifferent.—Mr Keyſler ſays, it is not unuſual for young travellers, when they go to any of the taverns in Milan, to be aſked, "whether they chooſe a *letto fornito*, or female bedfellow," who continues maſked till ſhe enters the bedchamber. Milan is deſcribed as inferior to Turin both in beauty and conveniency, many of the ſtreets being crooked and narrow, and paper windows much more frequent than in that city; even in grand palaces, the windows are often compoſed promiſcuouſly of glaſs and paper. Two large canals extend from hence, the one to the Teſſino, and the other to the Adda; the Teſſino having a communication with the Lago Maggiore, and, by a canal, with the Seſia; and the Adda iſſuing from the Lago di Como, and having a communication by canals with the Lombro and Serio. In a void ſpace in one of the ſtreets of Milan, where ſtood the houſe of a barber who had conſpired with the commiſſary of health to poiſon his fellow citizens, is erected a pillar called *Colonna Infame*, with an inſcription to perpetuate the memory of the execrable deſign. The environs of this city are very pleaſant, being adorned with beautiful ſeats, gardens, orchards, &c. About two Italian miles from it, at the ſeat of the Simonetti family, is a building, that would have been a maſterpiece of its kind had the architect deſigned it for an artificial echo. It will return or repeat the report of a piſtol above 60 times; and any ſingle muſical inſtrument well touched will have the ſame effect as a great number of inſtruments, and produce a moſt ſurpriſing and delightful concert.

According to Dr Moore, "there is no place in Italy, perhaps in Europe, where ſtrangers are received in ſuch an eaſy hoſpitable manner as at Milan. Formerly the Milaneſe nobility diſplayed a degree of ſplendour and magnificence, not only in their entertainments, but in their uſual ſtyle of living, unknown in any other country of Europe. They are under a neceſſity at preſent of living at leſs expence, but they ſtill ſhow the ſame obliging and hoſpitable diſpoſition. This country having, not very long ſince, been poſſeſſed by the French, from whom it devolved to the Spaniards, and from them to the Germans, the troops of thoſe nations have, at different periods, had their reſidence here, and in the courſe of theſe viciſſitudes, produced a ſtyle of manners, and ſtamped a character on the inhabitants of this duchy, different from what prevails in any other part of Italy; and nice obſervers imagine they perceive in Milaneſe manners, the politeneſs, formality, and honeſty imputed to thoſe three nations, blended with the ingenuity natural to Italians. The great theatre having been burnt to the ground laſt year, there are no dramatic entertainments, except at a ſmall temporary play houſe, which is little frequented; but the company aſſemble every evening in their carriages on the ramparts, and drive about, in the ſame manner as at Naples, till it is pretty late. In Italy, the ladies have no notion of quitting their carriages at the public walks, and uſing their own legs as in England and France. On ſeeing the number of ſervants, and the ſplendour of the equipages which appear every evening at the Corſo on the ramparts, one would not ſuſpect that degree of depopulation, and diminution of wealth, which we are aſſured has taken place within theſe few years all over the Milaneſe; and which proceeds from the burdenſome nature of ſome late taxes, and the inſolent and oppreſſive manner in which they are gathered."—E. Long. 9. 11. N. Lat. 45. 28.

MILBORN-PORT, a town of Somerſetſhire in England, ſeated on a branch of the river Parret, 115 miles from London. Though repreſented in parliament, it is no market town nor corporation; but it appears in Domeſday-book to have had a market once, and 56 burgeſſes. It is in a manner ſurrounded by Dorſetſhire. Here are nine capital burgeſſes, who yearly chooſe two bailiffs, that have the government of the borough under them, and jointly return the members to parliament with the two ſtewards, who are choſen yearly out of nine commonalty ſtewards, and have the cuſtody of the corporation-ſeal. Theſe two ſtewards alſo diſtribute the profits of the lands given to the poor here, of which the ſaid commonalty ſtewards are truſtees. The inhabitants in 1801 were nearly about 1000, the houſes not much above 200. W. Long. 2. 37. N. Lat. 50. 50.

MILBROOK, a town of Cornwall, on the weſt ſide of Plymouth haven. It has a good fiſhing trade, and has formerly furniſhed our fleet with many able hands

MILDENHALL, a town of Suffolk, ſeven miles from Newmarket, 12 from Bury, and 70 from London. It is a large populous town on the river Lark, a branch of the Ouſe, with a harbour for boats. It has a well frequented market on Fridays, eſpecially for fiſh and wild-fowl. Its church has a tower or ſteeple 120 feet high. E. Long. 0. 33. N. Lat. 52. 24.

MILDEW, is ſaid to be a kind of thick, clammy, ſweet juice, exhaled from, or falling down upon, the leaves and bloſſoms of plants. By its thickneſs and clammineſs it prevents perſpiration, and hinders the growth of the plant. It ſometimes reſts on the leaves of trees in form of a fatty juice, and ſometimes on the ears of corn. It is naturally very tough and viſcous, and becomes ſtill more ſo by the ſun's heat exhaling its more fluid parts; by which means the young ears of corn are ſo daubed over, that they can never arrive at their full growth. Bearded wheat is leſs ſubject to the mildew than the common ſort; and it is obſerved that newly dunged lands are more liable to mildew than others. The beſt remedy is a ſmart ſhower of rain, and immediately afterwards a briſk wind. If the mildew is ſeen before the ſun has much power, it has been recommended to ſend two men into the field with a long cord, each holding one end; and drawing this along the field through the ears, the dew will be diſlodged from them, before the heat of the ſun is able to dry it to that viſcous ſtate in which it does the miſchief. Some alſo ſay, that lands which have for many years been ſubject to mildews, have been cured of it by ſowing ſoot along with the corn, or immediately after it.

Mr J. S. Segar, the author of a treatiſe upon this ſubject, obſerves, that the mildew is of ſuch a ſharp corroſive nature, that it raiſes bliſters on the feet of the ſhepherds who go barefoot, and even conſumes the hoofs of the cattle. He ſuſpects that it poſſeſſes ſome arſenical qualities, though he does not pretend to affirm this poſitively. Its pernicious influence, according to him, is rendered ſtill more powerful by a variety of circumſtances; ſuch as ſending the cattle into the fields too early in the ſpring; their drinking water mixed with ice, or but lately thawed; their being kept in ſtables that are too cloſe and filthy, and which are not ſufficiently aired. The ſame author conſiders the mildew as a principal cauſe of epidemical diſtempers among the cattle. The mildew producing theſe diſeaſes, he ſays, is that which dries and burns the graſs and leaves. It falls uſually in the morning, particularly after a thunder ſtorm. Its poiſonous quality (which does not continue above 24 hours) never operates but when it has been ſwallowed immediately after its falling. The diſorder attacks the ſtomach, is accompanied with pimples on the tongue, loſs of appetite, a deſiccation of the aliments in the ſtomach, a cough, and difficulty of reſpiration. As a preſervative, the author preſcribes purging in ſpring and in winter. The medicine he adviſes is compoſed of 30 grains of ſulphur of antimony, and 60 grains of reſin of jalap. He is againſt vomiting, and every thing that is of a heating nature.

MILE, a meaſure of length or diſtance, containing eight furlongs. The Engliſh ſtatute mile is 80 chains, or 1760 yards; that is, 5280 feet.

We ſhall here give a table of the miles in uſe among the principal nations of Europe, in geometrical paces, 60,000 of which make a degree of the equator.

	Geometrical paces.
Mile of Ruſſia	750
of Italy	1000
of England	1200
of Scotland and Ireland	1500
Old league of France	1500
The ſmall league, *ibid.*	2000
The mean league, *ibid.*	2500
The great league, *ibid.*	3000
Mile of Poland	3000
of Spain	3428
of Germany	4000
of Sweden	5000
of Denmark	5000
of Hungary	6000

MILETUS, in *Ancient Geography*, a town of Crete mentioned by Homer; but where ſituated does not appear. It is ſaid to be the mother town of Miletus in Caria, whither a colony was led by Sarpedon, Minos's brother, (Ephorus, quoted by Strabo). *Mileſii*, the people, (Ovid).

MILETUS, in *Ancient Geography*, a celebrated town of Aſia Minor, on the confines of Ionia and Caria. It was the capital city of all Ionia, and famous both for the arts of war and peace. It was ſituated about 10 ſtadia ſouth of the mouth of the river Mæander, near the ſea coaſt. It was founded by a Cretan colony under Miletus, the companion of Bacchus; or (according to others) by Neleus the ſon of Codrus; or by Sarpedon a ſon of Jupiter. It has ſucceſſively been called *Lelegeis*, *Pithyuſa*, and *Anactoria*. The inhabitants, called *Mileſii*, were very powerful, and long maintained an obſtinate war againſt the kings of Lydia. They early applied themſelves to navigation; and planted no leſs than 80 colonies, or (according to Seneca) 380, in different parts of the world. It was the only town that made head againſt Alexander, and was with much difficulty taken. It gave birth to Thales,

Thales, one of the ſeven wiſe men, and the firſt who applied himſelf to the ſtudy of nature. It was alſo the country of Anaximander, the ſcholar and ſucceſſor of Thales, the inventor of ſun dials and the gnomon, and the firſt that publiſhed a geographical map; of Anaximenes, ſcholar and ſucceſſor to the foregoing; and of other great men. It was noted for its excellent wool, according to Virgil; and was alſo celebrated for a temple and oracle of Apollo Didymæus. This famous people, from being powerful, becoming afterwards opulent and abandoned to pleaſures, loſt both their riches and their power.—At preſent it is called by the Turks *Melas*, and not far diſtant from it runs the river Mæander. St Paul going from Corinth to Jeruſalem paſſed by Miletus, and as he went by ſea, and could not take Epheſus in his way, he cauſed the biſhops and prieſts of the church of Epheſus to come to Miletus (Acts xx. 15. &c.), which was about 12 leagues from them.

MILFOIL, or YARROW. See ACHILLEA, BOTANY *Index*.

MILFORD, a town of Suſſex county, in the Delaware ſtate, is ſituated at the ſource of a ſmall river, 15 milies from Delaware bay, and 150 ſouthward of Philadelphia. This town, which contains about 80 houſes, has been built, except one houſe, ſince the revolution. It is laid out with much taſte, and is by no means diſagreeable. The inhabitants are Epiſcopalians, Quakers, and Methodiſts.

MILFORD Haven, one of the fineſt harbours in Europe, and indiſputably the beſt in Britain, is ſituated in Pembrokeſhire in South Wales, and lies on the north ſide of the Briſtol channel. It is very large, ſafe, and deep; there is no danger of going in or out with the tide, or almoſt with any wind. If a ſhip comes in without a cable or anchor ſhe may run aſhore on the ooze, and there lie ſafe till ſhe is refitted; and in an hour's time ſhe may get out of the harbour into the open ſea. It lies extremely convenient for ſhips bound from the Engliſh or Briſtol channels to Ireland, or farther weſt, and from thence to the channels. It is ſaid, that 1000 ſail of any ſize may ride ſecure in this haven. It has 16 deep and ſafe creeks, five bays, and 13 roads, all diſtinguiſhed by their ſeveral names. The ſpring tide riſes 36 feet, ſo that ſhips may at any time be laid aſhore. Dale harbour is a ready outlet for ſmall veſſels, where they may ride in two or three fathoms at low water.—In the reign of Queen Elizabeth, before the Spaniſh invaſion, two forts were begun at the entrance of Milford Haven, one on each ſide, called *Nangle* and *Dale* blockhouſes; but they were not then finiſhed.—The Stack-rock riſes here above water, lying near the middle of the entrance between Nangle and Dale. Penermouth is the opening of that branch of the haven on which the town of Pembroke is ſeated, and where the cuſtomhouſe of Milford is kept. The breadth of the entrance between rock and rock is but 200 yards at high water, and 112 at low water. There is a ridge of rocky ground that has the name of *Carrs*, which runs almoſt acroſs Milford Haven, from Peter church towards Llandſtadwell, where it renders the landing place difficult to ſtrangers, from its not appearing at low water. The great convenience of this harbour is, that in a hour's time a ſhip may be in or out of it, and in the way between the Land's End and Ireland. As it lies near the mouth of the Severn, a ſhip in eight or ten hours may be over on the coaſt of Ireland, or off the Land's End in the Engliſh Channel; and a veſſel may get out hence to the weſt much ſooner than from either Plymouth or Falmouth. This harbour has been greatly improved by new works, at the expence of the government. The parliament on April 14. 1759 granted 10,000l. for fortifying the harbour of Milford, all of which was expended on the fort at Neyland, which, however, ſtill remains unfiniſhed.

MILIARY, in general, ſomething reſembling millet ſeed.

MILIARY Fever. See MEDICINE *Index*.

MILITANT, or CHURCH-MILITANT, denotes the body of Chriſtians while here on earth.

MILITARY, ſomething belonging to the ſoldiery or militia.

MILITARY Diſcipline, the training of ſoldiers, and the due enforcement of the laws and regulations inſtituted by authority for their conduct.

Next to the forming of troops, military diſcipline is the firſt object that preſents itſelf to our notice; it is the ſoul of all armies; and unleſs it be eſtabliſhed amongſt them with great prudence, and ſupported with unſhaken reſolution, they are no better than ſo many contemptible heaps of rabble, which are more dangerous to the very ſtate that maintains them than even its declared enemies.

MILITARY Execution, the ravaging or deſtroying of a country, or town, that refuſes to pay the contribution inflicted upon them.

MILITARY Exerciſe. See EXERCISE and WORDS *of Command*.

MILITARY State, in Britiſh polity, one of the three diviſions of the laity. See LAITY.

This ſtate includes the whole of the ſoldiery, or ſuch perſons as are peculiarly appointed among the reſt of the people for the ſafeguard and defence of the realm.

In a land of liberty, it is extremely dangerous to make a diſtinct order of the profeſſion of arms. In abſolute monarchies, this is neceſſary for the ſafety of the prince; and ariſes from the main principle of their conſtitution, which is that of governing by fear; but, in free ſtates, the profeſſion of a ſoldier, taken ſingly and merely as a profeſſion, is juſtly an object of jealouſy. In theſe no man ſhould take up arms but with a view to defend his country and its laws: he puts not off the citizen when he enters the camp; but it is becauſe he is a citizen, and would wiſh to continue ſo, that he makes himſelf for a while a ſoldier. The laws therefore, and conſtitution of theſe kingdoms, know no ſuch ſtate as that of a perpetual ſtanding ſoldier, bred up to no other profeſſion than that of war; and it was not till the reign of Henry VII. that the kings of England had ſo much as a guard about their perſons.

In the time of the Anglo-Saxons, as appears from Edward the Confeſſor's laws, the military force of England was in the hands of the dukes or heretochs, who were conſtituted through every province and county in the kingdom; being taken out of the principal nobility, and ſuch as were moſt remarkable for being *ſapientes, fideles, et animoſi.* Their duty was to lead and regulate the Engliſh armies with a very unlimited power; *prout eis viſum fuerit, ad honorem coronæ et utilitatem regni.* And becauſe of this great power they were elected by the people in their full aſſembly, or folkmote, in the ſame manner as ſheriffs were elected: following ſtill that old fundamental maxim of the Saxon conſtitution, that where any officer was entruſted with ſuch power, as, if abuſed, might tend to the oppreſſion of the people, that power was delegated to him by the vote of the people themſelves. So too, among the ancient Germans, the anceſtors of our Saxon forefathers, they had their dukes, as well as kings, with an independent power over the military, as the kings had over the civil ſtate. The dukes were elective, the kings hereditary: for ſo only can be conſiſtently underſtood that paſſage of Tacitus, *Reges ex nobilitate, duces ex virtute ſumunt.* In conſtituting their kings, the family or blood royal was regarded; in chooſing their dukes or leaders, warlike merit: juſt as Cæſar relates of their anceſtors in his time, that whenever they went to war, by way either of attack or defence, they elected leaders to command them. This large ſhare of power, thus conferred by the people, though intended to preſerve the liberty of the ſubject, was perhaps unreaſonably detrimental to the prerogative of the crown: and accordingly we find a very ill uſe made of it by Edric duke of Mercia, in the reign of King Edmund Ironſide; who, by his office of duke or heretoch, was entitled to a large command in the king's army, and by his repeated treacheries at laſt transferred the crown to Canute the Dane.

It ſeems univerſally agreed by all hiſtorians, that King Alfred firſt ſettled a national militia in this kingdom, and by his prudent diſcipline made all the ſubjects of his dominions ſoldiers: but we are unfortunately left in the dark as to the particulars of this his ſo celebrated regulation; though, from what was laſt obſerved, the dukes ſeem to have been left in poſſeſſion of too large and independent a power: which enabled Duke Harold, on the death of Edward the Confeſſor, though a ſtranger to the royal blood, to mount for a ſhort ſpace the throne of this kingdom, in prejudice of Edgar Etheling the rightful heir.

Upon the Norman conqueſt, the feodal law was introduced here in all its rigour, the whole of which is built on a military plan. In conſequence thereof, all the lands in the kingdom were divided into what were called *knight's fees*, in number above 60,000; and for every knight's fee, a knight or ſoldier, *miles*, was bound to attend the king in his wars, for 40 days in a year; in which ſpace of time, before war was reduced to a ſcience, the campaign was generally finiſhed, and a kingdom either conquered or victorious. By this means the king had, without any expence, an army of 60,000 men always ready at his command. And accordingly we find one, among the laws of William the Conqueror, which in the king's name commands and firmly enjoins the perſonal attendance of all knights and others; *quod habeant et teneant ſe ſemper in armis et equis, ut decet et oportet: et quod ſemper ſint prompti et parati ad ſervitium ſuum integrum nobis explendum et peragendum, cum opus adfuerit, ſecundum quod debent de feodis et tenementis ſuis de jure nobis facere.* This perſonal ſervice in proceſs of time degenerated into pecuniary commutations or aids; and at laſt the military part of the feodal ſyſtem was aboliſhed at the Reſtoration, by ſtat. 12 Car. II. c. 24. See *FEODAL Syſtem.*

In the mean time, we are not to imagine that the kingdom was left wholly without defence in caſe of domeſtic inſurrections, or the proſpect of foreign invaſions. Beſides thoſe who by their military tenures were bound to perform 40 days ſervice in the field, firſt the aſſize of arms, enacted 27 Hen. II. and afterwards the ſtatute of Wincheſter, under Edward I. obliged every man, according to his eſtate and degree, to provide a determinate quantity of ſuch arms as were then in uſe, in order to keep the peace; and conſtables were appointed in all hundreds by the latter ſtatute, to ſee that ſuch arms were provided. Theſe weapons were changed, by the ſtatute 4 and 5 Ph. and M. c. 2. into others of more modern ſervice; but both this and the former proviſions were repealed in the reign of James I. While theſe continued in force, it was uſual from time to time for our princes to iſſue commiſſions of array, and ſend into every county officers in whom they could confide, to muſter and array (or ſet in military order) the inhabitants of every diſtrict; and the form of the commiſſion of array was ſettled in parliament in the 5 Hen. IV. But at the ſame time it was provided, that no man ſhould be compelled to go out of the kingdom at any rate, nor out of his ſhire, but in caſes of urgent neceſſity; nor ſhould provide ſoldiers unleſs by conſent of parliament. About the reign of King Henry VIII. and his children, lord-lieutenants began to be introduced, as ſtanding repreſentatives of the crown, to keep the counties in military order; for we find them mentioned as known officers in the ſtatute 4 and 5 Ph. and M. c. 3. though they had not been then long in uſe; for Camden ſpeaks of them in the time of Queen Elizabeth as extraordinary magiſtrates, conſtituted only in times of difficulty and danger.

In this ſtate things continued till the repeal of the ſtatutes of armour in the reign of King James I.; after which, when King Charles I. had, during his northern expeditions, iſſued commiſſions of lieutenancy, and exerted ſome military powers which, having been long exerciſed, were thought to belong to the crown, it became a queſtion in the long parliament, how far the power of the militia did inherently reſide in the king; being now unſupported by any ſtatute, and founded only upon immemorial uſage. This queſtion, long agitated with great heat and reſentment on both ſides, became at length the immediate cauſe of the fatal rupture between the king and his parliament: the two houſes not only denying this prerogative of the crown, the legality of which claim perhaps might be ſomewhat doubtful; but alſo ſeizing into their hands the entire power of the militia, the illegality of which ſtep could never be any doubt at all.

Soon after the reſtoration of King Charles II. when the military tenures were aboliſhed, it was thought proper to aſcertain the power of the militia, to recognize the ſole right of the crown to govern and command them, and to put the whole into a more regular method of military ſubordination: and the order in which the militia now ſtands by law, is principally built upon the ſtatutes which were then enacted. It is true, the two laſt of them are apparently repealed; but many of their proviſions

proviſions are re-enacted, with the addition of ſome new regulations, by the preſent militia laws; the general ſcheme of which is to diſcipline a certain number of the inhabitants of every county, choſen by lot for three years, and officered by the lord-lieutenant, the deputy lieutenants, and other principal landholders, under a commiſſion from the crown. They are not compellable to march out of their counties, unleſs in caſe of invaſion or actual rebellion, nor in any caſe compellable to march out of the kingdom. They are to be exereiſed at ſtated times: and their diſcipline in general is liberal and eaſy; but, when drawn out into actual ſervice, they are ſubject to the rigours of martial law, as neceſſary to keep them in order. This is the conſtitutional ſecurity which our laws have provided for the public peace, and for protecting the realm againſt foreign or domeſtic violence; and which the ſtatutes declare as eſſentially neceſſary to the ſafety and proſperity of the kingdom.

When the nation was engaged in war, more veteran troops and more regular diſcipline were eſteemed to be neceſſary, than could be expected from a mere militia; and therefore at ſuch times more rigorous methods were put in uſe for the raiſing of armies and the due regulation and diſcipline of the ſoldiery, which are to be looked upon only as temporary excreſcences bred out of the diſtemper of the ſtate, and not as any part of the permanent and perpetual laws of the kingdom. For martial law, which is built upon no ſettled principles, but is entirely arbitrary in its deciſions, is, as Sir Matthew Hale obſerves, in truth and reality no law, but ſomething indulged rather than allowed as a law. The neceſſity of order and diſcipline in an army is the only thing which can give it countenance; and therefore it ought not to be permitted in time of peace, when the king's courts are open for all perſons to receive juſtice according to the laws of the land. Wherefore, Thomas earl of Lancaſter being convicted at Pontefract, 15 Edward II. by martial law, his attainder was reverſed 1 Edward III. becauſe it was done in time of peace. And it is laid down, that if a lieutenant, or other, that hath commiſſion of martial authority, doth in time of peace hang or otherwiſe execute any man by colour of martial law, this is murder; for it is againſt *magna charta*. And the petition of right enacts, that no ſoldier ſhall be quartered on the ſubject without his own conſent; and that no commiſſion ſhall iſſue to proceed within this land according to martial law. And whereas, after the Reſtoration, King Charles II. kept up about 5000 regular troops, by his own authority, for guards and garriſons, which King James II. by degrees increaſed to no leſs than 30,000, all paid from his own civil liſt; it was made one of the articles of the bill of rights, that the raiſing or keeping a ſtanding army within the kingdom in time of peace, unleſs it be with conſent of parliament, is againſt law.

But as the faſhion of keeping ſtanding armies (which was firſt introduced by Charles VII. in France 1445) has of late years univerſally prevailed over Europe (though ſome of its potentates, being unable themſelves to maintain them, are obliged to have recourſe to richer powers, and receive ſubſidiary penſions for that purpoſe), it has alſo for many years paſt been annually judged neceſſary by our legiſlature for the ſafety of the kingdom, the defence of the poſſeſſions of the crown of Great Britain, and the preſervation of the balance of power in Europe, to maintain even in time of peace a ſtanding body of troops, under the command of the crown; who are however *ipſo facto* diſbanded at the expiration of every year, unleſs continued by parliament. And it was enacted by ſtatute 10 William III. c. 1. that not more than 12,000 regular forces ſhould be kept on foot in Ireland, though paid at the charge of that kingdom: which permiſſion is extended by ſtatute 8 Geo. III. c. 13. to 10,235 men in time of peace.

To prevent the executive power from being able to oppreſs, ſays Baron Monteſquieu, it is requiſite that the armies with which it is intruſted ſhould conſiſt of the people, and have the ſame ſpirit with the people: as was the caſe at Rome, till Marius new-modelled the legions by enliſting the rabble of Italy, and laid the foundation of all the military tyranny that enſued. Nothing then, according to theſe principles, ought to be more guarded againſt in a free ſtate, than making the military power, when ſuch a one is neceſſary to be kept on foot, a body too diſtinct from the people. Like ours, therefore, it ſhould wholly be compoſed of natural ſubjects; it ought only to be enliſted for a ſhort and limited time; the ſoldiers alſo ſhould live intermixed with the people; no ſeparate camp, no barracks, no inland fortreſſes ſhould be allowed. And perhaps it might be ſtill better, if, by diſmiſſing a ſtated number, and enliſting others at every renewal of their term, a circulation could be kept up between the army and the people, and the citizen and the ſoldier be more intimately connected together.

To keep this body of troops in order, an annual act of parliament likewiſe paſſes, "to puniſh mutiny and deſertion, and for the better payment of the army and their quarters." This regulates the manner in which they are to be diſperſed among the ſeveral inn-keepers and victuallers throughout the kingdom; and eſtabliſhes a law martial for their government. By this, among other things, it is enacted, that if any officer or ſoldier ſhall excite, or join any mutiny, or, knowing of it, ſhall not give notice to the commanding officer, or ſhall deſert, or liſt in any other regiment, or ſleep upon his poſt, or leave it before he is relieved, or hold correſpondence with a rebel or enemy, or ſtrike or uſe violence to his ſuperior officer, or ſhall diſobey his lawful commands; ſuch offender ſhall ſuffer ſuch puniſhment as a court martial ſhall inflict, though it extend to death itſelf.

However expedient the moſt ſtrict regulations may be in time of actual war, yet in times of profound peace, a little relaxation of military rigour would not, one ſhould hope, be productive of much inconvenience. And, upon this principle, though by our ſtanding laws (ſtill remaining in force, though not attended to) deſertion in time of war is made felony without benefit of clergy, and the offence is triable by a jury, and before the judges of the common law; yet, by our militia laws before mentioned, a much lighter puniſhment is inflicted for deſertion in time of peace. So, by the Roman law alſo, deſertion in time of war was puniſhed with death, but more mildly in time of tranquillity. But our mutiny act makes no ſuch diſtinction: for any of the faults above mentioned are, equally at all times, puniſhable with death itſelf, if a court martial ſhall think proper. This diſcretionary power of the court martial is indeed to be guided by the directions of the crown: which, with regard to military offences, has almoſt an abſolute legiſlative power. "His Majeſty (ſays the act) may form articles of war, and conſtitute courts martial, with power to try any crime by ſuch articles, and inflict ſuch penalties as the articles direct." A vaſt and moſt important truſt! an unlimited power to create crimes, and annex to them any puniſhments not extending to life or limb! Theſe are indeed forbidden to be inflicted, except for crimes declared to be ſo puniſhable by this act; which crimes we have juſt enumerated, and among which, we may obſerve, that any diſobedience to lawful commands is one. Perhaps in ſome future reviſion of this act, which is in many reſpects haſtily penned, it may be thought worthy the wiſdom of parliament to aſcertain the limits of military ſubjection, and to enact expreſs articles of war for the government of the army, as is done for the government of the navy; eſpecially as, by our preſent conſtitution, the nobility and gentry of the kingdom, who ſerve their country as militia officers, are annually ſubjected to the ſame arbitrary rule during their time of exerciſe.

Blackſt. Comment.

One of the greateſt advantages of our law is, that not only the crimes themſelves which it puniſhes, but alſo the penalties which it inflicts, are aſcertained and notorious: nothing is left to arbitrary diſcretion: the king by his judges diſpenſes what the law has previouſly ordained, but is not himſelf the legiſlator. How much, therefore, is it to be regretted, that a ſet of men, whoſe bravery has ſo often preſerved the liberties of their country, ſhould be reduced to a ſtate of ſervitude in the midſt of a nation of freemen; for Sir Edward Coke will inform us, that it is one of the genuine marks of ſervitude, to have the law, which is our rule of action, either concealed or precarious; *Miſera eſt ſervitus, ubi jus eſt vagum aut incognitum.* Nor is this ſtate of ſervitude quite conſiſtent with the maxims of ſound policy obſerved by other free nations. For the greater the general liberty is which any ſtate enjoys, the more cautious has it uſually been in introducing ſlavery in any particular order or profeſſion. Theſe men, as Baron Monteſquieu obſerves, ſeeing the liberty which others poſſeſs, and which they themſelves are excluded from, are apt (like eunuchs in the eaſtern ſeraglios) to live in a ſtate of perpetual envy and hatred towards the reſt of the community, and indulge a malignant pleaſure in contributing to deſtroy thoſe privileges to which they can never be admitted Hence have many free ſtates, by departing from this rule, been endangered by the revolt of their ſlaves; while, in abſolute and deſpotic governments, where no real liberty exiſts, and conſequently no invidious compariſons can be formed, ſuch incidents are extremely rare. Two precautions are therefore adviſed to be obſerved in all prudent and free governments: 1. To prevent the introduction of ſlavery at all: or, 2. If it be already introduced, not to intruſt thoſe ſlaves with arms who will then find themſelves an overmatch for the freemen. Much leſs ought the ſoldiery to be an exception to the people in general, and the only ſtate of ſervitude in the nation.

But as ſoldiers, by this annual act, are thus put in a worſe condition than any other ſubjects; ſo, by the humanity of our ſtanding laws, they are in ſome caſes put in a much better. By ſtatute 43 Eliz. c. 3. a weekly allowance is to be raiſed in every county for the relief of ſoldiers that are ſick, hurt, and maimed: not forgetting the royal hoſpital at Chelſea for ſuch as are worn out in their duty. Officers and ſoldiers, that have been in the king's ſervice, are by ſeveral ſtatutes, enacted at the cloſe of ſeveral wars, at liberty to uſe any trade or occupation they are fit for, in any town in the kingdom (except the two univerſities), notwithſtanding any ſtatute, cuſtom, or charter to the contrary. And ſoldiers in actual military ſervice may make nuncupative wills, and diſpoſe of their goods, wages, and other perſonal chattels, without theſe forms, ſolemnities, and expences, which the law requires in other caſes. Our law does not indeed extend this privilege ſo far as the civil law, which carried it to an extreme that borders upon the ridiculous: for if a ſoldier, in the article of death, wrote any thing in bloody letters on his ſhield, or in the duſt of the field with his ſword, it was a very good military teſtament.

MILITARY Court. See CHIVALRY, *Court of.*

MILITARY Tenures, See TENURE, *FEODAL Syſtem*, and KNIGHT.

MILITARY Ways (*viæ militares*), are the large Roman roads which Agrippa procured to be made through the empire in the time of Auguſtus, for the more convenient marching of troops and conveyance of carriages. N. Bergier has written the hiſtory of the origin, progreſs, and amazing extent, of theſe military roads, which were paved from the gates of Rome to the extreme parts of the empire. See WAY.

MILITIA, in general, denotes the body of ſoldiers, or thoſe who make profeſſion of arms.

In a more reſtrained ſenſe, militia denotes the trained bands of a town or country, who arm themſelves, upon a ſhort warning, for their own defence. So that, in this ſenſe, militia is oppoſed to regular or ſtated troops. See *MILITARY State*, and *FEODAL Syſtem.*

MILIUM, MILLET, a genus of plants, belonging to the triandria claſs; and in the natural method ranking under the 4th order, *Gramina.* See BOTANY *Index.*

MILK, a well known fluid, prepared by nature in the breaſts of women, and the udders of other animals, for the nouriſhment of their young.—According to Dr Cullen *, milk is a connecting and intermediate ſubſtance between animals and vegetables. It ſeems immediately to be ſecreted from the chyle, both being a white liquor of the ſame conſiſtence: it is moſt copiouſly ſecreted after meals, and of an aceſcent nature. In moſt animals who live on vegetables, the milk is aceſcent; and it is uncertain, though at the ſame time no obſervation proves the contrary, whether it is not ſo likewiſe in carnivorous animals. But, whatever be in this, it is certain, that the milk of all animals who live on vegetables is aceſcent. Milk being derived from the chyle, we thence conclude its vegetable nature; for in thoſe who live on both promiſcuouſly, more milk is got, and more quickly, from the vegetable than the animal food. Milk, however, is not purely vegetable; though we have a vegetable liquor that reſembles its taſte, conſiſtence, colour, aceſcency, and the ſeparability of the oily part, viz. an emulſion of the nuces oleoſæ and farinaceous ſubſtances. But theſe want the coagulable part of milk, which ſeems to

---

* *Lect. on Mat. Med.*

to be of animal nature, approaching to that of the coagulable lymph of the blood. Milk, then, ſeems to be of an intermediate nature, between chyle taken up from the inteſtines and the fully elaborated animal fluid.

Its contents are of three kinds: 1ſt, An oily part, which, whatever may be ſaid concerning the origin of other oils in the body, is certainly immediately derived from the oil of the vegetables taken in; as with theſe it agrees very exactly in its nature, and would entirely, if we could ſeparate it fully from the coagulable part. Another mark of their agreement is the ſeparability, which proves that the mixture has been lately attempted, but not fully performed. 2dly, Beſides this oily, there is a proper coagulable part: And, 3dly, Much water accompanies both, in which there is diſſolved a ſaline ſaccharine ſubſtance. Theſe three can be got ſeparate in cheeſe, butter, and whey; but never perfectly ſo, a part of each being always blended with every other part.

Nothing is more common, from what has been ſaid of its immediate nature, than to ſuppoſe that it requires no aſſimilation; and hence has been deduced the reaſon of its exhibition in the moſt weakly ſtate of the human body. But wherever we can examine milk, we always find that it coagulates, ſuffers a decompoſition, and becomes aceſcent. Again, Infants, who feed entirely on milk, are always troubled with eructations, which every body obſerves are not of the ſame quality with the food taken; and therefore it appears, that, like all other food, milk turns naturally aceſcent in the ſtomach, and only enters the chyle and blood in conſequence of a new recompoſition. It approaches then to the nature of vegetable aliment, but is not capable of its noxious vinous fermentation, and therefore has an advantage over it; neither from this quality, like animal food, is it heating in the ſtomach, and productive of fever; though at the ſame time, from its quantity of coagulable matter, it is more nouriſhing than vegetables.

Milk is the food moſt univerſally ſuited to all ages and ſtates of the body; but it ſeems chiefly deſigned by nature as the food of infants. When animals are in the fœtus ſtate, their ſolids are a perfect jelly, incapable of an aſſimilatory power. In ſuch ſtate nature has perfectly aſſimilated food, as the albumen ovi in the oviparous, and in the viviparous animals certainly ſomewhat of the ſame kind, as it was neceſſary the veſſels ſhould be filled with ſuch a fluid as would make way for an after aſſimilation. When the infant has attained a conſiderable degree of firmneſs, as when it is ſeparated from the mother, yet ſuch a degree of weakneſs ſtill remains as makes ſomewhat of the ſame indication neceſſary; it behoves the infant to have an alkaleſcent food ready prepared, and at the ſame time its noxious tendency to be avoided. Milk then is given, which is alkaleſcent, and, at the ſame time, has a ſufficient quantity of acidity to correct that alkaleſcency. As the body advances in growth, and the alkaleſcent tendency is greater, the animal, to obviate that tendency, is led to take vegetable food, as more ſuited to its ſtrength of aſſimilation.

Dr Cullen obſerves, that milk is ſuited to almoſt all temperaments; and it is even ſo to ſtomachs diſpoſed to aceſcency, more than thoſe ſubſtances which have undergone the vinous fermentation; nay, it even cures the heartburn, checks vinous fermentation; and precipitates the lees, when, by renewal of fermentation, the wine happens to be fouled. It therefore very properly accompanies a great deal of vegetable aliment: although ſometimes its aceſcency is troubleſome, either from a large proportion taken in, or from the degree of it; for, according to certain unaccountable circumſtances, different acids are formed in the ſtomach in different ſtates of the body; in a healthy body, *e. g.* a mild one; in the hypochondriac diſeaſe ſometimes, one of a very acrid quality. When the acidity of milk is carried to a great degree, it may prove remarkably refrigerant, and occaſion cold crudities, and the recurrence of intermittent fevers. To take the common notion of its paſſing unchanged into the blood, it can ſuffer no ſolution. But if we admit its coagulum in the ſtomach, then it may be reckoned among ſoluble or inſoluble foods, according as that coagulum is more or leſs tenacious. Formerly rennet, which is employed to coagulate milk, was thought an acid; but, from late obſervations, it appears, that, if it be an acid, it is very different from other acids, and that its coagulum is ſtronger than that produced by acids. It has been imagined, that a rennet is to be found in the ſtomachs of all animals, which cauſes coagulation of milk; but according to Dr Cullen the coagulation of milk ſeems to be owing to a weak acid in the ſtomach, the relicks of our vegetable food, inducing, in healthy perſons, a weak and ſoluble coagulum: but in different ſtomachs this may be very different, in theſe becoming heavy and leſs ſoluble food, and ſometimes even evacuated in a coagulated undiſſolved ſtate both by ſtomach and ſtool.

As milk is aceſcent, it may be rendered ſometimes purgative by mixing with the bile; and ſome examples of this have been remarked. More commonly, however, it is reckoned among thoſe foods which occaſion coſtiveneſs.

Hoffman, in his experiments on milk, found that all kinds of it contained much water; and when this was diſſipated, found the reſiduums very different in their ſolubility. But we muſt not thence conclude, that the ſame inſolubility takes place in the ſtomach; for extracts made from vegetables with water are often very inſoluble ſubſtances, and hardly diffuſible through water itſelf: thereforo, in Hoffman's extracts, if we may ſo call them, of milk, ſomewhat of the ſame kind might have appeared; and theſe ſubſtances, which in their natural ſtate were not ſo, might appear very inſoluble. However, we may allow that milk is always ſomehow inſoluble in the inteſtines, as it is of a drying nature, and as cheeſe, &c. is very coſtive. And this effect ſhows that milk is always coagulated in the ſtomach; for if it remained fluid, no fæces would be produced, whereas ſometimes very hard ones are obſerved. In the blood veſſels, from its animal nature, it may be conſidered as nutritious; but when we conſider its vegetable contents, and aceſcency in the primæ viæ, we find that, like animal food, it does not excite that degree of fever in the time of digeſtion, and that from its aceſcency it will reſiſt putrefaction. Hence its uſe in hectic fevers, which, whatever be their cauſe, appear only to be exacerbations of natural feveriſh paroxyſms, which occur twice every day, commonly after meals, and at night. To obviate theſe, therefore, we give ſuch an aliment as produces the leaſt exacerbation of theſe fevers: and of this nature is milk, on account of its aceſcent vegetable nature.

There appears alſo ſomewhat peculiar to milk, which requires only a ſmall exertion of the animal powers in order to its aſſimilation; and beſides, in hectic complaints there is wanted an oily, bland food, approaching to the animal nature; ſo that on all theſe accounts milk is a diet peculiarly adapted to them, and, in general, to moſt convaleſcents, and to thoſe of inflammatory temperaments. So far of milk in general. We ſhall now ſpeak of the particular kinds which are in common uſe.

The milks of women, mares, and aſſes, agree very much in their qualities, being very dilute, having little ſolid contents, and, when evaporated to dryneſs, having theſe very ſoluble, containing much ſaccharine matter, of a very ready aceſcency, and, when coagulated, their coagulum being tender and eaſily broke down. From this view they have leſs oil, and ſeem to have leſs coagulable matter than the reſt.

The milks of cows, ſheep, and goats, agree in oppoſite qualities to the three juſt mentioned; but here there is ſomewhat more of gradation. Cows milk comes neareſt to the former milk: goats milk is leſs fluid, leſs ſweet, leſs flatulent, has the largeſt proportion of inſoluble part after coagulation, and indeed the largeſt proportion of coagulable part; its oily and coagulable parts are not ſpontaneouſly ſeparable, never throwing out a cream, or allowing butter to be readily extracted from it. Hence the virtues of theſe milks are obvious, being more nouriſhing, though at the ſame time leſs eaſily ſoluble in weak ſtomachs, than the three firſt, leſs aceſcent than theſe, and ſo more rarely laxative, and peculiarly fitted for the diet of convaleſcents without fever. The three firſt again are leſs nouriſhing, more ſoluble, more laxative, as more aceſcent, and adapted to the convaleſcents with fever.

Theſe qualities, in particular milks, are conſiderably diverſified by different circumſtances. Firſt, Different animals, living on the ſame diet, give a conſiderable different milk; for there ſeems to be ſomething in the conſtitution, abſtracting from the aliment, which conſtitutes a conſiderable diverſity of milk, not only in the ſame ſpecies of animals, but alſo in the ſame animal, at different ages, and at different diſtances after delivery: this applies to the choice of nurſes. Secondly, Milk follows the nature of the aliment more than any other juice in the human body, being more or leſs fluid and dilute, more or leſs ſolid and nouriſhing, in proportion as theſe qualities are more or leſs in the aliment. The nature of the aliment differs according to its time of growth, *e. g.* old graſs being always found more nouriſhing than young. Aliment, too, is always varied according to the ſeaſon, as that is warm or dry, moiſt or cloudy.

The milk of each particular kind of animal is fitter for particular purpoſes, when fed on proper food.—Thus the cow delights in the ſucculent herbage of the vale: if the ſheep be fed there he certainly rots, but on the higher and more dry ſide of the mountain he feeds pleaſantly and healthy; while the goat never ſtops near the bottom, but aſcends to the craggy ſummit: and certainly the milks of theſe animals are always beſt on their proper ſoil, and that of goats is beſt on a mountainous country. From a diſſertation of Linnæus, we have many obſervations concerning the diverſity of plants on which each animal chooſes to feed. All the Swediſh plants which could be collected together, were preſented alternately to domeſtic animals, and then it appeared that the goat lived on the greateſt variety, and even on many which were poiſonous to the reſt; that the cow choſe the firſt ſucculent ſhoots of the plant, and neglected the fructification; which laſt was preferred by the goat. Hence may be deduced rules concerning the paſturage of different animals; *e. g.* Farmers find, that, in a paſture which was only fit to feed a certain number of ſheep, an equal number of goats may be introduced, while the ſheep are no leſs nouriſhed than before.

It is not eaſy to aſſign the difference between milk freſh drawn and that detained in the open air for ſome time: but certainly there is ſome material one, otherwiſe nature univerſally would not have directed infants to ſucking; and indeed it ſeems, better than the other, fitted for digeſtion and nouriſhment. Phyſicians have ſuppoſed that this depended on the evaporation of ſome *ſpt. rector*: but our author cannot conceive any ſuch, except common water here; and beſides, theſe volatile parts can hardly be nutritious. A more plauſible account ſeems deducible from mixture: milk new drawn has been but lately mixed, and is expoſed to ſpontaneous ſeparation, a circumſtance hurtful to digeſtion; none of the parts being, by themſelves, ſo eaſily aſſimilated as when they are all taken together. Hence, then, milk new drawn is more intimately blended, and therefore then is moſt proper to the weakly and infants.

Another difference in the uſe of milk expoſed for ſome time to the air, is taking it boiled or unboiled. Phyſicians have generally recommended the former; but the reaſon is not eaſily aſſigned. Perhaps it is this: Milk kept for ſome time expoſed to the air has gone ſo far to a ſpontaneous ſeparation; whereas the heat thoroughly blends the whole, and hence its reſolution is not ſo eaſy in the ſtomach; and thus boiled milk is more coſtive than raw, and gives more fæces. Again, When milk is boiled, a conſiderable quantity of air is detached, as appears from the froth on the ſurface; and air is the chief inſtrument of fermentation in bodies; ſo that after this proceſs it is not liable to aceſcency: for theſe reaſons it is proper for the robuſt and vigorous.

Another difference of milk is, according as it is fluid or coagulated. The coagulated is of two kinds, as induced by rennet, or the natural aceſcency of the milk. The former preparation makes the firmer and leſs eaſily ſoluble coagulum; though, when taken with the whey unſeparated, it is leſs difficult of ſolution, though more ſo than any other coagulum in the ſame caſe. Many nations uſe the latter form, which is eaſier ſoluble, but very much aceſcent, and therefore, in point of ſolution, ſhould be confined to the vigorous, in point of aceſcency, to thoſe who live on alkaleſcent food; and in the laſt caſe, the Laplanders uſe it as their chief aceſcent condiment. From the ſame conſiderations it is more cooling, and in its other effects like all other aceſcent vegetables.

Milk by evaporation yields a ſweet ſaline matter, of which Dr Lewis gives the following proportion :

Twelve ounces of	Left of dry matter	From which water extracted a ſweet ſaline ſubſtance amounting to
Cows milk	13 drachms.	1½ drachms.
Goats milk	12½	1½
Human milk	8	6
Aſſes milk	8	6

The ſaline ſubſtance extracted from aſſes milk was white, and ſweet as ſugar ; thoſe of the others brown or yellow, and conſiderably leſs ſweet ; that from cows milk had the leaſt ſweetneſs of any.

On diſtilling 12 quarts of milk *in balneo mariæ*, at leaſt nine quarts of pure phlegm were obtained ; the liquor which afterwards aroſe was acidulous, and by degrees grew ſenſibly more and more acid as the diſtillation was continued. After this came over a little ſpirit, and at laſt, an empyreumatic oil. The remaining ſolid matter adhered to the bottom of the retort, in the form of elegant ſhining black flowers, which being calcined and elixated yielded a portion of fixed alkaline ſalt.

Milk ſet in a warm place, throws up to the ſurface an unctuous cream, from which, by agitation, the butter is eaſily ſeparated. The addition of alkaline ſalts prevents this ſeparation, not (as ſome have ſuppoſed) by abſorbing an acid from the milk, but by virtue of their property of intimately uniting oily bodies with watery liquors. Sugar, another grand intermedium betwixt oils and water, has this effect in a greater degree, though that concrete is by no means alkaline, or an abſorbent of acids.

The ſweet ſaccharine part of the milk remains diſſolved in the whey after the ſeparation of the curd or cheeſy matter, and may be collected from it in a white cryſtalline form, by boiling the whey till all remains of the curdled ſubſtance have fallen to the bottom ; then filtering, evaporating it to a due conſiſtence, ſetting it to ſhoot, and purifying the cryſtals by ſolution in water and a ſecond cryſtallization. Much has been ſaid of the medicinal virtues of this ſugar of milk, but it does not ſeem to have any conſiderable ones : It is from cows milk that it has been generally prepared ; and the cryſtals obtained from this kind of milk have but little ſweetneſs.

When milk is ſuffered to coagulate ſpontaneouſly, the whey proves acid, and on ſtanding grows more and more ſo till the putrefactive ſtate commences. Sour whey is uſed as an acid, preferably to the directly vegetable or the mineral acids, in ſome of the chemical arts ; as for diſſolving iron in order to the ſtaining of linen and leather. This acid was commonly made uſe of in the bleaching of linen, for diſſolving and extracting the earthy particles left in the cloth by the alkaline ſalts and lime employed for cleanſing and whitening it. Butter milk is preferred to plain ſour milk or ſour whey : This laſt is ſuppoſed to give the cloth a yellow colour. Dr Home, in his ingenious treatiſe on this ſubject, recommends water acidulated with ſulphuric acid (in the proportion of about half an ounce, or at moſt three quarters of an ounce, to a gallon), as preferable in many reſpects to the acid of milk, or of the more directly vegetable ſubſtances.

He obſerves, that the latter are often difficultly procurable, abound with oleaginous particles, and haſten to corruption ; whilſt the vitriolic acid is cheap, and pure, and indiſpoſed to putrefy : That milk takes five days to perform its office, whilſt the vitriolic acid does it in as many hours, perhaps in as many minutes : That this acid contributes alſo to whiten the cloth, and does not make it weaker though the cloth be kept in it for months. He finds, that acid, as well as alkalies, extract an oily matter from the cloth, and loſe their acidity and alkalicity. Since this treatiſe appeared, the uſe of ſour milk is very generally ſuperſeded by oil of vitriol.

It is obſervable, that aſſes milk is greatly diſpoſed, on ſtanding for a little time, to become thick and ropy. In the Breſlaw collection for the year 1720, there is a remarkable account of milk (which probably was that of the aſs) grown ſo thick and tenacious as to be drawn out into long ſtrings, which, when dried, were quite brittle.

New cows milk, ſuffered to ſtand for ſome days on the leaves of butterwort or ſun-dew, becomes uniformly thick, ſlippery, and coherent, and of an agreeable ſweet taſte, without any ſeparation of its parts. Freſh milk, added to this, is thickened in the ſame manner, and this ſucceſſively. In ſome parts of Sweden, as we are informed in the Swediſh Memoirs, milk is thus prepared for food.

New milk has a degree of glutinous quality, ſo as to be uſed for joining broken ſtone ware. There is a far greater tenacity in cheeſe properly prepared.

Milk, when examined by a microſcope, appears compoſed of numerous globules ſwimming in a tranſparent fluid. It boils in nearly the ſame degree of heat with common water ; ſome ſorts rather ſooner, and ſome a little later : after boiling, it is leſs diſpoſed to grow ſour than in its natural ſtate. It is coagulated by acids both mineral and vegetable, and by alkalies both fixed and volatile. The coagulum made by acids falls to the bottom of the ſerum ; that made by alkalies ſwims on the ſurface, commonly forming (eſpecially with volatile alkalies) a thick coriaceous ſkin. The ſerum, with alkalies, proves green or ſanious ; with acids, it differs little in appearance from the whey that ſeparates ſpontaneouſly. The coagulum formed by acids is diſſolved by alkalies, and that formed by alkalies is rediſſolved by acids ; but the milk does not in either caſe reſume its original properties. It is coagulated by moſt of the middle ſalts, whoſe baſis is an earth or a metallic body ; as ſolution of alum, fixed ſal ammoniac, ſugar of lead, green and blue vitriol ; but not by the chalybeate or purging mineral waters, nor by the bitter ſalt extracted from the purging waters. Among the neutral ſalts that have been tried, there is not one that produces any coagulation. They all dilute the milk, and make it leſs diſpoſed to coagulate with acids or alkalies : Nitre ſeems to have this effect in a greater degree than the other neutral ſalts. It is inſtantly coagulated by highly rectified ſpirit of wine, but ſcarcely by a phlegmatic ſpirit. It does not mingle with expreſſed oils. All the coagula are diſſolved by gall.

It has generally been ſuppoſed by medical authors, that the milk of animals is of the ſame nature with chyle, and that the human milk always coagulates in the ſtomach of infants; but in a late diſſertation upon the ſubject by Mr Clarke, member of the Royal Iriſh Academy, we find both theſe poſitions controverted. According to him, women's milk, in a healthy ſtate, contains no coagulable, mucilaginous, or cheeſy principle, in its compoſition; or it contains ſo little, that it cannot admit of any ſenſible proof. Dr Rutty ſtates, that it does not afford even a ſixth part of the curd which is yielded by cows milk; and Dr Young denies that it is at all coagulable either by rennets or acids. This is confirmed by Dr Ferris, who in 1782 gained the Harveian prize medal at Edinburgh by a diſſertation upon milk. Mr Clarke informs us, that he has made a vaſt number of experiments upon women's milk with a view to determine this point. He made uſe of ardent ſpirits, all the different acids, infuſions of infants ſtomachs, and procured the milk of a great many different women; but in no inſtance, excepting one or two, did he perceive any thing like curd. This took place in conſequence of a ſpontaneous aceſcency; and only a ſmall quantity of ſoft flaky matter was formed, which floated in the ſerum. This he looked upon to be a morbid appearance.

Iriſh Tranſ. for 1788.

The general opinion that women's milk is coagulable has ariſen from a ſingle circumſtance, viz. that infants frequently vomit the milk they ſuck in a ſtate of apparent coagulation. This greatly perplexed Dr Young; who, after having tried in vain to coagulate human milk artificially, concluded, that the proceſs took place ſpontaneouſly in the ſtomach; and that it would always do ſo if the milk were allowed to remain in a degree of heat equal to about 96 degrees of Fahrenheit. Mr Clarke took equal quantities of three different kinds of milk, and put them into bottles ſlightly corked, and theſe bottles into water, the temperature of which was kept up by a ſpirit of wine lamp as near as poſſible to 96° of Fahrenheit: but after frequently examining each bottle during the courſe of the experiment, at the expiration of ſeveral hours there was not the ſmalleſt tendency towards coagulation to be perceived in any of them; the cream was only thrown to the ſurface in a thick and adheſive form, and entirely ſeparated from the fluid below, which had ſomething of a gray and wheyiſh appearance. As the matter vomited by infants is ſometimes more adheſive than we can ſuppoſe cream to be, Mr Clarke ſuppoſed that the curd might be ſo entangled with the cream, as to be with difficulty ſeparated from it; but having collected a quantity of rich cream from the milk of different women, he repeated the experiment with preciſely the ſame event, not being able in any one inſtance to produce the ſmalleſt quantity of curd. To determine, however, what effects might be produced upon milk by the ſtomach of an infant, Mr Clarke made the following experiment: Having taken out the ſtomach of a fœtus which had been deprived of life by the uſe of inſtruments, he infuſed it in a ſmall quantity of hot water, ſo as to make a ſtrong infuſion. He added a tea-ſpoonful of this infuſion to equal quantities of cows and human milk; the conſequence of which was, that the cow's milk was firmly coagulated in a ſhort time, but the human milk was not altered in the leaſt; neither was the leaſt coagulation produced by adding a ſecond and third ſpoonful to the human milk. "Upon the whole, then, (ſays Mr Clarke), I am perſuaded it will be found, that human milk, in an healthy ſtate, contains little or no curd, and that the general opinion of its nature and properties is founded upon fallacious analogy and ſuperficial obſervations made on the matter vomited by infants. We may preſume, that the cream of women's milk, by its inferior ſpecific gravity, will ſwim on the ſurface of the contents of the ſtomach; and being of an oily nature, that it will be of more difficult digeſtion than any other conſtituent part of milk. When an infant then ſucks very plentifully, ſo as to over-diſtend the ſtomach, or labours under any weakneſs in the powers of digeſtion, it cannot appear unreaſonable to ſuppoſe, that the cream ſhall be firſt rejected by vomiting. Analogous to this, we know that adults affected with dyſpepſia often bring up greaſy fluids from the ſtomach by eructation, and this eſpecially after eating fat meat. We have, in ſome inſtances, known this to blaze when thrown into the fire like ſpirit of wine or oil." Our author derives a confirmation of his opinion from the following obſervation, viz. that curds vomited by infants of a few days old are yellow, while they become white in a fortnight or three weeks. This he accounts for from the yellow colour of the cream thrown up by the milk of women during the firſt four or five days after delivery.

Mr Clarke likewiſe controverts that common opinion of the human milk being ſo prone to acidity, that a great number of the diſeaſes of children are to be accounted for from that principle. "Whoever (ſays he) takes the trouble of attentively comparing human milk with that of ruminant animals, will ſoon find it to be much leſs prone to run into the aceſcent or acid proceſs. I have very often expoſed equal quantities of human and cows milk in degrees of temperature, varying from the common ſummer heat, or 65°, to 100°; and I have conſtantly found that cows milk acquires a greater degree of acidity in 36 hours than the human did in many days: cows milk becomes offenſively putrid in four or five days; a change which healthy human milk, expoſed in the ſame manner, will not undergo in many weeks, nay, ſometimes in many months. I once kept a few ounces of a nurſe's milk, delivered about ſix or ſeven days, for more than two years in a bottle moderately corked. It ſtood on the chimney-piece, and was frequently opened to be examined. At the end of this period it ſhowed evident marks of moderate acidity, whether examined by the taſte, ſmell, or paper ſtained with vegetable blues or purples; the latter it changed to a florid red colour, whereas cows milk kept a few days changed the colour of the ſame paper to a green, thereby clearly ſhowing its putreſcent tendency."

Our author next goes on to conſider of the probability there is of milk becoming ſo frequently and ſtrongly acid as to occaſion moſt of the diſeaſes of infants. He begins with an attempt to ſhow that the phenomena commonly looked upon to be indications of acrimony are by no means certain. Curdled milk has already been ſhown to be no ſign of acidity; and the other appearance, which has commonly been thought to be ſo certain, viz. green fæces, is, in the opinion of Mr Clarke, equally fallacious. In ſupport of this he quotes a letter from Dr Sydenham to Dr Cole; in which he ſays, that the green matter vomited by hyſterical women is not any proof of acrid humours being the cauſe of that diſeaſe, for ſea-ſick people do the ſame. The opinion of green fæces being an effect of acidity, proceeds upon the ſuppoſition that a mixture of bile with an acid produces a green colour: but it is found, that the vegetable acid, which only can exiſt in the human body, is unable to produce this change of colour, though it can be effected by the ſtrong mineral acids. As nothing equivalent to any of theſe acids can be ſuppoſed to exiſt in the bowels of infants, we muſt therefore take ſome other method of accounting for the green fæces frequently evacuated by them. "Why ſhould ſour milk, granting its exiſtence, give riſe to them in infants and not in adults? Have butter milk, ſummer fruits of the moſt aceſcent kind, lemon or orange juice, always this effect in adults by their admixture with bile? This is a queſtion which, I believe, cannot be anſwered in the affirmative."

On the whole, Dr Clarke conſiders the diſeaſe of acidity in the bowels, though ſo frequently mentioned, to be by no means common. He owns indeed, that it may ſometimes occur in infancy as well as in adults, from weakneſs of the ſtomach, coſtiveneſs, or improper food; and an indubitable evidence is afforded by fæces which ſtain the blue or purple colour of vegetables to a red, though nothing can be inferred with certainty from the colour or ſmell.

The doctor next proceeds to ſtate ſeveral reaſons for his opinion, that the greater number of infantile diſeaſes are not owing to acidity; 1. Women's milk in a healthy ſtate contains little or no coagulable matter or curd. 2. It ſhows leſs tendency out of the body to become aceſcent than many other kinds of milk. 3. The appearances which have been generally ſuppoſed to characterize its acidity do not afford ſatiſfactory evidence of ſuch a morbid cauſe. 4. Granting this to be the caſe, we have plenty of mild abſorbents, capable of deſtroying all the acid which can be ſuppoſed to be generated in the bowels of an infant; yet many children are obſerved to die in conſequence of theſe diſeaſes ſuppoſed to ariſe from acidity. 5. Though the milk of all ruminant animals is of a much more aceſcent nature than that of the human ſpecies, yet the young of theſe animals never ſuffer any thing like the diſeaſes attributed to acidity in infants. 6. Hiſtory informs us that whole nations uſe ſour curdled milk as a conſiderable part of their food, without feeling any inconvenience; which, however, muſt have been the caſe, if acidity in the ſtomach were productive of ſuch deleterious effect as has been ſuppoſed.

The reaſoning of Dr Clarke ſeems here to be very plauſible, and nothing has as yet been offered to contradict it. The reviewers in taking notice of the treatiſe only obſerve, that the doctor's poſitions are ſupported by great probability; yet "they have ſeen them, or think they have ſeen them, contradicted by the appearance of diſeaſes and the effects of medicines;" ſo that they muſt leave the ſubject to farther examination.

In a memoir by Meſſrs Parmentier and Deyeux, members of the royal college of pharmacy, &c. in Paris, we have a great number of experiments on the milk of aſſes, cows, goats, ſheep, and mares, as well as women. The experiments on cows milk, were made with a view to determine whether any change was made in the milk by the different kinds of food eaten by the animal. For this purpoſe ſome were fed with the leaves of *maize* or Turkey wheat; ſome with cabbage; others with ſmall potatoes; and others with common graſs. The milk of thoſe fed with the *maize* or Turkey wheat was extremely ſweet; that from the potatoes and common graſs much more ſerous and inſipid; and that from the cabbages the moſt diſagreeable of all. By diſtillation only eight ounces of a colourleſs fluid were obtained from as many pounds of each of theſe milks; which from thoſe who fed upon graſs had an aromatic flavour; a diſagreeable one from cabbage; and none at all from the potatoes and Turkey wheat. This liquid became fetid in the ſpace of a month, whatever ſubſtance the animal had been fed with, acquiring at the ſame time a viſcidity and becoming turbid; that from cabbage generally, but not always, becoming firſt putrid. All of them ſeparated a filamentous matter, and became clear on being expoſed to the heat of 25° of Reaumur's thermometer. In the reſiduums of the diſtillation no difference whatever could be perceived. As the only difference therefore exiſting in cows milk lies in the volatile part, our authors conclude, that it is improper to boil milk either for common or medicinal purpoſes. They obſerved alſo that any ſudden change of food, even from a worſe to a better kind was attended by a very remarkable diminution in the quantity of milk. All the reſiduums of the diſtillations yielded, in a ſtrong fire, a yellow oil and acid, a thick and black empyreumatic oil, a volatile alkali, and towards the end a quantity of inflammable air, and at laſt a coal remained containing ſome fixed alkali with muriatic acid.

On agitating in long bottles the creams from the milk of cows fed with different ſubſtances, all of them were formed into a kind of half-made butter; of which that formed from the milk from maize was white, firm, and inſipid; that from potatoes was ſofter and more pinguedinous; but that from common graſs was the beſt of all. Cabbage, as in other caſes, gave a ſtrong taſte.

In the courſe of their experiments, it was endeavoured to determine whether butter is actually contained in the cream, or whether it be a chemical production of the operation of churning. They could not find any reaſon abſolutely ſatisfactory on either ſide, but incline to the latter opinion; becauſe when cream is allowed to remain among the milk, and the whole curdled promiſcuouſly, only fat cheeſe, without any butter, is produced. The oily parts cannot be ſeparated into butter either by acids or any other means than churning: even the artificial mixture of oil with the cream is inſufficient for the purpoſe.

The ſerum of milk was reduced by filtration to a clear and pellucid liquor; and, by mixture with fixed alkali, depoſited a portion of cheeſy matter which had been diſſolved in the whey. The ſugar of milk was alſo found in this liquor.

In their experiments upon the milk of various animals, it was found that the milk of aſſes yielded by diſtillation an inſipid liquor, and depoſited a liquor ſimilar to the lymph of cows milk. It is coagulated by all the acids, but not into an uniform maſs; exhibiting only the appearance of diſtinct flocculi. It affords but little cream, which is converted with difficulty into a ſoft butter that ſoon becomes rancid. It has but a ſmall quantity of ſaccharine particles, and theſe are often mixed with muriatic ſelenite and common ſalt. Goats milk has a thick cream, and agreeable to the taſte; and the milk itſelf may be preſerved longer in a ſound ſtate than any other ſpecies, the ſcum on its ſurface being naturally convertible into palatable cheeſe. It is eaſily made into firm butter, which does not ſoon become rancid, and has a good flavour. The butter milk contains a large quantity of cheeſy matter, which readily coagulates; but has ſtill leſs ſaccharine matter than that of aſſes. Sheeps milk can ſcarce be diſtinguiſhed from that of a cow, and eaſily parts with its cream by ſtanding. It is of a yellow colour, an agreeable flavour, and yields a great proportion of butter; but this is not ſolid, and ſoon becomes rancid. Mares milk is the moſt inſipid and leaſt nutritious of any; notwithſtanding which it has been much recommended for weak and conſumptive patients: in which caſes it is probable that it proves efficacious by being more conſonant than any other to the debilitated powers of digeſtion. It boils with a ſmaller fire than any other kind of milk, is eaſily coagulated, and the diſtilled water does not ſoon change its nature. It has but a ſmall quantity of cheeſy matter, and very few oily particles: the cream cannot be made into butter; and the whey contains about as much ſugar as cows or goats milk.

In this memoir our authors remark, that in order to augment the quantity, as well as to improve the quality, of the milk of animals, they ſhould be well fed, their ſtalls kept clean, and their litter frequently renewed: they ſhould be milked at ſtated hours, but not drained: great attention ſhould alſo be paid to the breed; becauſe inferior cattle are maintained at as great expence as the moſt valuable kinds. No change ought to be made in the food; though if the milk be employed for medicinal purpoſes, it may be improved by a proper mixture of herbs, &c.

In their experiments on women's milk, Meſſrs Parmentier and Deyeux differ ſomewhat from Dr Clarke. They firſt tried the milk of a woman who had been delivered four months; and obſerved, that after the cream had been ſeparated the other part appeared of a more perfect white, and that it could not be coagulated either by vinegar or mineral acids; which they attributed to a ſuperabundance of ſerum. But they found that in proportion to the age of the milk it was found to be more eaſily coagulable; and this was confirmed by experiments made upon the milk of 20 nurſes. Its coagulability was not increaſed by heat. The cream, by agitation, formed a viſcid unctuous matter, but could not be changed into perfect butter; but they found that it was extremely difficult to determine the proportions of the various component parts in human milk, as it differs remarkably, not only in different ſubjects, but in the ſame ſubject at different times. In a nurſe aged about 32 years, who was extremely ſubject to nervous affections, the milk was one day found almoſt quite colourleſs and tranſparent. In two hours after, a ſecond quantity drawn from the breaſt was viſcid like the white of an egg. It became whiter in a ſhort time, but did not recover its natural colour before the evening. It was afterwards found that theſe changes were occaſioned by her having ſome violent hyſteric fits in the mean time.

Sugar of MILK. Different methods have been propoſed for obtaining the ſugar of milk. The following is an account of a method uſed by ſome of the Tartar nations of preſerving their milk by means of froſt: in which operation great quantities of the ſugar of milk are accidentally formed. The account was given by Mr Fahrig of Peterſburgh, who undertook a journey, by order of the academy of Peterſburgh, among the Mogul tribes who inhabit the country beyond the lake Baikal, on the banks of the river Salenga. Theſe people allow their milk to freeze in large quantity in iron kettles; and, when it is perfectly congealed, they place them over a gentle fire to ſoften the edges of the cake, after which it may be taken out with a wooden ſpatula. They commence theſe operations at the beginning of the cold, when they have milk in the greateſt abundance; after which it may be preſerved with great eaſe throughout the whole winter. Mr Fahrig having frequent opportunities of ſeeing theſe cakes, ſoon obſerved, that the ſurface of them was covered to a conſiderable depth with a farinaceous powder; and having eſtabliſhed a dairy upon the ſame plan with thoſe of the Moguls, he found the ſame thing take place with himſelf. This powder was extremely ſweet, and he received platefuls of it from the natives, who uſed it in their food, and ſweetened their other victuals with it. Having cauſed a number of cakes of frozen milk to be conveyed to the top of his houſe, where they were directly expoſed to the violent cold, he found that the ſeparation of the ſaccharine powder was greatly promoted by this means. He ſcraped the cakes every week to the depth of two inches, and afterwards ſpread out the powder upon an earthen plate in order to deſtroy the remains of moiſture which might have prevented it from keeping for any length of time. When expoſed in this manner it had a very agreeable and ſtrong ſaccharine taſte; diſſolved in warm water; and when ſtrongly ſtirred by means of a chocolate ſtick, would at all times produce an excellent and well taſted milk. Raw milk affords a much larger quantity of this ſaccharine matter than ſuch as has been boiled, or which has had the cream taken off it. Neither muſt the milk be ſuddenly expoſed to the cold before it has loſt its natural heat; for the ſudden contact of the cold drives all the cheeſy and fat part towards the middle, while the external parts conſiſt of little elſe than water. In order to allow the parts of the milk to be all properly mixed together, Mr Fahrig allowed the milk when newly taken from the cows to cool, and then poured it out into ſhallow kettles.

Our author is of opinion that this method of making milk would be of great ſervice to navigators to ſupply themſelves with milk during long ſea voyages: and he aſſures us, from his own experience, that it will always ſucceed, if proper attention be paid to it. He is of opinion, however, that all countries are not equally proper for the preparation of this ſaccharine matter: and indeed this ſeems very evidently to be the caſe, as the proceſs appears to be a cryſtallization of the ſaccharine parts of the milk, and a ſeparation of them from the aqueous ones by means of extreme cold. The country in which he made the experiments is one of the moſt elevated in all Aſia; and ſo cold, that, though it lies only in the 50th degree of north latitude, its rivers are frozen up for ſix months of the year. A very dry cold wind alſo prevails throughout almoſt the whole year; and the dry winds generally come from the north, being almoſt always preceded by a warm wind from the ſouth, which blows for ſome time. The dry rarefied air increaſes the evaporation from the ice cakes, and leaves nothing but the ſaccharine or pure conſtituent parts of the milk, which with the addition of water can always recompoſe the fluid.

MILK, in the wine trade. The coopers know very well the uſe of ſkimmed milk, which makes an innocent and efficacious forcing for the fining down of all white wines, arracks, and ſmall ſpirits; but it is by no means to be uſed for red wines, becauſe it diſcharges their colour. Thus, if a few quarts of well ſkimmed milk be put into a hogſhead of red wine, it will ſoon precipitate the greater part of the colour, and leave the whole nearly white: and this is of known uſe in the turning of red wines, when pricked, into white; in which a ſmall degree of acidity is not ſo much perceived.

Milk is, from this quality of diſcharging colour from wines, of uſe alſo to the wine coopers, for the whitening of wines that have acquired a brown colour from the caſk, or from having been haſtily boiled before fermenting; for the addition of a little ſkimmed milk, in theſe caſes, precipitates the brown colour, and leaves the wines almoſt limpid, or of what they call a *water whiteneſs*, which is much coveted abroad in wines as well as in brandies.

MILK of Lime; Milk of Sulphur. The name of *milk* is given to ſubſtances very different from *milk* properly ſo called, and which reſemble milk only in colour. Such is water in which quicklime has been ſlaked, which acquires a whiteneſs from the ſmall particles of the lime being ſuſpended in it, and has hence been called the milk of *lime*. Such alſo is the ſolution of liver of *ſulphur*, when an acid is mixed with it, by which white particles of ſulphur are made to float in the liquor.

MILK of Vegetables. For the ſame reaſon that milk of animals may be conſidered as a true animal emulſion, the emulſive liquors of vegetables may be called *vegetable milks*. Accordingly emulſions made with almonds are commonly called *milk of almonds*. But beſides this vegetable milk, which is in ſome meaſure artificial, many plants and trees contain naturally a large quantity of emulſive or milky juices. Such are lettuce, ſpurge, fig tree, and the tree which furniſhes the elaſtic American reſin. The milky juices obtained from all theſe vegetables derive their whiteneſs from an oily matter, mixed and undiſſolved in a watery or mucilaginous liquor. Moſt reſinous gums were originally ſuch milky juices, which afterwards become ſolid by the evaporation of their more fluid and volatile parts.

MILK-Fever. See MEDICINE *Index*.

MILKY-Hedge, the Engliſh name of a ſhrub growing on the coaſt of Coromandel, where it is uſed for hedging. The whole ſhrub grows very buſhy, with numerous erect branches, which are compoſed of cylindrical joints as thick as a tobacco pipe, of a green colour, and from three to ſix inches long: the joints are thicker than the other parts, but always give way firſt on any accidental violence offered to the plant. When broken it yields a milk of an exceſſively cauſtic quality, which bliſters any part of the ſkin it touches. When the joints are broken off at each end, the tube then contains but very little milk. In this ſtate Mr Ives ventured to touch it with his tongue, and found it a little ſweet. In the hedges it is ſeldom very woody; but when it is, the wood is very ſolid, and the bark gray and cracked. This plant, he informs us, has acquired great reputation in curing the venereal diſeaſe, on the following account: A poor Portugueſe woman, the eldeſt female of her family, had wrought ſurpriſing cures in the moſt inveterate venereal diſorders, even ſuch as the European phyſicians had pronounced incurable. Theſe facts became ſo notorious, that the ſervants of the Company, and eſpecially their ſurgeons, were induced to offer her a very conſiderable premium for a diſcovery of the medicine; but ſhe always refuſed to comply, giving for a reaſon, that while it remained a ſecret, it was a certain proviſion for the maintenance of the family in the preſent as well as in future generations. On account of this denial the Engliſh ſurgeons were ſometimes at the pains to have her motions without doors carefully watched; and as they were not able to diſcover that ſhe ever gathered of any other plant or tree but this, they conjectured that the milk of this tree was the ſpecific employed. Mr Ives inquired at the black doctors concerning the virtues of this plant; who all agreed, that it will cure the lues venerea, but differed as to the manner of adminiſtering it; ſome ſaying that a joint of it ſhould be eaten every morning; others that the milk only ſhould be dropped upon ſugar; and then put into milk, oil, &c. and given daily to the patient.

MILKY-Way. See ASTRONOMY *Index*.

MILL, a machine for grinding corn, &c. of which there are various kinds, according to the different methods of applying the moving power; as water-mills, wind-mills, mills worked by horſes, &c. See MECHANICS *Index*.

The firſt obvious method of reducing corn into flour for bread would be by the ſimple expedient of pounding. And that was for ages the only one which was practiſed by the various deſcendants of Adam, and actually continued in uſe among the Romans below the reign of Veſpaſian. But the proceſs was very early improved by the application of a grinding power, and the introduction of millſtones. This, like moſt of the common refinements in domeſtic life, was probably the invention of the antediluvian world, and certainly practiſed in ſome of the earlieſt ages after it; and, like moſt of them, it was equally known in the eaſt and weſt. Hence the Gauls and Britons appear familiarly acquainted with the uſe of hand-mills before the time of their ſubmiſſion to the Romans; the Britons particularly

larly diſtinguiſhing them, as the Highlanders and we diſtinguiſh them at preſent, by the ſimple appellations of *querns*, *curnes*, or *ſtones*. And to theſe the Romans added the very uſeful invention of water mills. For this diſcovery the world is pretty certainly indebted to the genius of Italy; and the machine was not uncommon in the country at the conqueſt of Lancaſhire. This, therefore, the Romans would neceſſarily introduce with their many other refinements among us. And that they actually did, the Britiſh appellation of a *water-mill* fully ſuggeſts of itſelf; the *melin* of the Welſh and Corniſh, the *mull*, *meill*, and *melin* of the Armoricans, and the Iriſh *muilean* and *muilind*, being all evidently derived from the Roman *mola* and *molendinum*. The ſubject Britons univerſally adopted the Roman name, but applied it, as we their ſucceſſors do, only to the Roman *mill*; and one of theſe was probably erected at every ſtationary city in the kingdom. One plainly was at Mancheſter, ſerving equally the purpoſes of the town and the accommodation of the garriſon.—And one alone would be ſufficient, as the uſe of handmills remained very common in both, many having been found about the ſite of the ſtation particularly; and the general practice having deſcended among us nearly to the preſent period. Such it would be peculiarly neceſſary to have in the camp, that the garriſon might be provided againſt a ſiege. And the water-mill at Mancheſter was fixed immediately below the Caſtlefield and the town, and on the channel of the Medlock. There, a little above the ancient ford, the ſluice of it was accidentally diſcovered about 30 years ago. On the margin of Dyer's croft, and oppoſite to ſome new conſtructions, the current of the river, accidentally ſwelled with the rains, and obſtructed by a dam, broke down the northern bank, ſwept away a large oak upon the edge of it, and diſcloſed a long tunnel in the rock blow. This has been ſince laid open in part with a ſpade. It appeared entirely uncovered at the top, was about a yard in width, and another in depth, but gradually narrowed to the bottom. The ſides ſhowed everywhere the marks of the tool on the rock, and the courſe of it was parallel with the channel. It was bared by the flood about 25 yards only in length, but was evidently continued for ſeveral further; having originally begun, as the nature of the ground evinces, juſt above the large curve in the channel of the Medlock.

Whitaker's Hiſt. of Mancheſter.

For the firſt five or ſix centuries of the Roman ſtate, there were no public bread bakers in the city of Rome. They were firſt introduced into it from the eaſt, at the concluſion of the war with Perſeus, and about the year 167 before Chriſt. And, towards the cloſe of the firſt century, the Roman families were ſupplied by them every morning with freſh loaves for breakfaſt.—But the ſame cuſtom, which prevailed originally among the Romans and many other nations, has continued nearly to the preſent time among the Mancunians. The providing of bread for every family was left entirely to the attention of the women in it; and it was baked upon ſtones, which the Welſh denominate *greidiols* and we *gredles*. It appears, however, from the kiln-burnt pottery which has been diſcovered in the Britiſh ſepulchres, and from the Britiſh appellation of an *odyn* or *oven* remaining among us at preſent, that furnaces for baking were generally known among the original Britons. An odyn would, therefore, be erected at the manſion of each Britiſh baron, for the uſe of himſelf and his retainers. And, when he and they removed into the vicinity of a Roman ſtation, the oven would be rebuilt with the manſion, and the public bakehouſes of our towns commence at the firſt foundation of them. One bakehouſe would be conſtructed, as we have previouſly ſhown one mill to have been ſet up, for the public ſervice of all the Mancunian families. One oven and one mill appear to have been equally eſtabliſhed in the town. And the inhabitants of it appear immemorially accuſtomed to bake at the one and grind at the other. Both, therefore, were in all probability conſtructed at the firſt introduction of water-mills and ovens into the country. The great ſimilarity of the appointments refers the conſideration directly to one and the ſame origin for them. And the general nature of all ſuch inſtitutions points immediately to the firſt and actual introduction of both. And, as the ſame eſtabliſhments prevailed equally in other parts of the north, and pretty certainly obtained over all the extent of Roman Britain, the ſame erections were as certainly made at every ſtationary town in the kingdom.

Mill, *John*, a very learned divine, was born at Shap in Weſtmoreland, about the year 1645; and became a ſervitor of Queen's college, Oxford. On his entering into orders he became an eminent preacher, and was made prebendary of Exeter. In 1681, he was created doctor of divinity; about the ſame time he was made chaplain in ordinary to King Charles II. and in 1685 he was elected principal of St Edmund's hall in Oxford. His edition of the Greek Teſtament, which will ever render his name memorable, was publiſhed about a fortnight before his death, which happened in June 1707. Dr Mills was employed 30 years in preparing this edition.

MILLSTONE, the ſtone by which corn is ground.—The millſtones which we find preſerved from ancient times are all ſmall, and very different from thoſe in uſe at preſent. Thoreſby mentions two or three ſuch found in England, among other Roman antiquities, which were but 20 inches broad; and there is great reaſon to believe that the Romans, as well as the Egyptians of old, and the ancient Jews, did not employ horſes, or wind, or water, as we do, to turn their mills, but made their ſlaves and captives of war do this laborious work: they were in this ſervice placed behind theſe millſtones, and puſhed them on with all their force. Sampſon, when a priſoner to the Philiſtines, was treated no better, but was condemned to the millſtone in his priſon. The runner or looſe millſtone, in this ſort of grinding, was uſually very heavy for its ſize, being as thick as broad. This is the millſtone which is expreſsly prohibited in Scripture to take in pledge, as lying looſe it was more eaſily removed. The Talmudiſts have a ſtory, that the Chaldeans made the young men of the captivity carry millſtones with them to Babylon, where there ſeems to have been a ſcarcity at that time; and hence, probably, their paraphraſe renders the text "have borne the mills or millſtones;" which might thus be true in a literal ſenſe. They have alſo a proverbial expreſſion of a man with a millſtone about his neck; which they uſe to expreſs a man under the ſevereſt weight

weight of affliction. This alſo plainly refers to this ſmall ſort of ſtones.

Rheniſh MILSTONE, a ſtone which has been claſſed among volcanic products, on account of its appearance, which is a blackiſh gray, porous, and very much reſembling a lava of Mount Veſuvius.

MILLENARIANS, or CHILIASTS, a name given to thoſe in the primitive ages, who believed that the ſaints will reign on earth with Chriſt 1000 years. See MILLENNIUM.

MILLENER, or MILLINER, one who ſells ribbands and dreſſes, particularly head dreſſes for women; and who makes up thoſe dreſſes.

Of this word different etymologies have been given. It is not derived from the French. The French cannot expreſs the notion of *milliner*, otherwiſe than by the circumlocution *marchand* or *marchande des modes*.

Neither is it derived from the Low Dutch language, the great, but neglected, magazine of the Anglo-Saxon. For Sewell, in his Dictionary Engliſh and Dutch, 1708, deſcribes *millener* to be "en kraamer van lint en andere optoniſelon, Franſche kraamer;" that is, "a pedlar who ſells ribbands and other trimmings or ornaments; a French pedlar."

Littleton, in his Engliſh and Latin dictionary, publiſhed 1677, defines millener, "a jack of all trades;" q. d. *millenarius*, or *mille mercium venditor*; that is, "one who ſells a thouſand different ſorts of things." This etymology ſeems fanciful: But, if he rightly underſtood the vulgar meaning of the word *millener* in his time, we muſt hold that it then implied what is now termed "a haberdaſher of ſmall wares," one who dealt in various articles of petty merchandiſe, and who did not *make up* the goods which he ſold.

Before Littleton's time, however, a ſomewhat nicer characteriſtic than ſeems compatible with his notion, appears to have belonged to them; for Shakeſpeare, in his Henry IV. makes Hotſpur, when complaining of the daintineſs of a courtier, ſay,

> "He was *perfumed* like a milliner."

The fact ſeems to be, that there were milleners of ſeveral kinds: as, *horſe milleners*, (for ſo thoſe perſons were called who make ornaments of coloured worſted for horſes); haberdaſhers of ſmall wares, the *milleners* of Littleton; and *milleners* ſuch as thoſe now peculiarly known by that name, whether male or female, and to whom Shakeſpeare's alluſion ſeems moſt appropriate.

Laſtly, Dr Johnſon, in his dictionary, derives the word from *milaner*, an inhabitant of *Milan*, from whence people of this profeſſion firſt came, as a *Lombard* is a banker.

MILLE PASSUS, or *Millia Paſſuum*; a very common expreſſion among the ancient Romans for a meaſure of diſtance, commonly called a *mile*. *Milliarium*, rarely uſed. Which Heſychius made to conſiſt of ſeven ſtadia; Plutarch, little ſhort of eight; but many others, as Strabo and Polybius, make it juſt eight ſtadia. The reaſon of this difference ſeems to be, that the former had a regard to the Grecian foot, which is greater than the Roman or Italic. This diſtance is oftentimes called *lapis*, which ſee. Each paſſus conſiſted of five feet (Columella).

MILLENNIUM, "a thouſand years;" generally employed to denote the thouſand years, during which, according to an ancient tradition in the church, grounded on ſome doubtful texts in the Apocalypſe and other Scriptures, our bleſſed Saviour ſhall reign with the faithful upon earth after the firſt reſurrection, before the final completion of beatitude.

Though there has been no age of the church in which the millennium was not admitted by individual divines of the firſt eminence, it is yet evident from the writings of Euſebius, Irenæus, Origen, and others among the ancients, as well as from the hiſtories of Dupin, Moſheim, and all the moderns, that it was never adopted by the whole church, or made an article of the eſtabliſhed creed in any nation.

About the middle of the fourth century the Millennians held the following tenets:

1ſt, That the city of Jeruſalem ſhould be rebuilt, and that the land of Judea ſhould be the habitation of thoſe who were to reign on earth 1000 years.

2dly, That the firſt reſurrection was not to be confined to the martyrs; but that after the fall of Antichriſt all the juſt were to riſe, and all that were on the earth were to continue for that ſpace of time.

3dly, That Chriſt ſhall then come down from heaven, and be ſeen on earth, and reign there with his ſervants.

4thly, That the ſaints during this period ſhall enjoy all the delights of a terreſtrial paradiſe.

Theſe opinions were founded upon ſeveral paſſages of Scripture, which the Millenarians among the fathers underſtood in no other than a literal ſenſe, but which the moderns, who hold that opinion, conſider as partly literal and partly metaphorical. Of theſe paſſages, that upon which the greateſt ſtreſs has been laid, we believe to be the following:—"And I ſaw an angel come down from heaven, having the key of the bottomleſs pit, and a great chain in his hand. And he laid hold on the dragon, that old ſerpent, which is the devil and Satan, and bound him a *thouſand years*, and caſt him into the bottomleſs pit, and ſhut him up, and ſet a ſeal upon him, that he ſhould deceive the nations no more till *the thouſand years* ſhould be fulfilled; and after that he muſt be looſed a little ſeaſon. And I ſaw thrones, and they ſat upon them, and judgment was given unto them: and I ſaw the ſouls of them that were beheaded for the witneſs of Jeſus, and for the word of God, and which had not worſhipped the beaſt, neither his image, neither had received his mark upon their foreheads, or in their hands; and they lived and reigned with Chriſt a *thouſand years*. But the reſt of the dead lived not again till *the thouſand years were finiſhed*. This is the firſt reſurrection *." This paſſage all the ancient Millenarians took in a ſenſe groſsly literal; and taught, that during the millennium the ſaints on earth were to enjoy every bodily delight. The moderns, on the other hand, conſider the power and pleaſure of this kingdom as wholly ſpiritual; and they repreſent them as not to commence till after the conflagration of the preſent earth. But that this laſt ſuppoſition is a miſtake, the very next verſe except one aſſures us: for we are there told, that "when the thouſand years are expired, Satan ſhall be looſed out of his priſon, and ſhall go out to deceive the nations which are in the four quarters of *the earth*;" and we have no reaſon to

* Rom. xx. 1—6.

believe that he will have ſuch power or ſuch liberty in "the new heavens and the *new earth* wherein dwelleth righteouſneſs."

For this and other reaſons, which our limits will not permit us to enumerate, the moſt judicious critics contend, that the prophecies of the millennium point, not to a reſurrection of martyrs and other juſt men to reign with Chriſt a thouſand years in a viſible kingdom upon earth, but to that ſtate of the Chriſtian church, which, for a thouſand years before the general judgment, will be ſo pure and ſo widely extended, that, when compared with the ſtate of the world in the ages preceding, it may, in the language of Scripture, be called a reſurrection from the dead. In ſupport of this interpretation they quote two paſſages from St Paul, in which a converſion from Paganiſm to Chriſtianity, and a reformation of life, is called a reſurrection from the dead :—"Neither yield ye your members as inſtruments of unrighteouſneſs unto ſin ; but yield yourſelves unto God as thoſe that are *alive from the dead* * :" And again, "Wherefore he ſaith, Awake thou that ſleepeſt, and *ariſe from the dead*, and Chriſt ſhall give thee light †." It is likewiſe to be obſerved, that in all the deſcriptions of the reſurrection and future judgment which are given us at ſuch length in the goſpels and epiſtles, there is no mention made of a *firſt* and *ſecond* reſurrection at the diſtance of a thouſand years from each other. There is indeed an order in the reſurrection : for we are told ‡, that "every man ſhall riſe in his own order ; Chriſt the firſt fruits, afterwards they that are Chriſt's at his coming," &c. But were the millennarian hypotheſis well founded, the words ſhould rather have run thus : "Chriſt the firſt fruits, then the martyrs at his coming, and a thouſand years afterwards the reſidue of mankind. Then cometh the end," &c.

Theſe arguments ſtrongly incline us to believe, that by the reign of Chriſt and the ſaints for a thouſand years upon earth, nothing more is meant, than that before the general judgment the Jews ſhould be converted, genuine Chriſtianity be diffuſed through all nations, and mankind enjoy that peace and happineſs which the faith and precepts of the goſpel are calculated to confer on all by whom they are ſincerely embraced.

Our Saviour's own account of his religion is, that from a ſmall beginning it will increaſe to the full harveſt. The millennium therefore is to be conſidered as the full effect of the Chriſtian principles in the hearts of men, and over the whole world ; and the divines who have treated of this ſubject endeavour to prove, that this is to be expected from the facts which have already exiſted, and from the importance of the Chriſtian doctrine.

1. The gradual progreſs of Chriſtianity is no objection to this fact. This is ſimilar to the progreſs and advancement from leſs to greater perfection in every thing which poſſeſſes vegetable or animal life. The ſame thing is obſerved in the arts, in civilization, in ſocieties, and in individuals—and why ſhould it not be admitted to have place in religion ? There is, indeed, a general principle on which a gradual progreſſion, both in the natural and moral world, is founded. The Almightly never employs ſupernatural means where the thing can be accompliſhed by thoſe which are natural. This idea is of the moſt general extent through the whole of the preſent ſyſtem of nature. The poſſibility of another plan could eaſily be admitted ; but in this caſe there would be a total alteration of every part of the works of God or of man that we are acquainted with. In the ſame manner, if the religion of Chriſt had been irreſiſtible, it would have totally altered its natural conſequences. It was neceſſary, therefore, from the preſent condition of man, as an active, intelligent, and accountable being, that means ſhould be employed ; and wherever means are employed, the effects produced muſt be gradual, and not inſtantaneous.

2. Though the progreſs of a divine revelation be gradual, yet it is to be expected, from the wiſdom and compaſſion of God, that it will ſtill be advancing in the hearts of men, and over the world. In the firſt age of the church, the word of God, ſupported by miracles, and by the animated zeal of men who ſpake what they ſaw and heard, grew and prevailed. In this caſe ſupernatural means were neceſſary, becauſe the prejudices of the world could not be ſubdued without them. It was the firſt watering of a plant which you afterwards leave to the dew of heaven. Miracles at the ſame time were employed only as the means of conviction ; and they were not continued, becauſe in this caſe they would have become a conſtant and irreſiſtible principle, incompatible with the condition of man as a reaſonable agent. After this power was withdrawn, there were many ages of ignorance and ſuperſtition in the Chriſtian church. But what is neceſſary to be eſtabliſhed on this ſubject is, not that the progreſs of Chriſtianity has never been interrupted, but that on the whole it has been advancing. The effects of this religion on mankind, in proportion as it was received, were immediate and viſible : It deſtroyed the groſs ſuperſtition of idol worſhip ; it aboliſhed the practice, which was general in the heathen world, of reducing to the loweſt ſtate of ſervitude the greateſt part of our brethren ; it ſoftened the horrors of war, even when the vices of mankind made defence neceſſary ; it entered into ſocial and private life, and taught men benevolence, humanity, and mercy. It is in theſe bleſſed effects that we can obſerve the progreſs of Chriſtianity even to this day. Superſtition and idolatry were ſoon engrafted on the ſtem which our Saviour planted in the world ; but the ſimplicity of the goſpel has been gradually undermining the fabric of ſuperſtition ; and the men who are moſt nearly intereſted in the deceit are now almoſt aſhamed to ſhow their faces in the cauſe. The practice of ſlavery has, generally ſpeaking, been extinguiſhed in the Chriſtian world ; yet the remains of it have been a diſgrace to the Chriſtian name, and the profeſſors of that religion have now begun to ſee the inconſiſtency. War is not only carried on with leſs animoſity, and leſs havock of the human ſpecies ; but men begin to cultivate more generally, and to delight in, the arts of peace. The increaſing ſpirit of charity and benevolence, of which it were eaſy to give unexampled inſtances in the preſent age, is a decided proof of the increaſing influence of Chriſtianity. At the ſame time, if, inſtead of theſe general principles, we were to deſcend to private examples of infidelity or of wickedneſs, it would be eaſy to bring proofs in ſupport of an oppoſite opinion : but the reaſoning would by no means be equally concluſive ; for if the general principles by which ſociety is regulated be more liberal and merciful,

---

* Rom. vi. 13.

† Eph v. 14.

‡ 1 Cor. xv. 23.

it is evident that there is more goodneſs in a greater number of the human race. Society is nothing more than a collection of individuals; and the general tone, eſpecially when it is on the ſide of virtue, which almoſt in every inſtance oppoſes the deſigns of leading and intereſted men, is a certain evidence of the private ſpirit. To ſhow that this reformation is connected with Chriſtianity, it is unneceſſary to ſtate any compariſon between the influence of heathen, and the influence of Chriſtian principles: between civilization as depending on the powers of the human underſtanding, and on the efficacy of the word of God. The whole of this controverſy may be appealed to an obvious fact, viz. that as any nation has come nearer to the ſimplicity of the goſpel in the ſtandard of its worſhip, it has been more poſſeſſed of thoſe national virtues which we have aſcribed to the influence of Chriſtianity. This fact is worth a thouſand volumes of ſpeculation on this ſubject.

3. A revelation ſanctioned by God, for a benevolent purpoſe, will be expected to produce effects correſponding to the wiſdom which gave it, and to the purpoſe for which it is employed. It may be gradual; but it will be increaſing, and it muſt increaſe, to the full harveſt. He that has begun the good work will alſo finiſh it. It is reaſonable to expect this illuſtrious ſucceſs of the goſpel, both from the nature of the thing, and from the prophecies contained in the ſacred ſcriptures. The precepts of the goſpel, in their genuine ſenſe, are admirably calculated for the peace and welfare both of individuals and ſociety. The greateſt liberality of mind, the greateſt generoſity of temper, the moſt unbounded love, and the greateſt indifference to the accumulation of this world's property, if they glowed from breaſt to breaſt, and operated with equal force on all men, would be productive of equal good and happineſs to all. We are ſcarcely able to perceive the force of this at firſt view, becauſe the deceit and impoſition which yet exiſt in the world, prevent the operation of the beſt principles even in the beſt hearts. But in proportion to the improvement of mankind, what is their real intereſt, and what are the real objects of happineſs, will gradually unfold. The contempt of vice will be greater in proportion to the ſcarcity of it: for one villain gives countenance and ſupport to another, juſt as iron ſharpeneth iron. This opens to our view another fact connected with the practice of Chriſtianity, namely, that the nearer it arrives to its perfect ſtate, it will be the more rapid in its progreſs. The beauty of holineſs will be more viſible; and, in the ſtrong language of the prophet, "the earth ſhall bring forth in one day, and a nation ſhall be born at once [*]." This future perfection of the goſpel is conſiſtent with its nature and importance.—We can ſcarcely believe that means ſo admirably adapted to the reformation of mankind ſhould be without their effect; and if the moſt difficult part be already accompliſhed, we have no reaſon to apprehend that the ſcheme will not be completed. This fact is alſo clearly the ſubject of ancient prophecy. For "thus ſaith the Lord [†], I will extend peace to her like a river, and the glory of the Gentiles like a flowing ſtream. And it ſhall come to paſs, from one ſabbath to another, and from one new moon to another, ſhall all fleſh come to worſhip before me, ſaith the Lord."—"Violence ſhall be no more heard in thy land, waſting nor deſtruction within thy border; but thou ſhalt call thy walls ſalvation, and thy gates praiſe." (Iſ. lx. 18.)

Without entering more minutely on the prophecy already quoted from chap. xx. of the book of the Revelation, it is ſufficient to obſerve, that Dr Whitby, in his treatiſe on the millennium at the end of his commentary, proves, in the cleareſt manner, from the ſpirit of the paſſage and the ſimilarity of the expreſſions with thoſe of other prophets, that it refers to a ſtate of the church for a thouſand years, which ſhall be like life from the dead. The commencement of this period is connected with two events: the fall of antichriſt, and the converſion of the Jews. The latter of theſe events muſt be conſidered as a key to all the prophecies concerning the millennium. As the Jews were the ancient people of God, and as their converſion is to be the previous ſtep to the general knowledge of Chriſtianity, the prophecies of the millennium have a chief relation to this important event. We have already obſerved, that God never interpoſes with miraculous power to produce what can be effected by natural means; and from what we know of human nature, we cannot but perceive that the converſion of the Jews will powerfully operate to the general converſion of mankind. Freed from thoſe prejudices which now make them the objects of hatred in all nations, and fired with that zeal by which new converts are always actuated, they will preach the goſpel with a fervour of which we, who have long been bleſſed with its rays, can hardly form a conception; and, by their preſent diſperſion over the whole earth, they will be enabled to adapt their inſtructions to every individual of the human race in the language of his fathers. Indeed, if they are not at ſome future period to be employed by Providence for this purpoſe, it is difficult, if not impoſſible, to give any reaſon for their diſperſed ſtate and political exiſtence. Juſt now it muſt be confeſſed that they are the moſt implacable enemies of the Chriſtian name; but their converſion is not on that account more unlikely or improbable than were events which have taken place of nearly equal importance a very few years ago. On the whole, the perfection of Chriſtianity is a doctrine of reaſonable expectation to the church; and it is impoſſible for the advocates for natural religion to deny, that unlimited obedience to its precepts is conſiſtent with the pureſt ſtate of liberty and of happineſs. This is the only millennium which the prophets and apoſtles, as we underſtand them, promiſe to the ſaints; but as men figuring in the very firſt ranks of learning have thought otherwiſe, we would not be too confident that our interpretation is juſt.—Such of our readers as wiſh for further information, will find it in the works of Mr Mede, Biſhop Newton, Dr Whitby and Dr Gill; and to thoſe maſterly writers we refer them for that ſatisfaction which in ſuch an article as this cannot be given.

MILLEPES, or WOOD-LOUSE; a ſpecies of ONISCUS. See ENTOMOLOGY *Index*.

MILLEPORA, in *Natural Hiſtory*, a name by which Linnæus diſtinguiſhes that genus of lithophytes, of a hard ſtructure and full of holes, which are not ſtellated or radiated, and whoſe animal is the hydra, in which it differs from the madrepora, and comprehending 14 different ſpecies.

In the millepora, the animal which forms and inhabits it occupies the ſubſtance; and it is obſerved that the

---

[*] Iſ. lxvi. 8.

[†] Ver. 12. 23.

the milleporæ grow upon one another; their little animals produce their ſpawn; which attaching itſelf either to the extremity of the body already formed, or underneath it, gives a different form to this production. Hence the various ſhapes of the millepora, which is compoſed of an infinite number of the cells of thoſe little inſects, which all together exhibit different figures, though every particular cellula has its eſſential form, and the ſame dimenſions, according to its own ſpecies.

MILLET. See Milium, Botany *Index*.

MILLIARE, or Milliarium, a Roman mile, which conſiſted of 1000 paces, *mille paſſus*, whence the name.

MILLIARIUM aureum, was a gilded pillar in the forum of Rome, at which all the highways of Italy met, as one common centre. From this pillar the miles were counted, and at the end of every mile a ſtone was put down. The milliary column was erected by Auguſtus Cæſar, and, as we are informed by travellers, is ſtill to be ſeen.

MILLING of Cloth. See Fulling.

MILLION, in *Arithmetic*, the ſum of ten hundred thouſand, or a thouſand times a thouſand. See Arithmetic.

MILLO, a part of Mount Zion at its extremity; and therefore called *Millo* of the city of David (2 Chron. xxxii.), taken in with the wall that encompaſſed Mount Zion. Uncertain whether *Beth Millo*, (Judges ix. 20.) denotes a place; if it did, it lay near Sechem.

MILLOT, Claude Francis Xavier, of the French academy, was born at Beſançon, March 1726, and was for ſome time a Jeſuit. He was conſecrated for the pulpit, and continued to preach after he left the ſociety: But the weakneſs of his voice, his timidity, and the awkwardneſs of his manner, not permitting him to continue in this profeſſion, he relinquiſhed it, although he had preached Advent ſermons at Verſailles, and Lent ſermons at Luneville. The marquis de Felino, miniſter of Parma, inſtituted an hiſtorical claſs for the benefit of the young nobility; and, at the deſire of M. le Duc de Nivernois, he gave the charge of it to the abbé Millot. The miniſter having occaſioned a kind of rebellion among the people by ſome innovations which he had made in the ſtate, the abbé continued attached to the intereſts of his patron, and would not deſert him till the ſtorm was blown over. When he was told that he would loſe his place by this conduct, he replied, "My place is with a virtuous perſecuted man who has been my benefactor; and that I ſhall never loſe." At length, having filled the hiſtorical chair with great approbation, he returned to France, and was appointed preceptor to M. le Duc d'Enghien. In this ſituation he died, A. D. 1785, aged 59. The abbé Millot did not ſhine in company; he was cold and reſerved in his manner; but every thing he ſaid was judicious, and exactly in point.—D'Alembert ſaid, that of all his acquaintance the abbé Millot had the feweſt prejudices and the leaſt pretenſion. He compoſed ſeveral works, which are digeſted with great care, and written in a pure, ſimple, and natural ſtyle. The principal are, 1. *Elemens de l'Hiſtoire de France, depuis Clovis juſqu' à Louis XIV.* 3 vols. in 12mo. The author, ſelecting the moſt curious and important facts, has ſuppreſſed every thing foreign to the ſubject; and has not only arranged the materials in their proper order, but choſen them with the greateſt judgment. Querlon thought this the beſt abridgement which we have of the hiſtory of France, and preferred it to that of the preſident Henault. 2. *Elemens de l'Hiſtoire d'Angleterre depuis ſon origine ſous les Romains, juſqu' à George II.* 3 vols. 12mo. In this valuable abridgement, the author ſatisfies, without tiring, his readers. It is all that is neceſſary for thoſe who wiſh to gain a general knowledge of the Engliſh hiſtory, without entering minutely into its particular parts.—3. *Elemens de l'Hiſtoire Univerſelle*, 9 vols. 12mo. A certain critic maintains, that this work is merely a counterfeit of Voltaire's general hiſtory. But this cenſure is altogether unjuſt. The ancient hiſtory in this work is wholly compoſed by the abbé Millot; and, no leſs than the modern part, diſcovers his abilities in the choice of facts, in diveſting them of uſeleſs circumſtances, in relating them without prejudice, and in adorning them with judicious reflections. 4. *L'Hiſtoire des Troubadours*, 3 vols. 12mo, compiled from the manuſcripts of M. de Saint Palaie. This work appears rather tedious, becauſe it treats of men almoſt unknown, and moſt of them deſerving to be ſo. What is there quoted from the Provençal poets is not at all intereſting; and, according to the obſervation of a man of wit, "it ſerves no purpoſe to ſearch curiouſly into a heap of old ruins while we have modern palaces to engage our attention." 5. *Memoires Politiques et Militaires pour ſervir à l'Hiſtoire de Louis XIV. et de Louis XV.* compoſed from original papers collected by Adrian Maurice duc de Noailles, marſhal of France, in 6 vols. 12mo. 6. The abbé Millot publiſhed alſo ſeveral Diſcourſes, in which he diſcuſſes a variety of philoſophical queſtions, with more ingenuity of argument than fire of expreſſion; and a tranſlation of the moſt ſelect harangues in the Latin hiſtorians; of which it has been remarked, as well as of the orations of the abbé d'Olivet, that they are coldly correct, and elegantly inſipid. The character of the author, more prudent and circumſpect than lively and animated, ſeldom elevated his imagination above a noble ſimplicity without warmth, and a pure ſtyle without oſtentation. Some of the critics, however, have accuſed him of declamation in ſome parts of his hiſtories, particularly in thoſe parts which concern the clergy. But, in our opinion, the word declamation is totally inapplicable to the writings of the abbé Millot. He flatters, it is true, neither prieſts nor ſtateſmen; and he relates more inſtances of vicious than virtuous actions, becauſe the one are infinitely more common than the other: But he relates them coldly; and he appears to be guided more by ſincerity and a love of truth, than by that partial philoſophy which blames the Chriſtian religion for thoſe evils which it condemns.

MILO, a celebrated athlete of Crotona in Italy. His father's name was Diotimus. He early accuſtomed himſelf to carry the greateſt burdens, and by degrees became a prodigy of ſtrength. It is ſaid that he carried on his ſhoulders a young bullock, four years old, for above forty yards; and afterwards killed it with one blow of his fiſt, and eat it up in one day. He was ſeven times crowned at the Pythian games, and ſix at the Olympian. He preſented himſelf a ſeventh time; but no one had the courage or boldneſs to enter the liſts againſt him. He was one of the diſciples of Pythagoras; and to his uncommon ſtrength, it is ſaid, the learned preceptor and his pupils owed their life: The pillar which ſupported the roof of the ſchool ſuddenly gave way; but Milo ſupported the whole weight of the building, and gave the philoſopher and his auditors time to eſcape. In his old age, Milo attempted to pull up a tree by the roots, and break it. He partly effected it; but his ſtrength being gradually exhauſted, the tree when half cleft re-united, and his hands remained pinched in the body of the tree. He was then alone; and, being unable to diſentangle himſelf, he was devoured by the wild beaſts of the place, about 500 years before the Chriſtian era.

Milo, *T. Annius*, a native of Lanuvium, who attempted to obtain the conſulſhip at Rome by intrigue and ſeditious tumults. Clodius the tribune oppoſed his views; yet Milo would have ſucceeded but for the following event: As he was going into the country, attended by his wife and a numerous retinue of gladiators and ſervants, he met on the Appian road his enemy Clodius, who was returning to Rome with three of his friends and ſome domeſtics completely armed.—A quarrel aroſe between the ſervants. Milo ſupported his attendants, and the diſpute became general.—Clodius received many ſevere wounds, and was obliged to retire to a neighbouring cottage. Milo purſued his enemy in his retreat, and ordered his ſervants to deſpatch him. The body of the murdered tribune was carried to Rome, and expoſed to public view. The enemies of Milo inveighed bitterly againſt the violence and barbarity with which the ſacred perſon of a tribune had been treated. Cicero undertook the defence of Milo; but the continual clamours of the friends of Clodius, and the ſight of an armed ſoldiery, which ſurrounded the ſeat of judgment, ſo terrified the orator, that he forgot the greateſt part of his arguments, and the defence he made was weak and injudicious.—Milo was condemned, and baniſhed to Maſſilia. Cicero ſoon after ſent his exiled friend a copy of the oration which he had prepared for his defence, in the form in which we have it now; and Milo, after he had read it, exclaimed, *O Cicero, hadſt thou ſpoken before my accuſers in theſe terms, Milo would not be now eating figs at Marſeilles.* The friendſhip and cordiality of Cicero and Milo were the fruits of long intimacy and familiar intercourſe. It was to the ſucceſsful labours of Milo that the orator was recalled from baniſhment, and reſtored to his friends.

Milo, (anciently *Melos*), an iſland in the Archipelago, about 50 miles in circumference, with a harbour, which is one of the largeſt in the Mediterranean. The principal town is of the ſame name as the iſland, and was prettily built, but abominably naſty: the houſes are two ſtories high, with flat roofs; and are built with a ſort of pumice ſtone, which is hard, blackiſh, and yet very light.

This iſland was formerly rich and populous. From the earlieſt times of antiquity it enjoyed pure liberty. The Athenians, not being able to perſuade the Melians to declare in their favour in the Peloponneſian war, made a deſcent upon the iſland, and attacked them vigorouſly. In two different expeditions they failed of their purpoſe: but returning with more numerous forces, they laid ſiege to Melos; and obliging the beſieged to ſurrender at diſcretion, put to the ſword all the men who were able to bear arms. They ſpared only the women and children, and theſe they carried into captivity. This act of cruelty puts humanity to the bluſh, and diſgraces the Athenian name. But war was then carried on with a degree of wild rage, unexampled in the preſent times. Republics know not how to pardon, and always carry their vengeance to an extravagant height. When Lyſander, the Lacedæmonian general, came to give law to the Athenians, he expelled the colony which they had ſent to Melos, and re-eſtabliſhed the unfortunate remains of its original inhabitants.

This iſland loſt its liberty when Rome, aſpiring to the empire of the world, conquered all the iſles of the Archipelago. In the partition of the empire, it fell to the ſhare of the eaſtern emperors, was governed by particular dukes, and was at laſt conquered by Soliman II. Since that period, it has groaned under the yoke of Turkiſh deſpotiſm, and has loſt its opulence and ſplendour. At the commencement of the preſent century, it boaſted of 17 churches and 11 chapels, and contained more than 20,000 inhabitants. It was very fertile in corn, wine, and fruits; and the whole ſpace from the town to the harbour, which is nearly two miles, was laid out in beautiful gardens. M. Tournefort, who viſited it in the year 1700, gives a fine deſcription of it. "The earth, being conſtantly warmed by ſubterraneous fires, produced almoſt without interruption plenteous crops of corn, barley, cotton, exquiſite wines, and delicious melons. St Elias, the fineſt monaſtery in the iſland, and ſituated on the moſt elevated ſpot, is encircled with orange, citron, cedar, and fig trees. Its gardens are watered by a copious ſpring. Olive trees, of which there are but few in the other parts of the iſland, grow in great numbers around this monaſtery. The adjacent vineyards afford excellent wine. In a word, all the productions of the iſland are the very beſt of their kinds; its partridges, quails, kids, and lambs, are highly valued, and yet may be bought at a very cheap price."

Were M. Tournefort to return to Milo, M. Savary * aſſures us, he would no longer ſee the fine iſland which he has deſcribed. "He might ſtill ſee alum, in the form of feathers, and fringed with ſilver thread, hanging from the arches of the caverns; pieces of pure ſulphur filling the clifts of the rocks; a variety of mineral ſprings; hot baths (though theſe are now only a ſet of ſmall dirty caves); the ſame ſubterraneous fires which in his days warmed the boſom of the earth, and were the cauſe of its extraordinary fertility: but inſtead of 5000 Greeks, all paying the capitation tax (A), he would now find no more than about 700 inhabitants

* *Letters on Greece*, Let. xlii.

(A) Grown up men are the only perſons who pay the capitation tax. Therefore, by adding to the number of 5000 who paid the tax, the women, boys, and girls, we find that Melos, in the days of Tournefort, contained at leaſt 20,000 ſouls.

inhabitants on an iſland 18 leagues in circumference. He would ſigh to behold the fineſt lands lying uncultivated, and the moſt fertile valleys converted into moraſſes; of the gardens ſcarcely a veſtige is left; three-fourths of the town in ruins, and the inhabitants daily decreaſing. In ſhort, during the laſt 50 years, Melos has aſſumed a quite different appearance. The plague, which the Turks propagate everywhere, has cut off one part of its inhabitants; the injudicious adminiſtration of the Porte, and the oppreſſive extortions of the captain pacha, have deſtroyed the reſt. At preſent, for want of hands, they cannot cut out a free channel for their waters, which ſtagnate in the valleys, corrupt, and infect the air with their putrid exhalations. The ſalt marſhes, of which there are numbers in the iſland, being equally neglected, produce the ſame effects. Add to theſe inconveniences, thoſe ſulphureous exhalations which ariſe all over the iſland, and by which the inhabitants of Melos are afflicted with dangerous fevers during three-fourths of the year. Perhaps they may be obliged to forſake their country. Every countenance is yellow, pale, and livid; and none bears any marks of good health. The prudent traveller will be careful to ſpend but a very ſhort time in this unwholeſome country, unleſs he chooſes to expoſe himſelf to the danger of catching a fever. To ſleep over night, or to ſpend but one day in the iſland, is often enough to occaſion his being attacked with that diſtemper.

"Yet (continues our author) a judicious and enlightened government might expel thoſe evils which ravage Melos. Its firſt care would be to eſtabliſh a lazaret, and to prohibit veſſels whoſe crews or cargoes are infected with the plague from landing. Canals might next be cut, to drain the marſhes, whoſe exhalations are ſo pernicious. The iſland would then be repeopled. The ſulphureous vapours are not the moſt noxious. Theſe prevailed equally in ancient times, yet the iſland was then very populous. M. Tournefort, who travelled through it at a time leſs diſtant from the period when it was conquered by the Turks, and when they had not yet had time to lay it waſte, reckons the number of its inhabitants (as we have ſaid) at about 20,000. The depopulation of Melos is therefore to be aſcribed to the deſpotiſm of the Porte, and its deteſtable police."

Sutherland's Tour up the Straits, p. 146.

The women of Milo, once ſo celebrated for their beauty, are now ſallow, unhealthy, and diſguſtingly ugly; and render themſelves ſtill more hideous by their dreſs, which is a kind of looſe jacket, with a white coat and petticoat, that ſcarcely covers two-thirds of their thighs, barely meeting the ſtocking above the knee. Their hind hair hangs down the back in a number of plaits; that on the fore part of the head is combed down each ſide of the face, and terminated by a ſmall ſtiff curl, which is even with the lower part of the cheek. All the inhabitants are Greeks, for the Turks are not fond of truſting themſelves in the ſmall iſlands; but every ſummer the captain baſhaw goes round with a ſquadron to keep them in ſubjection, and to collect the revenue. When the Ruſſians made themſelves maſters of the Archipelago, many of the iſlands declared in their favour; but being abandoned by the peace, they were ſo ſeverely mulcted by the grand ſignior, that they have profeſſed a determination to remain perfectly quiet in future. As the Turks, however, do not think them worth a garriſon, and will not truſt them with arms and ammunition, all thoſe which the Ruſſians may chooſe to invade will be obliged to ſubmit. The two points which form the entrance of the harbour, croſſing each other, render it imperceptible until you are cloſe to it. Thus, while you are perfectly ſecure within it, you find great difficulty in getting out, particularly in a northerly wind; and as no trade is carried on except a little in corn and ſalt, Milo would ſcarcely ever be viſited, were it not that, being the firſt iſland which one makes in the Archipelago, the pilots have choſen it for their reſidence. They live in a little town on the top of a high rock, which, from its ſituation and appearance, is called the *Caſtle.*—Partridges ſtill abound in this iſland; and are ſo cheap, that you may buy one for a charge of powder only. The peaſants get them by ſtanding behind a portable ſcreen, with a ſmall aperture in the centre, in which they place the muzzle of their piece, and then draw the partridges by a call. When a ſufficient number are collected, they fire among them, and generally kill from four to ſeven at a ſhot; but even this method of getting them is ſo expenſive, from the ſcarcity of ammunition, that the people can never afford to ſhoot them, except when there are gentlemen in the iſland, from whom they can beg a little powder and ſhot.

Milo is 60 miles north of Candia; and the town is ſituated in E. Long. 25. 15. N. Lat. 36. 27.

MILSTONE. See MILLSTONE.

MILT, in *Anatomy*, a popular name for the SPLEEN.

MILT, or *Melt*, in *Natural Hiſtory*, the ſoft roe in fiſhes; thus called from its yielding, by expreſſion, a whitiſh juice reſembling milk. See ROE.

The milt is properly the ſeed or ſpermatic part of the male fiſh. The milt of a carp is reckoned a choice bit. It conſiſts of two long whitiſh irregular bodies, each included in a very thin fine membrane. M. Petit conſiders them as the teſticles of the fiſh wherein the ſeed is preſerved; the lower part next the anus, he ſuppoſes to be the *veſiculæ ſeminales*.

MILTHORP, a port town of Weſtmoreland, at the mouth of the Can, eight miles ſouth from Kendal. It is the only ſea port in the county; and goods are brought hither in ſmall veſſels from Grange in Lancaſhire. Here are two paper mills. It has a market on Friday, and a fair on Old May day; and there is a good ſtone bridge over the river Betha, which runs through the town.

MILTIADES, an Athenian captain, ſon of Cypſelus. He obtained a victory in a chariot race at the Olympic games. He led a colony of Athenians to the Cherſoneſus. The cauſes of this appointment are ſtriking and ſingular. The Thracian Dolonci, haraſſed by a long war with the Abſynthians, were directed by the oracle of Delphi to take for their king the firſt man they met in their return home, who invited them to come under his roof and partake his entertainments. This was Miltiades, whom the appearance of the Dolonci, with their ſtrange arms and garments, had ſtruck. He invited them to his houſe, and was made acquainted with the commands of the oracle. He obeyed; and when the oracle of Delphi had approved a ſecond time the choice of the Dolonci, tiades.

lonci, he departed for the Cherſoneſus, and was inveſted by the inhabitants with ſovereign power. The firſt meaſures he took were to ſtop the further incurſions of the Abſynthians, by building a ſtrong wall acroſs the iſthmus. When he had eſtabliſhed himſelf at home, and fortified his dominions againſt foreign invaſion, he turned his arms againſt Lampſacus. His expedition was unſucceſsful; he was taken in an ambuſcade, and made priſoner. His friend Crœſus king of Lydia was informed of his captivity, and procured his releaſe. He lived few years after he had recovered his liberty. As he had no iſſue, he left his kingdom and poſſeſſions to Steſagoras the ſon of Cimon, who was his brother by the ſame mother. The memory of Miltiades was greatly honoured by the Dolonci, and they regularly celebrated feſtivals and exhibited ſhows in commemoration of a man to whom they owed their greatneſs and preſervation.

Miltiades, the ſon of Cimon, and brother of Steſagoras mentioned in the preceding article, was ſome time after the death of the latter, who died without iſſue, ſent by the Athenians with one ſhip to take poſſeſſion of the Cherſoneſus. At his arrival Miltiades appeared mournful, as if lamenting the recent death of his brother. The principal inhabitants of the country viſited the new governor to condole with him; but their confidence in his ſincerity proved fatal to them. Miltiades ſeized their perſons, and made himſelf abſolute in Cherſoneſus. To ſtrengthen himſelf, he married Hegeſipyla, the daughter of Olorus the king of the Thracians. His triumph was ſhort. In the third year of his government, his dominions were threatened by an invaſion of the Scythian Nomades, whom Darius had ſome time before irritated by entering their country. He fled before them; but as their hoſtilities were of ſhort duration, he was ſoon reſtored to his kingdom. Three years after, he left Cherſoneſus; and ſet ſail for Athens, where he was received with great applauſe. He was preſent at the celebrated battle of MARATHON; in which all the chief officers ceded their power to him, and left the event of the battle to depend upon his ſuperior abilities. He obtained an important victory over the more numerous forces of his adverſaries. Some time after, Miltiades was intruſted with a fleet of 70 ſhips, and ordered to puniſh thoſe iſlands which had revolted to the Perſians. He was ſucceſsful at firſt, but a ſudden report that the Perſian fleet was coming to attack him, changed his operations as he was beſieging Paros. He raiſed the ſiege, and returned to Athens. He was accuſed of treaſon, and particularly of holding correſpondence with the enemy. The falſity of theſe accuſations might have appeared, if Miltiades had been able to come into the aſſembly. But a wound which he had received before Paros detained him at home; and his enemies, taking advantage of his abſence, became more eager in their accuſations, and louder in their clamours. He was condemned to death; but the rigour of his ſentence was retracted on the recollection of his great ſervices to the Athenians, and he was put into priſon till he had paid a fine of 50 talents to the ſtate. His inability to diſcharge ſo great a ſum detained him in confinement; and his wounds becoming incurable, he died a priſoner about 489 years before the Chriſtian era. His body was ranſomed by his ſon Cimon; who was obliged to borrow and pay the 50 talents, to give his father a decent burial.—The accuſations againſt Miltiades were probably the more readily believed by his countrymen, when they remembered how he made himſelf abſolute in Cherſoneſus; and in condemning the barbarity of the Athenians towards a general, who was the ſource of their military proſperity, we muſt remember the jealouſy which ever reigns among a free and independent people, and how watchful they are in defence of the natural rights which they ſee wreſted from others by violence. Cornelius Nepos has written the life of Miltiades the ſon of Cimon; but his hiſtory is incongruous and unintelligible, from his confounding the actions of the ſon of Cimon with thoſe of the ſon of Cypſelus. Greater reliance is to be placed on the narration of Herodotus, whoſe veracity is confirmed, and who was indiſputably better informed and more capable of giving an account of the life and exploits of men who flouriſhed in his age, and of which he could ſee the living monuments. Herodotus was born about ſix years after the famous battle of Marathon: and C. Nepos, as a writer of the Auguſtan age, flouriſhed about 450 years after the age of the father of hiſtory.

Miltiades, Milton.

MILTON, John, the moſt illuſtrious of the Engliſh poets, was deſcended of a genteel family, ſeated at a place of their own name, viz. *Milton*, in Oxfordſhire. He was born December 9. 1608, and received his firſt rudiments of education under the care of his parents, aſſiſted by a private tutor. He afterwards paſſed ſome time at St Paul's ſchool, London; in which city his father had ſettled, being engaged in the buſineſs of a ſcrivener. At the age of 17, he was ſent to Chriſt's college, Cambridge; where he made great progreſs in all parts of academical learning; but his chief delight was in poetry. In 1628, he proceeded bachelor of arts, having performed his exerciſe for it with great applauſe. His father deſigned him for the church; but the young gentleman's attachment to the Muſes was ſo ſtrong, that it became impoſſible to engage him in any other purſuits. In 1632, he took the degree of maſter of arts; and having now ſpent as much time in the univerſity as became a perſon who determined not to engage in any of the three profeſſions, he left the college, greatly regretted by his acquaintance, but highly diſpleaſed with the uſual method of training up youth there for the ſtudy of divinity; and being much out of humour with the public adminiſtration of eccleſiaſtical affairs, he grew diſſatisfied with the eſtabliſhed form of church government, and diſliked the whole plan of education practiſed in the univerſity. His parents, who now dwelt at Horton, near Colnbrook, in Buckinghamſhire, received him with unabated affection, notwithſtanding he had thwarted their views of providing for him in the church, and they amply indulged him in his love of retirement; wherein he enriched his mind with the choiceſt ſtores of Grecian and Roman literature; and his poems of *Comus*, *l'Allegro*, *Il Penſeroſo*, and *Lycidas*, all wrote at this time, would have been ſufficient, had he never produced any thing more conſiderable, to have tranſmitted his fame to the lateſt poſterity. However, he was not ſo abſorbed in his ſtudies as not to make frequent excurſions to London; neither did ſo much excellence paſs

paſs unnoticed among his neighbours in the country, with the moſt diſtinguiſhed of whom he ſometimes choſe to relax his mind, and improve his acquaintance with the world as well as with books.—After five years ſpent in this manner, he obtained his father's permiſſion to travel for farther improvement. At Paris he became acquainted with the celebrated Hugo Grotius; and from thence travelling into Italy, he was everywhere careſſed by perſons of the moſt eminent quality and learning.

Upon his return home, he ſet up a genteel academy in Alderſgate ſtreet.—In 1641, he began to draw his pen in defence of the Preſbyterian party; and the next year he married the daughter of Richard Powell, Eſq. of Foreſt Hill in Oxfordſhire. This lady, however, whether from a difference on account of party, her father being a zealous royaliſt, or ſome other cauſe, ſoon thought proper to return to her relations; which ſo incenſed her huſband, that he reſolved never to take her again, and wrote and publiſhed ſeveral tracts in defence of the doctrine and diſcipline of divorce. He even made his addreſſes to another lady; but this incident proved the means of a reconciliation with Mrs Milton.

In 1644, he wrote his Tract upon Education; and the reſtraint on the liberty of the preſs being continued by act of parliament, he wrote boldly and nobly againſt that reſtraint. In 1645, he publiſhed his juvenile poems; and about two years after, on the death of his father, he took a ſmaller houſe in High Holborn, the back of which opened into Lincoln's-Inn Fields.—Here he quietly proſecuted his ſtudies, till the fatal cataſtrophe and death of Charles I.; on which occaſion he publiſhed his Tenure of Kings and Magiſtrates, in juſtification of the fact. He was now taken into the ſervice of the commonwealth, and made Latin ſecretary to the council of ſtate, who reſolved neither to write to others abroad, nor to receive any anſwers, except in the Latin tongue, which was common to them all. The famous Εικων Βασιλικη coming out about the ſame time, our author, by command, wrote and publiſhed his *Iconoclaſtes* the ſame year. It was alſo by order of his maſters, backed by the reward of 1000l. that in 1651 he publiſhed his celebrated piece, entitled *Pro Populo Anglicano Defenſio;* "A Defence of the people of England, in anſwer to Salmaſius's Defence of the King; which performance ſpread his fame over all Europe. He now dwelt in a pleaſant houſe with a garden in Petty France, Weſtminſter, opening into St James's Park. In 1652 he buried his wife, who died not long after the delivery of her fourth child; and about the ſame time he alſo loſt his eye-ſight, by a *gutta ſerena*, which had been growing upon him many years.

Cromwell took the reins of government into his own hand in the year 1653; but Milton ſtill held his office. His leiſure hours he employed in proſecuting his ſtudies; wherein he was ſo far from being diſcouraged by the loſs of his ſight, that he even conceived hopes this misfortune would add new vigour to his genius; which in fact ſeems to have been the caſe.—Thus animated, he again ventured upon matrimony: his ſecond lady was the daughter of Captain Woodſtock of Hackney: ſhe died in childbed about a year after. On the depoſition of the protector, Richard Cromwell, and on the return of the long parliament, Milton being ſtill continued ſecretary, he appeared again in print; pleading for a farther reformation of the laws relating to religion; and, during the anarchy that enſued, he drew up ſeveral ſchemes for re-eſtabliſhing the commonwealth, exerting all his faculties to prevent the return of Charles II. England's deſtiny, however, and Charles's good fortune prevailing, our author choſe to conſult his ſafety, and retired to a friend's houſe in Bartholomew Cloſe. A particular proſecution was intended againſt him; but the juſt eſteem to which his admirable genius and extraordinary accompliſhments entitled him, had raiſed him ſo many friends, even among thoſe of the oppoſite party, that he was included in the general amneſty.

This ſtorm being over, he married a third wife, Elizabeth, daughter of Mr Minſhall a Cheſhire gentleman; and not long after he took a houſe in the Artillery Walk, leading to Bunhill Fields. This was his laſt ſtage: here he ſat down for a longer continuance than he had been able to do anywhere; and though he had loſt his fortune (for every thing belonging to him went to wreck at the Reſtoration), he did not loſe his taſte for literature, but continued his ſtudies with almoſt as much ardour as ever; and applied himſelf particularly to the finiſhing his grand work, the *Paradiſe Loſt;* one of the nobleſt poems that ever was produced by human genius.—It was publiſhed in 1667, and his *Paradiſe Regained* came out in 1670.—This latter work fell ſhort of the excellence of the former production; although, were it not for the tranſcendent merit of Paradiſe Loſt, the ſecond compoſition would doubtleſs have ſtood foremoſt in the rank of Engliſh epic poems. After this he publiſhed many pieces in proſe; for which we refer our readers to the edition of his Hiſtorical, Poetical, and Miſcellaneous Works, printed by Millar, in 2 vols. 4to, in 1753.

In 1674, this great man paid the laſt debt to nature at his houſe in Bunhill Fields, in the 66th year of his age; and was interred on the 12th of November, in the chancel of St Giles's, Cripplegate.—A decent monument was erected to his memory, in 1737, in Weſtminſter Abbey, by Mr Benſon, one of the auditors of the impreſt.—Milton was remarkably handſome in his perſon; but his conſtitution was tender, and by no means equal to his inceſſant application to his ſtudies.—Though greatly reduced in his circumſtances, yet he died worth 1500l. in money, beſides his houſehold goods.—He had no ſon: but left behind him three daughters, whom he had by his firſt wife.

MILTON, the name of ſeveral places in England; particularly,

MILTON, or *Middleton*, in Dorſetſhire, ſouth-weſt of Blandford, near the road to Dorcheſter, 114 miles from London. It is chiefly noted for its abbey, built by King Athelſtan. The church ſtands near the ſouth ſide of the abbey. It is a large and magnificent pile of Gothic architecture, and contains ſeveral ancient monuments. Here is an almhouſe for ſix people, who have 12s. a-week, and three yards of cloth for a gown, one pair of ſhoes and ſtockings, and 10s. each on St Thomas's day yearly. Here is a free ſchool, and a market on Tueſdays.

MILTON, in Kent, near Sittingbourn and the iſle of Sheppey, 6 miles north-weſt of Feverſham, and 40 from

from London. It is alſo called *Middleton* from its ſituation near the middle of the county, i e. from Deptford to the Downs. The kings of Kent had a palace here, which was caſtellated, and ſtood below the church; but was burnt down in Edward the Confeſſor's time by Earl Goodwin, &c. Its church ſtands near a mile off. On approaching the town up the Thames, by the Eaſt Swale, it ſeems hid among the creeks: yet it is a large town; and has a conſiderable market on Saturdays, and a fair on July 24. The oyſters taken here are the moſt famous of any in Kent. This town is governed by a portreeve, choſen yearly on St James's day, who ſuperviſes the weights and meaſures all over the hundred of Milton.

Milton, in Kent, a mile on the eaſt ſide of Graveſend, was incorporated with it in the reign of Queen Elizabeth, by the name of the portreeve, jurats, and inhabitants of the towns of Graveſend and Milton. King Henry VIII. raiſed a platform or blockhouſe here, for the defence both of this town and Graveſend, and the command of the river. It has a fair January 25.

MILVIUS, Molvius, or Mulvius, *Pons*; a bridge on the Tiber, built by Æmilius Scaurus the cenſor, in the time of Sylla, at two miles diſtance from the city, on the Via Flaminia, and repaired by Auguſtus. From this bridge the ambaſſadors of the Allobroges were brought back to Rome, by Cicero's management, and made a diſcovery of Catiline's conſpiracy (Salluſt). Near it Maxentius was defeated by Conſtantine (Eutropius). Now called *Ponte Molle*.

Milvius, a ſpecies of Falco. See Falco, Ornithology *Index*.

MIMI, Mimes, in the ancient comedy, were buffoons or mimics, who entertained the people by taking off certain characters, uſing ſuch geſtures as ſuited the perſons or ſubjects they repreſented. There were on the Roman ſtage female performers of this kind called *mimæ*. The word is derived from *μιμεομαι*, *I imitate*. Some of the *mimi* acted their parts to the ſound of the *tibia*; theſe they called *mimauli*.

Mimi were alſo a kind of farces or ludicrous comedies, generally performed by one perſon. They had no acts, nor any *exordium*.—The *mimi* were introduced upon the Roman ſtage long after comedy and tragedy had arrived at their full perfection. The actor wore no maſk, but ſmeared his face with ſoot, was dreſſed in lambſkin, wore garlands of ivy, and carried a baſket of flowers and herbs, in honour of Bacchus, and diverted the audience with apiſh tricks and ridiculous dances. This was the ſtate of the *mimi* ſoon after their firſt introduction; but they underwent many alterations, which it would take up too much room to relate, and which are not of ſufficient importance to juſtify a detailed account. See Pantomimes.

MIMESIS, in *Rhetoric*, the imitating the voice and geſtures of another perſon.

MIMNERMUS, an ancient poet and muſician, flouriſhed about the beginning of the ſixth century B. C. He was of Smyrna, and cotemporary with Solon. Athenæus gives him the invention of pentameter verſe. His elegies, of which only a few fragments are preſerved, were ſo much admired in antiquity, that Horace preferred them to thoſe of Callimachus. He compoſed a poem of this kind, as we learn from Pauſanias, upon the battle fought between the people of Smyrna, and the Lydians under Gyges. He likewiſe was author of a poem in elegiac verſe, quoted by Strabo, which he entitled *Nanno*, and in which we may ſuppoſe he chiefly celebrated a young and beautiful girl of that name, who, according to Athenæus, was a player on the flute, with whom he was enamoured in his old age. With reſpect to love matters, according to Propertius, his verſes were more valuable than all the writings of Homer.

Plus in amore valet Mimnermi verſus Homero.
Lib. I. Eleg. ix. v. 11.

And Horace bears teſtimony to his abilities in deſcribing that ſeducing paſſion:

Si Mimnermus uti cenſet, ſine amore jociſque
Nil eſt jucundum, vivas in amore jociſque.
Lib. I. Epiſt. vi. v. 65.

If, as wiſe Mimnermus ſaid,
Life unbleſt with love and joy
Ranks us with the ſenſeleſs dead,
Let theſe gifts each hour employ.

Alluding to ſome much admired lines of the Greek poet, which have been preſerved by Stobæus.

Τις δε βιος, τι δε τερπνον ατηρ χρυσης 'Αφροδιτης, &c.

What is life and all its pride,
If love and pleaſure be denied?
Snatch, ſnatch me hence, ye Fates, whene'er
The am'rous bliſs I ceaſe to ſhare.
Oh let us crop each fragrant flow'r
While youth and vigour give us pow'r:
For frozen age will ſoon deſtroy
The force to give or take a joy;
And then, a prey to pain and care,
Deteſted by the young and fair,
The ſun's bleſt beams will hateful grow,
And only ſhine on ſcenes of wo.

MIMOSA, the Sensitive Plant, a genus of plants belonging to the monœcia claſs; and in the natural method ranking under the 33d order, *Lomentaceæ*. See Botany and Materia Medica *Index*.

The name *mimoſa*, ſignifying "mimic," is given to this genus on account of the ſenſibility of the leaves, which, by their motion, mimic or imitate, as it were, the motion of animals.

MINA, or Maneh, a ſpecies of money which properly ſignifies *one part* or *ounce*. It is obſerved that this word occurs only in the books of Kings, Chronicles, Ezra, and Ezekiel. This prophet (xlv. 12.) tells us, that the minah or maneh was valued at 60 ſhekels, which in gold make of our Engliſh money about 54¾ pounds, and in ſilver almoſt ſeven pounds. Thus for the Hebrew maneh. But the Greek or Attic mina, which is probably that mentioned in the books of the Maccabees and in the New Teſtament, is valued at 100 drachmæ, or about 2l. 17s. ſterling. There was alſo a leſſer mina, which was valued at 75 drachmæ.

MINAGNGHINIM, a pulſative inſtrument of muſic, among the Hebrews, which was a ſquare table of wood, fitted with a handle; over this table was ſtretched an iron chain, or hempen cord, paſſing through balls of wood or braſs, which ſtruck againſt the table, when the inſtrument was ſhaken, and occaſioned a clear ſound, which might be heard at a great diſtance.

MINCHA, in the Jewiſh cuſtoms, offerings of meal, cakes, or biſcuits, made in the temple of the Lord. The Seventy have ſometimes preſerved this word in their tranſlation; but inſtead of *mincha* they read *manaa*, which doubtleſs was the received pronunciation in their time. We find *manaa* in the ſame ſenſe, in Baruch i. 10. Levit. ii. 3. &c. See the Greek of Jerem. xvii. 26. Dan. ii. 46. 2 Kings viii. 5, 9. xvii. 7. xx. 12. 2 Chron. vii. 7. Nehem. xiii. 5. 9. &c.

MINCHING-HAMPTON, a town of Glouceſterſhire, 20 miles from Bath and Briſtol, and near 90 from London, with a market on Tueſdays, and two fairs. The pariſh is pretty large, being bounded on the north by the Stroud, and on the ſouth by the brook Avening; and has 12 hamlets belonging to it, with a common called Amberley. Here is a good large rectory church, built in form of a croſs. In 1801 the inhabitants amounted to 3419, many of whom are employed in the woollen manufacture. W. Long. 2. 14. N. Lat. 51. 38.

MINCIUS, a river of the Tranſpadana in Italy; running from, or rather tranſmitted through, the Lacus Benacus, from north to ſouth, into the Padus; but originally riſing in the Rhetian Alps. Now Mincio or Menzo, running through the duchy of Mantua into the Po.

MIND, a thinking intelligent being, otherwiſe called *ſpirit*, in oppoſition to matter or body. See METAPHYSICS, Part III.

MINDANAO, or MAGINDANAO, a large iſland of Aſia in the Eaſt Indies, and one of the Philippines; 160 miles in length, and 120 in breadth. The interior parts contain ſeveral chains of lofty mountains, between which are extenſive plains, where vaſt herds of cattle roam at large in the moſt delicious paſtures. Several deep valleys alſo interſect, as it were, certain parts of the country, through which, during the rainy ſeaſons, vaſt torrents pour from the mountains, and force their impetuous way to the ſea. The rains and vapours which lodge in the plains diffuſe themſelves into meandering rivulets, and, collecting a variety of ſmall ſtreams in their courſe, approach the ſea in the form of conſiderable rivers.—The ſovereign of Magindanao is a powerful prince, and has ſeveral inferior chiefs, who acknowledge him as their head. Nevertheleſs, there are others of them who refuſe ſubmiſſion to him, and are conſequently in a continual ſtate of war; ſo that peace, at leaſt, does not appear to be one of the bleſſings of this iſland. The Spaniards, indeed, aſſert their right to the entire dominion of Magindanao; but it is mere aſſertion; for though they have forts, &c. on the iſland, it is by no means in a ſtate of ſubjection to their nation.

The air is eſteemed ſalubrious, particularly in the vicinity of the ſea. The heat there is not, in any degree, ſo intenſe as might be expected in a country which is ſituated on the very verge of the torrid zone. The prevalence of the eaſterly winds, in that part of the coaſts which is waſhed by the Pacific ocean, renders the air cool and pleaſant, the trade wind blowing inceſſantly on its ſhores. It acts, indeed, with ſo much power as to ſweep the whole breadth of the iſland; and though in its paſſage it loſes much of its ſtrength, it retains a ſufficient degree of force to afford refreſhing breezes to the inhabitants of the weſtern ſhore. The interior parts are much colder, from a very cloudy atmoſphere, which frequently hangs over the ſummits of the mountains in thick and humid vapours. The ſoil, which is very exuberant, is ſuited to the cultivation of the whole vegetable tribes. Rice is produced in the greateſt abundance; a pecul, or 133 pounds, may be purchaſed for a Spaniſh dollar. Every part of the iſland abounds with buffaloes, cows, hogs, goats, &c. It affords alſo great variety of fowls, and a ſpecies of duck, whoſe head is of a fine ſcarlet colour. Here is alſo a ſmall breed of horſes, remarkable for their ſpirit. The natives, however, principally employ buffaloes in the various branches of huſbandry and agriculture.

The city of Magindanao is ſituated on the ſouth-eaſt ſide of the iſland, has a river capable of admitting ſmall veſſels, and carries on a conſiderable trade with Manilla, Sooloo, Borneo and the Moluccas. Their exports are rice, tobacco, bees wax, and ſpices; in return for which they receive coarſe cloths of Coromandel, China ware, and opium. The village or town of Samboingan is ſituated on the banks of a ſmall rivulet, which empties itſelf immediately into the ſea, and is agreeably ſhaded by groves of cocoa trees. The number of its inhabitants is about 1000, among which are included the officers, ſoldiers, and their reſpective families. In its environs there are ſeveral ſmall look-out houſes, erected on poſts of twelve feet high, in all of which a conſtant guard is kept; ſo that it appears as if the Spaniards were in a continual ſtate of enmity with the natives. The houſes are built of thoſe ſimple materials which are of very general uſe in the eaſtern ſeas. They are erected on poſts, and built of bamboo, covered with mats; the lower apartments ſerve for their hogs, cattle, and poultry, and the upper ones are occupied by the family.

MINDELHEIM, a town of Germany, in the circle of Suabia, and in Algow, with a caſtle. It is capital of a ſmall territory between the rivers Iller and Lech, ſubject to the houſe of Bavaria. It was taken by the Imperialiſts after the battle of Hochſtet, who erected it into a principality in favour of the duke of Marlborough; but it returned back to the houſe of Bavaria by the treaty of Raſtadt. It is 33 miles ſouth-eaſt of Ulm. E. Long. 10. 40. N. Lat. 48. 5.

MINDELHEIM, a diſtrict of Germany, in Suabia, lying between the biſhoprick of Augſburg and the abbacy of Kempten, which is 20 miles in length and 16 in breadth.

MINDEN, a conſiderable town of Germany, in the circle of Weſtphalia; and capital of a territory of the ſame name; ſeated on the river Weſer, which renders it a trading place. It formerly belonged to the king of Pruſſia, who ſecularized the biſhoprick. It is 27 miles eaſt by ſouth of Oſnaburg, and 37 weſt of Hanover. E. Long. 9. 5. N. Lat. 52. 22.

MINDEN (the principality of), in Germany, lies in the circle of Weſtphalia, to the north of the county of Ravenſburg, and along each ſide of the river Weſer.

It is about 22 miles ſquare, and Minden and Peterſhagen are the principal places. It was formerly a biſhopric, but is now ſecularized; was afterwards ceded to the elector of Brandenburg, and is now annexed to the new kingdom of Weſtphalia.

MINDORA, an iſland of Aſia, in the Eaſt Indies, and one of the Philippines, 50 miles in circumference, and ſeparated from Luconia by a narrow channel. It is full of mountains, which abound in palm trees and all ſorts of fruits. The inhabitants are idolaters, and pay tribute to the Spaniards, to whom this iſland belongs.

MINE, in *Natural Hiſtory*, a deep pit under ground, from whence various kinds of minerals are dug out; but the term is more particularly applied to thoſe which yield metals. Where ſtones only are procured, the appellation of *quarries* is univerſally beſtowed upon the places from which they are dug out, however deep they may be.

The internal parts of the earth, as far as they have been yet inveſtigated, do not conſiſt of one uniform ſubſtance, but of various *ſtrata* or beds of ſubſtances, extremely different in their appearances, ſpecific gravities, and chemical qualities, from one another. Neithere are theſe ſtrata ſimilar to one another either in their nature or appearance in different countries; ſo that even in the ſhort extent of half a mile, the ſtrata will be found quite different from what they are in another place. As little are they the ſame either in depth or ſolidity. Innumerable cracks and fiſſures, by the miners called *lodes*, are found in every one of them; but theſe are ſo entirely different in ſize and ſhape, that it is impoſſible to form any inference from their ſize in one place to that in another. In theſe lodes or fiſſures the metallic ore is met with; and, conſidering the great uncertainty of the dimenſions of the lodes, it is evident that the buſineſs of mining, which depends on that ſize, muſt in like manner be quite uncertain and precarious. Mr Price, in his treatiſe on the Corniſh mines, obſerves, that "the comparative ſmallneſs of the largeſt fiſſures to the bulk of the whole earth is really wonderful. In the fineſt pottery we can make, by a microſcopic view, we may diſcover numerous cracks and fiſſures, ſo ſmall as to be impenetrable by any fluid, and impervious to the naked eye; as, by the laws of nature originally impoſed by the Creator, it happens that matter cannot contract itſelf into ſolid large maſſes, without leaving fiſſures between them, and yet the very fiſſures are as neceſſary and uſeful as the ſtrata through which they paſs. They are the drains that carry off the redundant moiſture from the earth; which, but for them, would be too full of fens and bogs for animals to live or plants to thrive on. In theſe fiſſures, the ſeveral ingredients which form *lodes*, by the continual paſſing of waters, and the menſtrua of metals, are brought out of the adjacent ſtrata, collected and conveniently lodged in a narrow channel, much to the advantage of thoſe who ſearch for and purſue them; for if metals and minerals were more diſperſed, and ſcattered thinly in the body of the ſtrata, the trouble of finding and getting at them would be endleſs, and the expence of procuring them exceed the value of the acquiſition.

The inſides of the fiſſures are commonly coated over with a hard, cryſtalline, earthy ſubſtance or rind, which very often, in the breaking of hard ore, comes off along with it, and is commonly called the *capels* or *walls* of the lode: but Mr Price is of opinion, that the proper walls of the lode are the ſides of the fiſſure itſelf, and not the coat juſt mentioned, which is the natural plaſter upon thoſe walls, furniſhed perhaps by the contents of the fiſſures, or from oozings of the ſurrounding ſtrata.

The breadth of a lode is eaſily known by the diſtance betwixt the two incruſted ſides of the ſtones of ore; and if a lode yields any kind of ore, it is a better ſign that the walls be regular and ſmooth, or at leaſt that one of them be ſo, than otherwiſe; but there are not many of theſe fiſſures which have regular walls until they have been ſunk down ſome fathoms.

Thus the inner part of the fiſſure in which the ore lies, is all the way bounded by two walls of ſtone, which are generally parallel to one another, and include the breadth of the vein or lode. Whatever angle of inclination ſome fiſſures make in the ſolid ſtrata at their beginning, they generally continue to do the ſame all along. Some are very uncertain in their breadth, as they may be ſmall at their upper part and wide underneath, and *vice verſa*. Their regular breadth, as well as their depth, is ſubject to great variation; for though a fiſſure may be many fathoms wide in one particular place, yet a little further eaſt or weſt it may not perhaps be one inch wide. This exceſſive variation happens generally in very compact ſtrata, when the vein or fiſſure is ſqueezed, as it were, through hard rocks which ſeem to compreſs and ſtraiten it. A true vein or fiſſure, however, is never entirely obliterated, but always ſhows a ſtring of metallic ore or of a veiny ſubſtance; which often ſerves as a leader for the miners to follow until it ſometimes leads them to a large and richly impregnated part. Their length is in a great meaſure unlimited, though not the ſpace beſt fitted for yielding metal. The richeſt ſtate for copper, according to Mr Price, is from 40 to 80 fathoms deep; for tin, from 20 to 60: and though a great quantity of either may be raiſed at 80 or 100 fathoms, yet, "the quality (ſays our author) is often too much decayed and dry for metal."

Mr Price informs us, that the fiſſures or veins of the Corniſh mines extend from eaſt to weſt; or, more properly, one end of the fiſſure points weſt and by ſouth, or weſt and by north; while the other tends eaſt and by ſouth, or eaſt and by north. Thus they frequently paſs through a conſiderable tract of country with very few variations in their directions, unleſs they be interrupted by ſome intervening cauſe.—But, beſides this eaſt and weſt direction, we are to conſider what the miners call the *underlying* or *hade* of the vein or lode; viz. the deflection or deviation of the fiſſure from its perpendicular line, as it is followed in depth like the ſlope of the roof of a houſe, or the deſcent of the ſteep ſide of a hill. This ſlope is generally to the north or ſouth; but varies much in different veins, or ſometimes even in the ſame vein; for it will frequently ſlope or underlie a ſmall ſpace in different ways, as it may appear to be forced by hard ſtrata on either ſide.—Some of the fiſſures do not vary much from a perpendicular, while ſome deviate more than a fathom; that is, for every fathom they deſcend in perpendicular height, they deviate likewiſe as much to the ſouth or north. Others differ ſo much from the perpendicular, that they aſſume a poſition almoſt horizontal; whence they are alſo called *horizontal* or *flat lodes*, and ſometimes *lode plots*. Another kind of theſe has an irregular poſition with regard to the reſt; widening horizontally for a little way, and then deſcending perpendicularly almoſt like ſtairs, with only a ſmall ſtring or leader to follow after; and thus they alternately vary and yield ore in ſeveral flat or horizontal fiſſures. This, by the Corniſh tinners, is called (but in Mr Price's opinion erroneouſly) a *floor* or *ſquat;* which, properly ſpeaking, is a hole or chaſm impregnated with metal, making no continued line of direction or regular walls. Neither does a floor of ore deſcend to any conſiderable depth; for underneath it there appears no ſign of a vein or fiſſure, either leading directly down or any other way. This kind of vein is very rare in Britain. The fiſſures moſt common in Britain are the perpendicular and inclined, whether their direction be north or ſouth, eaſt or weſt.

The perpendicular and horizontal fiſſures (according to our author) probably remain little altered from their firſt poſition, when they were formed at the induration of the ſtrata immediately after the waters left the land. The perpendicular fiſſures are found more commonly ſituated in level ground, at a diſtance from hills, and from the ſea ſhore; but with regard to the latter, we find that the upper and under maſſes of ſtrata differ in their ſolidity and other properties. "Hence, (ſays our author) it is very plain, that inclined fiſſures owe their deflection or underlie to ſome ſecondary cauſe, violence, or ſubſidence, of the earth: for though perpendicular fiſſures are ſeldom to be ſeen, yet ſuch as are inclined at very conſiderable depths, become more and more perpendicular, as the more central ſtrata by reaſon of the vaſt ſuperincumbent weight, do not ſeem ſo likely to be driven out of their poſition as thoſe which lie nearer the ſurface."

The fiſſures are often met with fractured as well as inclined; the reaſon of which, in Mr Price's opinion, has been a ſubſidence of the earth from ſome extraordinary cauſe. "The original poſition (ſays he) muſt have been horizontal, or parallel to the ſurface of the earth: but we often find theſe ſtrata very ſenſibly declined from that firſt poſition; nay, ſometimes quite reverſed, and changed into perpendicular. When we ſee a wall lean, we immediately conclude that the foundation has given way, according to the angles which the walls make with the horizon; and when we find the like declination in ſtrata, we may conclude, by parity of reaſon, that there has been a like failure of what ſupported them, in proportion to that declination; or that whatever made the ſtrata to fall ſo much awry, muſt alſo cauſe every thing included in thoſe ſtrata to fall proportionally. Wherever the greateſt ſubſidence is to the north, the top of the lode or fiſſure will point to the north, and of conſequence underlie to the ſouth, and *vice verſa:* the ſlide or heave of the lode manifeſts the greater ſubſidence of the ſtrata; but the ſame lode is frequently fractured and heaved in ſeveral places, all of which, by due obſervation, will ſhow us they were occaſioned by ſo many ſeveral ſhocks or ſubſidencies, and that the ſtrata were not unfooted, ſhaken, or brought to fall only once or twice, but ſeveral times."

Mr Price, in the courſe of his work, obſerves, that, though the metallic veins generally run from eaſt to weſt, they are frequently interſected by veins or *lodes*, as he calls them, of other matters, which run from north to ſouth. Some of theſe croſs veins contain lead or antimony, but never tin or copper. Sometimes one of theſe unmetallic veins interſects the true one at right angles, ſometimes obliquely; and ſometimes the mixture of both is ſo intimate, that the moſt expert miners are at a loſs to diſcover the ſeparated part of the true vein. When this laſt is intercepted at right angles, it is moved either north or ſouth, a very little way, perhaps not more than one fathom; in which caſe, the miners having worked to a ſmall diſtance in one of theſe directions, if they find themſelves diſappointed, turn to the other hand, and ſeldom fail of meeting with what they expected. Sometimes they are directed in their ſearch by the pointing of a rib or ſtring of the true vein; but when the interruption happens in an oblique direction, the difficulty of finding the vein again is much greater.

When two metallic veins in the nighbourhood of each other run in an oblique direction, and of conſequence meet together, they commonly produce a body of ore at the place where they interſect; and if both are rich, the quantity will be conſiderable; but if one be poor and the other rich, then both are either enriched or impoveriſhed by the meeting. After ſome time they ſeparate again, and each will continue its former direction near to the other; but ſometimes, though rarely, they continue united.

It is a ſign of a poor vein when it ſeparates or diverges into ſtrings; but on the contrary, when ſeveral of them are found running into one, it is accounted a promiſing ſign. Sometimes there are branches without the walls of the vein in the adjacent ſtrata, which often come either obliquely or tranſverſely into it. If theſe branches are impregnated with ore, or if they underlie faſter than the true vein, that is, if they dip deeper into the ground, then they are ſaid to overtake or come into the lode, and to enrich it; or if they do not, then they are ſaid to go off from it, and to impoveriſh it. But neither theſe nor any other marks either of the richneſs or poverty of a mine are to be entirely depended upon; for many mines, which have a very bad appearance at firſt, do nevertheleſs turn out extremely well afterwards; while others, which in the beginning ſeemed very rich, turn gradually worſe and worſe: but in general, where a vein has a bad appearance at firſt, it will be imprudent to be at much expence with it.

Veins of metal, as has been already obſerved, are frequently, as it were, ſo compreſſed betwixt hard ſtrata, that they are not an inch wide: nevertheleſs, if they have a ſtring of good ore, it will generally be worth while to purſue them: and they frequently turn out well at laſt, after they have come into ſofter ground. In like manner, it is an encouragement to go on if the branches or leaders of ore enlarge either in width or depth as they are worked; but it is a bad ſign if they continue horizontal without inclining downwards; though it is not proper always to diſcontinue the working

ing of a vein which has an unfavourable aſpect at firſt. Veins of tin are worth working when only three inches wide, provided the ore be good; and copper ores when ſix inches wide will pay very well for the working. Some of the great mines, however, have very large veins, with a number of other ſmall ones very near each other. There are alſo veins, croſſing one another ſometimes met with, which are called *contras*, vulgarly *caunters*. Sometimes two veins run down into the ground in ſuch a manner that they meet in the direction of their depth; in which caſe the ſame obſervations apply to them which are applicable to thoſe that meet in a horizontal direction. Sometimes a vein will ſuddenly diſappear without giving any warning, by becoming narrower, or of worſe quality; which by the miners is called a *ſtart* or *leap*, and is very common in the mines of Cornwall. In one day's time they may thus be diſappointed in the working of a rich vein of tin, and have no further ſign of any thing to work upon. At the fractured extremity of their vein they perceive a body of clay or other matter; and the method of recovering their vein is to drive on the work in the direction of the former part, ſo that their new work ſhall make the ſame angle with the clay that the other part of the vein does. Sometimes they ſink a ſhaft down from the ſurface; but it is generally a matter of difficulty to recover a vein when thus loſt.

The method of diſcovering mines is a matter of ſo much difficulty, that it ſeems ſurpriſing how thoſe who were totally unacquainted with the nature of metals firſt came to think of digging them out of the earth. According to Lucretius, the diſcovery was made by the conflagration of certain woods, which melted the veins of metal in the earth beneath them; but this ſeems rather to be improbable. Ariſtotle, however, is of the ſame opinion with Lucretius, and tells us, that ſome ſhepherds of Spain having ſet fire to the woods, the earth was thus heated to ſuch a degree that the ſilver near the ſurface of it melted and flowed into a maſs; and that in a ſhort time the metallic maſs was diſcovered by the rending of the earth in the time of an earthquake: and the ſame ſtory is told by Strabo, who aſcribes the diſcovery of the mines of Andaluſia to this accident. Cadmus is ſaid by ſome to have been the firſt who diſcovered gold: while others aſcribe this to Thoas the Thracian, to Mercury the ſon of Jupiter, or to Piſus king of Italy; who having left his own country, went into Egypt, where he was elected king after the death of Mizraim the ſon of Ham; and, on account of his diſcovery, was called the *Golden God*. Others ſay, that *Eaclis* or Cæacus the ſon of Jupiter, or Sol the ſon of Oceanus, was the firſt diſcoverer; but Æſchylus attributes the diſcovery not only of gold, but of all other metals, to Prometheus. The braſs and copper mines in Cyprus were firſt diſcovered by Cinyra the ſon of Agryopa; and Heſiod aſcribes the diſcovery of the iron mines of Crete to the Cretan Dactyli Idæi. The extraction of lead or tin from its ore in the iſland of Caſſiteris, according to ſeveral ancient authors, was diſcovered by Midacritus.—The Scripture, however, aſcribes the invention of braſs and iron, or at leaſt of the methods of working them, to Tubal Cain before the flood.

In more modern times, we know that mines have been frequently diſcovered by accident; as in ſea cliffs, among broken craggy rocks, by the waſhing of the tide or floods, alſo by irruptions and torrents of water iſſuing out of hills and mountains, and ſometimes by the wearing of high roads. Mr Price mentions another way by which mines have been diſcovered, viz. by fiery corruſcations; which, he ſays, he has heard from perſons whoſe veracity he is unwilling to queſtion. "The tinners (ſays he) generally compare theſe effluvia to blazing ſtars or other whimſical likeneſſes, as their fears or hopes ſuggeſt; and ſearch with uncommon eagerneſs the ground over which theſe jack-a-lanterns have appeared and pointed out. We have heard but little of theſe phenomena for many years; whether it be, that the preſent age is leſs credulous than the foregoing, or that the ground, being more perforated by innumerable new pits ſunk every year, ſome of which, by the ſtannary laws, are prevented from being filled up, has given theſe vapours a more gradual vent, it is not neceſſary to inquire, as the fact itſelf is not generally believed."

Mines, however, are now moſt commonly diſcovered by inveſtigating the nature of ſuch veins, ores, and ſtones as may ſeem moſt likely to turn to account: but there is a particular ſagacity, or habit of judging from particular ſigns, which can be acquired only by long practice. Mines, eſpecially thoſe of copper, may alſo be diſcovered by the harſh and diſagreeable taſte of the waters which iſſue from them; though it is probable that this only happens when the ore lies above the level of the water which breaks out; for it does not ſeem likely that the taſte of the ore could *aſcend*, unleſs we were to ſuppoſe a pond or lake of water ſtanding above it. The preſence of copper in any water is eaſily diſcovered by immerging in it a bit of poliſhed iron, which will thus inſtantly be turned of a copper colour, by reaſon of the precipitation of the metal upon it. A candle, or piece of tallow put into water of this kind, will in a ſhort time be tinged of a green colour.

Another and ſtill more remarkable method of diſcovering mines is ſaid to be by the *virgula divinatoria*, or "divining rod;" which, however incredible the ſtories related concerning it may be, is ſtill relied on by ſome, and among others by Mr Price. It is not known who was the inventor of this method; but Agricola ſuppoſes that it took its riſe from the magicians, who pretended to diſcover mines by enchantment. No mention is made of it, however, before the 11th century, ſince which time it has been in frequent uſe; and the Corpuſcular Philoſophy has even been called in to account for it. But before we pretend to account for phenomena ſo very extraordinary as thoſe reported of the *virgula divinatoria*, it is neceſſary, in the firſt place, to determine whether or not they exiſt. Mr Price, as has been already hinted, believes in it, though he owns that by reaſon of his conſtitution of mind and body, he is almoſt incapable of co-operating with its influence. The following account, however, he gives from Mr William Cookworthy of Plymouth, a gentleman of known veracity and great chemical abilities.

He had the firſt information concerning this rod from one Captain Ribeira, who deſerted from the Spaniſh ſervice in Queen Anne's reign, and became captain-commandant in the garriſon of Plymouth; in which

which town he ſatisfied ſeveral intelligent perſons of the virtues of the rod, by many experiments on pieces of metal hid in the earth, and by an actual diſcovery of a copper mine near Oakhampton, which was wrought for ſome years. This captain very readily ſhowed the method of uſing the rod in general, but would not by any means diſcover the ſecret of diſtinguiſhing the different metals by it: though, by a conſtant attention to his practice, Mr Cookworthy diſcovered it. Captain Ribeira was of opinion, that the only proper rods for this purpoſe were thoſe cut from the nut or fruit trees; and that the virtue was confined to certain perſons, and thoſe, comparatively ſpeaking, but few: but Mr Price ſays, that the virtue reſides in all perſons and in all rods under certain circumſtances. “The rod (ſays he) is attracted by all the metals, by coals, limeſtone, and ſprings of water, in the following order: 1. Gold; 2. Copper; 3. Iron; 4. Silver; 5. Tin; 6. Lead; 7. Coals; 8. Limeſtone and ſprings of water. One method of determining the different attractions of the rod is this: Stand, holding the rod with one foot advanced; put a guinea under that foot, and an halfpenny under the other, and the rod will be drawn down; ſhift the pieces of money, and the rod will be drawn towards the face, or backwards to the gold, which proves the gold to have the ſtronger attraction.

“The rods formerly uſed were ſhoots of one year's growth that grew forked; but it is found, that two ſeparate ſhoots tied together with packthread or other vegetable ſubſtance anſwer rather better than ſuch as are naturally forked, as the ſhoots of the latter are ſeldom of an equal ſize. They are to be tied together by the greater ends, the ſmall ones being held in the hands. Hazle rods cut in the winter, ſuch as are uſed for fiſhing rods, and kept till they are dry, do beſt; though, where theſe are not at hand, apple-tree ſuckers, rods from peach trees, currants, or the oak, though green, will anſwer tolerably well.”

Our author next proceeds to deſcribe the manner of holding the rod; of which he gives a figure, as he ſays it is difficult to be deſcribed. The ſmall ends being crooked, are to be held in the hands in a poſition flat or parallel to the horizon, and the upper part in an elevation not perpendicular to it, but at an angle of about 70 degrees. “The rod (ſays he) being properly held by thoſe with whom it will anſwer, when the toe of the right foot is within the ſemidiameter of the piece of metal or other ſubject of the rod, it will be repelled towards the face, and continue to be ſo while the foot is kept from touching or being directly over the ſubject; in which caſe it will be ſenſibly and ſtrongly attracted, and be drawn quite down. The rod ſhould be firmly and ſteadily graſped; for if, when it has begun to be attracted, there be the leaſt imaginable jerk or oppoſition to its attraction, it will not move any more till the hands are opened, and a freſh graſp taken. The ſtronger the graſp the livelier the rod moves, provided the graſp be ſteady and of an equal ſtrength. This obſervation is very neceſſary, as the operation of the rod in many hands is defeated purely by a jerk or counteraction; and it is from thence concluded, that there is no real efficacy in the rod, or that the perſon who holds it wants the virtue; whereas, by a proper attention to this circumſtance in uſing it, five perſons in ſix have the virtue, as it is called; that is, the nut or fruit-bearing rod will anſwer in their hands. If a rod, or the leaſt piece of one of the nut-bearing or fruit kind, be put under the arm, it will totally deſtroy the operation of the *virgula divinatoria*, in regard to all the ſubjects of it, except water, in thoſe hands in which the rod naturally operates. If the leaſt animal thread, as ſilk, or worſted, or hair, be tied round or fixed on the top of the rod, it will in like manner hinder its operation; but the ſame rod placed under the arm, or the ſame animal ſubſtances tied round or fixed on the top of the rod, will make it work in thoſe hands, in which without theſe additions it is not attracted.”

Such are the accounts of this extraordinary rod, to which it is probable that few will aſſent; and we believe the inſtances of mines have been diſcovered by it are but very rare. Another and very ancient mode of diſcovering mines, leſs uncertain than the divining rod, but extremely difficult and precarious, is that called *ſhoding*; that is, tracing them by looſe ſtones, fragments, or *ſhodes*, which may have been ſeparated or carried off to a conſiderable diſtance from the vein, and are found by chance in running waters, on the ſuperficies of the ground, or a little under.—“When the tinners (ſays Mr Price) meet with a looſe ſingle ſtone of tin ore, either in a valley or in ploughing or hedging, though at 100 fathoms diſtance from the vein it came from, thoſe who are accuſtomed to this work will not fail to find it out. They conſider, that a metallic ſtone muſt originally have appertained to ſome vein, from which it was ſevered and caſt at a diſtance by ſome violent means. The deluge, they ſuppoſe, moved moſt of the looſe earthy coat of the globe, and in many places waſhed it off from the upper towards the lower grounds, with ſuch a force, that moſt of the backs or lodes of veins which protruded themſelves above the faſt were hurried downwards with the common maſs: whence the ſkill in this part of their buſineſs lies much in directing their meaſures according to the ſituation of the ſurface.” Afterwards, however, our author complains that this art of *ſhoding*, as he calls it, is in a great meaſure loſt.

The following account of a method of finding ſilver mines by Alonzo Barba ſeems to be ſimilar to that of ſhoding juſt now mentioned. “The veins of metal (ſays he) are ſometimes found by great ſtones above ground; and if the veins be covered, they hunt them out after this manner; viz. taking in their hands a ſort of mattock, which has a ſteel point at one end to dig with, and a blunt head at the other wherewith to break ſtones, they go to the hollows of the mountains, where the current of rain water deſcends, or to ſome other part of the ſkirts of the mountains, and there obſerve what ſtones they meet with, breaking in pieces thoſe that ſeem to have any metal in them; whereof they find many times both middling ſort of ſtones and ſmall ones alſo of metal. Then they conſider the ſituation of that place, and whence theſe ſtones can tumble, which of neceſſity muſt be from higher ground, and follow the track of them up the hill as long as they can find any of them,” &c.

“Another way (ſays Mr Price) of diſcovering lodes is is by working drifts acroſs the *country*, as we call it, that is, from north to ſouth, and *vice verſa*. I tried the experiment in an adventure under my management, where I drove all open at graſs about two feet in the ſhelf, very much like a level to convey water upon a mill wheel; by ſo doing I was ſure of cutting all lodes in my way: and I did accordingly diſcover five courſes, one of which has produced above 180 tons of copper ore, but the others were never wrought upon. This method of diſcovering lodes is equally cheap and certain; for 100 fathoms in ſhallow ground may be driven at 50s. expence."

In that kind of ground called by our author *feaſible*, and which he explains by the phraſe *tenderſtanding*, he tells us, that "a very effectual, proving, and conſequential way is, by driving an adit from the loweſt ground, either north or ſouth; whereby there is a certainty to cut all lodes at 20, 30, or 40 fathoms deep, if the level admits of it. In driving adits or levels acroſs, north or ſouth, to unwater mines already found, there are many freſh veins diſcovered, which frequently prove better than thoſe they were driving to."

After the mine is found, the next thing to be conſidered is, whether it may be dug to advantage. In order to determine this, we are duly to weigh the nature of the place, and its ſituation, as to wood, water, carriage, healthineſs, and the like; and compare the reſult with the richneſs of the ore, the charge of digging, ſtamping, waſhing, and ſmelting.

Particularly the form and ſituation of the ſpot ſhould be well conſidered. A mine muſt either happen, 1. In a mountain; 2. In a hill; 3. In a valley; or, 4. In a flat. But mountains and hills are dug with much greater eaſe and convenience, chiefly becauſe the drains and burrows, that is, the adits or avenues, may be here readily cut, both to drain the water and to form gangways for bringing out the lead, &c. In all the four caſes, we are to look out for the veins which the rains or other accidental thing may have laid bare; and if ſuch a vein be found, it may often be proper to open the mine at that place, eſpecially if the vein prove tolerably large and rich; otherwiſe the moſt commodious place for ſituation is to be choſen for the purpoſe, viz. neither on a flat, nor on the tops of mountains, but on the ſides. The beſt ſituation for a mine is a mountainous, woody, wholeſome ſpot; of a ſafe eaſy aſcent, and bordering on a navigable river. The places abounding with mines are generally healthy; as ſtanding high, and everywhere expoſed to the air; yet ſome places where mines are found prove poiſonous, and can upon no account be dug, though ever ſo rich; the way of examining a ſuſpected place of this kind, is to make experiments upon brutes, by expoſing them to the effluvia or exhalations, to find the effects.

Devonſhire and Cornwall, where there are a great many mines of copper and tin, is a very mountainous country, which gives an opportunity in many places to make adits or ſubterraneous drains to ſome valley at a diſtance, by which to carry off the water from the mine, which otherwiſe would drown them out from getting the ore. Theſe adits are ſometimes carried a mile or two, and dug at a vaſt expence, as from 2000l. to 4000l. eſpecially where the ground is rocky; and yet they find this cheaper than to draw up the water out of the mine quite to the top, when the water runs in plenty, and the mine is deep. Sometimes, indeed, they cannot find a level near enough to which an adit may be carried from the very bottom of the mine; yet they find it worth while to make an adit at half the height to which the water is to be raiſed, thereby ſaving half the expence.

Mr Coſtar, conſidering that ſometimes from ſmall ſtreams, and ſometimes from little ſprings or collections of rain water, one might have a good deal of water above ground, though not a ſufficient quantity to turn an overſhot wheel, thought that if a ſufficient fall might be had, this collection of water might be made uſeful in raiſing the water in a mine to the adit, where it may be carried off.

But now the moſt general method of draining mines is by the ſteam engine. See *STEAM-Engine*.

Mine, in the military art, denotes a ſubterraneous canal or paſſage, dug under the wall or rampart of a fortification, intended to be blown up by gunpowder.

The alley or paſſage of a mine is commonly about four feet ſquare; at the end of this is the chamber of the mine, which is a cavity of about five feet in width and in length, and about ſix feet in height; and here the gunpowder is ſtowed. The sauciſſe of the mine is the train, for which there is always a little aperture left.

Two ounces of powder have been found, by experiment, capable of raiſing two cubic feet of earth; conſequently 200 ounces, that is, 12 pounds 8 ounces, will raiſe 200 cubic feet, which is only 16 feet ſhort of a cubic toiſe, becauſe 200 ounces, joined together, have proportionably a greater force than two ounces, as being an united force.

All the turnings a miner uſes to carry on his mines, and through which he conducts the sauciſſe, ſhould be well filled with earth and dung; and the maſonry in proportion to the earth to be blown up, as 3 to 2. The entrance of the chamber of the mine ought to be firmly ſhut with thick planks, in the form of a St Andrew's croſs, ſo that the encloſure be ſecure, and the void ſpaces ſhut up with dung or tempered earth. If a gallery be made below or on the ſide of the chamber, it muſt abſolutely be filled up with the ſtrongeſt maſonry, half as long again as the height of the earth; for this gallery will not only burſt, but likewiſe obſtruct the effect of the mine. The powder ſhould always be kept in ſacks, which are opened when the mine is charged, and ſome of the powder ſtrewed about: the greater the quantity of earth to be raiſed is, the greater is the effect of the mine, ſuppoſing it to have the due proportion of powder. Powder has the ſame effect upon maſonry as upon earth, that is, it will proportionably raiſe either with the ſame velocity.

The branches which are carried into the ſolidity of walls do not exceed three feet in depth, and two feet ſix inches in width nearly: this ſort of mine is moſt excellent to blow up the ſtrongeſt walls.

The weight of a cubic foot of powder ſhould be 80lb.; 1 foot 1 inch cube will weigh 100lb. and 1 foot 2 inches and $\frac{11}{12}$ 150lb.; and 200lb. of powder will be 1 foot 5 inches cube; however, there is a diverſity in this, according to the quantity of ſaltpetre in the gunpowder.

If, when the mines are made, water be found at the bottom of the chamber, planks are laid there, on which the powder is placed either in ſacks or barrels of 100 lb. each. The ſauciſſe muſt have a clear paſſage to the powder, and be laid in an auget or wooden trough, through all the branches. When the powder is placed in the chamber, the planks are laid to cover it, and others again acroſs theſe; then one is placed over the top of the chamber, which is ſhaped for that purpoſe; between that and thoſe which cover the powder, props are placed, which ſhore it up; ſome inclining towards the outſide; others to the inſide of the wall; all the void ſpaces being filled with earth, dung, brick, and rough ſtones. Afterwards planks are placed at the entrance of the chamber, with one acroſs the top, whereon they buttreſs three ſtrong props, whoſe other ends are likewiſe propped againſt another plank ſituated on the ſide of the earth in the branch; which props being well fixed between the planks with wedges, the branch ſhould then be filled up to its entrance, with the forementioned materials. The ſauciſſes which paſs through the ſide branches muſt be exactly the ſame length with that in the middle, to which they join: the part which reaches beyond the entrance of the mine is that which conveys the fire to the other three; the ſauciſſes being of equal length, will ſpring together.

From a great number of experiments, it appears, 1. That the force of a mine is always towards the weakeſt ſide; ſo that the diſpoſition of the chamber of a mine does not at all contribute to determine this effect. 2. That the quantity of powder muſt be greater or leſs, in proportion to the greater or leſs weight of the bodies to be raiſed, and to their greater or leſs coheſion; ſo that you are to allow for each cubic fathom

Of looſe earth, - -	9 or 10lb.
Firm earth and ſtrong ſand,	11 or 12
Flat clayey earth, - -	15 or 16
New maſonry, not ſtrongly bound,	15 or 20
Old maſonry, well bound, -	25 or 30

3. That the aperture, entonnoir of a mine, if rightly charged, is a cone, the diameter of whoſe baſe is double the height taken from the centre of the mine. 4. That when the mine has been overcharged, its entonnoir is nearly cylindrical, the diameter of the upper extreme not much exceeding that of the chamber. 5. That beſides the ſhock of the powder againſt the bodies it takes up, it likewiſe cruſhes all the earth that borders upon it, both underneath and ſidewiſe.

To charge a mine ſo as to have the moſt advantageous effect, the weight of the matter to be carried muſt be known; that is, the ſolidity of a right cone, whoſe baſe is double the height of the earth over the centre of the mine: thus, having found the ſolidity of the cone in cubic fathoms, multiply the number of fathoms by the number of pounds of powder neceſſary for raiſing the matter it contains; and if the cone contains matters of different weights, take a mean weight between them all, always having a regard to their degree of coheſion.

As to the diſpoſition of mines, there is but one general rule, which is, That the ſide towards which one would determine the effect be the weakeſt; but this varies according to occaſions and circumſtances.

The calculation of mines is generally built upon this hypotheſis, That the entonnoir of a mine is the fruſtum of an inverted cone, whoſe altitude is equal to the radius of the excavation of the mine, and the diameter of the whole leſſer baſe is equal to the line of leaſt reſiſtance; and though theſe ſuppoſitions are not quite exact, yet the calculations of mines deduced from them have proved ſucceſsful in practice; for which reaſon this calculation ſhould be followed till a better and more ſimple be found out.

M. de Valliere found that the entonnoir of a mine was a paraboloid, which is a ſolid generated by the rotation of a ſemiparabola about its axis; but as the difference between theſe two is very inſignificant in practice, that of the fruſtum of a cone may be uſed.

MINEHEAD, a town of Somerſetſhire, 166 miles from London. It is an ancient borough, with a harbour in the Briſtol channel, near Dunſter caſtle, much frequented by paſſengers to and from Ireland. It was incorporated by Queen Elizabeth, with great privileges, on condition the corporation ſhould keep the quay in repair; but its trade falling off, the quay was neglected, and they loſt their privileges. A ſtatute was obtained in the reign of King William, for recovering the port, and keeping it in repair, by which they were to have the profits of the quay and pier for 36 years, which have been computed at about 200l a-year; and they were at the expence of new-building the quay. In purſuance of another act, confirming the former; a new head has been built to the quay, the beach cleared, &c. ſo that the biggeſt ſhip may enter, and ride ſafe in the harbour. The town contains about 500 houſes, and 2000 ſouls. It was formerly governed by a portreeve, and now by two conſtables choſen yearly at a court leet held by the lord of the manor. Its chief trade is with Ireland, from whence about 40 veſſels uſed to come hither in a year with wool; and about 400 chaldrons of coals are yearly imported at this place, Watchet, and Poriock, from South Wales, which lies directly oppoſite to it about ſeven leagues over, the common breadth of this channel all the way from Holmes to the Land's End. Here are ſeveral rich merchants, who have ſome trade alſo to Virginia and the Weſt Indies; and they correſpond much with the merchants of Barneſtaple and Briſtol in their foreign commerce. Three or four thouſand barrels of herrings, which come up the Severn in great ſhoals about Michaelmas, are caught, cured, and ſhipped off here every year, for the Mediterranean, &c. The market here is on Wedneſday, and fair on Whitſun-Wedneſday.

MINERAL, in *Natural Hiſtory*, is uſed in general for all foſſil bodies, whether ſimple or compound, dug out of a mine; from whence it takes its denomination. See MINERALOGY.

MINERAL Waters. All waters naturally impregnated with any heterogeneous matter which they have diſſolved within the earth may be called *mineral waters*, in in the moſt general and extenſive meaning of that name ; in which are therefore comprehended almoſt all thoſe that flow within or upon the ſurface of the earth, for almoſt all theſe contain ſome earthy or ſaline matter. But, ſtrictly ſpeaking, thoſe waters only which hold in ſolution ſuch a quantity of foreign ingredients as to give them properties which are eaſily recognized by the taſte or ſmell come under the denomination of mineral waters. For the methods of analyzing mineral waters, ſee CHEMISTRY *Index*.

Here we ſhall give a tabular view of the more remarkable mineral waters which have been diſcovered and examined.

An ALPHABETICAL TABLE of the moſt noted Mineral Waters in Europe, exhibiting their Medicinal Properties and Contents.

Names of Springs.	*Countries in which they are found.*	*Contents and Quality of the Water.*	*Medicinal Virtues.*
Abcourt,	Near St Germains in France.	A cold chalybeate water, containing beſides the iron a ſmall quantity of foſſil alkali ſaturated with fixed air.	Diuretic and purgative. Internally uſed in dropſies, jaundice, and obſtructions of the viſcera ; externally in ſcorbutic eruptions, ulcers, &c.
Aberbrothick,	County of Forfar in Scotland.	A cold chalybeate. Contains iron diſſolved in fixed air.	Diuretic and corroborative. Uſed in indigeſtions, nervous diſorders, &c.
Acton,	Middleſex county, England.	Contains Epſom and ſea ſalt. Cold.	Strongly purgative, and cauſes a ſoreneſs in the fundament.
Aghaloo,	Tyrone, Ireland.	Sulphur, foſſil alkali, and ſome purging ſalt. Cold.	Alterative and corroborant. Uſeful in ſcrofulous diſorders, worms, and cutaneous diſeaſes.
Aix-la-Chapelle,	Juliers in Germany.	Sulphureous and hot. Contain aerated calcareous earth, ſea ſalt, foſſil alkali, and ſulphur.	Diaphoretic, purgative, and diuretic. Uſed as baths as well as taken internally. Uſeful in rheumatiſms, and all diſeaſes proceeding from a debility of the ſyſtem.
Alford or Awford,	Somerſetſhire, England.	A purging ſalt along with ſea ſalt. Cold.	Strongly purgative.
Aſkeron,	Yorkſhire, in England.	Contains Epſom ſalt, aerated calcareous earth, and ſulphur. Cold.	Diuretic. Uſeful when drunk in leproſy, and other cutaneous diſeaſes.
Antrim,	Ireland.		Similar to Borrowdale water, but weaker.
Baden,	Swabia in Germany.	Hot and ſulphureous ſprings and baths, reſembling thoſe of Aix-la-Chapelle.	See AIX-LA-CHAPELLE, and BADEN, in the order of the Alphabet.
Bagnigge,	Middleſex, near London.	Epſom ſalt and muriated magneſia. Cold. Another ſpring contains iron and fixed air.	Strongly purgative, three half pints being a doſe. The chalybeate ſpring alſo proves purgative when the bowels contain any vitiated matter.
Balimore,	Worceſterſhire in England.	A fine cold chalybeate, containing iron rendered ſoluble by fixed air, along with ſome other ſalt ſuppoſed to be foſſil alkali.	Corroborative, and good in obſtructions of the viſcera. Drank from two to three pints in a morning.
Ball or Baudwell,	Lincolnſhire in England.	A cold petrifying water ; contains aerated calcareous earth or magneſia.	Corroborative and aſtringent. Drunk to the quantity of two pints, or two and a half.
Balaruc,	Languedoc in France.	Hot, and contain ſome purging ſalts.	Drank as purgatives, and uſed as hot baths. Uſeful in ſcrofulous and cutaneous diſorders.
Ballycaſtle,	Antrim in Ireland.	Chalybeate and ſulphureous. Cold.	Reſembles that of Balimore in virtue.
Ballynahinch,	Down in Ireland.	Iron, fixed air, and ſulphur. Cold.	Uſeful in ſcorbutic diſorders and diſeaſes of indigeſtion.
Ballyſpellan,	Near Kilkenny in Ireland.	Iron, fixed air, and probably foſſil alkali.	Similar in virtue to that of Balimore.

Names of Springs.	*Countries in which they are found.*	*Contents and Quality of the Water.*	*Medicinal Virtues.*
Bagneres,	Bigorre in France.	Earth and ſulphur. Hot.	The waters uſed in baths, like thoſe of Aix-la-Chapelle. Some of the ſprings purgative, others diuretic.
Bareges,	Bigorre in France.	Sea ſalt, foſſil alkali, calcareous earth, ſelenites, ſulphur, and a fine bituminous oil. Hot.	Diuretic and diaphoretic. Uſeful in nervous as well as cutaneous diſorders, in old wounds and ſome venereal complaints. Uſed as baths, as well as taken internally to the quantity of a quart or three pints.
Barnet and North-hall,	Hertfordſhire in England.	Epſom ſalt, and aerated calcareous earth.	Purgative.
Bath,	Somerſetſhire in England.	Iron, aerated calcareous earth, ſelenite, Glauber's ſalt, and ſea ſalt. Hot.	Powerfully corroborative, and very uſeful in all kinds of weakneſſes. Uſed as a bath, and taken internally.
Bandola,	Italy.	Iron, fixed air, foſſil alkali, and a little ſulphur.—Cold.	Gently laxative, diuretic, and diaphoretic.
Borrowdale,	Cumberland in England.	A great quantity of ſea ſalt, aerated calcareous earth, and ſome bittern. Cold.	Strongly emetic and catharic. Sometimes uſeful in the jaundice and dropſy, ſcorbutic diſorders, and chronic obſtructions. Uſed likewiſe as a bath in cutaneous diſeaſes. Taken in the doſe of a pint, containing only about ſeven drachms and a half of ſea ſalt; ſo that a great part of the virtue muſt reſide in the aerated calcareous earth.
Brentwood,	Eſſex in England.	Epſom ſalt, and aerated calcareous earth.	Purgative.
Briſtol,	Somerſetſhire in England.	Calcareous earth, ſea ſalt, Epſom ſalt, Glauber's ſalt, and ſelenites. Hot.	Uſed as a bath; and drank from four to eight ounces at a time, to two quarts per day. Uſeful in conſumptions, diabetes, fluor albus, &c.
Bromley,	Kent in England.	Iron and fixed air. Cold.	Diuretic and corroborative.
Broughton,	Yorkſhire in England.	Sulphur, ſea ſalt, Epſom ſalt, and aerated earth. Cold.	Similar to Harrowgate.
Buxton,	Derbyſhire in England.	A ſmall quantity of ſea ſalt, foſſil alkali, Epſom ſalt, and aerated calcareous earth. Hot. Here is alſo a fine cold chalybeate ſpring.	Uſeful in gout, rheumatiſm, and other diſorders in which tepid baths are ſerviceable. Uſed as baths, and drank to the quantity of five or ſix pints per day.
Caroline baths,	Bohemia.	Iron, fixed air, aerated earth, ſea ſalt, foſſil alkali, Epſom ſalt, and Glauber's ſalt. Hot.	Purgative, and uſed as baths. Of ſervice in diſorders of the ſtomach and bowels, ſcrofula, &c.
Carlton,	Nottinghamſhire in England.	Iron diſſolved in fixed air, along with a bituminous oil, which gives it the ſmell of horſe dung.—Cold.	Diuretic and corroborative.
Carrickfergus,	Antrim in Ireland.	Seems from its bluiſh colour to contain a very ſmall quantity of copper. Cold.	Weakly purgative.
Carrickmore,	Cavan in Ireland.	Foſſil alkali, fixed air, and ſome purging ſalt. Cold.	Purgative and diuretic.
Caſhmore,	Waterford in Ireland.	Green vitriol.	Purgative, diuretic, and ſometimes emetic.
Caſtle-Connel,	Limerick in Ireland.	Iron diſſolved in fixed air, &c. Cold.	Reſembles the German Spaw, and is in conſiderable repute.
Caſtle-Leod,	Roſs-ſhire in Scotland.	Aerated earth, ſelenites, Glauber's ſalt, and ſulphur. Cold.	Diuretic, diaphoretic, and corroborant; uſeful in cutaneous diſeaſes.

Names of Springs.	*Countries in which they are found.*	*Contents and Quality of the Water.*	*Medicinal Virtues.*
Caſtlemain,	Kerry in Ireland.	Iron, ſulphur, and fixed air. Cold.	Corroborant and diuretic.
Cawley,	Derbyſhire in England.	Epſom ſalt, aerated calcareous earth, and ſulphur. Cold.	Gently purgative.
Cawthorp,	Lincolnſhire in England.	Iron, fixed air, and probably foſſil alkali. Cold.	Purgative, and corrects acidities.
Chadlington,	Oxfordſhire in England.	Foſſil alkali, ſea ſalt, and ſulphur. Cold.	Purgative.
Chaude Fontaine,	Liege in Germany.	Aerated earth, foſſil alkali, and fixed air. Hot.	Reſembles thoſe of Aix-la-Chapelle and Buxton.
Cheltenham,	Glouceſterſhire in England.	Calcareous earth, iron, Epſom ſalt, and common ſalt. Cold.	Purgative and corroborant; taken in the quantity of from one to three or four pints. It is uſeful in caſes of indigeſtion and ſcorbutic diſorders; alſo in the gravel.
Chippenham,	Wiltſhire in England.	Iron diſſolved in fixed air.	Diuretic and corroborative.
Cleves,	Germany.	Iron, fixed air, and other ingredients of Pyrmont water.	Diuretic and corroborant.
Clifton,	Oxfordſhire in England.	Foſſil alkali, and aerated calcareous earth or ſelenite. Cold.	Gently laxative, and uſed as a bath for cutaneous diſorders.
Cobham,	Surry in England.	Iron, and ſome purging ſalt.	Purgative, diuretic, and corroborant.
Codſalwood,	Staffordſhire in England.	Sulphur, fixed air, and aerated earth.	Reſembles the Aſkeron water.
Colcheſter,	Eſſex in England.	Epſom ſalt, and aerated calcareous earth.	Strongly purgative.
Colurian,	Cornwall in England.	Iron, fixed air, and aerated earth.	Corroborative and diuretic.
Comner, or Cumner,	Berkſhire in England.	Some purging ſalt, and probably aerated earth; the water is of a whitiſh colour.	Purgative, in the quantity of one, two, or three quarts.
Coolauran,	Fermanagh in Ireland.	Iron, fixed air, and aerated earth.	Diuretic.
Corſtorphine,	Mid Lothian in Scotland.	Sulphur, ſea ſalt, clay, and Epſom ſalt. Cold.	Diuretic and laxative.
Coventry,	Warwickſhire in England.	Iron, fixed air, and ſome purging ſalt.	Purgative, diuretic, and corroborant.
Crickle Spaw,	Lancaſhire in England.	Sulphur, ſea ſalt, and aerated earth.	Purgative, and reſembling Harrowgate water.
Croft,	Yorkſhire in England.	Aerated earth, vitriolated magneſia, and ſea ſalt.	Purgative, and reſembling Aſkeron water.
Croſstown,	Waterford in Ireland.	Martial vitriol.	Diuretic, purgative, and ſometimes emetic.
Cunley-houſe,	Lancaſhire in England.	Sulphur, aerated earth, and fixed air.	Purgative, and reſembling the Aſkeron water.
Das Wild Bad,	Nuremberg in Germany.	Iron, fixed air, and ſome ſaline matter.	Corroborant. Uſeful in obſtructions of the viſcera, and female complaints.
D' ax en Foix,	15 leagues from Thoulouſe in France.	Similar to Aix-la-Chapelle. Hot.	Uſed as a bath, and alſo drank, like the Aix-la-Chapelle waters.
Deddington,	Oxford in England.	Iron, ſulphur, aerated earth, ſea ſalt, or foſſil alkali.	Alterative, purgative in large quantity, and uſeful in ſcorbutic and cutaneous diſorders.
Derby,	Near the capital of Derbyſhire in England.	Iron diſſolved by fixed air.	Corroborant.
Derryinch,	Fermanagh in Ireland.	Sulphur and foſſil alkali.	Diuretic and diaphoretic.
Derrindaff,	Cavan in Ireland.	Sulphur and purging ſalt.	Similar to the *Aſkeron* water.

Names of Springs.	*Countries in which they are found.*	*Contents and Quality of the Water.*	*Medicinal Virtues.*
Derryleſter,	Cavan in Ireland.	Similar to *Swadlingbar* water.	
Dog and Duck,	St George's Fields, London.	Aerated magneſia, Epſom ſalt, and ſea ſalt.	Cooling and purgative, but apt to bring on or increaſe the fluor albus in women.
Dortſhill,	Staffordſhire in England.	Iron diſſolved in fixed air.	Corroborant.
Drigwell,	Cumberland in England.	Similar to Deddington.	
Dropping-well,	Yorkſhire in England.	Aerated earth.	Aſtringent and corroborant.
Drumas-nave,	Leitrim in Ireland.	Sulphur, foſſil alkali, with ſome purging ſalt.	Powerfully diuretic and anthelmintic, and of uſe in cutaneous and ſcrofulous diſorders.
Drumgoon,	Fermanagh in Ireland.	Similar to the former.	
Dublin ſalt ſprings,	Ireland.	Sea ſalt and Epſom ſalt.	Purgative.
Dulwich,	Kent in England.	Sea ſalt and Epſom ſalt.	Purgative and diuretic. Uſeful in nervous caſes and diſeaſes proceeding from debility.
Dunnard,	18 miles from Dublin.	Iron diſſolved in fixed air.	Diuretic and corroborant.
Dunſe,	Scotland.	Iron diſſolved in fixed air, with a little ſea ſalt and bittern.	Similar to the former.
Durham,	England.	Sulphur, ſea ſalt, and a little aerated earth. In the middle of the river is a ſalt ſpring.	Similar to the Harrowgate water.—That of the ſalt ſpring uſed as a purgative.
Egra,	Bohemia.	Similar to Cheltenham water.	
Epſom,	Surry in England.	Vitriolated and muriated magneſia, with a ſmall quantity of aerated calcareous earth.	Purgative, and of uſe in waſhing old ſores.
Fairburn,	Roſs-ſhire in Scotland.	Sulphur, aerated earth, and Glauber's ſalts.	Alterative, and uſeful in cutaneous diſeaſes.
Felſtead,	Eſſex in England.	Similar to Iſlington.	
Filah,	Yorkſhire in England.	Sea ſalt and aerated earth.	Powerfully diuretic and purgative.
Frankfort,	Germany.	Sulphur and ſea ſalt.	Similar to Harrowgate.
Gainſborough,	Lincolnſhire in England.	Sulphur, iron, aerated earth, and Epſom ſalt.	Diuretic and laxative.
Galway,	Ireland.	Similar to Tunbridge water.	
Glanmile,	Ireland.	Similar to Peterhead water.	
Glaſtonbury,	Somerſetſhire in England.	Similar to Clifton water.	
Glendy,	Merns county in Scotland.	Similar to Peterhead water.	
Granſhaw,	Down in Ireland.	Iron; ſimilar to the German Spaw.	
Haigh,	Lancaſhire in England.	Green vitriol, iron diſſolved by fixed air, with ſome aerated earth.	Emetic and cathartic.
Hampſtead,	England.	Green vitriol, iron diſſolved by fixed air, and a ſmall quantity of aerated earth.	Alterative and corroborant. The water is taken from half a pint to ſeveral pints; is better in the morning than in the middle of the day, and in cold than hot weather.
Hanbridge,	Lancaſhire in England.	Similar to Scarborough water.	Leſs purgative than the Scarborough water.

Names of Springs.	*Countries in which they are found.*	*Contents and Quality of the Water.*	*Medicinal Virtues.*
Hanlys,	Shropſhire in England.	Epſom, or other purging ſalt.	Purgative.
Harrowgate,	Yorkſhire in England.	Sulphur, ſea ſalt, and ſome purging ſalt. Some chalybeate ſprings here alſo.	Alterative, purgative, and anthelmintic; uſeful in ſcurvy, ſcrofula, and cutaneous diſeaſes. Uſed externally for ſtrains and paralytic weakneſſes.
Hartfell,	Annandale in Scotland.	Green vitriol, alum, and azotic gas.	Aſtringent and corroborant. Uſeful in all kinds of inward diſcharges of blood.
Hartlepool,	Durham in England.	Sulphur, iron diſſolved by fixed air, with ſome purging ſalt.	Diuretic and laxative.
Holt,	Wiltſhire in England.	Purging ſalt, with a large quantity of aerated earth.	Mildly purgative. Uſeful in old ulcers and cutaneous diſorders.
Joſeph's well,	Stock Common near Cobham in Surry.	A very large proportion of Epſom ſalt, and poſſibly a little ſea ſalt.	Alterative, purgative, and diuretic. Drank to about a quart, it paſſes briſkly without griping: taken in leſs doſes as an alterative, it is a good antiſcorbutic.
Ilmington,	Warwickſhire in England.	Aerated foſſil alkali, with ſome iron diſſolved by fixed air.	Diuretic and laxative.
Inglewhite,	Lancaſhire in England.	Sulphur, and iron diſſolved by fixed air.	Alterative. Uſeful in ſcorbutic and cutaneous diſeaſes.
Iſlington,	Near London.	Iron diſſolved by fixed air.	Corroborant. Uſeful in lowneſs of ſpirits and nervous diſeaſes. Operates by urine, and may be drank in large quantity.
Kanturk,	Cork in Ireland.	Similar to the water at Peterhead.	
Kedleſtone,	Derbyſhire in England.	Sulphur, ſea ſalt, and aerated earth.	Similar to Harrowgate; but intolerably fetid.
Kenſington,	Near London.	Similar to Acton water.	
Kilbrew,	Meath in Ireland.	A large quantity of green vitriol.	Emetic and cathartic, in the doſe of half a pint.
Kilburn,	Near London.	Fixed air, hepatic air, Epſom ſalt, Glauber's ſalt; muriated magneſia, ſea ſalt, aerated earth, and iron.	
Killaſher,	Fermanagh in Ireland.	Sulphur and foſſil alkali.	Similar to Swadlingbar water.
Killingſhanvally,	Fermanagh, Ireland.	Similar to Hanlys chalybeate water.	
Kilroot,	Antrim in Ireland.	Nature of Borrowdale water, but weaker.	
Kinalton,	Nottinghamſhire in England.	A purging ſalt.	Purgative.
Kincardine,	Merns in Scotland.	Similar to the water of Peterhead.	
Kingſcliff,	Northamptonſhire in England.	Similar to Cheltenham waters.	
Kirby,	Weſtmoreland in England.	Iron, fixed air, and probably ſome foſſil alkali.	Laxative, and uſeful in correcting acidities.
Knareſborough,	See *Dropping-well.*		
Knowſley,	Lancaſhire in England.	Similar to Scarborough water.	
Kuka,	Bohemia.	Aerated fixed alkali.	Operates by inſenſible perſpiration, ſometimes by ſpitting, ſweat or urine.
Lancaſter,	England.	Similar to Tunbridge water.	
Latham,	Lancaſhire in England.	Similar to the former.	

Llandrindod,

Names of Springs.	*Countries in which they are found.*	*Contents and Quality of the Water.*	*Medicinal Virtues.*
Llandrindod,	Radnor in South Wales.	Three ſprings; a purgative, a ſulphureous, and chalybeate.	Uſeful in the ſcurvy, leproſy, cutaneous diſorders, &c.
Llangybi,	Caernarvonſhire in North Wales.		Uſeful in diſorders of the eyes, ſcrofula, &c.
Leamington,	Warwickſhire in England.	Sea-ſalt and aerated calcareous earth.	Emetic and cathartic. Uſeful in old ſores, and cures mangy dogs.
Leez,	Eſſex in England.	Similar to Iſlington water.	
Lincomb,	Somerſetſhire in England.	Aerated iron, foſſil alkali, and a little Epſom ſalt.	
Liſbeak,	Fermanagh in Ireland.	Sulphur, &c.	Similar to Swadlingbar water.
Lis done-Vurna,	Clare in Ireland.	Foſſil alkali, with much iron.	Emetic, cathartic, and diuretic.
Loanſbury,	Yorkſhire in England.	Sulphur, and ſome purging ſalt.	Uſed only for waſhing mangy dogs and ſcabby horſes.
Maccroomp,	Cork in Ireland.	Similar to Ilmington water.	
Mahereberge,	Kerry in Ireland.	Similar to Borrowdale water.	
Mallow,	Cork in Ireland.	A hot water, ſimilar to that of Briſtol.	
Malton,	Yorkſhire in England.	Iron and fixed air in conſiderable quantity.	Similar to Scarborough water, but is ſometimes apt to vomit.
Malvern,	Glouceſterſhire in England.	Iron. Two ſprings.	Diuretic and cathartic; uſed alſo externally. Recommended as excellent in diſeaſes of the ſkin; in leproſies, ſcorbutic complaints, ſcrofula, old ſores, &c. Alſo ſerviceable in inflammations and other diſeaſes of the eyes; in the gout and ſtone, in bilious and paralytic caſes, and in female obſtructions. The external uſe is by waſhing the part at the ſpout ſeveral times a-day, and afterwards covering it with cloths dipt in the water and kept conſtantly moiſt; alſo by general bathing.
Markſhall,	Eſſex in England.	Similar to Iſlington.	
Matlock,	Derbyſhire in England.	Warm ſprings, of the nature of the Briſtol water, except that they are very ſlightly impregnated with iron, but contain a great quantity of aerated earth. They are colder than the Buxton; but their virtues ſimilar to thoſe of the two places mentioned.	
Maudſley,	Lancaſhire in England.	Sulphur and ſea ſalt.	Similar to Harrowgate.
Mechan,	Fermanagh in Ireland.	Sulphur and foſſil alkali.	Similar to the waters of Drumgoon.
Miller's Spaw,	Lancaſhire in England.	Similar to Tunbridge.	
Moffat,	Annandale in Scotland.	Sulphurated hydrogen, carbonic acid and azotic gaſes, with common ſalt.	Alterant, diuretic, and ſometimes purgative. Is uſed as a bath, and the ſteam of the hot water has been found ſerviceable in relaxing hard tumors and ſtiff joints.
Moſs-houſe,	Lancaſhire in England.	Similar to Iſlington water.	Purges ſtrongly.
Moreton,	Shropſhire in England.	Similar to Holt water.	

Names of Springs.	*Countries in which they are found.*	*Contents and Quality of the Water.*	*Medicinal Virtues.*
Mount d'Or,	France.	Warm, and ſimilar to the waters of Aix-la-Chapelle.	Diuretic, purgative, and diaphoretic.
Nevil Holt,	Leiceſterſhire in England.	Selenite or aerated earth, and Epſom ſalt.	Purgative, diuretic, and diaphoretic.—Powerfully antiſeptic in putrid diſeaſes, and excellent in diarrhœa, dyſenteries, &c.
New Cartmall,	Lancaſhire in England.	Sea ſalt and aerated earth.	Purgative.
Newnham Regis,	Warwickſhire in England.	Similar to Scarborough water.	
Newtondale,	Yorkſhire in England.	Aerated calcareous earth or magneſia.	Aſtringent or tonic.
Newton-Stewart,	Tyrone in Ireland.	Similar to Tunbridge.	
Nezdenice,	Germany.	Fixed air, foſſil alkali, iron, and earth.	Diuretic, diaphoretic, and tonic.
Nobber,	Meath in Ireland.	Martial vitriol.	Similar to Hartfell.
Normanby,	Yorkſhire in England.	Sulphur, much fixed air, ſome ſea ſalt, and Epſom ſalt.	Similar to Aſkeron water.
Nottington,	Dorſetſhire, England.	Sulphur, foſſil alkali, and earth.	Uſeful in cutaneous diſeaſes.
Orſton,	Nottingham, England.	Much fixed air, Epſom ſalt, and a little ſea ſalt, with ſome iron.	Purgative.—It intoxicates by reaſon of the great quantity of air contained in it.
Oulton,	Norfolk, England.	Similar to Iſlington.	
Owen Breun,	Cavan, Ireland.	Sulphur, Epſom ſalt, and foſſil alkali.	Similar to Aſkeron water.
Pancras,	Near London.	Epſom ſalt, and aerated earth.	Diuretic and purgative.
Paſſy,	Near Paris.	Similar to Pyrmont water.	
Peterhead,	Aberdeen county, Scotland.	A ſtrong chalybeate, but of which no analyſis has been publiſhed.	Similar to Iſlington, but more powerful.
Pettigoe,	Donnegal, Ireland.	Sulphur and purging ſalt.	Similar to Aſkeron water.
Pitkeathly,	Perthſhire, Scotland.	Sea ſalt, a ſmall quantity of muriated and likewiſe of aerated earth.	Gently purgative. Very uſeful in ſcrofulous and ſcorbutic habits.
Plombiers,	Lorraine, France.	Saline matter, probably foſſil alkali, with a ſmall portion of oil.—Warm.	Uſed as a bath, and for waſhing ulcers. Inwardly taken it cures complaints from acidity, hemorrhagies, &c.
Pontgibault,	Auvergne, France.	Foſſil alkali and calcareous earth.	Diuretic and laxative.
Pougues,	Nivernois, France.	Calcareous earth, magneſia, foſſil alkali, ſea ſalt, earth of alum, and ſiliceous earth.	Diuretic and laxative.
Pyrmont,	Weſtphalia, Germany.	Aerated iron, calcareous earth, magneſia, Epſom ſalt, and common ſalt.	Diuretic, diaphoretic, and laxative. Recommended in caſes where the conſtitution is relaxed; in female complaints, in cutaneous diſeaſes, in nervous diſorders, in the gravel and urinary obſtructions; and conſidered as among the beſt reſtoratives in decayed and broken conſtitutions.
Queen Camel,	Somerſetſhire, England.	Sulphur, ſea ſalt, foſſil alkali, calcareous earth, and bituminous oil.	Uſed in ſcrofulous and cutaneous diſorders.
Richmond,	Surry in England.	Similar to Acton water.	
Rippon,	Yorkſhire, England.	Sulphur, ſea ſalt, and aerated earth.	Diaphoretic and alterant.

Names of Springs.	*Countries in which they are found.*	*Contents and Quality of the Water.*	*Medicinal Virtues.*
Road,	Wiltſhire, England.	Sulphur, iron, foſſil alkali, and fixed air.	Uſeful in ſcrofula, ſcurvy, and cutaneous diſorders.—Acts as a laxative.
St Bartholomew's well,	Cork in Ireland.	Foſſil alkali, iron, and fixed air.	Similar to Tilbury water.
St Bernard's well,	Near Edinburgh.	Similar to the waters of Moffat.	Somewhat congenial with Moffat and Harrowgate. In nervous and ſtomachic caſes, analeptic and reſtorative; in ſcorbutic, ſcrofulous, and moſt dropſical caſes, reckoned a ſpecific.
St Eraſmus's well,	Staffordſhire, England.		Similar to Borrowdale water.
Scarborough,	Yorkſhire, England.	Aerated calcareous earth, Epſom ſalt, ſea ſalt, and iron.	Diuretic and purgative.
Scollienſis,	Switzerland.	Iron, foſſil alkali, and a great quantity of fixed air.	Excellent in colic pains, both as a cure and preventive.
Seidlitz,	Bohemia.	Epſom ſalt.	Strongly purgative.
Seltzer,	Germany.	Calcareous earth, magneſia, foſſil alkali, and fixed air.	Diuretic. Uſeful in the gravel, rheumatiſm, ſcurvy, ſcrofula, &c.
Sene, or Send,	Wiltſhire, England.	Similar to Iſlington.	
Seydſchutz,	Germany.	Similar to Seidlitz.	
Shadwell,	Near London.	Green vitriol.	Emetic and cathartic.
Shapmoor,	Weſtmoreland, England.	Sulphur and purging ſalt.	Similar to Aſkeron water.
Shettlewood,	Derbyſhire, England.		Similar to Harrowgate water.
Shipton,	Yorkſhire, England.	Sulphur, ſea ſalt, and purging ſalt.	Similar to Harrowgate.
Somerſham,	Huntingdonſhire, England.	Green vitriol, alum, and fixed air.	Corroborant and alterative. Uſeful for waſhing foul ulcers and cancers.
Spaw,	Liege in Germany.	Foſſil alkali, iron, aerated earth, Epſom ſalt, and ſea ſalt.	Diuretic and purgative. Serviceable in many diſorders. See the article Spaw.
Stanger,	Cumberland, England.	Green vitriol.	Emetic and cathartic.
Stenfield,	Lincolnſhire, England.	Similar to Orſton.	
Streatham,	Surry, England.	Aerated earth, Epſom ſalt, ſea ſalt, and muriated magneſia.	Purgative.
Suchaloza,	Hungary.		Similar to Nezdenice.
Sutton bog,	Oxfordſhire, England.	Sulphur, foſſil alkali, and ſea ſalt.	Alterative and laxative.
Swadlingbar,	Cavan in Ireland.	Sulphur, earth, ſea ſalt, and foſſil alkali.	Alterative and diaphoretic.
Swanſey,	Glamorganſhire in North Wales.	Green vitriol.	Similar to Shadwell.
Sydenham,	Kent in England.	Similar to Epſom, but weaker.	
Tarleton,	Lancaſhire in England.	Similar to Scarborough water.	
Tewkſbury,	Glouceſterſhire in England.	Similar to Acton.	
Thetford,	Norfolk in England.	Foſſil alkali, fixed air, and iron.	Purgative and diuretic.
Thoroton,	Nottinghamſhire in England.	Similar to Orſton.	
Thurſk,	Yorkſhire in England.	Similar to Scarborough.	
Tibſhelf,	Derbyſhire in England.	Iron diſſolved in fixed air.	Similar to Spaw water.

Names of Springs.	*Countries in which they are found.*	*Contents and Quality of the Water.*	*Medicinal Virtues.*
Tilbury,	Eſſex in England.	Foſſil alkali.	Diuretic and diaphoretic.
Tober Bony,	Near Dublin in Ireland.	Foſſil alkali, earth, and bituminous oil.	Similar to Tilbury.
Tonſtein,	Cologne in Germany.	Foſſil alkali.	Similar to Seltzer, but more purgative.
Tralee,	Kerry in Ireland.	Similar to Caſtle Connel.	
Tunbridge,	Kent in England.	Iron, ſome ſea ſalt, with a little ſelenites and calcareous earth.	An excellent chalybeate, uſeful in all diſeaſes for which the Spaw is recommended.
Upminſter,	Eſſex in England.	Sulphur, foſſil alkali, and purging ſalt.	Purgative and diuretic.
Vahls,	Dauphiny in France.	Foſſil alkali.	Diuretic and laxative.
Wardrew,	Northumberland.	Sulphur, earth, and ſea ſalt.	Similar to Harrowgate water.
Weatherſtack,	Weſtmoreland in England.	Iron, ſea ſalt, and a ſmall quantity of hepatic gas.	Purgative.
Wallenfrow,	Northamptonſhire in England.	Similar to Iſlington water.	
Weſt Aſhton,	Wiltſhire in England.	Similar to Iſlington.	
Weſtwood,	Derbyſhire in England.	Green vitriol.	Similar to Shadwell. Uſed for waſhing ulcers of the legs.
Wexford,	Ireland.	Similar to Iſlington.	
Whiteacre,	Lancaſhire in England.	Aerated iron, and probably calcareous earth.	Somewhat aſtringent.
Wiggleſworth,	Yorkſhire in England.	Sulphur, earth, and common ſalt.	Emetic in the quantity of two quarts, and ſaid to be cathartic in the quantity of three; a ſingular circumſtance if true.
Wildungan,	Waldech in Germany.	Similar to the waters of Bath.	Uſeful in ſcorbutic and gouty diſeaſes.
Windgate Spaw,	Northumberland.	Carbonate of iron, green vitriol, alum, common ſalt, calcareous earth.	Corroborant and diuretic; and uſeful in ſtomach complaints and ſcrofula.
Witham,	Eſſex in England.	Aerated iron, and common ſalt.	Diuretic, alterative, and corroborant.
Wirkſworth,	Derbyſhire in England.	Sulphur, purging ſalt, and aerated iron.	Uſeful in ſcrofulous and cutaneous diſeaſes.
Zahorovice,	Germany.	Similar to Nezdenice water.	Much eſteemed in ſcrofulous caſes.

MINERALOGY.

1 ition.

MINERALOGY is that branch of natural hiſtory which has for its object the deſcription and diſcrimination of inorganized or mineral ſubſtances, as they are found in the earth or on its ſurface.

2 ry.

The knowledge of ſome mineral bodies may be conſidered as coeval with the earlieſt ages of the world. The rudeſt and moſt barbarous nations could not be ignorant of ſome of the properties of the ſubſtances which were moſt familiar to their obſervation; and mankind have made little progreſs in civilization, when they are entirely unacquainted with the nature of thoſe matters from which ſome of the metals are extracted.

Precious ſtones, it ſeems not at all improbable, firſt attracted the notice of mankind. The richneſs of colour, brilliancy, luſtre, and durability of theſe bodies, could not fail to excite admiration, and make them be ſought after as ornaments, even by the leaſt civilized people, and in countries where they are moſt abundant. They were well known, it would appear from the ſacred writings, among the Jews and Egyptians in the time of Moſes. At this period, however, both the Jews and Egyptians had advanced far in refinement.

But this knowledge was too limited to be dignified with the name of *Mineralogy.* It wanted that comprehenſive, connected, and ſcientific view which could entitle it to that denomination. And indeed it may be ſaid to be only of modern date that the knowledge of minerals roſe to the rank of ſcience, and aſſumed any thing like a regular and connected form.

3 Writers on minerals.

Dioſcorides and Theophraſtus among the Greeks, and Pliny among the Romans, have, it is true, deſcribed a few mineral bodies; and Avicenna, an Arabian philoſopher and phyſician, who flouriſhed in the end of the 10th and beginning of the 11th century, arranged thoſe objects into four great claſſes, viz. 1. Stony bodies. 2. Saline bodies. 3. Inflammable bodies; and, 4. Metals —an arrangement which, it is curious to remark, muſt be well founded; for it has been adopted, ſometimes indeed with ſlight deviations, by almoſt all mineralogical writers ſince that period. But ſtill the knowledge of minerals was bounded by very narrow limits.

The variety and value of mineral productions in Germany have excited more attention to theſe ſtudies, and have thus rendered this knowledge of more intereſt and importance than in any other country. To Germany indeed it muſt be acknowledged that mineralogy is indebted in a great meaſure for its origin, and for a very ample ſhare of its progreſſive improvement. 4 Agricola. George Agricola, a native of Miſnia, in which country he ſettled as a phyſician, lived during the firſt half of the 16th century. Being ſtrongly attached by inclination to the ſtudy of minerals, he removed to Chemnitz in Hungary, where he might have an opportunity of proſecuting his favourite ſtudies; and there, by the moſt unwearied application to mineralogy, and particularly to the various operations on the metals, he became the moſt celebrated metallurgiſt of his time. He is ſuppoſed to be the firſt German author who profeſſedly wrote on mineral ſubſtances. The following titles chiefly comprehend the various heads into which his works on metallurgy and mineralogy are divided, *De Ortu et Cauſis Subterraneorum; De Natura eorum quæ affluunt ex Terra; De Natura Foſſilium; de Medicatis Fontibus; De Subterraneis Animantibus; De Veteribus et Novis Metallis;* and *De Re Metallica.* His arrangement of minerals is into two great diviſions. 1. Simple or Homogeneous Minerals; and, 2. Heterogeneous Minerals. The firſt, or ſimple minerals, includes four ſubdiviſions, viz. 1. Terra; 2. Succus Concretus; 3. Lapis; 4. Metallum. The ſecond great diviſion, the heterogeneous minerals, comprehends two ſubdiviſions, viz. 1. Compound minerals; 2. Mixed minerals.

5 Beccher. Several writers on mineralogy appeared in the courſe of the 17th century; and about the beginning of the 18th Beccher propoſed an arrangement of bodies on chemical principles, or according to their conſtituent parts. 6 Linnæus. In the year 1736, Linnæus publiſhed a ſyſtem of mineralogy, in which mineral bodies are divided into three claſſes, viz. 1. *Petræ;* 2. *Mineræ;* 3. *Foſſilia.* Theſe are ſubdivided into orders: the firſt containing three, *Vitreſcentes, Calcareæ, Apyræ;* the ſecond containing three, *Salia, Sulphurea, Mercurialia;* and the third alſo containing three, *Concreta, Petrifacta, Terræ.* Three years afterwards the ſyſtem of Cramer appeared, according to which all mineral ſubſtances are arranged into ſeven claſſes, of which the following are the titles. 1. Metals; 2. Semimetals; 3. Salts; 4. Inflammable ſubſtances; 5. Stones; 6. Earths; and, 7. Waters. 7 Wallerius. About 10 years after the firſt publication of the mineral ſyſtem of Linnæus, Wallerius profeſſor of mineralogy at Upſal, and his cotemporary, communicated to the world a more enlarged and improved arrangement of mineral bodies than any which had hitherto appeared. According to the ſyſtem of Wallerius, all minerals are diſtributed into four claſſes, each of which is ſubdivided into four orders. The firſt claſs, *Terræ*, includes the orders *Macræ, Pingues, Minerales,* and *Arenaceæ;* to the ſecond claſs, *Lapides*, belong the orders *Calcarei, Vitreſcentes, Apyri, Saxa;* the third claſs, *Mineræ*, comprehends the orders *Salia, Sulphurea, Semimetalla* and *Metalla;* and the fourth, *Concreta*, is compoſed of the orders *Pori, Petrifacta, Figurata,* and *Calculi.*

Of the ſyſtematic writers on mineralogy from the time of Linnæus, which have now been mentioned, and of others which the limits of this hiſtorical ſketch do not permit us to notice, it is to be obſerved, that by all of them, although the general arrangement of Avicenna was not followed, yet in the ſubordinate diviſions his claſſes were adopted, and conſtituted ſome of their orders. 8 Cronſtedt. The claſſes of Avicenna were not reſtored till the time of Cronſtedt, a Swediſh mineralogiſt, in whoſe ſyſtem, which was publiſhed in the year 1758, they reſumed the place which they formerly held. The ſyſtem of Cronſtedt is divided into four claſſes, *Terræ, Salia, Phlogiſtica,* and *Metalla.* The firſt claſs, *Terræ*, includes 9 orders, *Calcareæ, Siliceæ, Granatinæ, Argillaceæ, Micaceæ, Fluores, Aſbeſtinæ, Zeoliticæ,* and *Magneſiæ.* To the ſecond claſs, *Salia*, belong two orders, *Acida* and *Alkalina.* The third claſs, *Phlogiſtica*, conſiſts only of one order; and the fourth claſs, *Metalla*, is compoſed of two orders, *Metalla perfecta* and *Semimetalla.* The ſyſtem of Cronſtedt, the moſt complete which had yet been offered to the world, and which, by comparing it with the ſyſtems accounted by ſome the moſt perfect of the preſent day, will be found not much different in its arrangement, continued to be read and ſtudied for more than twenty years, and was tranſlated into different languages. This arrangement is founded on chemical principles. The firſt claſs, for inſtance, is divided into nine orders already enumerated, and correſponding, as he ſuppoſed, to nine earths, of one of which the ſtones included in each order are chiefly compoſed. But as the improvements in chemical analyſis led to greater accuracy of inveſtigation, the earths which Cronſtedt ſuppoſed to be ſimple were found to be compound. The number of ſimple or primitive earths was then diminiſhed to five; and thus the number of genera, as they appeared in the *Sciagraphia Regni Mineralis* of Bergman, publiſhed in 1782, was alſo five. 9 Bergman. At that period five earths only were known. The ſame method of conſtructing the genera is ſtill followed, ſo that the number of genera has increaſed in proportion to the number of earths which have been ſince diſcovered.

10 Werner. In the year 1780, a tranſlation of Cronſtedt's mineral ſyſtem appeared in Germany, accompanied with notes by Werner, the celebrated profeſſor of mineralogy at Freyberg in Saxony. Six years before this time Werner had publiſhed a ſeparate treatiſe on the claſſification of minerals, in which he exhibited his method of deſcribing them by means of external characters. The notes on Cronſtedt's ſyſtem are to be conſidered as a farther illuſtration of this method, as well as a catalogue of minerals belonging to Pabſt Von Ohain, which was drawn up by the ſame naturaliſt and publiſhed in 1791. In Germany the method of Werner, we believe, is almoſt excluſively adopted; and it is chiefly followed in moſt other countries, France excepted, where mineralogical knowledge is alſo greatly cultivated.

11 Kirwan. Mr Kirwan firſt introduced the knowledge of this ſyſtem into Britain, in his treatiſe on mineralogy publiſhed in 1784; and about ten years afterwards it was ſtill farther elucidated by the ſame author in an improved and enlarged edition of that work. In preparing the latter edition, Mr Kirwan enjoyed the peculiar advantage of conſulting one of the completeſt and beſt arranged collections of minerals which had yet been made in any country. 12 Leſkean collection of minerals. This is the Leſkean collection of foſſils, which Mr Kirwan pronounces to be the moſt perfect monument of mineralogical ability now extant.

“ That the poſſeſſion of this cabinet, Mr Kirwan proceeds to ſtate, ſhould eſcape the vigilance of the moſt learned nations, and fall to the lot of Ireland, hitherto ſo inattentive to matters of this nature, was little to be expected. Through the active zeal however of two of its moſt enlightened patriots (A), and the influence ſecured to them by former ſervices of the moſt eſſential nature, the ſums requiſite for its purchaſe, and for building a repoſitory to receive it, were obtained *.” This ſplendid and extenſive collection, we are farther informed, was made by Leſke, whoſe name it now bears, and who was one of the earlieſt and moſt eminent of the diſciples of Werner. It was arranged between the years 1782 and 1787, according to the principles of Werner, and with his aſſiſtance. After the death of Mr Leſke, a catalogue was drawn up by Karſten, another of Werner's diſciples. This catalogue in its arrangement correſponds to the arrangement of the cabinet, which is divided into five parts.

The firſt part, which is denominated the *characteriſtic* part, conſiſts of 580 ſpecimens. Theſe are intended for the illuſtration of the external characters, or the principles of the claſſification.

The ſecond, which is the *ſyſtematic* or oryctognoſtic part, comprehends all ſimple minerals diſtributed according to their genera and ſpecies agreeable to the method then followed by Werner. This part contains 3268 ſpecimens.

The third part, which is called the *geognoſtic* or *geological*, includes the ſubſtances found in the different kinds of rocks, as they are divided into *primitive*, *tranſition*, *ſtratiform*, *alluvial*, and *volcanic* mountains. This part of the collection is peculiarly rich in petrifactions; and the whole number of ſpecimens which it contains extends to 1100.

The fourth part is intended to illuſtrate the mineralogy of every country on the globe, by exhibiting its mineral productions. The order of arrangement of this part is from America to Aſia, Europe, and Africa. As there are many countries yet unexplored, it is the moſt imperfect diviſion of the whole collection; and indeed, as Mr Kirwan obſerves, it can only be completed by national opulence.

The fifth part is called the *economical* collection. It is formed of 474 ſpecimens of minerals which are employed in arts and manufactures, as in architecture, ſculpture, agriculture, jewellery, colouring, dyeing, clothing, pottery, glazing, enamelling, poliſhing of metals, furnace-building, medicine, metallurgy, &c. The whole cabinet conſiſts of 7331 ſpecimens.

Such is the valuable ſource from which Mr Kirwan derived the information detailed in his ſyſtem of mineralogy. And here we are led to throw out a hint that the friends of this ſcience could not more effectually promote its knowledge, and encourage its progreſs, than by eſtabliſhing ſimilar collections wherever it is taught and ſtudied. But patriotiſm and power are unfortunately oftener directed to deeds of ſplendour and magnificence, than they are occupied in forming and accompliſhing the humbler and more permanent plans of national utility.

But to reſume our narrative of the hiſtory of mineralogy, we cannot help expreſſing our regret that Mr Kirwan has never found it convenient to reviſe and improve his ſyſtem as he might have done, aided by the immenſe ſtock of mineralogical knowledge which has been accumulated ſince its firſt publication. This is the more to be regretted, becauſe, notwithſtanding the rapid progreſs of the ſcience, and the great improvements which the ſyſtem of Werner has received, no good or even tolerable account of it has yet appeared in the Engliſh language.

France, where many branches of natural hiſtory have long flouriſhed, has contributed largely to the ſcience of mineralogy. Even the period of war, which at firſt ſight would appear to be extremely adverſe to the tranquil purſuits of knowledge, has in this caſe proved peculiarly favourable to the ſtudy of mineralogy in that kingdom. The knowledge of minerals has not only been encouraged and promoted in France, by being forced to direct her attention to her own reſources, while her intercourſe with other countries from which ſhe derived various commodities indiſpenſably neceſſary for economical purpoſes was interrupted; but alſo by the ſubjugation to her overgrown power, of thoſe parts of Europe where mineralogy has been moſt cultivated and improved, thus affording every facility of correſpondence, and rendering acceſſible thoſe mineral treaſures which exhibit the beſt and fulleſt illuſtration of the ſcience. The French government, indeed, whatever form it may have aſſumed, has invariably been impreſſed with the importance of mineralogy; and even during the horrors of revolution, has never failed to promote its progreſs, by forming and ſupporting extenſive collections, and eſtabliſhing able and enlightened teachers at the expence of the nation.

Of the works on mineralogy which have appeared in France, we ſhall only mention the treatiſes of Brochant, Hauy, and Brongniart. They are the ſources from which the information in the following treatiſe is chiefly derived, and they may be recommended as the beſt guides to the ſtudy of this department of natural hiſtory. 13 Brochant. The ſyſtem of Brochant is formed entirely on the principles of Werner's claſſification, and is undoubtedy the moſt perſpicuous account of the ſyſtem of the German mineralogiſt which has yet been publiſhed. The principles on which the elaborate and ingenious method of arrangement propoſed by the celebrated Hauy have been already detailed. (See CRYSTALLIZATION). Here we ſhall only remark that the ſtudy of the regular forms of minerals with a view to methodical arrangement, was ſucceſsfully proſecuted by Bergman and Romé de Liſle; but has been extended and carried to the higheſt degree of perfection by the ſagacity, profound phyſical knowledge, and mathematical addreſs of the Abbé Hauy. 14 Hauy. But although the mineral ſyſtem of this diſtinguiſhed philoſopher be founded on characters the moſt certain and the moſt uniformly permanent, yet it

---

(A) The Right Honourable John Forſter, late Speaker of the Iriſh Houſe of Commons, and the Right Honourable W. B. Cunningham.

it may be doubted whether the previous knowledge neceſſary to underſtand it, and in ſome caſes the difficulty of applying its principles in aſcertaining ſome of the moſt eſſential characters, may not preclude this work from being ſo generally and practically uſeful as other ſyſtems. The ſcientific mineralogiſt however will always regard it as a monument of indefatigable induſtry and patient reſearch which has rarely been equalled, and will derive from it the moſt material aid in his ſtudies.

The ſyſtem of Hauy conſiſts of four claſſes. I. The firſt claſs conſiſts of ſubſtances which are compoſed of an acid united to an earth or an alkali, and ſometimes to both; and it contains three orders; 1. Earths combined with an acid; 2. Alkalies combined with an acid; and, 3. Earths and alkalies combined with an acid. II. This claſs includes only earthy ſubſtances, but ſometimes combined with an alkali. It conſtitutes the ſiliceous genus of other ſyſtems. III. The third claſs comprehends combuſtible ſubſtances which are not metals. It is divided into two orders; the firſt containing ſimple, and the ſecond compound combuſtibles. IV. The metals form the fourth claſs. It is divided into three orders, which are characterized by different degrees of oxidation. Beſides theſe claſſes there are three appendices. The firſt contains thoſe ſubſtances whoſe nature is not ſufficiently known to have their places accurately aſſigned in the ſyſtem. The ſecond appendix includes aggregates of different mineral ſubſtances. It is divided into three orders. The firſt treats of primitive rocks; the ſecond of ſecondary and tertiary rocks; and the third of breccias. The third appendix is devoted to the conſideration of volcanic products. This is divided into ſix claſſes; but it is to be obſerved, that the volcanic products of this mineralogiſt comprehend, not only ſuch ſubſtances as are univerſally allowed to have a volcanic origin, but alſo baſalts, traps, and other minerals, the origin of which is ſtill queſtioned.

15 Brongni

The ſyſtem of Brongniart takes a wider range than other ſyſtems, including ſubſtances which are not treated of by writers on mineralogy. It is divided into five claſſes. The firſt contains thoſe ſubſtances, excluding the metals, which are combined with oxygen. It contains two orders; the firſt including air and water, and the ſecond the acids. The ſecond claſs, which treats of ſaline bodies, is divided into two orders: the firſt comprehends the alkaline ſalts, and the ſecond the earthy ſalts. The third claſs, containing the ſtones, is divided into three orders: the firſt, hard ſtones; the ſecond magneſian; and the third argillaceous. The fouth claſs contains the combuſtible ſubſtances, which are divided into two orders; firſt compound, and ſecond, ſimple combuſtibles. The fifth claſs includes the metals, which are divided into two orders; firſt, the brittle, and ſecond the ductile metals. The treatiſe of Brongniart, notwithſtanding ſome pecularities in the claſſification which are not quite familiar to us, will be found one of the moſt uſeful that has hitherto appeared, not only on account of the accuracy of the deſcriptions, which are diveſted of every kind of redundancy, but alſo on account of the intereſting geological diſcuſſions which are introduced, as well as numerous and important practical details in metallurgy and other uſeful arts.

The following treatiſe will be divided into two parts. The firſt part will contain the claſſification and deſcription of minerals; and the ſecond part will be deſtined to the analyſis of minerals and to metallurgy, or the method of extracting metals from their ores.

PART I. OF THE CLASSIFICATION OF MINERALS.

THE method to be followed in this treatiſe is nearly that of Werner, all the material parts of which we ſhall freely borrow from the work of Brochant already noticed, as the beſt on the ſubject which we have had an opportunity of conſulting. We ſhall however occaſionally avail ourſelves of any uſeful information which may be derived from the mineralogy of Kirwan, Brongniart, and Hauy; and in particular we ſhall inſert the eſſential characters of the ſpecies given by the latter.

The univerſal characters employed by Werner in the deſcription of minerals are ſeven in number: 1. Colour; 2. Coheſion; 3. Unctuoſity; 4. Coldneſs; 5. Weight; 6. Smell; 7. Taſte. The table and the illuſtrations which follow are chiefly taken from Weaver's tranſlation of Werner's treatiſe on that ſubject.

In the following table is exhibited the arrangement of the generic external characters of foſſils.

Claſſifica-tion.

Common Generic External Characters.

I. The Colour.

II. The Coheſion of the particles, in relation to which Foſſils are diſtinguiſhed into

Solid and Fluid.

Solid and Friable.

		Particular generic characters of ſolid Foſſils.	Particular generic characters of friable Foſſils.	Particular generic characters of fluid foſſils.
Characters for the Sight.	External Appearance.	The external Form. The external Surface. The external Luſtre.	The external Form.	The external Form.
	Appearance of the Fracture.	The internal Luſtre. The Fracture. The form of the Fragments.	The Luſtre. The appearance of the particles.	The Luſtre.
	Appearance of the diſtinct Concretions.	The Form of the diſtinct Concretions. The Surface of Separation. The Luſtre of Separation.		
	General Appearance.	The Tranſparency. The Streak. The Stain.	The Stain.	The Tranſparency.
Characters for the Touch.		The Hardneſs. The Solidity. The Frangibility. The Flexibility. The Adheſion to the Tongue.	The Friability.	The Fluidity. Wetting of the fingers.
Characters for the Hearing.	The Sound.	The Ringing. The Creaking. The Ruſtling.		

Remaining Common Generic External Characters.

Characters for the	Touch.	III. The Unctuoſity. IV. The Coldneſs. V. The Weight.
	Smell.	VI. The Smell.
	Taſte.	VII. The Taſte.

EXTERNAL CHARACTERS of Minerals arranged according to their reſpective generic characters, and illuſtrated by appropriate examples.

Common Generic External Characters.

I. THE COLOUR.

The moſt obvious of the external characters of minerals, is colour; it is alſo one of the moſt certain characters, and often ſerves as the principal diſtinguiſhing mark of many mineral ſubſtances. In deriving the characters of minerals from colour, three things are conſidered: 1. The ſeveral principal colours, with their varieties. 2. The ſhade of colour. 3. The tarniſhed colours.

I. *Principal Colours.*

The ſeveral principal colours are not derived from the diviſion of the ſolar ray by means of the priſm, but are ſuch as are conſidered ſimple in common life. The principal colours are the eight following; viz. white, gray, black, blue, green, yellow, red, and brown.

A. WHITE is the firſt principal colour, and it includes the following eight varieties.

1. *Snow white*, as ſnow white quartz, white lead ore, Carrara marble.

Claſſification.

2. *Reddiſh white*, as porcelain earth, reddiſh white quartz.

3. *Yellowiſh white*, as white amber, zeolite, chalk.

4. *Silver white*, as native ſilver, native biſmuth, and arſenical pyrites.

5. *Grayiſh white*, as ſeveral kinds of gypſum, quartz, and foliated granular limeſtone.

6. *Greeniſh white*, as white amianthus, talc, and calcareous ſpar.

7. *Milk white*, as calcedony, opal, and milk white quartz.

8. *Tin white*, as native quickſilver, native antimony, and white cobalt ore.

B. Gray is the ſecond principal colour, and its varieties are the following.

1. *Lead gray*, as in common galena, compact galena, gray antimonial ore, and vitreous copper ore.

2. *Bluiſh gray*, as in bluiſh gray clay, bluiſh gray marble, and bluiſh gray limeſtone.

3. *Pearl gray*, as in quartz, calcedony, and porcelain jaſper.

4. *Reddiſh gray*, as in granular limeſtone and feldſpar.

5. *Smoke gray*, as in gray hornſtone, and in dark gray flint.

6. *Greeniſh gray*, as in cat's eye, prehnite, and ſome varieties of argillaceous ſchiſtus.

7. *Yellowiſh gray*, as in yellowiſh gray calcedony, yellowiſh gray tripoli.

8. *Steel gray*, as in ſpecular iron ore, gray copper ore, ſtriated gray ore of manganeſe.

9. *Aſh gray*, as in quartz, wacken, and ſome varieties of argillaceous ſchiſtus.

C. Black, which is the third principal colour, is divided into the ſix following varieties.

1. *Grayiſh black*, as in baſalt, black limeſtone, and black flint.

2. *Browniſh black*, as in black blende, tin-ſtone cryſtals, black cobalt ore, and bituminous ſhale.

3. *Dark black*, or *velvet black*, as in Iceland agate or obſidian, ſchorl, and jet.

4. *Iron black*, as in micaceous iron ore, magnetic iron ſtone, and ſometimes in antimoniated ſilver ore.

5. *Greeniſh black*, as in pitchſtone, hornblende, and ſerpentine.

6. *Bluiſh black*, as in aluminous ſhale, black cobalt ore, dull black lead ore.

D. Blue is the fourth principal colour, including ſeven varieties.

1. *Indigo blue*, as in blue martial earth.

2. *Pruſſian blue*, as in the ſapphire and blue rock ſalt.

3. *Azure blue*, as in lapis lazuli, and azure copper ore.

4. *Violet blue*, as in fluor ſpar, amethyſt, and in rock ſalt.

5. *Lavender blue*, as in a variety of porcelain, jaſper, and lithomarga.

6. *Smalt blue*, as in light azure copper ore, and blue martial earth.

7. *Sky blue*, as in light azure copper ore, blue native vitriol, and ſky blue fluor ſpar.

E. Green is the fifth principal colour, of which there are the following varieties.

1. *Verdigreaſe green*, as in green copper ore, green fluor ſpar.

2. *Celadon green*, as in the Braſilian beryl, and in pure green earth.

3. *Mountain green*, as in actynolite, hornſtone, and in moſt beryls.

4. *Emerald green*, as in fibrous malachite and fluor ſpar.

5. *Leek green*, as in actynolite, jade, and praſium.

6. *Apple green*, as in chryſolite, prehnite, and nickel ore.

7. *Graſs green*, as in ſome varieties of chryſopraſe and ſome green lead ores.

8. *Piſtachio green*, as in chryſolite, iron ſhot green copper ore.

9. *Aſparagus green*, as in chryſo beryl, and ſome varieties of green lead ore.

10. *Olive green*, as in green lead ore, ſerpentine, pitchſtone, and garnet.

11. *Blackiſh green*, as in dark green ſerpentine.

12. *Canary green*, as in green lead ore, micaceous uranitic ore, and green ſteatites.

F. Yellow is the ſixth of the principal colours. It includes 12 varieties, which are the following.

1. *Sulphur yellow*, as in native ſulphur and ſome varieties of ſerpentine.

2. *Lemon yellow*, as in yellow orpiment, and ſome yellow lead ores.

3. *Gold yellow*, as in native gold.

4. *Bell metal yellow*, as in iron pyrites.

5. *Straw yellow*, as in calamine and biſmuth ochre.

6. *Wine yellow*, as in Saxon topaz and yellow calcareous ſpar.

7. *Iſabella yellow*, as in calamine and ſparry iron ore.

8. *Ochre yellow*, as in iron ochre, yellow jaſper, and calamine.

9. *Orange yellow*, as in red orpiment and red lead ore.

10. *Honey yellow*, as in amber fluor ſpar and calcedony.

11. *Wax yellow*, as in yellow lead ore, common opal, and calcedony.

12. *Braſs yellow*, as in copper pyrites, and native gold.

G. Red is the ſeventh principal colour, and it includes the following 15 varieties.

1. *Morning* or *aurora red*, as in red lead ore, red orpiment.

2. *Hyacinth red*, as in the hyacinth, and a variety of brown blende.

3. *Brick red*, as in porcelain jaſper.

4. *Scarlet red*, as in light red cinnabar.

5. *Copper red*, as in native copper.

6. *Blood red*, as in Bohemian garnet, and red carnelian.

7. *Carmine red*, as in red copper ore, and clear red cinnabar.

8. *Cochineal red*, as in cinnabar, ſometimes jaſper, and red quartz.

9. *Crimſon red*, as in ruby, oriental garnet, and red cobalt ore.

10. *Columbine red*, as in precious garnet, and red cobalt ore.

11. *Fleſh red*, as in feldſpar, red gypſum, red quartz, and fleſh red barytes.

Claſſification.

12. *Roſe red*, as in red zeolite, roſe red quartz, and ruby.

13. *Peach bloſſom red*, as in ſtriated and earthy red cobalt ores.

14. *Cherry red*, as in red antimony ore and ruby.

15. *Browniſh red*, as in red argillaceous iron ſtone, and red earthy iron ſtone.

H. BROWN is the eighth and laſt of the principal colours. It is divided into the eight following varieties.

1. *Reddiſh brown*, as in brown tin ſtone, and brown blende.

2. *Clove brown*, as in rock cryſtal, brown iron ore, and thumerſtone.

3. *Hair brown*, as in wood tin ore from Cornwall.

4. *Yellowiſh brown*, as in brown iron ochre and jaſper.

5. *Tombac brown*, or pinchbeck brown, as in brown mica.

6. *Wood brown*, as in bituminous wood, a variety of aſbeſtus.

7. *Liver brown*, as in brown cobalt ore, and brown jaſper.

8. *Blackiſh brown*, as in lowland argillaceous iron ore, mineral pitch, and bituminous wood.

II. *Shade or Intenſity of Colour.*

Colours may be determined by the relation in which they ſtand to each other with regard to intenſity or ſhade. Thus among the principal colours, there are ſome which are light, as white and yellow; and ſome which are dark, as blue and black; and beſides, the varieties of the principal colours differ from each other in reſpect to ſhade. Thus among the blue colours, indigo blue is dark, azure blue clear, and ſky blue light; and even the varieties may afford a diverſity of ſhade, as, for inſtance, clear canary green, light canary green.

Here it ought to be remarked, that the peculiar ſhade of colour in a mineral is frequently owing to its greater or leſs tranſparency, the paleneſs being in proportion to the degree of tranſparency, and the darkneſs to the degree of opacity. The degree of luſtre alſo in minerals produces great variety in the ſhade of colour.

In diſcriminating the ſhade or intenſity of colour, four degrees have only in general been adopted. Theſe are the following. 1. *Dark.* 2. *Clear.* 3. *Light.* 4. *Pale.*

1. *Dark*, as in Bohemian garnet, which is dark blood red.

2. *Clear*, as in green hornſtone, which is clear mountain green.

3. *Light*, as in red carnelian, which is light blood red.

4. *Pale*, as in aquamarine, which is pale mountain green.

III. *Tarniſhed Colours.*

Tarniſhed colours afford peculiar characteriſtic marks of many minerals. By tarniſhing, is meant a difference in the colour of the ſurface after expoſure to the air from what the freſh fracture of the mineral exhibits.

Some minerals are always found tarniſhed in their natural poſition in the earth, as in common galena, gray ore of antimony and blende: ſome tarniſh on every freſh fracture being made, as in native arſenic and copper pyrites; while others are tarniſhed in both caſes, as in native arſenic, and purple copper ore.

The colours of tarniſhed minerals are divided into, 1. *Simple*, and 2. *Variegated.*

1. SIMPLE TARNISHED COLOURS afford five varieties.

a. Gray is the tarniſhed colour of white cobalt ore, and ſteel gray of brown hematites.

b. Black is the tarniſhed colour of native arſenic, brown hematites, and gray cobalt ore.

c. Brown is the tarniſhed colour of native ſilver, which is white.

d. Reddiſh, of native biſmuth, the freſh fracture of which is ſilver white.

e. Yellowiſh, of white cobalt ore, and argentiferous arſenical pyrites.

2. VARIEGATED TARNISHED COLOURS include four varieties.

a. Pavonine tarniſhed, as in copper pyrites, purple copper ore and common pyrites.

b. Irideſcent tarniſhed, as in gray antimonial ore, galena, ſpecular iron ore.

c. Columbine tarniſhed, as in copper pyrites.

d. Steel-coloured tarniſhed, as in gray cobalt ore.

IV. *The Play of Colour.*

The play of colour in a mineral can only be obſerved in ſunſhine or in a ſtrong light. By this is underſtood that property which ſome minerals poſſeſs of refracting from particular ſpots the different rays of light. This effect is produced by the peculiar aſſociation of the molecules of the mineral, and the various degrees of its tranſparency. Accidental cauſes, however, produce a ſimilar effect, ſuch as ſlight rifts, cracks, &c.

The play of colour is remarkable in the diamond and in the opal, and ſometimes in rock cryſtal.

V. *The Mutable Reflection of Colour.*

This is diſtinguiſhed from the play of colour by the mineral exhibiting in the ſame ſpot a change of colour according to the poſition of its ſurface being varied, producing a different angle with the incident rays of light. This change takes place, 1. *On the ſurface;* 2. *Internally.*

1. The *ſuperficial* mutable reflection is finely exemplified in Labrador ſtone, and in a variety of marble which contains petrified ſhells.

2. The *internal* mutable reflection of colour appears in cat's eye, precious opal, and moonſtone.

VI. *The Mutation of Colour.*

This is diſtinguiſhed from the tarniſh; in which latter the ſurface only undergoes a change of colour, but in the mutation of colour, the effect penetrates the mineral, and ſometimes pervades the whole. This affords two varieties.

1. *The fading of colour.*—By this is meant that the colour of a mineral becomes paler when it is expoſed to the light, heat, or is undergoing decompoſition. Examples of theſe changes may be obſerved in ſtriated red cobalt ore, which expoſed to the air becomes pale browniſh; blue fluor ſpar becomes green; chryſopraſe becomes light green; pearl gray ſilver ore becomes clear brown.

2. *The perfect change of colour* is often the conſequence of fading, when one colour is loſt, and a new one

one appears, as in light-coloured ſparry iron ore; earthy gray ore of manganeſe, and argillaceous iron ſtone.

VII. *Delineations of Colours.*

The delineations of colours are obſerved on ſimple minerals, the ſame ſpecimen containing ſeveral colours, which paſs through its interior, according to certain delineations. Of theſe delineations the following nine varieties are deſcribed.

1. *Dotted*, when fine points of another colour are diſperſed over the ſurface, as in ſerpentine, and ſome varieties of jaſper.

2. *Spotted*, when the points or ſpots are of the ſize of a lentil to that of a ſixpence, or from one-fourth to one inch in diameter. The ſpots are round and regular, or irregular.

a. Regular, as in ſome varieties of ſerpentine, and in argillaceous ſchiſtus.

b. Irregular, as in a variety of marble from Bayreuth.

3. *Nebulous or cloudy*, when the ſpots are large and irregular, forming with the ground colour the appearance of clouds, as in calcedony and jaſper.

4. *Flamy*, when the ſpots are large, and drawn in one direction to a ſharp point, as in ſtriped jaſper and ſome marbles.

5 *Striped*, when large ſpots are drawn in the ſame direction, and run parallel through the whole ſpecimen. There are two varieties.

a. Straight or curved ſtriped, as in ſtraight ſtriped jaſper.

b. Broad or linear, as in linear ſtriped agate, calcedony, &c.

6. *Annular*, when the ſtripes form concentric circles, as in jaſper, carnelian, and flints.

7. *Dendritic*, when the delineation reſembles the trunk of a tree ſeparating into ramifications, as in ſteatites, ſome limeſtones, Egyptian marble, and calcedony.

8. *Ruinous*, when the delineation preſents the appearance of ruins, as in Florentine or landſcape marble.

9. *Veined*, when the delineation conſiſts of variouſly coloured narrow ſtripes, croſſing each other in different directions, forming ſometimes the appearance of a net, as in marble, ſerpentine, and jaſper.

II. THE COHESION OF THE PARTICLES.

The coheſion of the particles in minerals is the ſecond common generic character, which is obſerved by the ſight, and alſo by the touch. According to this property, minerals are divided into ſolid, friable, and fluid; but theſe properties alſo belong to the particular generic characters of minerals, to be afterwards deſcribed.

Particular Generic External Characters of Solid Minerals.

1. The External Appearance.

In the external appearance of a mineral, three things are to be obſerved, the external form, the external ſurface, and the external luſtre.

1. The external form of a mineral is that figure or ſhape of the natural ſurface, which its primitive individuals are found to poſſeſs. The external forms of ſolid minerals are diſtinguiſhed into common, particular, regular or cryſtallized, and extraneous.

1. *Common External Shape.*

When a mineral exhibits no reſemblance to any known ſubſtances in common life, it is ſaid to be of a common form. Of common forms there are ſix kinds.

A. *Maſſive*, when a mineral is of an indeterminate form, or amorphous, and of nearly equal dimenſions, from the ſize of a hazel nut to the greateſt magnitude, and when it is incorporated with another ſolid mineral, it is ſaid to be maſſive. Solid minerals are moſt frequently found of this external form, and ſome are never found otherwiſe, as in ſteatites, common pit-coal, galena, and copper pyrites.

B. *Diſſeminated*, or interſperſed, when a mineral, without any particular form, is in ſmall pieces not exceeding the ſize of a hazel nut, incorporated with another ſolid mineral. This affords three varieties.

a. Coarſely interſperſed, in ſize of a hazel nut to that of a pea, as in copper pyrites.

b. Finely interſperſed, from the ſize of a pea to that of a grain of millet, as in tinſtone, in granular quartz.

c. Minutely interſperſed, from the ſize of a grain of millet till it is ſcarcely perceptible to the eye, as in interſperſed native gold.

C. In angular pieces, of which there are two varieties.

a. Sharp-cornered, as in calcedony and in quartz.

b. Blunt-cornered, as in common opal.

D. In grains. Detached minerals, from the ſize of a hazel nut to that which may be diſtinguiſhed by the eye, are ſaid to be in grains. Theſe are diſtinguiſhed,

a. According to ſize, into

α. In groſs grains from the ſize of a hazel nut to that of a pea, as in lowland argillaceous iron ore.

β. Large grains, from the ſize of a pea to that of a hemp ſeed, as in precious garnet, magnetic iron ſand.

γ. Small grains, from the ſize of hemp ſeed to that of millet, as in the above minerals.

δ. In minute or fine grains, ſuch as are ſmaller than millet ſeeds, as platina, native gold, tinſtone.

b. According to the form, which is in

α. Angular grains, as in magnetic iron ſand.

β. Rounded grains, as in platina and native gold.

c. According as they inhere in other minerals. In this reſpect they are, *α.* Looſe, *β.* Partially, or *γ.* Wholly.

E. In plates, diſtinguiſhed into

a. Thick plates, as in red ſilver ore.

b. Thin plates, as in vitreous ſilver ore.

F. In membranes or flakes, when the thickneſs does not much exceed that of paper, divided into

a. Thick, as in native ſilver.

b. Thin, as in iron pyrites.

c. Very thin, as in vitreous ſilver ore.

2. *Particular External Forms.*

The forms which come under this denomination exhibit a greater or leſs reſemblance, both to natural and artificial objects. They are called particular, becauſe, like the former, they are not uſual or common. There

There are five kinds of particular external forms, viz. elongated, rounded, flattened, impreſſed, and confuſed.

A. ELONGATED. Of this there are 11 varieties.

a. Dentiform, as in native ſilver, and dentiform vitreous ſilver ore.

b. Filiform, as in native ſilver, and vitreous ſilver ore.

c. Capillary, reſembling hairs, as in native gold and native ſilver.

d. Reticulated, as in native ſilver, native copper, and a variety of galena.

e. Dendritic, which is either regular or irregular, as in native ſilver and native copper.

f. Coralliform, as in calcareous ſtalactites, commonly known by the name of *flos ferri*, and brown hæmatites.

g. Stalactitiform, as in calcareous ſinter, brown iron ſtone, and calcedony.

h. Tubuliform, as in compact brown iron ſtone, and galena.

i. Fiſtuliform, as in martial pyrites.

k. Fruteſcent, or *arbuſtiform*, as in black iron ſtone, and compact gray ore of manganeſe.

l. Matraſiform, having the figure of a chemical matraſs, as in black hæmatites, and gray ore of manganeſe.

B. ROUNDED, of which there are five varieties.

a. Botryform, reſembling a bunch of grapes, as in black cobalt ore, malachite, and copper pyrites.

b. Globular, of which there are five varieties.

α. *Perfectly globular*, as in piſolite, and white cobalt ore.

β. *Elliptical*, as in quartz and flint.

γ. *Amygdaloid*, as in zeolite and green earth.

δ. *Spheroidal*, as in Egyptian jaſper and calcedony.

ε. *Imperfectly globular*, as in carnelian and calcedony.

c. Kidneyform, as in red hæmatites, native arſenic, and malachite.

d. Bulbous or *nodular*, as in nodular flint and martial pyrites.

e. Liquiform, as in a ſingular variety of galena, from Freyberg.

C. FLATTENED. Of the particular forms of this denomination there are three kinds.

a. Specular, as in compact galena, and compact red iron ſtone.

b. In *laminæ* or *leaves*, which form is peculiar to metals, as in native gold and ſilver.

c. Pectinated, as in quartz from Schemnitz.

D. IMPRESSED. Particular forms of theſe afford ſix varieties.

a. Cellular, of which there are ſeveral kinds, as,

α. *Straight cellular*, which preſents two varieties. 1. Hexahedral, as in quartz; 2. Polyhedral, as in cellular quartz and calcareous ſpar.

β. *Round cellular*, as, 1. Parallel round, as in quartz; 2. Spongiform, as alſo in quartz; 3. Indeterminate, as in brown iron ſtone; 4. Double, as in quartz and hepatic pyrites; 5. Veiny, as in white cobalt ore.

b. With impreſſions, which are,

α. *Cubical*, as in quartz and fluor ſpar.

β. *Pyramidal*, as in quartz, fluor ſpar, and vitreous ſilver ore.

γ. *Conical*, as in native arſenic and quartz.

δ. *Tabular* or *priſmatic*, as in quartz.

ε. *Globular*, as in vitreous ſilver ore.

c. Peforated, as in lowland argillaceous iron ore.

d. Corroded, as in quartz, galena, and vitreous ſilver ore.

e. Heteromorphous, as in native iron, ſwampy iron ore, and native arſenic.

f. Veſicular, as in lavas, pumice ſtones, baſalt, and wacken.

E. CONFUSED, of which there is only one variety.

a. Ramoſe, as in native iron, ſometimes native copper, and vitreous ſilver ore.

3. *Regular External Forms* or *Cryſtallizations*.

In deſcribing cryſtallizations or regular forms of minerals, four things are to be conſidered; the eſſential quality of the cryſtals; the form, aggregation, and magnitude.

A. THE ESSENTIAL QUALITY OF CRYSTALS, WHICH IS EITHER GENUINE OR SPURIOUS.

a. Genuine or *true cryſtals*, which are the moſt common, as in calcareous and fluor ſpars.

b. Spurious or *after cryſtals*, which are diſtinguiſhed from true cryſtals by being hollow, having a rough or druſy ſurface, and the ſolid angles or edges never ſharp or well defined. Examples are found in quartz of the ſpurious cryſtals of the cube, and of the octahedron of fluor ſpar.

B. FORM OF CRYSTALS. This is the moſt conſpicuous property of cryſtals, and commonly ſerves as a diſtinctive character of thoſe minerals which have regular forms. The form of cryſtals is compoſed of planes; of edges formed by the junction of two planes; of determinate angles, and of ſolid angles formed by the union of three or more planes in one point.

α. In the form of cryſtals, the primary or fundamental forms are firſt to be conſidered, and then the variations or modifications of theſe forms.

I. THE PARTS OF THE PRIMARY FORM ARE,

1. Planes, which are either

a. Lateral planes, forming the confines of the body towards its ſmalleſt extent; or, *b.* Extreme or terminal planes, which form the confines of the body towards its greateſt extent.

2. Edges, which are,

a. Lateral edges, or, *b.* Extreme edges.

3. Solid angles, which have been defined above.

II. KINDS OF PRIMARY FORMS, which are the ſeven following.

1. *The Icoſahedron*, which is compoſed of 20 equilateral triangular planes, united under equal angles, as in iron pyrites.

2. *The Dodecahedron*, which is compoſed of twelve regular, pentangular planes, united under equal obtuſe angles, as in iron pyrites, and white cobalt ore.

3. *The Hexahedron*, including the cube and the rhomb, is compoſed of ſix quadrilateral planes, as in calcareous ſpar, fluor ſpar, iron pyrites, galena, &c.

4. *The Priſm*, which is one of the moſt common cryſtallizations among minerals, is compoſed of an indeterminate number of quadrangular lateral planes, having the ſame direction, and all terminating in two extreme planes, each of which has as many ſides as the cryſtallization poſſeſſes lateral planes; as in various lead ores, rock cryſtal, topaz, and ſhorl.

5. *The Pyramid* is compoſed of an indeterminate number of triangular, lateral planes, converging to a

point, and of a baſe having as many ſides as the cryſtallization has lateral planes; as in quartz, calcareous ſpar, and amethyſt.

6. *The Table*, which is compoſed of two parallel lateral planes, much larger in compariſon than the other planes; the extreme planes being indeterminate in number, ſmall, and narrow; as in tabular cryſtallized ſpecular iron ore, calcareous ſpar, and heavy ſpar.

7. *The Lens*, conſiſts of two lateral planes only, differing according as the lateral planes are differently curved. Of this there are two kinds: 1. The common lens, compoſed of two convex lateral planes; and, 2. The ſelliform, conſiſting of one convex and one lateral plane, ſomewhat reſembling a ſaddle. Cryſtals of both kinds are obſerved in ſparry iron ore and calcareous ſpar.

III. DIFFERENCES IN EACH KIND OF PRIMARY FORMS.

Theſe primary forms differ from each other according to ſimplicity, poſition, number of planes, ſize of the planes, angles under which they meet, direction of the planes, and fulneſs of the cryſtal.

1. *Simplicity*. This diſtinction is confined to the pyramid, which is either,

A. *Simple*, as in light red ſilver ore, gray copper ore, quartz, amethyſt; and

B. *Double*, in which thoſe of the one pyramid are either,

a. Set on the lateral planes of the other, and this α. directly, or β obliquely; or *b*. on the lateral edges of the other. Examples of this are obſerved in double pyramidal vitreous ſilver ore, galena, rock cryſtal, ruby, and diamond.

2. *Poſition*, which is either

A. *Erect*, which is very common; or, B. *Inverted*, which has only been obſerved in ſimple hexahedral pyramidal cryſtals of calcareous ſpar.

3. *Number of planes*, in the primary form, is in ſome determinate, and in the others variable. Here are to be conſidered,

A. The kind of planes, as

a. In the priſm and pyramid, in which the lateral planes vary; and, *b*. In the table, in which the extreme planes vary.

B. The number of planes, which in the priſm and pyramid are found,

a. *Trihedral*, having three planes, as in the trihedral priſm of ſhorl, and the trihedral pyramid of gray copper ore.

b. *Tetrahedral*, having four planes, as in the tetrahedral priſm of arſenical pyrites, and in the double tetrahedral pyramid of ruby and galena.

c. *Hexahedral*, as in the hexahedral priſm and pyramid of calcareous ſpar.

d. *Octahedral*, as in the octahedral priſm of topaz; and in the double octahedral pyramid of garnet and zeolite.

The table occurs,

a. *Quadragonal*, having four extreme planes, as in heavy ſpar, yellow lead ore, and calamine.

b. *Hexagonal*, having ſix extreme planes, as in mica and heavy ſpar.

c. *Octagonal*, or with eight extreme planes, as in yellow lead ore and heavy ſpar.

4. *The ſize of the planes*, in relation to each other, which are ſaid to be

A. Equal, or

B. Unequal; and this latter is either indeterminate, or determinate.

a. *Indeterminate*, which is obſerved in the lateral planes of the hexahedral priſm of rock cryſtal.

b. *Determinately unequal*, as in priſmatic white lead ore, and hexahedral priſmatic calcareous ſpar. In this latter the following varieties are obſerved.

α. Alternately broad and narrow. β. The two oppoſite broader; and, γ. The two oppoſite narrower.

5. *Angles under which the planes are aſſociated*. Theſe are angles of the lateral edges, of the extreme edges, and of the ſummit.

A. *Angles of the lateral edges*. Theſe are,

a. *Equiangular*, as in the icoſahedral cryſtals of iron pyrites.

b. *Rectangular*, as in cubical fluor ſpar.

c. *Oblique angular*, as in rhomboidal calcareous ſpar.

d. *Unequiangular*, as in the hexahedral priſm of rock cryſtal, and in the octahedral priſm of topaz.

A. Angles of the extreme edges are,

a. *Equiangular*, as in the hexagonal table of mica.

b. *Rectangular*, as in the quadragonal table of heavy ſpar.

c. *Oblique angular*, which is either, α. Parallel, as in the tetrahedral priſm of feldſpar; or, β. Alternate oblique angular, as in copper pyrites.

d. *Unequiangular*, as in the hexagonal table of prehnite.

C. Angles of the ſummit, which are confined to the pyramid, and preſent the following varieties.

a. *Very obtuſe*, when the angle is from 150° to 130°, as in tourmalin.

b. *Obtuſe*, when the angle is from 130° to 110°, as in calcareous ſpar.

c. *Rather obtuſe*, from 110° to 90°, as in honey ſtone.

d. *Rectangular*, as in zircon.

e. *Rather acute*, from 90°, to 70°, as in quartz.

f. *Acute*, from 70° to 50°, as in calcareous ſpar.

g. *Very acute*, from 50° to 30°, as in ſapphire.

6. *The direction of the lateral planes*. Theſe are either ſtraight or curvated.

A. *Straight planes* are even ſurfaces, and are the moſt common.

B. *Curvated planes* are diſtinguiſhed according to poſition and form.

a. *Poſition*, which is, α. Inwardly curvated or concave; or, β. Outwardly curvated or convex; and, γ. Inwardly and outwardly curvated, or concave and convex. The firſt is obſerved in fluor ſpar, the ſecond in diamond, and the third in ſparry iron ſtone.

b. *The form* is either, α. Spherical, as in brown ſpar; β. Cylindrical, in which the curvature runs, 1. Parallel to the ſides, as in iron pyrites, or, 2. Parallel to the diagonal, as in fluor ſpar; and, γ. Conical, as in gypſum.

7. *The fulneſs of the cryſtal*. Cryſtals are either full and perfect, or hollowed at the extremity, or throughout.

A. Full or perfect cryſtals, which is moſt commonly the caſe.

B. Hollowed

ſſifica-
n.

B. Hollowed at the extremity, as in calcareous ſpar, green lead ore, &c.

C. Hollow through the whole cryſtal, as in priſmatic beryl.

β. Modifications of the primary form.

The changes or alterations which take place on the principal or fundamental form, are three; truncation, bevelling, and acumination.

I. Truncation. In the truncation are to be conſidered the parts and the determination.

1. The parts of the truncation are the planes, the edges, and the angles.

2. The determination of the truncation relates to,

a. The ſituation as it occurs at the angles or edges of the primary form.

b. Its magnitude, which, in relation to the planes of the primary form, is ſmall or large: in the one caſe the angles or edges are ſaid to be ſlightly, in the other deeply truncated.

c. The application of the truncation, which is either direct or oblique. The edges of cubical iron pyrites afford an example of oblique truncation.

d. The direction of the truncation, which preſents either an even or a curvated ſurface.

Cubical galena, with truncated angles; tetrahedral priſmatic tin ſtone cryſtals, with truncated edges; double tetrahedral pyramidal tin ſtone cryſtals, with truncated edges, are inſtances of truncation.

II. Bevelling, in which the parts and determination are alſo to be conſidered.

1. The parts of the bevelling are, the planes, the edges, and the angles. The bevelling edges are diſtinguiſhed into the proper bevelling edge, which is formed by the conjunction of the bevelling planes, and the bevelling edges formed by the junction of the bevelling planes with the lateral planes of the primary form.

2. The determination of the bevelling, in which is to be obſerved,

A. Its ſituation as it takes place, *a.* At the extreme planes, which is confined to the priſm and table; *b.* At the edges, which is met with in the hexahedron, priſm, pyramid, and table: and, *c.* At the angles, which is a very rare occurrence.

B. Its magnitude, which is ſaid to be ſlight or deep.

C. The angle under which the bevelling planes conjoin, which is ſaid to be, *a.* Acutely, *b.* Rectangularly, or, *c.* Obtuſely bevelled.

D. The continuation of the bevelling, which is either uninterrupted, or interrupted. Of the latter caſe there are two varieties, when it is once or twice interrupted. The lateral edges of double trihedral pyramidal calcareous ſpar are once interruptedly bevelled; and the obtuſe extreme edges of quadrangular tabular heavy ſpar, are twice interruptedly bevelled.

E. The application, *a.* Of the bevelling itſelf, which is either direct or oblique (the former is the moſt common, and the latter occurs in priſmatic baſaltic hornblende); and, *b.* Of the bevelling planes, which are ſet, either on the lateral planes, or on the lateral edges.

III. The acumination, in which are alſo to be conſidered the parts of the acumination and the determination.

1. The parts of the acumination conſiſt of,

A. The acuminating planes. B. The acuminating edges; which are diſtinguiſhed into, *a.* Proper edges of acumination, formed by the junction of the acuminating planes; *b.* The extreme edges of acumination; *c.* The edges between the acuminating and lateral planes. C. The angles of acumination.

Claſſification.

2. The determination of the acumination relating to,

A. Its ſituation, as it occurs at, *a.* The ſolid angles; or, *b.* At the extreme planes of the primary form. The acumination of the priſm is always at the extreme planes; of the cube uſually at the angles, and of the pyramid generally at the ſummit.

B. The planes themſelves, in which are to be obſerved,

a. Their number, which is either equal to, or fewer than thoſe of the primary form. In the hexahedral priſm of calcareous ſpar and garnet, and in the trihedral priſm of tourmaline, the acumination is by three planes; in the tetrahedral priſm of jargon and hyacinth, by four planes; in the hexahedral priſm of calcareous ſpar and rock cryſtal, by ſix planes; and in tetrahedral priſmatic topaz, by eight planes.

b. Their relative ſize, which is either equal or unequal. In quartz and rock cryſtal, the planes of acumination are generally indeterminately unequal; and in heavy ſpar they are determinately equal.

c. Their form, which is determinate, as in hyacinth and calcareous ſpar; or indeterminate, as in jargon and wolfram.

d. Their application, which is either on the lateral planes of the primary form, as in jargon and hyacinth, or on the lateral edges, as in calcareous ſpar and garnet.

C. The ſummit of the acumination, which is, *a.* Obtuſe, as in hexahedral priſmatic garnet; *b.* Rectangular, as in tetrahedral priſmatic jargon; or, *c.* Acute, as in hexahedral priſmatic calcareous ſpar.

D. The magnitude of the acumination, which is ſaid to be, *a.* Slightly acuminated, as in gray copper ore and copper pyrites; or, *b.* Deeply, as in fluor ſpar, with the angles acuminated by 6 planes.

E. Determination of the acumination; which is either a point or a line. The firſt is the moſt common; and the laſt is met with in priſmatic white lead ore and heavy ſpar.

γ. Manifold modifications of the primary form.

In theſe modifications cryſtals are either, 1. Situated beſide each other; or, 2. Placed the one above the other.

But in deſcribing a cryſtallization, the number of its planes in general, and of each kind in particular, and their figure, if determinate, may be noticed, to render the deſcription more accurate. As, for inſtance, cubical galena, with truncated angles, conſiſts of 6 octangular and 4 triangular planes.

And ſtill further, in explaining the form of cryſtallizations, by way of addition may be mentioned,

1. The different modes of determination of which they are capable. Two different modes may in ſome caſes be adopted.

a. The repreſentative, by which is underſtood the deſcription of a cryſtallization according to its apparent form; or,

b. The derivative, which is founded on the conſideration of its derivation, and its relation to the other cryſtals of the ſame mineral. The priſmatic cryſtallization of the tourmaline is repreſentatively an enneahedral

Claſſification.

dral priſm, and derivatively a trihedral priſm, with the three lateral ſides bevelled.

But, in general, the chief or eſſential form of a cryſtallization is determined by, *a*. The largeſt planes; *b*. The greateſt regularity; *c*. The moſt frequent occurrence of the cryſtallizations; *d*. The affinity to the other primary forms; *e*. The ſuitableneſs and peculiarity of its modifications; and, *f*. The greateſt ſimplicity in the mode of determination.

2. The tranſitions from one primary form into another. Theſe ariſe,

a. From the gradually increaſed extent of the modifying planes, and the decreaſed extent of the primary planes; or,

b. From a change in the relative ſize of the planes; or,

c. From a change in the angles under which the planes are aſſociated; or,

d. From the convexity of the planes; or,

e. From the aggregation of cryſtals.

3. The difficulties which are oppoſed to the exact determination of cryſtals. Theſe proceed, *a*. From their compreſſion, ſome planes being uncommonly large or ſmall; or, *b*. From their penetrating each other, as in tin-ſtone cryſtals; or, *c*. From their partial concealment, as in feldſpar, hornblende, and garnet; or, *d*. From their being broken, as often happens in the cryſtallization of precious ſtones; or, *e*. From their extreme minuteneſs.

C. The aggregation of cryſtals. According to this, cryſtals are either,

a. *Single*, in which caſe they are, α. Looſe or detached, as in precious ſtones, cubical iron pyrites, &c.; β. Inhering or inlaying in another mineral, as feldſpar in porphyry; or, γ. Adhering, as in quartz cryſtals; or,

b. *Aggregated*, which are either regular or irregular.

α. Regular or determinate; ſuch are, 1. Twin cryſtals, as in ſtaurolite or croſs ſtone; and, 2. Triple cryſtals, as in calcareous ſpar and ruby: but this is very rare.

β. Many ſingly aggregated cryſtals, are ſuch cryſtals as are, 1. Heaped upon one another, as in calcareous and fluor ſpars; 2. Adhering laterally, as in amethyſt cryſtals; and, 3. Implicated one in the other, as in gray antimonial ore, and in the hexahedral priſms of calcareous ſpar.

γ. Many doubly aggregated cryſtals are diſtributed according to the form they aſſume; ſuch as the following, are enumerated.

1. *Scopiform*, when aggregated, needle-like, and capilliform cryſtals diverge from a common centre, as in zeolite, ſtriated red cobalt ore, and capilliform pyrites.

2. *Faſciform*, which is compoſed of double ſcopiform, with a common centre, as in calcareous ſpar, zeolite, and prehnite.

3. *Acicular* or *columnar*. Elongated, equally thick priſms adhering laterally together, are of this deſcription, as in acicular heavy ſpar, and a variety of white lead ore.

4. *In a row*, like a ſtring of pearls, as in pyramidal cryſtals of quartz.

5. *Bud-like*, in ſimple pyramids whoſe baſes are connected, and whoſe joints are directed towards each other, as in bud-like druſen of quartz.

6. *Globular*, a caſual aggregation, conſiſting moſtly of tables or cubes, arranged in a globular form, as in octahedral iron pyrites.

7. *Amygdaloid*, when the tables are externally accumulated, ſmaller upon ſmaller, as in heavy ſpar.

8. *Pyramidal*, which takes place chiefly in priſms nearly parallel, the ſummits inclining to each other; the central priſm being the higheſt, as in calcareous ſpar.

9. *Roſe-like*, compoſed of thin tables, on whoſe lateral planes others are aſſembled, and arranged in a roſe-like appearance.

D. The magnitude of cryſtals, which is determined,

a. According to the greateſt dimenſion, as α. Of an uncommon ſize, in cryſtals which exceed two feet, as in quartz and rock cryſtal; β. Very large, from two feet to ſix inches, as in rock cryſtal and calcareous ſpar; γ. Large, from ſix to two inches, as in iron pyrites, fluor ſpar, and garnet; δ. Of a middling ſize, from two inches to half an inch, which are very common; ε. Small, from half an inch to one-eighth of an inch, alſo very common; ζ. Very ſmall, from one-eighth of an inch to ſuch as may be diſtinguiſhed by the naked eye, as in corneous ſilver ore, and very ſmall tin ſtone cryſtals; η. Minute, whoſe form cannot be diſtinguiſhed by the naked eye, as in native gold and green lead ore.

b. According to relative dimenſions, when compared with others; and this is diſtinguiſhed into α. Short or low, and long or high; β. Broad and narrow, or longated; γ. Thick and thin, or ſlender; δ. Needle-like and capilliform; ε. Spicular, and ζ. Globular or teſſular.

4. Extraneous external forms, or petrifactions, which are divided into petrifactions of animals, and petrifactions of vegetables.

A. Petrifactions of animals, or zoolites, as

a. Of the claſs mammalia, the parts of which commonly found are the bones, the teeth, horns, and ſkeletons. Such are the bones of the elephant and the rhinoceros, which are found in Siberia, and the bones of the mammoth from North America.

b. Of birds, petrifactions of which are very rare. Some ſkeletons of aquatic birds have been met with in limeſtone near Oening.

c. Of amphibious animals, ſuch as thoſe of the tortoiſe, found in the ſame vicinity as the bones of the elephant; of frogs and toads, in the ſwine ſtone of Oening; and of an animal reſembling a crocodile in aluminous ſhale near Whitby in Yorkſhire.

d. Of fiſhes, of which whole fiſhes, ſkeletons, and impreſſions, have been found in different places.

e. Of inſects, petrifactions of which are not very common, excepting inſects, ſuch as crabs, which have been frequently obſerved.

f. Of vermes, of which numerous petrifactions are found belonging to the orders *teſtacea*, *cruſtacea*, and *corrallina* or corals.

B. Petrifactions of vegetables, which are leſs numerous in the mineral kingdom than thoſe of animals. Theſe are diſtinguiſhed into

a. *Petrified wood*, the moſt uſual of which are petrifactions of the trunk, branches, or roots of trees, and commonly conſiſting of ſiliceous ſubſtances, as woodſtone, jaſper, horn ſtone.

b. Impreſſions of leaves and plants, which are not uncommon in the ſtrata of coal countries, particularly in the ſhale, ſand ſtone, the argillaceous iron ſtone, and the coal itſelf.

II. THE EXTERNAL SURFACE, which is the ſecond particular generic character of ſolid minerals; and this is,

1. *Uneven*, having irregular elevations and depreſſions, as in calcedony.

2. *Granular*, when the elevations are ſmall, round, and nearly equal, as in ſtalactitical brown hæmatites.

3. *Druſy*, having minute, prominent, equal cryſtals on the ſurface, as in iron pyrites and quartz cryſtals.

4. *Rough*, when the elevations are minute and almoſt imperceptible, as in cellular quartz.

5. *Scaly*, when the ſurface is compoſed of ſlender ſplinters like ſcales, as in chryſolite.

6. *Smooth*, as in hæmatites and fluor ſpar.

7. *Streaked*, which is either ſingly or doubly ſtreaked.

A. Singly ſtreaked ſurfaces are,

a. Tranſverſely, as in rock cryſtals; *b*. Longitudinally, as in topaz and priſmatic ſhorl; *c*. Diagonally, as in ſpecular iron ore; and *d*. Alternately, as in iron pyrites.

B. Doubly ſtreaked, which is,

a. *Plumiformly*, or like a feather, as in native ſilver and native biſmuth; and

b. *Retiformly*, as in gray cobalt ore.

8. *Rugoſe*. Of ſlight linear elevations, as in calcedony.

III. THE EXTERNAL LUSTRE, in which are to be determined,

1. The intenſity of the luſtre, which is diſtinguiſhed into different degrees, as

A. *Reſplendent*, which is the ſtrongeſt kind of luſtre, as in native quickſilver, galena, and rock cryſtal.

B. *Shining*, as in gray copper ore, heavy ſpar, and pitch-ſtone.

C. *Weakly ſhining*, as in iron pyrites, fibrous gypſum, and garnet.

D. *Glimmering*, as in earthy talc, in the fracture of flint, and of ſteatites.

E. *Dull*, as in moſt friable minerals, as in earthy lead ore, mountain-cork, chalk, &c.

2. The kind of luſtre, which is either common or metallic.

A. The common luſtre belongs chiefly to earthy ſtones and ſalts. It is diſtinguiſhed into

a. *Glaſſy*, as in quartz and rock cryſtal.

b. *Waxy* or *greaſy*, as in opal, and in yellow and green lead ores.

c. *Pearly*, as in zeolite.

d. *Diamond*, as in white lead ore and diamond.

e. *Semimetallic*, as in mica and hæmatites.

B. Metallic luſtre, which is peculiar to metals and moſt of their ores, as native gold and native ſilver, copper pyrites, and galena.

Appearance of the fracture.

Here, as in the external appearance, three kinds of characters preſent themſelves; I. The internal luſtre; II. The fracture; III. The form of the fragment.

Claſſification.

I. *The internal luſtre*, the characters of which are to be determined in the ſame manner as the external luſtre.

II. The *fracture*, which is either compact or jointed.

1. The compact fracture, which is diſtinguiſhed into ſplintery, conchoidal, uneven, earthy, and hackly.

A. *Splintery*, which is either

a. Coarſe ſplintery, as in quartz, praſe, and jade; or

b. Fine ſplintery, as in hornſtone and fine ſplintery limeſtone.

B. *Even*, which happens in minerals that are uſually opake, and have only a glimmering luſtre, as in compact galena, calcedony, and yellow carnelian.

C. *Conchoidal*, which is diſtinguiſhed,

a. According to the ſize, into large and ſmall.

b. According to the appearance, into perfect and imperfect; and

c. According to the depth into deep and flat.

Flint, opal, jaſper, and obſidian, afford examples of the conchoidal fracture.

D. *Uneven*, which is either,

a. Of a coarſe grain, as in copper pyrites.

b. Of a ſmall grain, as in gray copper ore, and

c. Of a fine grain, as in arſenical pyrites.

E. *Earthy*, which is the common fracture in earths and ſtones, as in marl, chalk, limeſtone.

F. *Hackly*, in which the fracture exhibits ſharp points, which is peculiar to the metals, as in native gold and native copper.

2. The jointed fracture. This is divided into the fibrous, ſtriated, foliated, and ſlaty.

A. The fibrous fracture, in which are to be obſerved,

a. The thickneſs of the fibres, as they are coarſe, fine, or delicate, as gypſum, fine fibrous malachite, and in wood-tin-ore.

b. The direction of the fibres, which are ſtraight, as in red hæmatites, and gray antimonal ore; or curved, as in black hæmatites, and fibrous rock ſalt.

c. The poſition of the fibres, which is α. Parallel, as in rock ſalt and amianthus: β. Diverging, which is, 1. Stelliform, as in black hæmatites, and fibrous zeolite; or, 2. Scopiform, as in fibrous malachite: or γ. Promiſcuous, as in gray antimonial ore.

d. The length of the fibres, which is α. Long, as in gypſum and amianthus; or β. Short, as in red hæmatites.

B. Striated, in which are to be conſidered,

a. The breadth of the ſtriæ, which are, α. Narrow, as in azure copper ore; β. Broad, as in actynolite and hornblende; or γ. Very broad, as in ſapphire and zeolite.

b. The direction of the ſtriæ, which is either, α. Straight, as in gray ore of mangneſe; or β. Curved, as in zeolite and actynolite.

c. The poſition of the ſtriæ, which is α. Parallel, as in aſbeſtus and hornblende; β. Diverging, which is diſtinguiſhed into ſtelliform, as in iron pyrites and zeolite, or ſcopiform, as in actynolite and limeſtone; or γ. Promiſcuous, as in gray antimonial ore and actynolite.

d. *Length of the ſtriæ*, as being α. Long ſtriated, as in aſbeſtus and gray antimonial ore; or β. Short ſtriated, as in actynolite.

C. The

Claſſification

C. *The foliated fracture*, in which are to be determined,

a. The magnitude of the folia, as being α. Large foliated, as in mica and ſpecular gypſum. β. Scaly foliated, which is diſtinguiſhed into 1. Coarſe, 2. Small, and 3. Fine ſcaly foliated, as in micaceous iron ore and gypſum. γ. Granularly foliated, which is diſtinguiſhed into 1. Groſs, 2. Coarſe, 3. Small, and 4. Fine granularly foliated, as in ſparry iron ore, blende, and calcareous ſpar.

b. The perfectneſs of the folia, as being α. Perfectly foliated, as in feldſpar; β. Imperfectly foliated, as in topaz; or. γ. Concealed foliated, as in emerald.

c. The direction of the folia, which is α. Straight, as in large foliated blende; or β. Curved foliated. The latter is diſtinguiſhed into 1. Spherically curved, as in heavy ſpar; 2. Undularly curved, as in talc; 3. Petaloidally curved, as in galena; or, 4. Indeterminately curved, as in mica and ſpecular gypſum.

d. The paſſage or cleavage of the folia, which is,

α. According to the angle which one paſſage forms with another; and this is either, 1. Rectangular, or, 2. oblique angular; or,

β. According to the number of the cleavages, and is either,

1. A ſingle cleavage, as in mica and talc; 2. A double cleavage, as in feldſpar and hornblende; 3. A triple cleavage, as in calcareous ſpar and ſparry iron ore; 4. A quadruple cleavage, as in fluor ſpar; 5. A ſextuple cleavage, as in yellow, brown, and black blende.

D. The ſlaty fracture, in which are to be determined the thickneſs and direction of the lamellæ.

a. The thickneſs of the lamellæ, which is either, α. Thick, or β Thin ſlaty.

b. The direction of the lamellæ, as being either, α Straight, or β. Curved ſlaty; the latter being diſtinguiſhed into, 1. Undularly, or 2. Indeterminately curved.

In ſome minerals which poſſeſs diſtinct parts, two kinds of fracture may be obſerved. Thus, in fibrous gypſum, and in red and brown hæmatites, both the fibrous and foliated fracture appear; the fibres are then interſected by the folia under a certain angle. In topaz, the tranſverſe fracture is foliated, and the longitudinal fracture is conchoidal.

III. The form of the fragments, which is either regular or irregular.

1. Regular fragments, as when they are,

A. Cubical, as in galena and rock ſalt.

B. Rhomboidal, in which caſe the fragments are

a. Specular on all the planes, as in heavy ſpar;

b. On four planes, as in feldſpar and hornblende; and,

c. On two planes, as in ſpecular gypſum.

C Trapezoidal fragments, &c.

D. Trihedral pyramidal fragments are rarely to be ſeen diſtinctly, excepting in fluor ſpar.

D. Dodecahedral fragments, as in blende.

2. Irregular fragments, as when they are,

a. Cuneiform, as in wood-tin-ore, and malachite.

B. Specular, as in amianthus.

C. Tabular, as in mica and talc.

D. Indeterminate, which are the moſt common among ſolid minerals, and are diſtinguiſhed into

a. Very ſharp edged, as in obſidian, common opal, and rock cryſtal.

b. Sharp edged, as in hornſtone and quartz.

c. Moderately ſharp edged, as in limeſtone.

d. Rather blunt edged, as in ſteatites; and

e. Blunt edged, as in chalk and fullers earth.

3. The appearance of the diſtinct concretions.

In determining this character, the form of the diſtinct concretions, the ſurface of ſeparation, and the luſtre of ſeparation, are to be conſidered.

I. The form of the diſtinct concretions, which is either granular, lamellar, columnar, or pyramidal.

1. Granular, diſtinct concretions are diſtinguiſhed,

A. With reſpect to the form, into

a. Round granular, which is either α. Spherically round, as in roe ſtone and piſolite; or β. Lenticularly granular, as in argillaceous iron ſtone; or γ. Elongated round granular, as in quartz: and,

b. Angularly granular, which is either α. Common, as in galena and calcareous ſpar; or β. Elongated annularly granular, as in hornblende and granular limeſtone.

B. With regard to the ſize of the concretions. Theſe are,

a. Groſs granular, as in zeolite and blende.

b. Coarſe granular, as in mica, galena, and piſolite.

c. Small granular, as in roe ſtone and garnet; and

d. Fine granular diſtinct concretions, as in granular limeſtone and galena.

2. Lamellar diſtinct concretions. The differences to be obſerved here are, with reſpect to the direction or form, and the thickneſs.

A. With reſpect to the direction or form, they are either,

a. Straight lamellar: and again either quite ſtraight, as in ſome galena and heavy ſpar; or fortification-like, as in ſome amethyſt and calcedony.

b. Curved lamellar, which is either indeterminate, as in galena and ſpecular iron ore; reniform, as in fibrous malachite and native arſenic; or concentric, which is either ſpherical concentric, as in calcedony and piſolite, or conically concentric, as in ſome ſtalactites and hæmatites.

B. With regard to the thickneſs, as being

a. Very thick, the concretions exceeding one-half inch, as in amethyſt and heavy ſpar.

b. Thick, the concretions being between one-half and one-fourth inch, as in heavy ſpar and native arſenic.

c. Thin, between one-fourth and one-half inch, as in calcedony.

d. Very thin, from a line to a thickneſs juſt perceptible to the naked eye, as in ſpecular iron.

3. Columnar diſtinct concretions, which are diſtinguiſhed with regard to the direction, thickneſs, form, and poſition.

A. The direction, which is either,

a. Straight columnar, as in ſchorl and calcareous ſpar, and,

b. Curved columnar, as in argillaceous iron ſtone, and ſpecular iron ore.

B. The thickneſs is diſtinguiſhed into,

a. Very thick, when the diameter exceeds two inches, as in baſalt and quartz.

b. Thick

fica-n.

Claſſification.

b. Thick columnar, from two inches to one-fourth inch, as in amethyſt and calcareous ſpar.

c. Thin, from one-fourth to one-half inch, as in calcareous ſpar and argillaceous iron ſtone.

d. Very thin, the thickneſs being leſs than a line, as in ſchorl and columnar argillaceous iron ſtone.

C. The form of the concretions being either

a. Perfectly columnar, as in argillaceous iron ſtone.

b. Imperfectly, as in amethyſt.

c. Cuneiform columnar, as in calcareous ſpar and arſenical pyrites.

D. The poſition of the concretions, which is either

a. Parallel columnar, as in ſchorlite, or

b. Diverging or promiſcuous columnar, as in ſchorl and arſenical pyrites.

4. Pyramidal diſtinct concretions. This form of concretion is very rare, and has been obſerved only in the baſalt of Iceland, Faro, and Bohemia.

II. The ſurface of ſeparation, which is diſtinguiſhed into

1. Smooth, as in wood tin ore.

2. Rough, as in native arſenic.

3. Uneven, as in galena and blende; and

4. Streaked, which is either,

A. Longitudinally ſtreaked, as in ſchorl and ſchorlite.

B. Tranſverſely and fortification-like, as in amethyſt and ſpecular iron ore.

III. The luſtre of ſeparation. This character is to be determined in the ſame manner as the external luſtre.

4. *The General Appearance.*

This comprehends three particular generic characters, the tranſparency, the ſtreak, and the ſtain.

I. The tranſparency, which is diſtinguiſhed into the following five degrees.

1. Tranſparent, which is either,

A. Common, as when objects appear ſingle through a tranſparent mineral; or,

B. Doubling, when objects appear double, as in calcareous ſpar, or double refracting ſpar, jargon, and chryſolite.

2. Semitranſparent, as in opal and calcedony.

3. Tranſlucent, as in flint, cat's eye, and fluor ſpar.

4. Tranſlucent at the edges, as in hornſtone and foliated gypſum.

5. Opake, which is peculiar to minerals of a metallic luſtre, as in malachite and jaſper.

II. The ſtreak, which is either,

1. Of the ſame colour, or,

2. Different from that of the mineral, and whoſe luſtre is the ſame; or,

B. More or leſs different.

In red ſilver ore the ſtreak is a dark crimſon red; in cinnabar, ſcarlet red; in green lead ore, greeniſh-white; in red lead ore, clear lemon yellow.

III. The ſtain. With reſpect to this character, minerals are diſtinguiſhed into ſuch as,

1. Simply ſtain, and this either ſtrongly or weakly, as gray ore of manganeſe, and red ſcaly iron ore; and into ſuch as

2. Both ſtain and mark, as chalk and plumbago; and

3. Such as do not ſtain.

Characters for the Touch.

Characters of this deſcription are, hardneſs, ſolidity, frangibility, flexibility, and adheſion to the tongue.

I. The *hardneſs*, which is determined by the following degrees.

1. Hard, as when a mineral gives fire with ſteel, but cannot be ſcraped with the knife. This character is diſtinguiſhed into,

A. Hard, when the file makes a conſiderable impreſſion, as in feldſpar and ſchorl.

B. Very hard, on which it makes a weak impreſſion, as in rock cryſtal and topaz.

C. Extremely hard, on which the file makes no impreſſion, as diamond and emery.

2. Semihard may be ſlightly ſcraped with a knife, but gives no fire with ſteel, as red copper ore, blende, limeſtone.

3. Soft, eaſily ſcraped with the knife, as in galena, mica, aſbeſtus.

4. Very ſoft, which receives an impreſſion from the nail, as in gypſum, chalk, talc.

II. The *ſolidity*, according to which ſolid minerals are diſtinguiſhed into,

1. Brittle, when the particles are in the higheſt degree coherent and immoveable, as in quartz, gray copper ore, and copper pyrites.

2. Sectile, when the particles are coherent but not perfectly immoveable among one another, as in plumbago and galena.

3. Malleable, when the integrant particles are coherent and alſo more or leſs moveable among one another, as in the moſt of the native metals.

III. The *frangibility*, with regard to which ſolid minerals are either,

1. Very difficultly frangible, as native metals, and maſſive common horneblende.

2. Difficultly frangible, as in praſe, maſſive quartz, and aſbeſtus.

3. Rather eaſily frangible, as iron pyrites, vitreous copper ore.

4. Eaſily frangible, as in galena, opal, and heavy ſpar.

5. Very eaſily frangible, as in amber and pitcoal.

IV. The *flexibility*, according to which ſolid minerals are,

1. Flexible, which is diſtinguiſhed into,

A. Common, as in malleable minerals, amianthus, gold ore.

B. Elaſtic, as in mica, elaſtic mineral pitch from Derbyſhire.

2. Inflexible, ſuch minerals as break when the direction of the fibres is changed.

V. The *adheſion to the tongue*, according to which ſome minerals poſſeſs this property

1. Strongly, as in hydrophane.

2. Rather ſtrongly, as in bole and lithomarga.

3. Weakly, as talc.

4. Very weakly, as in clay.

5. No adheſion at all, as is the caſe with moſt minerals.

Characters for the Hearing.

I. The ſound, which is diſtinguiſhed into

1. Ringing or ſounding, as in native arſenic and common ſlate.

2. Creaking, as in native amalgam when preſſed with the finger.

3. Ruſtling, as in paſſing the finger over mountain cork and farinaceous zeolite.

2. Particular generic characters of friable minerals. The characters included under this title are the external form, the luſtre, the appearance of the particles, the ſtain and the friability.

I. The external form, which is either *maſſive*, as in porcelain earth; *interſperſed*, as in black ſilver ore; as a *thick or thin cruſt*, as in black copper ore; *ſpumiform*, as in red and brown ſcaly iron ores; *dendritic*, as gray ore of mangaueſe; or *reniform*, as pure clay and earthy talc.

II. The luſtre, which is determined as in ſolid minerals; but here it is diſtinguiſhed,

1. With regard to intenſity, as

A. Glimmering, as in earthy talc and ſcaly iron ore; and,

B. Dull, as in earthy lead ore and lithomarga.

2. With regard to the kind, as it is *common* or *metallic*.

III. The appearance of the particles, which is either,

1. Duſty, as in black copper ore, iron ochres.

2. Scaly, as in earthy talc.

IV. The ſtain is diſtinguiſhed in friable minerals as being either

1. Strong, as in ſcaly iron ore.

2. Weak, as in earthy lead ores.

V. The friability, with regard to which friable minerals are either

1. Pulverulent, as earthy lead ores, and blue martial earth.

2. Looſely coherent, as ſcaly iron ore and clays.

3. Particular generic characters of fluid minerals. Theſe characters relate to the external form, the luſtre, the tranſparency, the fluidity, and the wetting of the fingers.

I. The external form, which is either,

1. In globules; and, 2. Liquiform; both which characters belong to native mercury.

II. The luſtre, which is determined as formerly explained, and is either 1. Common; or 2. Metallic, as in native mercury.

III. The tranſparency, of which three degrees are diſtinguiſhed in fluid minerals: 1. Tranſparent, as in naphtha; 2. Turbid, as in petroleum; 3. Opake, as in native mercury.

IV. The fluidity, which is characteriſed by being, 1. Perfectly fluid, as mercury, and, 2. Coheſive, as in mineral tar.

V. The wetting of the fingers. 1. Some fluid minerals wet the fingers, as mineral tar; and, 2. Some do not, as native mercury.

Remaining Common Generic External Characters.

The remaining common generic characters are the unctuoſity; the coldneſs; the weight; the ſmell; and the taſte.

III. The unctuoſity, of which there are four degrees.

1. Meagre, as is the caſe with moſt minerals.

2. Rather greaſy, as pipe clay.

3. Greaſy, as fullers earth and ſteatites.

4. Very greaſy, as talk and plumbago.

IV. The coldneſs, which includes three degrees.

1. Cold, having the coldneſs of quartz, as hornſtone, jaſper, marble.

2. Rather cold, as ſerpentine, gypſum.

3. Slightly cold, as amber, pitcoal, and chalk.

By this character cut and poliſhed ſtones may be diſtinguiſhed, where ſome of the other characters are loſt; and by it alſo natural gems may be diſtinguiſhed from thoſe which are artificial.

V. The weight.—This character is moſt accurately diſcovered by taking the ſpecific gravity of a mineral by means of a hydroſtatic balance. See HYDRODYNAMICS. But when this cannot be had recourſe to, a mineral is examined by lifting it in the hand and comparing its weight, thus eſtimated by the feeling, with its volume, by which means an approximation may be made to its ſpecific gravity. Five degrees of this mode of eſtimating the weight of minerals have been aſſumed.

1. Supernatant, ſuch minerals as ſwim in water, as naphtha, mountain cork.

2. Light, ſuch minerals as have a ſpecific gravity between 1.000 and 2.000, (taking water at 1.000) as amber, mineral pitch, and pitcoal.

3. Rather heavy, are ſuch minerals as have a ſpecific gravity between 2.000 and 4.000, which is the caſe with moſt kinds of ſtones, as amianthus, rock cryſtal, mica, fluor ſpar, diamond.

4. Heavy, when the ſpecific gravity is from 4.000 to 6.000, as in moſt metallic ores, ſuch as gray copper ore, red hæmatites, white lead ore, and in ſome others as heavy ſpar.

5. Extremely heavy, when the ſpecific gravity exceeds 6.000, which includes the native metals, as native gold, native copper, and native ſilver, and ſome others, as galena, tinſtone cryſtals, ſulphurated biſmuth, and vitreous ſilver ore.

VI. The ſmell is characteriſtic of only a ſmall number of minerals. It is obſerved either,

1. Of itſelf without addition, and is,

A. Bituminous, as mineral pitch and naphtha.

B. Slightly ſulphureous, as in native ſulphur and gray antimonial ore.

C. Bitteriſh, as in ochre kept cloſe ſhut up for ſome time.

D. Clayey, as in yellow chalk.

2. After breathing on a mineral, which ſhould be cold and breathed upon ſtrongly and quickly, when the ſmell perceived is,

A. Clayey bitter, as in hornblende and ſome ſienites.

3. After rubbing or ſtriking, when the ſmell emitted is,

A. Urinous, as in ſwineſtone after rubbing.

B. Sulphureous, as in pyrites.

C. Garlic, as in arſenical pyrites and white cobalt ore.

D. Empyreumatic, as in quartz and pitcoal.

VII. The taſte, which is characteriſtic of one claſs of minerals, only, viz. the ſalts; and it is either,

1. Sweetiſh ſaline, as rock ſalt.

2. Sweetiſh aſtringent, as native alum.

3. Souriſh aſtringent, as native vitriol.

4. Bitter ſaline, as native Epſom ſalt.

5. Cooling ſaline, as native nitre.

6. Lixivious, as native alkali.

7. Urinons, as native ſal ammoniac.

Beſide the characters which we have now illuſtrated, ſome others are occaſionally and ſucceſsfully employed in the deſcription of minerals. Theſe have been brought under

Claſſification.

under the denomination of phyſical, chemical, and empirical characters.

1. *Phyſical.* The moſt common of the phyſical characters is the property which ſome minerals poſſeſs of exhibiting ſigns of electricity and magnetiſm. Some minerals become electric by being heated, and others by friction; and the electricity thus excited is in ſome vitreous or poſitive, and in others reſinous or negative. Some minerals, too, and particularly ſome varieties of iron ore, are diſtinguiſhed by being attracted by the magnet. Such are magnetic pyrites, and magnetic iron ſand. By filing a mineral ſo fine that the particles ſhall ſwim on water, and then applying a magnet, the ſlighteſt degree of magnetic effect may be obſerved. Among the phyſical properties of minerals alſo, may be reckoned the phoſphoreſcence, which is produced by friction, as in ſome varieties of blende; or by expoſure to heat, as fluor ſpar, and ſome calcareous ſpars. To theſe characters alſo belongs the peculiar property of Lemnian earth and ſome other boles, which being thrown into water ſplit into pieces with a crackling noiſe; and the property of ſome opals and other ſtones, of acquiring a higher degree of tranſparency when they are immerſed in water, hence called hydrophanes.

2. *Chemical characters.*—By ſome ſimple experiments, the nature of many mineral ſubſtances may be eaſily and quickly aſcertained, and particularly by means of acids. Thus, the nitrous acid is employed to diſcover whether a mineral effervеſces, from which character the nature of the mineral can be more certainly known than by any other. Ammonia, or the volatile alkali, diſſolves copper, and aſſumes a blue colour. Acetic acid is ſucceſsfully employed as a teſt of lead, which communicates to the acid a ſweetiſh taſte. By means of heat, and particularly by the uſe of the blowpipe, much knowledge may be obtained of the nature of minerals. Some are volatilized; in others the colour is changed; and while ſome are nearly fuſed at different temperatures, others burn with a flame of peculiar colours.

3. *Empirical characters.*—Among theſe characters, the moſt common is the peculiar effloreſcence which takes place in ſome ores. In copper ores the effloreſcence is green or blue; in iron ores, brown, yellow, or red; in cobalt, peach bloſſom red; and in arſenic, white.

Characters for the diſtinction of minerals may be obtained from the circumſtance of certain minerals being found generally accompanying others; as native arſenic with orpiment; gray copper ore with copper pyrites, and gray ſilver ore; red copper ore with native copper: white cobalt ore is rarely found without nickel; and by attending to this circumſtance, it will not be miſtaken for arſenical pyrites.

For the ſake of brevity, Mr Kirwan, and others after him, have adopted a method of expreſſing ſome of the characters by means of numbers. The following table exhibits ſome of theſe characters and correſponding numbers.

Reſplendent, denoted by the number	4.
Shining	3.
Weakly ſhining	2.
Glimmering	1.
Dull	0.

Fragments, when the form is indeterminate.

Very ſharp-edged	4.
Sharp-edged	3.
Rather ſharp-edged	2.
Rather blunt	1.
Perfectly blunt	0.

Tranſparency.

Tranſparent	4.
Semitranſparent	3.
Tranſlucent	2.
Tranſlucent at the edges	1.
Opake	0.

Hardneſs.

Of chalk, denoted by	3.
Yielding to the nail	4.
May be ſcraped with a knife	5.
Yields more difficultly to the knife	6.
Scarcely yields to the knife	7.
Does not give fire with ſteel	8.
Gives feeble ſparks with ſteel	9.
Gives lively ſparks	10.

But it is obvious that this abridged mode of expreſſing theſe characters, by means of numbers, can only be advantageouſly employed by thoſe who have made themſelves quite familiar with the different numbers correſponding to the different ſhades of character, and who can thus recollect them with facility and preciſion. To others this method of deſcription, by requiring conſtant reference to the explanation, may prove rather embarraſſing, ſo that what is gained in brevity may be loſt in perſpicuity. We propoſe, therefore, ſtill to retain the verbal mode of expreſſion in preference to the numerical.

TABLE OF MINERALS arranged in the order of their Genera and Species, each Genus being divided into Families or Groupes, the characters of which latter are derived from their external properties according to the method of Werner.

FIRST CLASS.

EARTHS & STONES.

I. DIAMOND Genus.

Diamond.

II. ZIRCON Genus.

Zircon.
Hyacinth.

III. SILICEOUS Genus.

Chryſolite Family.

Chryſoberyl.
Chryſolite.
Olivine.
Coccolite.
Augite.
Veſuvian.

Garnet Family.

Leucite.
Melanite.
Garnet.
  a. Precious.
  b. Common.
  c. Bohemian or Pyrope.
Grenatite or Staurolite.

Ruby Family.

Ceylanite.
Spinelle.
Sapphire.
Corundum.
Adamantine ſpar.
Emery.

Claſſification

Schorl Family.
Topaz.
Pyrophyſalite.
Euclaſe.
Emerald.
Beryl.
Schorlite.
Schorl.
  a. Common.
  b. Electric or Tourmaline.
Piſtazite.
Zoiſite.
Axinite or Thumerſtone.

Quartz Family.
Quartz.
  a. Amethyſt.
    Common.
    Fibrous.
  b. Rock cryſtal.
  c. Roſe-coloured or milk quartz.
  d. Common quartz.
  e. Praſe.
  f. Ferruginous quartz, or iron flint.
Hornſtone.
  a. Splintery.
  b. Conchoidal.
  c. Ligniform.
Flinty ſlate.
  a. Common.
  b. Lydian ſtone.
Flint.
Calcedony.
  a. Common.
  b. Carnelian.
Opal.
  a. Precious.
  b. Common.
  d. Ligniform.
Menilite.
Jaſper.
  a. Egyptian.
  b. Ribband.
  c. Porcelain.
  d. Common.
  e. Agate.
  f. Opal.
Heliotrope or Bloodſtone.
Chryſopraſe.
Plaſma.
Cats eye.

Pitchſtone Family.
Obſidian.
Pitchſtone.
Pearlſtone.
Pumice.

Zeolite Family.
Prehnite.
  a. Fibrous.
  b. Foliated.
Zeolite.
  a. Mealy } Meſotype.
  b. Fibrous }
  c. Radiated } Stilbite.
  d. Foliated }
Cubizite, Chabaſie or Analcime.
Croſs-ſtone, Staurolite.
Laumonite.
Dipyre.
Natrolite.
Azurite.
Lazulite.
Hydrargillite.

Feldſpar Family.
Andaluſite.
Feldſpar.
  a. Adularia.
  b. Labradore ſtone.
  c. Common feldſpar.
  d. Compact.
  e. Hollow ſpar, chiaſtolite.
Scapolite.
Arctizite or Wernerite.
Diaſpore.
Spodumene.
Meionite.
Sommite.
Ichthyophthalmite.

IV. ARGILLACEOUS Gen.

Clay Family.
Native alumina.
Porcelain earth.
Common clay.
  a. Loam.
  b. Pipe clay.
  c. Potters clay.
  d. Variegated clay.
  e. Slaty clay.
Clayſtone.
Adheſive ſlate.
Poliſhing ſlate.
Tripoli.
Floatſtone.
Alum ſtone.

Clay Slate Family.
Aluminous ſchiſtus.
  a. Common.
  b. Shining.
Bituminous ſchiſtus.
Drawing ſlate.
Whet ſlate.
Clay ſlate.

Mica Family.
Lepidolite.
Mica.
Pinite.
Potſtone.
Chlorite.
  a. Earthy.
  b. Common.
  c. Foliated.
  d. Schiſtoſe.

Trap Family.
Hornblende.
  a. Common.
  b. Baſaltic.
  c. Labradore.
  d. Schiſtoſe.
Baſalt.
Wacken.
Phonolite or Clinkſtone.
Lava.

Lithomarga Family.
Green earth.
Lithomarga.
  a. Friable.
  b. Indurated.
Rock ſoap.
Umber.
Yellow earth.

V. MAGNESIAN Genus.

Soap Stone Family.
Native magneſia.
Bole.
Sea froth.
Fullers earth.
Steatites.
Figure ſtone.

Talc Family.
Nephrite.
  a. Common.
  b. Axe-ſtone.
Serpentine.
  a. Common.
  b. Precious.
Schillerſtone.
Talc.
  a. Earthy.
  b. Common.
  c. Indurated.
Aſbeſtus.
  a. Mountain cork.
  b. Amianthus.
  c. Common aſbeſtus.
  d. Ligniform aſbeſtus.

Actynolite Family.
Cyanite.
Actynolite.
  a. Aſbeſtous.
  b. Common.
  c. Glaſſy.
Tremolite.
  a. Aſbeſtous.
  b. Common.
  c. Glaſſy.
Smaragdite.
Sahlite.
Schalſtone.

VI. CALCAREOUS Genus.

Family of *Carbonates*.
Agaric mineral.
Chalk.
Limeſtone.
  a. Compact.
    a′. Common.
    b′. Oolite or roe-ſtone.
  b. Foliated.
    a′. Granular.
    b′. Calcareous ſpar.
  c. Fibrous.
    a′. Common.
    b′. Calcareous ſinter.
  d. Piſolite or pea-ſtone.
Calcareous tufa.
Foam earth.
Slaty ſpar.
Arragonite.
Brown ſpar.
Dolomite.
Rhomb or bitter ſpar.
Swineſtone.
Marl.
  a. Earthy.
  b. Indurated.
Bituminous marl ſlate.

Family of *Phoſphates*.
Apatite.
Aſparagus ſtone.
Phoſphorite.

Family of *Fluates*.
Fluor.
  a. Earthy.
  b. Compact.
  c. Fluor ſpar.

Family of *Sulphates*.
Gypſum.
  a. Earthy.
  b. Compact.
  c. Foliated.
  d. Fibrous.
Selenite.
Anhydrite.
Cube ſpar.

VII. BARYTIC Genus.

Family of *Carbonates*.
Witherite.

Family of *Sulphates*.
Heavy ſpar.
  a. Earthy.
  b. Compact.
  c. Granular.
  d. Foliated.
  e. Common.
  f. Columnar.
  g. Fibrous.
  h. Bolognian.

VIII. STRONTIAN Genus.

Family of *Carbonates*.
Strontites.

Family of *Sulphates*.
Celeſtine.
  a. Fibrous.
  b. Foliated.

SECOND CLASS.

SALTS.

I. Genus SULPHATES.

Native vitriol.
Native alum.
Mountain butter.
Capillary ſalt.
Native Epſom ſalt.
Native Glauber ſalt.

II.

Claſſification.

II. Genus Nitrates.
Native nitre.
III. Genus Muriates.
Rock ſalt.
a. Foliated.
b. Fibrous.
Sea ſalt.
Native ſal ammoniac.
IV. Genus Carbonates.
Native ſoda.
Native magneſia.
V. Genus Borates.
Boracite.
VI. Genus Fluates.
Cryolite.

Third Class.

COMBUSTIBLES.

I. Genus Sulphur.
Native ſulphur.
a. Common.
b. Volcanic.
II. Bituminous Genus.
Petroleum, or mineral oil.
Mineral pitch.
a. Elaſtic.
b. Earthy.
c. Slaggy.
Amber.
a. White.
b. Yellow.
Brown coal.
a. Common.
b. Bituminous wood.
c. Earth coal.
d. Alum earth.
e. Moor coal.
Black coal.
a. Pitch coal.
b. Columnar coal.
c. Slaty coal.
d. Cannel coal.
e. Foliated coal.
f. Coarſe coal.
Coal blende.
a. Conchoidal.
b. Slaty.
III. Graphite Genus.
Graphite.
a. Scaly.
b. Compact.
Mineral charcoal.

Fourth Class.

METALLIC ORES.

I. Platina Genus.
Native platina.
II. Gold Genus.
Native gold.
a. Golden yellow.
b. Braſs yellow.
c. Grayiſh yellow.
III. Mercury Genus.
Native mercury.
Native amalgam.
Corneous ore of mercury.
Liver ore of mercury.
a. Compact.
b. Slaty.
Cinnabar.
a. Common.
b. Fibrous.
IV. Silver Genus.
Native ſilver.
a. Common.
b. Auriferous.
Antimonial ſilver ore.
Arſenical ſilver ore.
Corneous ſilver ore.
Sooty ſilver ore.
Vitreous ſilver ore.
Brittle vitreous ſilver ore.
Red ſilver ore.
a. Dark red.
b. Bright red.
White ſilver ore.
Black ſilver ore.
V. Copper Genus.
Native copper.
Vitreous copper ore.
a. Compact.
b. Foliated.
Variegated copper ore.
Copper pyrites.
White copper ore.
Gray copper ore.
Black copper ore.
Red copper ore.
a. Compact.
b. Foliated.
c. Capillary.
Brick red copper ore.
a. Earthy.
b. Indurated.
Emerald copper ore.
Azure copper ore.
a. Earthy.
b. Indurated.
Malachite.
a. Fibrous.
b. Compact.
Green copper ore.
Ferruginous green copper ore.
a. Earthy.
b. Slaggy.
Micaceous copper ore.
a. Foliated.
b. Lenticular.
Muriate of copper.
VI. Iron Genus.
Native iron.
Iron pyrites.
a. Common.
b. Radiated.
c. Capillary.
d. Hepatic.
Magnetic pyrites.
Magnetic iron ore.
a. Common.
b. Arenaceous.
Specular iron ore.
a. Common.
a'. Compact.
b'. Foliated.
b. Micaceous iron ore.
Red iron ore.
a. Red iron froth.
b. Compact.
c. Red hæmatites.
d. Red ochre.
Brown iron ore.
a. Brown iron froth.
b. Compact.
c. Brown hæmatites.
d. Brown ochre.
Sparry iron ore.
Black iron ore.
a. Compact.
b. Black hæmatites.
Argillaceous iron ſtone.
a. Red chalk.
b. Columnar argillaceous iron ſtone.
c. Granular.
d. Common.
e. Reniform.
f. Piſiform.
Bog iron ſtone.
a. Moraſſy.
b. Swampy.
c. Meadow.
Blue earthy iron ſtone.
Green earthy iron ſtone.
VII. Lead Genus.
Galena.
a. Common.
b. Compact.
Blue lead ore.
Brown lead ore.
Black lead ore.
White lead ore.
Green lead ore.
Red lead ore.
Yellow lead ore.
Native ſulphate of lead.
Earthy lead ore.
a. Friable.
b. Indurated.
VIII. Tin Genus.
Tin pyrites.
Common tinſtone.
Grained tin ore.
IX. Bismuth Genus.
Native biſmuth.
Vitreous biſmuth.
Ochre of biſmuth.
X. Zinc Genus.
Blende.
a. Yellow.
b. Brown.
c. Black.
Calamine.
a. Compact.
b. Foliated.
XI. Antimony.
Native antimony.
Gray ore of antimony.
a. Compact.
b. Foliated.
c. Radiated.
d. Plumoſe.
Red ore of antimony.
White ore of antimony.
Ochre of antimony.
XII. Cobalt Genus.
White cobalt ore.
Gray cobalt ore.
Shining cobalt ore.
Black cobalt ochre.
a. Friable.
b. Indurated.
Brown cobalt ochre.
Yellow cobalt ochre.
Red cobalt ochre.
a. Earthy.
b. Radiated.
XIII. Nickel Genus.
Copper-coloured nickel.
Nickel ochre.
XIV. Manganese Genus.
Gray ore of mangaueſe,
a. Radiated.
b. Foliated.
c. Compact.
d. Earthy.
Black ore of manganeſe.
Red ore of manganeſe.
XV. Molybdena Genus.
Sulphuret of molybdena.
XVI. Arsenic Genus.
Native arſenic.
Arſenical pyrites.
a. Common.
b. Argentiferous.
Orpiment.
a. Yellow.
b. Red.
Native oxide of arſenic.
XVII. Tungsten Genus.
Wolfram.
Tungſtate of lime.
XVIII. Titanium Genus.
Menachanite.
Octahedrite.
Titanite.
Nigrine.
Brown ore.
Iſerine.
XIX. Uranium Genus.
Pitchy ore.
Micaceous uranite.
Uranite ochre.
XX. Tellurium Genus.
Native tellurium.
Graphic ore.
Yellow ore.
Black or foliated ore.
XXI. Chromium Genus,
Needle ore.
Ochre of chromium.
XXII. Columbium Gen.
XXIII. Tantalium Gen.
XXIV. Cerium Genus,

Diamond genus.

I. Genus. DIAMOND.

One Species. Diamond.

Id. Kirwin, I. 393. *Le Diamant*, Brochant, II. 153. Haüy, III. 287.

Eſſential character.—Scratches all other minerals.

External characters.—Its moſt common colours are grayiſh white and yellowiſh white; ſmoke gray and yellowiſh gray; clove brown; ſometimes aſparagus green, paſſing to piſtachio green and apple green; ſometimes a wine yellow and citron yellow, and alſo blue and roſe red.

When the diamond is cut, it preſents a ſplendid and varied play of colours, which is one of its moſt ſtriking characters.

It is found ſometimes in rounded grains, which are ſuppoſed to have been cryſtals with the edges worn; but it is moſt frequently met with cryſtallized.

The primitive form is a regular octahedron, the integrant molecule a regular tetrahedron; but the form which it commonly aſſumes is the ſpheroidal, with 48 curvilineal faces, ſix of which correſpond to the ſame face of the primitive octahedron. Beſides this form there are various others, as the double three-ſided pyramid, the dodecahedron, &c. All the modifications of the cryſtals of the diamond, Haüy obſerves, ſeem to be the effects of its tendency to cryſtallize in a regular figure of 48 plane faces, which, if it ever has exiſted, has not yet been diſcovered; and it is eaſy to conceive that this form would be produced by intermediate decrements on all the angles of the nucleus; but the deviations from this form ſeem to have been occaſioned by its precipitate formation.

The external luſtre is from four to one; internal four. The fracture is ſtraight foliated, with a fourfold cleavage, parallel to the faces of the octahedron; tranſparency four to three; hardneſs ten; brittle; ſpecific gravity 3.518 to 3.600. Becomes poſitively electric by friction, even before it is poliſhed.

Chemical character.—When expoſed to a ſufficient temperature, it is entirely conſumed. This has been fully aſcertained by the experiments of modern chemiſts, from which it is concluded, that the diamond is entirely compoſed of pure carbone. See Chemistry.

Mr Boyle was the firſt, according to Henckel, who ſubjected the diamond to the action of heat, and in his experiments he found that it exhaled very copious and acrid vapours. This was about the year 1673; but in the year 1694 the experiment was repeated by the order of Coſmo III. grand duke of Tuſcany. Diamonds were expoſed to the heat of the powerful burning glaſs of Tſchirnhauſen, the action of which was even aided by means of another burning glaſs; and about the end of 30 ſeconds a diamond of 20 grains loſt its tranſparency, ſeparated into ſmall pieces, and was at laſt entirely diſſipated. The ſame experiment was repeated on other diamonds, always with the ſame reſult, and without exhibiting the leaſt ſign of fuſion. Newton, in his treatiſe on Optics, has placed the diamond among combuſtibles, ſuppoſing that it is a coagulated unctuous ſubſtance. He had been led to this by obſerving its extraordinary refractive power, which in combuſtible bodies he found to be in a ratio conſiderably higher than their denſity. According to this general law he concluded, that the diamond as well as water contained an inflammable principle, both of which have ſince been verified. Newton's treatiſe was not publiſhed till 1704; but it appears that part of it was compoſed and read to the Royal Society in the year 1675, nearly 20 years before the Florentine experiments were made.

But nearly 70 years before this latter period, Boetius de Boodt, in his Hiſtory of Stones, appears to have been perfectly ſatisfied, from an experiment which he deſcribes, that the diamond was of an inflammable nature. This document, which we preſume will gratify the curioſity of many of our readers, is too ſingular to be omitted. "Maſtix deinde calefieri parum, quemadmodum et adamas debet, idque, ut impoſitus ac ſupra poſitus maſtici ſtatim illi unione vera uniatur, ac vivos undique radios a ſe jaceat. Hanc unionem reſpuunt aliæ omnes gemmæ diaphanæ—cur vero legitimus adamas ſolus tincturam illam recipiat, aliæ gemmæ non, difficile eſt ſcire. Exiſtimo mutuum illum et amicum amplexum *propter ſimilitudinem aliquam quam habent in materia et qualitatibus*; hoc eſt, tota utriuſque natura fieri, quod itaque maſtix *quæ igneæ naturæ eſt* adamanti facile jungi poſſit, ſignum eſt; id propter materiæ ſimilitudinem fieri, *ac adamantis materiam igneam, et ſulphuream eſſe*, atque ipſius humidum intrinſicum et primogenium cujus beneficio coagulatus eſt, *plane fuiſſe oleoſum et igneum*, aliarum vero gemmarum aqueum.—Non mirum itaque ſi pinguis, oleoſa, et ignea maſticis ſubſtantia illi abſque viſus termino adpingi et applicari, aliis vero gemmis non poſſit." *Boetius de Boodt, Gem. et Lapid. Hiſt.* Hanoviæ, 1609. 4to. lib. ii. cap. 1.

For the ſake of the Engliſh reader we ſhall tranſlate this curious document. "If maſtich and the diamond be expoſed to heat, and brought into contact, they enter into perfect union, and emit a very lively flame, which does not take place in any other gem. But what is the reaſon that the diamond alone poſſeſſes this property? I am of opinion that this mutual combination ariſes from a certain reſemblance which each of the ſubſtances poſſeſſes in its nature and properties: on this account, therefore, the maſtich, which is of a combuſtible nature, may be united to the diamond from a ſimilarity in their nature, which ſhows that the diamond is compoſed of *combuſtible* and ſulphureous matter; and that the humid and original particles of its compoſition, by means of which it was coagulated, or aſſumed a ſolid form, have been decidedly of an oily and *inflammable* nature, while thoſe of other gems have been of an aqueous nature. It is not, therefore, ſurpriſing that the fat, oily, and combuſtible ſubſtance of maſtich may enter into intimate union with the diamond, but cannot be combined with other gems."

Localites, &c.—The diamond is found in various places of the Eaſt Indies, as in the provinces of Golconda and Viſapour, in the peninſula of Hither India; and in the kingdoms of Pegu and Siam, in the peninſula of Farther India, and nearly, it is obſerved, in the ſame degree of latitude. In 1728 the diamond was diſcovered in Braſil, in the diſtrict of Serro-do-Frio, which is ſituated in the ſame ſouthern latitude as the countries which produce the diamond on the north ſide of the equator. The native repoſitory of the diamond, ſo far as is known, is a ferruginous ſoil, but whether it be produced on the ſpot where it is diſcovered, or have been tranſported from the place of its origin, has not been aſcertained. It is found alſo in veins filled with ſoil of a ſimilar nature. We ſhall here add a ſhort hiſtory of the diamond mines.

The diamond mines are found only in the kingdoms of Golconda, Viſapour, Bengal, the iſland of Borneo, and Braſil. There are four or five mines, or rather three mines and two rivers, whence diamonds are obtained. The mines are, 1. That of Raolconda, in the province of Carnatica, five days journey from Golconda, and eight from Viſapour. It has been diſcovered about 200 years. 2. That of Gani, or Coulour, ſeven days journey from Golconda eaſtward. It was diſcovered 150 years ago by a peaſant, who digging in the ground found a natural fragment of 25 carats. 3. That of Soumelpour, a large town in the kingdom of Bengal, near the Diamond-mine. This is the moſt ancient of all: it ſhould rather be called that of *Goual*, which is the name of the river, in the ſand whereof theſe ſtones are found. 4. The fourth mine, or rather the ſecond river, is that of Succudan, in the iſland of Borneo; and, 5. That of Serro-do-Frio in Braſil.

Diamond-mine of Raolconda.—In the neighbourhood of this mine the earth is ſandy, and full of rocks and copſe-wood. In theſe rocks are found ſeveral little veins of half and ſometimes a whole inch broad, out of which the miners, with a kind of hooked irons, draw the ſand or earth wherein the diamonds are; breaking the rocks when the vein terminates, that the track may be found again, and continued. When a ſufficient quantity of earth or ſand is drawn forth, they waſh it two or three times, to ſeparate the ſtones. The miners work quite naked, except a thin linen cloth before them; and beſides this precaution, have likewiſe inſpectors, to prevent their concealing diamonds, which, however, they frequently find means to do, by watching opportunities when they are not obſerved, and ſwallowing them.

Diamond-mine of Gani or Coulour.—In this mine are found a great number of diamonds from 10 to 40 carats, and even more. It was here that the famous diamond of the Great Mogul, which before it was cut weighed 793 carats, was found. The diamonds of this mine are not very clear: their water is uſually tinged with the quality of the ſoil; being black where that is marſhy, red where it partakes of red, ſometimes green and yellow, if the ground happen to be of thoſe colours. Another defect of ſome conſequence is a kind of greaſineſs appearing on the diamond, when cut, which takes off part of its luſtre.—There are uſually no leſs than 60,000 perſons employed in this mine.

When the miners have found a place where they intend to dig, they level another ſomewhat bigger in the neighbourhood thereof, and incloſe it with walls about two feet high, only leaving apertures from ſpace to ſpace, to give paſſage to the water. After a few ſuperſtitious ceremonies, and a kind of feaſt which the maſter of the mine makes for the workmen, to encourage them, every one goes to his buſineſs, the men digging the earth in the place firſt diſcovered, and the women and children carrying it off into the other walled round. They dig a few feet deep, and till ſuch time as they find water. Then they ceaſe digging; and the water thus found ſerves to waſh the earth two or three times, after which it is let out at an aperture reſerved for that end. This earth being well waſhed, and well dried, they ſift it in a kind of open ſieve, and laſtly, ſearch it well with the hands to find the diamonds. This mine is in a plain of about one league and a half in extent, bounded on one ſide by a river, and on the other by a range of lofty mountains, which form a ſemicircle. It is ſaid that the nearer the digging is carried to the mountains, the diamonds are the larger.

Diamond genus.

Diamond-mine of Soumpelpour, or river Goual.—Soumelpour is a conſiderable town near the river Goual, which runs into the Ganges. It is from this river that all our fine diamond points, or ſparks, called *natural ſparks*, are brought. They never begin to ſeek for diamonds in this river till after the great rains are over, that is, after the month of December; and they uſually even wait till the water is grown clear, which is not before January. The ſeaſon at hand, eight or ten thouſand perſons, of all ages and ſexes, come out of Soumelpour and the neighbouring villages. The moſt experienced among them ſearch and examine the ſand of the river, and particularly where it is mixed with pyrites, going from Soumelpour to the very mountain whence it ſprings. When all the ſand of the river, which at that time is very low, has been well examined, they proceed to take up that wherein they judge diamonds likely to be found; which is done after the following manner: They dam the place round with ſtones, earth, and faſcines, and throwing out the water, dig about two feet deep: the ſand thus got is carried into a place walled round on the bank of the river. The reſt is performed after the ſame manner as at other mines.

Diamond-mine in the iſland of Borneo, or river of Succudan.—We are but little acquainted with this mine; ſtrangers being prohibited from having acceſs to it: though very fine diamonds have been brought to Batavia by ſtealth. They were formerly imagined to be ſofter than thoſe of the other mines; but experience ſhows they are in no reſpect inferior.

Diamond-mine of Serro-do-Frio.—A deſcription of this mine was given by D'Andrada in 1792, to the Natural Hiſtory Society of Paris. The mine is ſituated to the north of Villa Rica, in the 18th degree of ſouth latitude. The whole country in which the diamonds are found abounds with ores of iron; and the ſtratum of ſoil, immediately under the vegetable ſoil, contains diamonds diſſeminated in it, and attached to a gaugue or matrix which is more or leſs ferruginous; but they are never found in veins.

When this mine was firſt diſcovered, the ſearching for diamonds was ſo ſucceſsful, that the Portugueſe fleet which arrived from Rio de Janeiro in 1730 brought no leſs than 1146 ounces of diamonds. This unuſual quantity introduced into the market immediately reduced the price; and to prevent this circumſtance recurring, the Portugueſe government determined to limit the number of men employed in the mines.

16
Method of cutting and poliſhing diamonds.

As the diamond is the hardeſt of all ſubſtances, it can only be cut and poliſhed by itſelf. To bring it to that perfection which augments its price ſo conſiderably, the lapidaries begin by rubbing ſeveral againſt each other, while rough; after having firſt glued them to the ends of two wooden blocks, thick enough to be held

held in the hand. It is this powder thus rubbed off the ſtones, and received in a little box for the purpoſe, that ſerves to grind and poliſh them.

Diamonds are cut and poliſhed by means of a mill, which turns a wheel of ſoft iron ſprinkled over with diamond-duſt mixed with oil of olives. The ſame duſt, well ground, and diluted with water and vinegar, is uſed in the ſawing of diamonds; which is performed with an iron or braſs wire, as fine as a hair. Sometimes, in lieu of ſawing the diamonds, they cleave them, eſpecially if there be any large ſhivers in them.

The method of cutting and poliſhing the diamond was not diſcovered till the 15th century. The diamonds which were employed as ornaments before that period, were in their rough and natural ſtate. The invention is aſcribed to Louis Berguen, a native of Bruges, who in the year 1476, cut the fine diamond of Charles the Bald, duke of Burgundy, which he loſt the ſame year at the battle of Morat. This diamond was then ſold for a crown, but afterwards came into the poſſeſſion of the duke of Florence.

The *firſt water* in diamonds means the greateſt purity and perfection of their complexion, which ought to be that of the pureſt water. When diamonds fall ſhort of this perfection, they are ſaid to be of the *ſecond* or *third* water, &c. till the ſtone may be properly called a *coloured one.*

17 Of eſtimating.

The value of diamonds is eſtimated by Mr Jefferies by the following rule. He firſt ſuppoſes the value of a rough diamond to be ſettled at 2l. per carat, at a medium; then to find the value of diamonds of greater weights, multiply the ſquare of their weight by 2, and the product is the value required. *E. g.* to find the value of a rough diamond of two carats: 2 × 2=4, the ſquare of the weight; which, multiplied by two, gives 8l. the true value of a rough diamond of two carats. For finding the value of manufactured diamonds, he ſuppoſes half their weight to be loſt in manufacturing them; and therefore, to find their value, we muſt multiply the ſquare of double their weight by 2, which will give their true value in pounds. Thus, to find the value of a wrought diamond weighing two carats; we firſt find the ſquare of double the weight, viz. 4 × 4=16; then 16 × 2=32. So that the true value of a wrought diamond of two carats is 32l. On theſe principles Mr Jefferies has conſtructed tables of the price of diamonds from 1 to 100 carats.

18 Celebrated diamonds.

The greateſt diamond ever known in the world is one belonging to the king of Portugal, which was found in Braſil. It is ſtill uncut: and Mr Magellan informs us, that it was of a larger ſize; but a piece was cleaved or broken off by the ignorant countryman, who chanced to find this great gem, and tried its hardneſs by the ſtroke of a large hammer upon the anvil.

This prodigious diamond weighs 1680 carats: and although it is uncut, Mr Romé de l'Iſle ſays, that it is valued at 224 millions ſterling; which gives the eſtimation of 79,36 or about 80 pounds ſterling for each carat: viz. for the multiplicand of the ſquare of its whole weight. But even in caſe of any error of the preſs in this valuation, if we employ the general rule above mentioned, this great gem muſt be worth at leaſt 5,644,800 pounds ſterling, which are the product of 1680 by two pounds, viz, much above five millions and a half ſterling. But this gem is ſuppoſed by ſome to be a white topaz.

The famous diamond which adorns the ſceptre of the empreſs of Ruſſia under the eagle at the top of it weighs 779 carats, and is worth at leaſt 4,854,728 pounds ſterling, although it hardly coſt 135,417 guineas. This diamond was one of the eyes of a Malabarian idol, named *Scharingham.* A French grenadier, who had deſerted from the Indian ſervice, contrived ſo well as to become one of the prieſts of that idol, from which he had the opportunity to ſteal its eye: he run away to the Engliſh at Trichinopoly, and thence to Madras. A ſhip-captain bought it for twenty thouſand rupees: afterwards a Jew gave ſeventeen or eighteen thouſand pounds ſterling for it: at laſt a Greek merchant named *Gregory Suffras*, offered it to ſale at Amſterdam in the year 1766: and Prince Orloff made this acquiſition for his ſovereign the empreſs of Ruſſia. This diamond is of a flattened oval form and of the ſize of a pigeon's egg.

The diamond of the Great Mogul is cut in roſe; weighs 279$\frac{9}{10}$ carats, and it is worth 380,000 guineas. This diamond has a ſmall flaw underneath near the bottom: and Tavernier, page 389, who examined it, valued the carat at 150 French livres. Before this diamond was cut, it weighed 793$\frac{5}{8}$ carats, according to Romé de l'Iſle: but Tavernier, page 339, of his ſecond volume, ſays that it weighed 900 carats before it was cut. If this be the very ſame diamond, its loſs by being cut was very extraordinary.

Another diamond of the king of Portugal, which weighs 215 carats, is extremely fine, and is worth at leaſt 369,800 guineas.

The diamond of the grand duke of Tuſcany, now of the emperor of Germany, weighs 139$\frac{1}{2}$ carats; and is worth at leaſt 109,520 guineas. Tavernier ſays, that this diamond has a little hue of a citron colour; and he valued it at 135 *livres tournoiſes* the carat. Robert de Berquen ſays, that this diamond was cut into two: that the grand Turk had another of the ſame ſize: and that there were at Biſnagar two large diamonds, one of 250 and another of 140 carats.

The diamond of the late king of France, called the *Pitt* or *Regent*, weighs 136$\frac{3}{4}$ carats: this gem is worth at leaſt 208,333 guineas, although it did not coſt above the half of this ſum. Patrin ſays, that it is believed to be at Berlin, (I. 226.) and we may add, that it has probably been carried back to France among other ſpoils.

The other diamond of the ſame monarch, called the *Sancy*, weighs 55 carats; it coſt 25,000 guineas: and Mr Dutens ſays, that it is worth much above that price.

Brilliant DIAMOND, is that cut in faces both at top and bottom; and whoſe table, or principal face at top, is flat. To make a complete ſquare brilliant, if the rough diamond be not found of a ſquare figure, it muſt be made ſo; and if the work is perfectly executed, the length of the axis will be equal to the ſide of the ſquare baſe of the pyramid.—Jewellers then form the table and collet by dividing the block, or length of the axis, into 18 parts. They take $\frac{5}{18}$ from the upper part, and $\frac{1}{18}$ from the lower. This gives a plane at $\frac{4}{18}$ diſtance from the girdle for the table; and a ſmaller plane at $\frac{1}{18}$ diſtance for the collet; the breadth of which will be be $\frac{1}{5}$ of the breadth of the table. In this ſtate the ſtone is ſaid to be a *complete ſquare table* diamond.—The brilliant is an improvement on the table-diamond, and was introduced within the 17th century, according to Mr Jefferies.

II. Genus. ZIRCON.

1. Species. Zircon.

Jargon, Kirw. I. 257. *Zircon*, Haüy, II. 465. *Id.* Brochant, I. 159.

Eſſen. Char.—Its ſpecific gravity about 4.4; the joints natural, ſome of which are parallel, and others are oblique to the axis of the cryſtals.

Exter. Char.—Colours reddiſh and yellowiſh, greeniſh, greeniſh yellow, and whitiſh. The colour in general varies from green to gray, and is moſt commonly pale; and the poliſhed ſtone exhibits in ſome degree the play of colours of the diamond.

It is found in rounded, angular, or flattened grains, or in ſmall angular fragments with notched edges, and alſo cryſtallized. The primitive form is an octahedron with iſoſceles triangles, and the integrant molecule is an irregular tetrahedron. The following are the moſt common forms of its cryſtals.

1. A priſm with four rectangular faces, each baſe of which has a pyramid with four faces placed on the four lateral faces, which terminates ſometimes in a line, but moſt frequently in a point.

2. The preceding cryſtal, in which the oppoſite lateral edges of the priſm are truncated.

3. The cryſtal (1.) in which the edges of the faces of the pyramid are bevelled.

4. The cryſtal (1.) having the lateral edges of the priſm, and the ſummit of the pyramid truncated.

5. The cryſtal (1.) in which the angles between the priſm and the pyramid are bevelled.

6. A priſm with four faces, having the two oppoſite narrow, and the two others broad.

7. A double pyramid with four faces, with the edges of the common baſe truncated.

8. The perfect octahedron with obtuſe angles.

The cryſtals are commonly ſmall; the ſurface ſmooth, but that of the angular fragments is rough. Luſtre, 3 and 4; internal luſtre, 4 and 3; ſomewhat vitreous, or approaching to that of the diamond. Fracture imperfect or flat conchoidal; fragments, 3. Tranſparency, 4, 3. Cauſes double refraction. Hardneſs, 9; brittle. Spec. grav. 4.416 to 4.4700.

Chem. Char.—Infuſible by the blow-pipe without addition, but with borax it forms a tranſparent colourleſs glaſs. The following are its conſtituent parts.

Zirconia,	70
Silica,	26
Iron,	1
Loſs,	3
	100

Localities.—The zircon was firſt found in Ceylon, accompanied with cryſtals of ſpinelle and tourmaline, in a river near the middle of the iſland; and more lately it has been found in Norway, in a rock compoſed of feldſpar and hornblende.

Zircon genus.

Uſes.—The zircon is employed as a precious ſtone, and particularly as an ornament in mourning.

2. Species. Hyacinth.

Id. Kirw. I. 257. *Zircon*, Haüy, II. 465. *L'Hyacinthe*, Brochant, I. 163.

Eſſen. Char.—The ſame as the firſt ſpecies.

Exter. Char.—The moſt common colour is what is called hyacinth red, blood red, and yellowiſh brown.

It is found in rounded grains, and frequently in cryſtals, the primitive form of which is the ſame as the firſt ſpecies. The cryſtals are,

1. A priſm with four faces.

2. The ſame ſlightly truncated on its edges.

3. The double pyramid with four faces, or a very obtuſe octahedron, which is a rare variety.

4. A priſm with ſix faces, each baſe of which is terminated by an acumination with three faces, placed alternately on the three lateral edges, forming the rhomboidal dodecahedron.

The cryſtals are commonly ſmall, the ſurface ſmooth; external luſtre, 3, 4; internal, 4; greaſy; fracture ſtraight foliated; cleavage double, rectangular; fragments, 3; tranſparency, 4, 2; cauſes double refraction; hard and brittle; unctuous to the touch when cut; ſpec. grav. 4.385 to 4.620.

Chem. Char.—By the action of the blow-pipe the hyacinth loſes its colour, but retains its tranſparency. It is infuſible without borax, which converts it into a tranſparent colourleſs glaſs.

Conſtituent Parts.

	From Ceylon.	From Expailly.	
Zirconia,	70	64.5	66
Silica,	25	32	31
Oxide of iron,	0.5	2	2
Loſs,	4.5	1.5	1
	100 Klap.	100 Vauq.	100 Vauq.

Localities.—It is found in Ceylon in ſimilar ſituations with the former; in Brazil, Bohemia, and in the rivulet Expailly, in Velay in France; and alſo in the neighbourhood of Piſa in Italy.

Uſes.—As it is ſuſceptible of a fine poliſh, the hyacinth has been ranked among precious ſtones.

Remarks.—The analogy between the cryſtalline forms of the zircon and hyacinth; their double refraction; the ſimilarity of their other characters, and particularly the reſults of chemical analyſis, have led Haüy to form them into one ſpecies.

A variety, under the name of *cinnamon ſtone*, has been conſidered as a diſtinct ſpecies; but the differences are ſo very ſlight, that it may be included in the deſcription of the preceding.

III. Genus. SILICEOUS.

1. Species. Chrysoberyl.

Id. Emm. Wid. Lenz. Kirw. *Chryſopale*, Lam. *Cymophane*, Haüy.

Exter. Char.—The colour is an aſparagus green; paſſing

Siliceous genus.

paſſing ſometimes to a greeniſh white, and ſometimes to an olive green; ſometimes bright brown and yellowiſh brown, paſſing to yellowiſh gray; affords a feeble change of colour from bluiſh to milky white.

It is found in angular or rounded grains, which appear to have been water worn; and in cryſtals, exhibiting, 1. A table with ſix faces, elongated, of various thickneſs, truncated on the terminal edges. 2. A priſm with four rectangular faces. 3. A priſm with ſix faces, of which four are broader and two are narrower oppoſite to each other.

The grains are ſlightly rough, and have a conſiderable external luſtre. The cryſtals are ſtriated lengthwiſe on their lateral faces; the other faces are ſmooth; luſtre external very ſhining—internal the ſame, intermediate between that of the diamond and the vitreous luſtre.

The fracture is in all directions perfectly conchoidal; the fragments are indeterminate with ſharp edges. It has little tranſparency, but a conſiderable degree of hardneſs. Spec. grav. 3.698 to 3.719 Wern. 3.710 Klap. 3.796 Haüy.

Chem. Char.—It is infuſible without addition by the action of the blow-pipe. By Klaproth's analyſis, the following are its conſtituent parts.

Alumina,	71.5
Silica,	18
Lime,	6
Oxide of iron,	1.5
Loſs,	3
	100

Localities.—Brazil, Ceylon, Siberia.

Uſes.—The hardneſs of the chryſoberyl, and change of colour which it exhibits, have procured it a place among precious ſtones of inferior value. It is known in commerce under the name of *changeable opal* or oriental chryſolite.

2. Species. CHRYSOLITE.

Id. Emm. Wid. Lenz. Muſ. Leſk. Kirw. *Peridot*, Daub. Haüy.

Exter. Char.—The moſt common colour is a bright piſtachio green, paſſing to an olive green; ſometimes of a bright aſparagus or clear meadow green; rarely the green approaches to brown and almoſt to a cherry red.

It is found in angular fragments with the edges a little notched, or in rounded grains, or in cryſtals having the angles and edges a little notched. The forms of its cryſtals are, 1. A large rectangular priſm having its lateral edges truncated and ſometimes bevelled, and terminated by a ſix-ſided priſm, of which two oppoſite ſides are placed on the ſmall lateral faces of the priſm. The four others on the lateral truncated faces, the latter forming a more acute angle than the two former.

2. The next form varies from the preceding, in having two additional terminating faces, placed on the broad faces of the priſm, each of which is conſequently ſituated between two of the planes correſponding to the truncated planes.

3. In another variety the ſummit of the pyramid is truncated by a convex cylindrical plane, the convexity of which paſſes from one of the ſmall oppoſite lateral planes towards the other.

4. In ſome inſtances the cryſtals are ſo ſmall, that the ſmall lateral faces almoſt entirely diſappear, while the two larger aſſume a curved form, giving ſuch cryſtals a tabular appearance.

The external ſurface of the angular fragments and of the rounded cryſtals is ſcaly, which affords an eſſential character to this mineral. The ſmall lateral planes are ſmooth, the broad ones are diſtinctly ſtriated lengthwiſe. Externally the ſurface is ſhining; internally ſhining and vitreous.

The fracture in all directions is perfectly conchoidal; the form of the fragments is indeterminate, with very ſharp edges. It is almoſt always tranſparent, and refracts double; it is not ſo hard as quartz. Brittle. Spec. grav. 3.340 to 3.420 Wern. 3.428 Haüy.

Chem. Char.—By the action of the blow-pipe it is fuſed with borax without efferveſcence, and affords a greeniſh, tranſparent glaſs.

Conſtituent parts.

	Cryſtalliſed.	Cut.	Cryſtalliſed.
Silica,	38	39	38
Magneſia,	39.5	43.5	50.5
Oxide of iron,	19.	19	9.5
Loſs,	3.5		2.
	100 Klap.	100.5 Vauq.	100 Vauq.

Localities, &c.—This mineral is brought from the Levant, but it is not known whether it is found in Aſia or Africa. It has been diſcovered in Bohemia; and cryſtalliſed ſpecimens included in a kind of lava, have been brought from the iſle of Bourbon. As it is uſually found in rounded fragments, in the midſt of earthy ſubſtances, its relative ſituation is ſcarcely known.

Uſes.—The chryſolite has been often employed for various purpoſes as a precious ſtone, but as it poſſeſſes no great degree of hardneſs, it is not much eſteemed.

Subſtances of a very different nature have been, at different times, deſcribed under the name of *Chryſolite.* It appears that the yellow chryſolite of the ancients is the ſame with our topaz, and that their green topaz is our chryſolite. Plin. lib. xxxvii. cap. 8.

3. Species. OLIVINE.

Id. Emm. Wid. Lenz. Kirw. Lameth. *Chryſolite en grains irreguliers*, De Born. *Peridot Granuliforme*, Haüy. *Chryſolith des Volcans*, of many mineralogiſts.

Exter. Char.—The moſt common colour is a bright olive green, ſometimes of an apple green, piſtachio, or mountain green; a wine, honey, or orange yellow, and ſometimes alſo a reddiſh brown, and browniſh black; but theſe latter varieties are rare. It is found in rounded pieces, from the ſize of the head to that of a grain of millet, moſt commonly included, and diſſeminated in baſalt. It has been found cryſtalliſed.

Internally,

Internally, this mineral varies in its luſtre between ſhining and weakly ſhining; in the yellow varieties the luſtre is between vitreous and reſinous.

The fracture is more or leſs conchoidal; ſometimes uneven; the ſhape of the fragments is indeterminate, with ſharp edges. The rounded pieces of a certain ſize are compoſed of diſtinct granular concretions, with ſmall grains.

It is ſometimes tranſparent, and varies to ſemitranſparent and tranſlucent. It is brittle and not ſo hard as quartz. Spec. grav. 3.225 to 3.265.

Chem. Char.—Olivine is infuſible by the action of the blow-pipe; in nitric acid it loſes its colour, giving to the liquid a pale yellow colour.

Conſtituent Parts. Klaproth.

Silica,	48 to	52.0	52
Magneſia,	37	38.5	37.75
Lime,	00.25	00.25	0.25
Oxide of iron,	12.5	12.	10.75
Loſs,	2.25		—
	100.00—	102.75	100.75

Localities, &c.—Olivine is found in different countries, as in Bohemia and Saxony, and in Vivarais in France, and moſt commonly in rounded pieces in the cavities of baſalt. Brochant ſays that it has not been diſcovered in the baſalts of Ireland, England, Sweden, Norway, and Italy. We have, however, collected ſpecimens of olivine among the baſaltic rocks of the Giant's Cauſeway in Ireland.

Olivine and chryſolite are conſidered by Haüy as one ſpecies, and deſcribed under the name peridot.

4. Species. Coccolite.

Coccolithe, Brochant, ii. 504. Haüy, iv. 355. D'Andrada. Nich. 4to. Jour. v. 495.

Exter. Char.—Colour, meadow green, olive, or blackiſh green. It is found in maſſes which are compoſed of ſeparate pieces, granular, in ſmall grains, which may be eaſily ſeparated; theſe grains are angular, and diſcover ſome appearance of tendency to cryſtallization.

Luſtre, reſplendent, vitreous; fracture foliated; cleavage double, as examined by Haüy, but ſingle according to D'Andrada: it is hard, ſcratches glaſs; the grains are often tranſlucent. Spec. grav. 3.316 to 3.373.

Chem. Char.—Coccolite is infuſible without addition before the blow-pipe. With borax it melts into a pale yellow tranſparent glaſs, and with carbonate of potaſh into an olive green veſicular glaſs.

Conſtituent Parts.

Silica,	50.0
Lime,	24.0
Magneſia,	10.0
Oxide of iron,	7.0
Oxide of mangane̋ſe,	3.0
Alumina,	1.5
Loſs,	4.5
	100

Localities.—It is found in the iron mines of Hellеſta and Aſſebo in Sudermania, at Nerica in Sweden, and near Arendal in Norway.

Siliceous genus.

5. Species. Augite.

Octahedral Baſaltine, Kirw. i. 219. *L'Augite*, Brochant, i. 179. *Pyroxene*, Hauy, iii. 80.

Eſſen. Char.—Diviſible, parallel to the ſides of an oblique rhomboidal priſm, of about 92° and 88°, which is ſubdivided in the direction of the great diagonals of the baſes.

Exter. Char.—Colour, olive green, black, white, and gray. It is found ſometimes in rounded pieces, and in grains, but moſt frequently cryſtallized. The primitive form is an oblique-angled priſm, the baſes of which are rhombs; the integrant molecule is an oblique triangular priſm. The form of the cryſtals is generally a ſix and eight-ſided priſm, which is terminated by a two ſided ſummit. The cryſtals are commonly ſmall, ſmooth, and brilliant, ſometimes a little ſhining. Internal luſtre ſhining, and almoſt reſplendent, reſinous. Fracture perfectly foliated; cleavage double; tranſlucent at the edges; harder than olivine; gives lively ſparks with ſteel, and ſcratches glaſs; rather brittle; ſpec. grav. 3.226 to 3.777.

Chem. Char.—Fuſible before the blow-pipe with difficulty, and only in ſmall fragments, which melt into a black enamel.

Conſtituent Parts.

	From Ætna, Vauquelin.	From Arendal, Roux.
Silica,	52	45
Lime,	13.20	30.5
Alumina,	3.33	3
Magneſia,	10	
Oxide of iron,	14.66	16
Oxide of mangane̋ſe,	2	5
Loſs,	4.81	.5
	100.00	100

Localities, &c.—Augite is found in baſalt along with olivine and hornblende, in Bohemia, Hungary, and Tranſylvania; in the baſalt of Arthur's ſeat near Edinburgh.

6. Species. Vesuvian.

La Veſuvienne, Brochant, i. 184. *Idocraſe*, Hauy, ii. 574.

Eſſen. Char.—Diviſible, parallel to the faces and diagonals of a rectangular priſm, with ſquare baſes; melts into a yellow glaſs.

Exter. Char.—Colour brown, orange, dark green, and yellowiſh green.

This mineral is found maſſive, diſſeminated, or cryſtallized. Primitive form, a rectangular priſm, little different from a cube; integrant molecule a triangular priſm. The forms of its cryſtals are, a rectangular priſm, with four ſides, truncated on all its edges, or truncated on its lateral edges; or a ſix-ſided priſm truncated on all its edges. The cryſtals are uſually ſmall, ſingle ſometimes, and ſometimes in groups. Lateral planes longitudinally ſtreaked. Some are ſmooth;

ſmooth ; luſtre reſplendent, vitreous ; internal luſtre ſhining, reſinous. Fracture imperfectly conchoidal, ſometimes uneven, often alſo foliated. Fragments indeterminate, with rather ſharp edges. Tranſlucent, and almoſt ſemitranſparent ; hard, brittle ; ſpecific gravity 3.365 to 3.420.

Chem. Char.—Fuſible without addition into a yellow glaſs.

Conſtituent Parts. Klaproth.

	From Veſuvius.	From Siberia.
Silica,	35.50	42
Lime,	33.	34
Alumina,	22.25	16.25
Oxide of iron,	7.5	5.50
Oxide of manganeſe,	.25	an atom.

Localities, &c.—It is found in the neighbourhood of Veſuvius, accompanied by limeſtone in ſmall grains, feldſpar, mica, hornblende, and calcareous ſpar ; and it is ſuppoſed to have been thrown out of the volcano unchanged. In Siberia it is found in ſteatites, ſometimes mixed with cryſtals of magnetic iron.

Uſes.—At Naples it is employed as a precious ſtone.

7. Species. LEUCITE.

La Leucite, Brochant, i. 188. *Veſuvian*, Kirwan, i. 285. *Amphigene*, Haüy, ii. 559.

Eſſen. Char.—Diviſible, parallel to the faces of a cube, and at the ſame time to thoſe of a rhomboidal dodecahedron.

Exter. Char.—Colour grayiſh or yellow white.

It is rarely found maſſive or in grains, but moſt frequently cryſtallized. The primitive form of its cryſtals is the cube ; the integrant molecule an irregular tetrahedron ; the moſt common form of the cryſtals is a ſhort double pyramid with eight faces oppoſed baſe to baſe, each ſummit of which is ſurmounted by an obtuſe acumination with four faces, correſponding alternately to the four lateral edges of the pyramid, and thus producing a figure of twenty-four trapezoidal faces ; the cryſtals are commonly ſmall, the ſurface rough and dull, or at moſt feebly ſhining. Internal luſtre ſhining, vitreous. Fracture foliated, ſometimes conchoidal. Fragments indeterminate with ſharp edges. Semitranſparent or tranſlucent. Scarcely ſcratches glaſs. Brittle. Spec. grav. 2.455 to 2.490.

Chem. Char.—Infuſible before the blow-pipe, but with borax gives a tranſparent glaſs.

Conſtituent Parts.

	Klaproth.	Vauquelin.
Silica,	54	56
Alumina,	24	20
Potaſh,	21	20
Lime,	—	2
Loſs,	1	2
	100	100

Localities, &c.—Leucite is found in the lavas of Veſuvius, and in the baſalts of Italy ; in baſalts and other rocks of Bohemia, and alſo, it is ſaid, in a granitic rock in the Pyrenees.

8. Species. MELANITE, or *Black Garnet.*

La Melanite, Brochant, i. 191.

Exter. Char.—Colour velvet black, or browniſh or grayiſh black. It is moſt commonly found cryſtallized, in ſix-ſided priſms, terminated at each extremity by an obtuſe acumination, with three planes placed alternately on three of the lateral edges ; the priſms are ſometimes truncated on all the edges, and ſometimes only the lateral edges. The ſurface is ſmooth and ſhining. Internal luſtre ſhining. Fracture imperfect, flat, conchoidal. Fragments indeterminate, ſharp-edged, opaque, hard, and rather brittle. Spec. grav. 3.691 to 3.800.

Conſtituent Parts. Vauquelin.

Silica,	35
Alumina,	6
Lime,	32
Oxide of iron and of manganeſe,	25
Loſs,	2
	100

Localities.—It has been found only at Freſcati and St Albano near Rome.

9. Species. GARNET.

Le Grenat, Brochant, i. 193. *Garnet*, Kirwan, i. 238. *Grenat*, Hauy, ii. 540.

Eſſen. Char.—Specific gravity at leaſt 3.5. The forms derived from the rhomboidal dodecahedron.

The primitive form is a rhomboidal dodecahedron. The inclination of each rhomb to the two adjacent is 120°, the plain angles 109° 28′ 16″ and 70° 31′ 44″. The integrant molecule is the tetrahedron, whoſe faces are iſoſceles triangles equal and ſimilar.

The garnet is divided into three ſubſpecies, the precious, common, and Bohemian garnet.

Subſpecies 1. PRECIOUS GARNET.

Exter. Char.—Colour red, of which there are ſeveral varieties, as blood red, cherry red, hyacinth red, ſometimes brown and even black.

The garnet is rarely found maſſive or diſſeminated, but ſometimes in rounded grains, and moſt frequently cryſtallized, of which the following are the forms.

1. A priſm with ſix ſides terminated by a double obtuſe ſummit with three faces, correſponding alternately to the three lateral edges at each end of the priſm, and thus forming a rhomboid of twelve faces.
2. The ſame cryſtal truncated on all its edges, forming a figure of 36 faces. The faces of the truncations are elongated hexagons.
3. A ſhort double pyramid, with eight faces oppoſed baſe to baſe, the ſummits of each of which are ſurmounted by an obtuſe acumination, correſponding alternately to the four lateral edges of one of the pyramids,

mids, forming a cryſtal of 24 ſides, which are pretty equal trapezoids.

4. The preceding form with twelve truncations; eight on the eight acute alternating angles of the two ſummits, and four on the obtuſe angles of the common baſe of the two pyramids, making in all 36 faces.

The ſurface is a little unequal in the grains, ſmooth in the cryſtals, and almoſt always ſtreaked diagonally. The luſtre varies from ſhining to reſplendent, and is vitreous. Fracture more or leſs perfectly conchoidal, ſometimes uneven or ſplintery, and ſometimes foliated. Fragments indeterminate with ſharp edges. Tranſparent or tranſlucent. Scratches quartz. Refraction ſimple. Brittle. Spec. grav. 4.085 to 4.352.

Chem. Char.—Before the blow-pipe it is fuſible into a dark enamel.

Conſtituent Parts.

	Klaproth.	Vauquelin.
Silica,	35.75	36
Alumina,	27.25	22
Lime,	—	3
Oxide of iron,	36	41
Oxide of mangeneſe,	.25	–
Loſs,	.75	–
	100.00	102

Localities, &c.—The garnet is not uncommon in moſt countries of the world, and it is uſually found in primitive rocks.

Uſes.—It is employed as a precious ſtone.

The precious garnet is ſuppoſed to be the carbuncle of the ancients.

Subſpecies 2. COMMON GARNET.

Eſſen. Char.—The ſame as the precious garnet.

Exter. Char.—It is found maſſive and diſſeminated, and alſo ſometimes cryſtallized. The forms of the cryſtals are the ſame as thoſe of precious garnet. The ſurface of the cryſtals is diagonally ſtreaked.

Colour brown, green, greeniſh black, browniſh red, and orange yellow. Luſtre ſhining, reſinous, or vitreous. Fracture uneven, ſometimes ſplintery. Fragments ſharp-edged. Rarely tranſparent, ſometimes tranſlucent, and commonly at the edges; not ſo hard as the precious garnet. Brittle. Spec. grav. from 3.668 to 3.757.

Chem. Char.—Melts before the blow-pipe into a dark enamel, and eaſier than the former.

Conſtituent Parts. Vauquelin.

	Black Garnet.	Yellowiſh Garnet.
Silica,	43	38
Alumina,	16	20
Lime,	20	31
Oxide of iron,	16	10
Water,	4	–
Loſs,	1	1
	100	100

Localities, &c.—The common garnet is found in micaceous ſchiſtus, gneis, ſerpentine, and other primitive rocks, in Saxony, Bohemia, France, Sweden.

Uſes.—It is rarely employed as a precious ſtone, but frequently as a flux for iron ores.

Subſpecies 3. PYROPE, or *Bohemian Garnet.*

Pyrope, Brochant, ii. 498.

Eſſen. Char.—The ſame as the garnet.

Exter. Char.—This mineral is found in ſmall, round angular fragments: it is never cryſtallized.

Colour dark blood red, which, by holding it between the eye and the light, becomes yellow. Luſtre reſplendent, vitreous. Fracture conchoidal. Fragments indeterminate and ſharp-edged. Perfectly tranſparent. Scratches quartz. Spec. grav. 3.718 to 3.941.

Conſtituent Parts.	Klaproth.
Silica,	40
Alumina,	28.5
Lime,	3.5
Magneſia,	10
Oxide of iron,	16.5
Oxide of manganeſe,	.25
Loſs,	1.25
	100

Localities, &c.—This mineral is found in ſerpentine in Saxony; the moſt beautiful are from Bohemia, where it is found in alluvial land.

Uſes.—It is employed in jewellery. The ſmall grains are uſed as a ſubſtitute for emery in poliſhing.

This mineral is formed into a ſeparate ſpecies by ſome, and is diſtinguiſhed from the garnet by its colour, want of cryſtallization, and tranſparency; but theſe differences in the external characters Hauy conſiders as inſufficient to conſtitute a different ſpecies of two minerals which agree in a greater number of other characters. Magneſia indeed has been detected in the latter as one of its conſtituents, no trace of which has been yet diſcovered in the former.

10. Species. GRENATITE.

Grenatite, Brochant, ii. 496. *Id.* Sauſſure, § 1900.
Staurotide, Hauy, iii. 93. *Pierre de Croix*, De Liſle, ii. 434.

Eſſen. Char.—Diviſible parallel to the ſides of a rhomboidal priſm, whoſe angles are equal to 129° 30′, and 50° 30′, which may be ſubdivided in the direction of the ſhort diagonals of the baſes.

Exter. Char.—Grenatite is always found cryſtallized. The primitive form is a rectangular priſm with rhomboidal baſes, having the angles inclined, as mentioned in the eſſential character. The integrant molecule is a triangular priſm. It is frequently met with in double cryſtals, croſſing each other in the form of a croſs, from which the name is derived, ſometimes at right angles, and ſometimes obliquely; ſometimes alſo there are oblique triple croſſings. The ſurface is ſmooth and ſhining, or uneven and dull.

The colour is reddiſh or blackiſh brown; internal luſtre ſhining, between vitreous and reſinous. Fracture

Siliceous genus.

imperfectly foliated, in the direction of the axis; in other directions uneven, ſmall grained, or ſometimes a little conchoidal; often opaque, ſometimes tranſlucent. Scratches quartz feebly; ſpecific gravity 3.2861.

Chem. Char.—Before the blow-pipe it becomes brown without fuſion, and is then converted into a fritty ſubſtance.

Conſtituent Parts.

	Vauquelin.
Silica,	33.
Alumina,	44.
Lime,	3.84
Oxide of iron,	13.
Oxide of manganeſe,	1.
Loſs,	5.16
	100

Localities, &c.—It is found is ſmall cryſtals in micaceous ſchiſtus, at St Gothard in Switzerland, in Brittany in France, and in Spain, in primitive rocks.

11. Species. CEYLANITE.

Pleonaſte, Hauy, iii. 17. *Spinelle Pleonaſte*, Brongniart, i. 438.

Eſſen Char.—Scratches glaſs ſlightly, and is diviſible into a regular octahedron.

Exter. Char.—This mineral is found in rounded maſſes, and alſo cryſtallized. Primitive form of the cryſtals, a regular octahedron. The integrant molecule a regular tetrahedron. The edges of the octahedron are ſometimes truncated, and form a regular 12-ſided rhomboid. The cryſtals are ſmall; the fracture is conchoidal; the luſtre ſhining and vitreous.

The colour is ſometimes perfectly black, brown, bright blue, purpliſh red, or dark green. It is hard, but not very brittle. Spec. grav. 3.76 to 3.79.

Chem. Char.—Infuſible before the blow-pipe.

Conſtituent Parts.	Deſcotils.
Alumina,	68
Magneſia,	12
Silica,	2
Oxide of iron,	16
Loſs,	2
	100

Localities, &c.—This mineral is met with in the iſland of Ceylon, along with tourmaline and other cryſtallized ſubſtances, which have been carried from their native repoſitories by means of water. It has been found alſo in diſſeminated cryſtals in the cavities of the lava of Veſuvius; and very ſmall blue cryſtals of ceylanite have been obſerved in the volcanic (baſaltic) rocks at Cloſterlach on the banks of the Rhine.

12. Species. SPINELLE.

Spinel and *Balaſs Ruby*, Kirw. i. 253. *Le Spinel*, Brochant, i. 202. *Spinelle*, Hauy, ii. 496.

Eſſen. Char.—Scratches quartz ſtrongly; the primitive and common form, a regular octahedron.

Exter. Char.—Spinelle is found in rounded grains, or cryſtallized: the primitive form of the cryſtals is a regular octahedron; the integrant molecule the regular tetrahedron. Its uſual forms are a double pyramid with four faces applied baſe to baſe, conſtituting a perfect octahedron; or it is truncated on all it edges, or only on thoſe of the common baſe of the two pyramids. It is met with alſo in the form of a double cryſtal, compoſed of two octahedrons, which are often flattened

Colour uſually red, of various ſhades, from carmine red to roſe red; ſometimes reddiſh white, and orange yellow. Faces of the octahedron ſmooth, thoſe of the truncations longitudinally ſtreaked. Luſtre reſplendent, vitreous; fracture conchoidal; the longitudinal fracture is foliated; fragments indeterminate, ſharp-edged; ſemitranſparent, and ſometimes tranſparent. Scratches quartz; is ſcratched by ſapphire. Spec. grav. 3.570 to 3.645.

Chem. Char.—Before the blow-pipe it is infuſible; but with borax it melts, and without frothing up.

Conſtituent Parts.

	Klaproth.	Vauquelin.
Alumina,	74.50	82.47
Silica,	15.50	—
Magneſia,	8.25	8.78
Oxide of iron,	1.50	—
Lime,	.75	—
Chromic acid,	—	6.18
Loſs,	—	2.57
	100.5	100

Localities, &c.—Cryſtals of ſpinelle are found in Ceylon, in a river which comes from the high mountains in the middle of that iſland: they are accompanied with zircon, tourmaline, and different other ſtones. It is found alſo in Pegu.

Uſes.—Spinelle is ranked among precious ſtones, and is greatly eſteemed when it is of a certain ſize. It is ſaid that a fine ſpinelle ruby, whoſe weight exceeds four carats, is worth half the price of a diamond of the ſame weight.

13. Species. SAPPHIRE.

Oriental Ruby, *Sapphire*, and *Topaz*, Kirwan, i. 250. *Le Saphir*, Brochant, i. 207. *Teleſie*, Hauy, ii. 480.

Eſſen. Char.—Specific gravity about 4; natural joints very diſtinct, and perpendicular to the axis of the cryſtals.

Exter. Char.—Sapphire is found in fragments, in rounded pieces, and alſo cryſtallized. The primitive form of the cryſtal, according to Hauy, is a regular ſix-ſided priſm, and the integrant molecule is a triangular, equilateral priſm; but, according to Bournon, the primitive form is a rhomboid, whoſe angles are 96° and 84°. The uſual forms of the cryſtals are, 1. A ſmall ſix-ſided priſm. 2. A pyramid with ſix faces, very ſharp, double, the two pyramids applied baſe to baſe. 3. The ſame cryſtal with the ſummit truncated. 4. A pyramid with ſix faces, double; the two pyramids applied baſe to baſe, but leſs ſharp than the ſecond form. The ſurface of the cryſtals is ſmooth, and often ſtreaked tranſverſely.

The principal colour is blue, varying between Pruſſian and indigo blue; other varieties are of a deep violet blue. Sapphires are alſo found red, yellowiſh, and greeniſh. Two or three colours appear in the ſame cryſtal, ſometimes in bands and ſometimes in concentric circles. Externally, the luſtre of the ſapphire is ſhining; internally, reſplendent and vitreous. Fracture perfectly conchoidal. Fragments ſharp-edged; tranſparent or ſemitranſparent, ſometimes only tranſlucent. Scratches all other earthy ſubſtances. Brittle. Spec. grav. 3.991 to 4.283.

Chem. Char.—Infuſible before the blow-pipe. Melts with borax without intumeſcence. The blue variety, expoſed to a ſtrong heat, loſes its colour, Haüy.

Conſtituent Parts.

	Klaproth.	Bergman.
Alumina,	98.5	58.
Silica,		35.
Lime,	00.5	5.
Oxide of iron,	1.	2.
	100	100

	Sapphire.	Oriental Ruby.
Alumina,	92	90
Silica,	5.25	7
Oxide of iron,	1.	1.2
Loſs,	1.75	1.8
	100	100

Localities, &c.—The fineſt ſapphires are brought from Pegu and the iſland of Ceylon. The ſapphire is alſo found in Bohemia, accompanied with zircon, Bohemian garnet, and magnetic iron; and in the river Expailly in France.

Uſes.—The ſapphire, next to the diamond, is the moſt highly valued of precious ſtones.

14. Species. CORUNDUM.

Corindon, Haüy, iii. 1. *Adamantine Spar*, Kirw. i. 335. *Le Spath Adamantin*, Broch. i. 356.

Eſſen. Char.—Scratches quartz; diviſible into a rhomboid ſomewhat acute.

Exter. Char.—This mineral is found maſſive, diſſeminated, and cryſtallized; 1. In ſix-ſided priſms, having the extremities broken, and the faces ſometimes unequal. 2. A ſix-ſided priſm, terminated by a ſix-ſided pyramid. 3. A pyramid with ſix ſhort faces, whoſe ſummit is ſtrongly truncated; and, 4. The preceding cryſtal terminated by a three-ſided pyramid. From the inveſtigations of Count de Bournon and Mr Greville, it appears that the cryſtallization of corundum is ſimilar to that of the ſapphire *. Luſtre, which is intermediate between reſinous and vitreous, ſhining or weakly ſhining; croſs fracture uneven, or ſplintery, ſometimes foliated; fragments rhomboidal, ſometimes ſharp-edged.

Phil. ranſ. 98.

The colour is greeniſh white, greeniſh gray, and aſparagus green, tranſlucent at the edges; refraction double. Extremely hard. Spec. grav. 3.710 to 3.873.

Chem. Char.—Entirely infuſible before the blow-pipe.

Conſtituent Parts. Klaproth.

	From China.	From Bengal.
Silica,	6.5	5.50
Alumina,	84.	89.50
Oxide of iron,	7.5	1.25
Loſs,	2.	3.75
	100	100

According to Chenevix.

	From the Carnatic.	From Malabar.
Silica,	5	7
Alumina,	91	86.5
Oxide of iron,	1.5	4
Loſs,	2.5	2.5
	100	100

Localities.—Corundum is found in a hard rock near the river Cavery, ſouth of Madras; on the Malabar coaſt; in the iſland of Ceylon; in the kingdom of Ava; and in China.

15. Species. ADAMANTINE SPAR.

Exter. Char.—This mineral, which ought undoubtedly to be conſidered as a variety of corundum, is found maſſive, in rolled pieces, and cryſtallized in ſix-ſided priſms, and ſix-ſided acute pyramids with truncated extremities. Internal luſtre ſplendent; fracture foliated; fragments rhomboidal.

Colour dark hair brown; very hard. Spec. grav. 3.981.

Conſtituent Parts. Klaproth.

	From China.
Silica,	6.5
Alumina,	84.
Oxide of iron,	7.5
Loſs,	2.
	100

Localities.—This mineral has been only met with in China.

16. Species. EMERY.

Fer Oxydé Quartziférе, Hauy, iv. 112. *Emery*, Kirw. ii. 193. *L'Emeril*, Broch. ii. 292.

Eſſen. Char.—The powder ſcratches all bodies except the diamond.

Exter. Char.—This mineral is found maſſive and diſſeminated. The luſtre is glimmering or weak ſhining, and adamantine. Fracture fine-grained, uneven; fragments a little blunt-edged.

Colour grayiſh black, bluiſh, ſmoke or ſteel gray; generally opaque, but ſometimes tranſlucent at the edges: extremely hard. Spec. grav. about 4.

Chem. Char.—Becomes black under the blow-pipe, but is infuſible. Colours borax of a dirty yellow.

Conſtituent

Conſtituent Parts.

	Tennant.
Alumina,	86
Silica,	3
Oxide of iron,	4
Loſs,	7
	100 *

Localities, &c.—This mineral is found in Saxony, diſſeminated in a bed of indurated ſteatites, mixed with common talc; alſo in the iſland of Naxos in the Archipelago; and in Italy, Spain, and Peru.

Uſes.—Emery, as well as the two former ſpecies, is employed, when reduced to powder, in cutting and poliſhing hard ſtones, glaſs, and metals.

Not only the external characters, but alſo the near approach in the proportion of their conſtituent parts, of the three ſpecies laſt deſcribed, would lead to conſider them as the ſame ſpecies, or at leaſt as varieties. Emery is by ſome mineralogiſts arranged among the ores of iron.

17. Species. TOPAZ.

Occidental Topaz, Kirw. i. 254. *La Topaze*, Broch. i. 212. *Topaze*, Hauy, ii. 504.

Eſſen. Char.—Refraction double; joints very diſtinct; perpendicular only to the axis of the cryſtals.

Exter. Char.—The topaz is ſometimes found maſſive, ſometimes diſſeminated, and ſometimes in rounded fragments; but it is moſt commonly cryſtallized. The primitive form of its cryſtals is a right-angled priſm, whoſe baſes are rhombs, and having the large angle 124° 22′; the integrant molecule is the ſame. The moſt common forms of the topaz are,

1. A priſm with eight ſides, terminated at the one end by a four-ſided ſummit, and at the other (which but rarely happens), by one of a different form. In a variety of the Brazilian topaz, the one ſummit preſents ſix ſides, and the other ten; and the electricity exhibited by the latter by means of heat, is negative, while that of the former is poſitive. This difference in the two oppoſite ſummits of a cryſtal, as has been obſerved by Hauy, is a peculiarity in all cryſtals which acquire by means of heat two kinds of electricity.

2. The next common form of the topaz is an eight-ſided priſm, whoſe baſe is horizontal, and bordered with a row of ſix oblique faces. This variety, which is found in the mines of Saxony, becomes readily electric by friction, but not by heat.

The prevailing colour of the topaz is yellow of various ſhades. The cryſtals are of middling ſize; their lateral faces are ſometimes convex and cylindrical; the ſurface of the ſame faces is longitudinally ſtriated, while that of the other faces is ſmooth. Luſtre vitreous; croſs fracture perfectly foliated; longitudinal fracture conchoidal; fragments indeterminate; tranſparent; ſometimes ſemitranſparent or tranſlucent; refraction double; ſcratches rock-cryſtal. Spec. grav. 3.464 to 3.564.

Chem. Char.—Infuſible before the blow-pipe, but melts with borax without intumeſcence. The Brazilian topaz heated in a crucible aſſumes a roſe red colour, when it is called by the jewellers *ruby of Brazil.* The Saxon topaz becomes white when expoſed to heat; and thus deprived of colour, is ſold for the diamond. According to Vauquelin, all the varieties of topaz reduced to powder, and added to ſyrup of violets, at the end of two or three hours communicate a green colour.

Conſtituent Parts.

According to Klaproth and Vauquelin.

Alumina,	47	to	50
Silica,	28	to	30
Fluoric acid,	17	to	20
Iron,	0	to	4

Localities, &c.—The topaz is found in different parts of Saxony, particularly in the mountain Schneeckenſtein, which is denominated *topaz rock*, and is arranged with the primitive mountains. In this rock the topaz is mixed with quartz, ſchorl, mica, and lithomarga. Near Zinnwald it is found in granite. It is alſo found mixed with ores of tin. In Siberia the topaz is found in graphic granite, accompanied with beryl, quartz, and garnet. Topaz is alſo met with in Brazil and Aſia Minor.

Uſes.—The topaz is employed for the purpoſes of jewellery as a precious ſtone, but it is not conſidered of very great value.

18. Species. PYROPHYSALITE.

This mineral which was deſcribed and analyſed by Hiſenger and Berzelius, is of a greeniſh white colour. When thrown on hot coals it becomes phoſphoreſcent, and gives out a greeniſh flame. When it is ſtrongly heated by the action of the blow-pipe, the ſurface is covered with ſmall veſicles which explode. Theſe phenomena are aſcribed to the fluate of lime which forms one of its conſtituent parts, and which ſometimes appears ſurrounding it with a cruſt.

Localities, &c.—Gahn found this ſtone at Finbo near Fahlun in Sweden, in nodules imbedded in a granite, compoſed of white quartz, feldſpar, and ſilvery mica. The nodules are ſeparated from the rock by a greeniſh yellow talc †.

19. Species. EUCLASE.

Id. Hauy, ii. 531. *Id.* Brochant, ii. 508.

Eſſen. Char.—Diviſible by two longitudinal lines perpendicular to each other.

Exter. Char.—This mineral has only been found cryſtallized. The primitive form of the cryſtals is a rectangular priſm with ſquare baſes, and that of the integrant molecule is the ſame. The moſt common form under which it appears is an oblique four-ſided priſm, with the edges truncated in various ways. The cryſtals are ſtreaked longitudinally. The luſtre is reſplendent and vitreous. Longitudinal fracture foliated; croſs fracture conchoidal.

Colour, bright ſea green. Tranſparent, and refracts double. Scratches quartz, Very frangible; hence its name ſignifying eaſily broken. Spec. grav. 3.062.

Chem. Char.—Loſes its tranſparency before the blowpipe, and melts into a white enamel.

Conſtituent

---

* Phil. Tranſ. 1802. p. 400.

Conſtituent Parts. Vauquelin.

Silica,	35	to	36
Alumina,	18		19
Glucina,	14		15
Iron,	2		3
Loſs,	31		27
	100		100

Localities.—This mineral was brought from Peru, and has never been found any where elſe. It was in ſingle cryſtals, ſo that its repoſitory is unknown. It is by ſome mineralogiſts arranged among the ores of iron.

20. Species. Emerald.

Id. Kirw. i. 247. *L'Emeraude*, Brochant, i. 217. *Emeraude*, Hauy. ii. 516.

Eſſen. Char.—Scratches glaſs eaſily; diviſible, parallel to the faces, and to the baſes of a regular hexahedral priſm.

Exter. Char.—The emerald is only found cryſtallized, and the primitive form of its cryſtals is a regular ſix-ſided priſm; the integrant molecule is a triangular priſm, the ſides ſquare, and the baſes equilateral triangles. The uſual forms are, 1. A perfect ſix-ſided priſm; 2. Truncated on its lateral edges; 3. Truncated on its terminal edges; 4. Truncated on its terminal angles; and, 5. Having the terminal edges bevelled. The cryſtals are ſeldom large. Their ſurface is ſmooth and ſhining; internal luſtre ſhining and reſplendent; vitreous; fracture conchoidal or unequal, ſometimes tranſverſely foliated; fragments indeterminate, ſharp-edged.

Colour emerald green of all ſhades; moſt commonly tranſparent, ſometimes only tranſlucent; refraction double; with difficulty ſcratches quartz. Spec. grav. 2.600 to 2.775.

Chem. Char.—Fuſible before the blow-pipe, but with difficulty; melts readily with borax.

Conſtituent Parts.

	Vauquelin.	Klaproth.
Silica,	64.50	68.50
Alumina,	16.	15.75
Glucina,	13.	12.50
Oxide of chromium,	3.25	.30
Lime,	1.60	.25
Oxide of iron,		1.
Water,	2.	
	100.35	98.3

Localities, &c.—The fineſt emeralds are brought from Peru, where they are found in veins or cavities of the granite mountains. They are alſo found in Upper Egypt, Ethiopia, and in the iſland of Ceylon. The emerald is accompanied by calcareous ſubſtances, as carbonate of lime and gypſum.

Uſes.—The rich green of the emerald has obtained for it a high rank among precious ſtones, and it is employed for ſimilar purpoſes.

21. Species. Beryl.

Aqua Marina et Samaragdus, *Beryllus*, Wallerius, i. 254. *Aigue Marine de Siberie*, Romé de Liſle, ii. 252. *Id.* De Born, i. 71. *Beryl*, Kirw. i. 248. *Le Beril Noble*, Brochant, i. 220. *Emeraude Limpide, vert-bleuatre, jaune-verdatre*, &c. Hauy, ii. 521.

Eſſen. Char.—The ſame as the emerald.

Exter. Char.—The beryl is ſometimes found in rounded fragments, but moſt commonly cryſtallized, and the forms of its cryſtal are the ſame as the emerald. The lateral faces of the cryſtals are deeply ſtriated.

The colours of the beryl are uſually a pale or yellowiſh green; external luſtre ſhining; internal reſplendent, vitreous; longitudinal fracture conchodial, or foliated. Cleavage fourfold. Fragments indeterminate and ſharp-edged; often tranſparent, ſometimes ſemitranſparent, and tranſlucent. The latter variety is diſtinguiſhed by tranſverſe rents. Refraction in a ſlight degree double; nearly as hard as topaz; brittle; ſpec. grav. 2.65 to 2.75. Becomes electric by friction.

Chem. Char.—Before the blow-pipe it is fuſible, but with difficulty, and yields a white, ſcarcely tranſlucent glaſs.

Conſtituent Parts.

	Vauquelin.	Roſe.
Silica,	68	69
Alumina,	15	14
Glucina,	14	14
Lime,	2	
Oxide of iron,	1	1
	100	98

Localities, &c.—The beryl is brought from the Eaſt Indies, and from Brazil; but the fineſt and pureſt are found in Daouria, on the frontiers of China, in the neighbourhood of Nertſchink; and the matrix of theſe beryls is ſaid to be an indurated clay, reſembling jaſper. The beryl is alſo found in Siberia, where it is uſually accompanied with quartz, feldſpar, garnets, tourmaline, mica, and fluor ſpar, in the veins of primitive mountains. The beryls from Siberia are almoſt all found in graphic granite. Beryl is alſo found in Saxony, and lately in France, in a large vein of quartz traverſing graphic granite. Dolomieu found the beryl perfectly tranſparent and colourleſs, in the granite of the iſland of Elba.

Uſes.—The beryl is employed as a precious ſtone, but is not greatly eſteemed.

Remarks.—The emerald and the precious beryl approach ſo nearly to each other, not only in the forms of their cryſtals, which are almoſt the ſame, and in their conſtituent parts, which afford but ſlight variations, but alſo in their other characters, that they ought to be conſidered, as has been done by Hauy, as varieties of the ſame ſpecies. The only differences which exiſt between them ſeem to be accidental. Theſe are chiefly in the colour, and in the cryſtallization; the former of which is a finer green, and the latter is more perfect in the emerald than in the beryl. The colouring matter of the emerald is oxide of chromium, while that of the beryl

ryl is oxide of iron. In all the other characters they are nearly the ſame.

22. Species. SCHORLITE, or *Schorlous Beryl.*

Schorlite, Kirw. i. 286. *Le Beril Schorliforme*, Brochant, i. 224. *Leucolite* and *Pycnite*, Hauy, iii. 236.

Eſſen. Char.—Infuſible. Original form of the cryſtals a regular hexahedral priſm.

Exter. Char.—This mineral is uſually found cryſtallized, in longiſh maſſes, mixed with other ſubſtances, and generally imbedded in granite; the form of the cryſtals when they are regular, is a ſix-ſided priſm, which is ſometimes truncated on its terminal edges, and ſometimes the form diſappears from its being deeply and longitudinally ſtriated. The cryſtals are generally large.

Colour white, ſtraw yellow, or reddiſh. Tranſlucent or nearly opaque. External luſtre ſhining between vitreous and reſinous. Croſs facture imperfectly foliated, longitudinal, imperfectly conchoidal. Scratches quartz ſlightly. Brittle. Spec. grav. 3.514 to 3.530.

Chem. Char.—Infuſible with the blow-pipe; with borax yields a tranſparent glaſs.

Conſtituent Parts.

	Klaproth.	Vauquelin.	Vauquelin, another analyſis.
Silica,	50	36.8	30
Alumina,	50	52.6	60
Lime,	—	3.3	2
Water,	—	1.5	1
Fluoric acid,	—	—	6
Loſs,	—	5.8	1
	100	100	100

Localities, &c.—This mineral is generally found imbedded in granite; ſometimes it is met with in gneis, accompanied with lepidolite. It enters into the compoſition of a rock formed of quartz and gray mica at Altenberg in Saxony. A red variety of this mineral was formerly conſidered by mineralogiſts as a cryſtallized lepidolite. Schorlous beryl has been arranged as a ſubſpecies of beryl; but its ſpecific gravity, different degree of hardneſs, and eſpecially its compoſition, are characters ſufficiently diſtinct to conſtitute a ſeparate ſpecies.

23. Species. SCHORL.

This ſpecies is divided into two ſubſpecies; 1. Black or common ſchorl, and 2. Tourmaline.

Subſpecies 1. BLACK SCHORL.

Schorl, Kirw. i. 265. *Le Schorl Noir*, Brochant, i. 226. *Tourmaline*, Hauy, iii. 31.

Eſſen. Char.—Electric by heat in the two oppoſite extremities; forms of the cryſtals derived from a rhomboid.

Exter. Char.—This mineral is found in maſſes, and diſſeminated, but moſt frequently cryſtallized. The primitive form of its cryſtals is an obtuſe rhomboid; the integrant molecule is a tetrahedron. Its uſual forms are, 1. A three-ſided priſm, with the lateral edges either truncated or bevelled; 2. The ſame priſm having a three-ſided obtuſe ſummit, the ſides correſponding to the lateral edges. The truncations, and bevelments of the lateral edges vary in the ſize of the faces, thus producing priſms of ſix and nine ſides. The lateral faces of the three-ſided priſm are often convex. The lateral ſurfaces are longitudinally and deeply ſtriated. The luſtre, both external and internal, which is vitreous, varies between ſhining and weakly ſhining. The fracture is imperfectly conchoidal or uneven; croſs fracture is ſometimes convex on the one ſide and concave on the other. When black ſchorl is maſſive, it is found in ſeparate pieces, thin, and apparently fibrous, parallel, or interwoven and divergent. The faces of theſe ſeparate pieces are ſtriated lengthwiſe. The fragments are indeterminate.

Colour velvet black of various ſhades. Commonly opaque, rarely tranſlucent, except in ſmall cryſtals. Streak gray. Inferior to quartz in hardneſs. Specific gravity 3.092 to 3.212.

Chem. Char.—Under the blow-pipe it froths up, and melts into a grayiſh white enamel.

Conſtitutent Parts. Wiegleb.

Alumina,	40.83
Silica,	33.33
Iron,	20.41
Manganeſe,	3.33

Phyſical Char.—Black ſchorl becomes electric by heat; and the electricity of one extremity of the cryſtal is poſitive, while that of the other is negative; but when it cools, it is ſaid, that the nature of the electricity is reverſed; the poſitive extremity becomes negative, and the negative becomes poſitive.

Localities, &c.—Black ſchorl is uſually found in granite, gneis, and other primitive rocks; in veins of tin and ores of iron; in the topaz rock of Schneeckenſtein in Saxony, of which it conſtitutes a part. It is alſo met with in Switzerland, Spain, Hungary, and Britain.

Subſpecies 2. TOURMALINE.

Id. Kirw. i. 271. *Le Schorl Electrique*, Brochant, i. 229. *Tourmaline Verte*, Hauy, iii. 41.

Eſſen. Char.—The ſame as black ſchorl.

Exter. Char.—The tourmaline is found ſometimes in maſſes and grains, but moſt commonly cryſtallized. The form of its cryſtals is a regular three-ſided priſm, with the edges, 1. Either truncated or bevelled. 2. A regular three-ſided priſm with the lateral faces convex, and terminating in an obtuſe, three-ſided priſm, the ſides of which correſpond to the lateral faces at one extremity, and to the lateral edges at the other. 3. An obtuſe, double three-ſided pyramid, the faces of the one correſponding to the edges of the other. 4. A ſix-ſided priſm with equal angles. 5. A ſix-ſided priſm, the ſides meeting two and two alternately under three obtuſe angles. 6. A nine-ſided priſm, having three lateral angles acute, and ſix obtuſe alternately. 7. The ſame cryſtal having the three acute lateral edges truncated, and thus forming a twelve-ſided priſm. The ſurface of the cryſtals is ſometimes ſmooth, but

Siliceous genus.

moſt frequently ſtriated longitudinally. Luſtre ſhining and vitreous. Longitudinal fracture conchoidal; croſs fracture foliated. The direction of the plates is inclined to the axis of the priſm. Fragments indeterminate; the cryſtals are uſually opaque, when ſeen laterally.

The colour of the tourmaline is greeniſh, of various ſhades, yellowiſh brown, and very rarely indigo blue. The colours are uſually very deep, and at firſt ſight appear black. It is uſually tranſlucent, and ſometimes approaching to tranſparent, particularly when it is ſeen in a direction perpendicular to the axis of the priſm; but it appears opaque when it is ſeen in a direction perpendicular to the baſis of the priſm, even when the height of the priſm is leſs than its thickneſs. It is harder than quartz. Brittle. Spec. grav. 3.086 to 3.363.

Chem. Char.—With the blow-pipe the tourmaline melts into a grayiſh white, porous enamel.

Conſtituent Parts.

	Bergman.	Vauquelin.
Silica,	37	40.
Alumina,	39	39.
Lime,	15	3.84
Oxide of iron,	9	12.50
——— manganeſe,		2.
	100	97:34

Bergman's analyſis is of the tourmaline of Ceylon. Vauquelin's is that of the green tourmaline of Brazil.

Phyſical Char.—The property of the tourmaline, of becoming electric by heat, has been already noticed as one of its diſtinctive characters. This phyſical property has occupied the attention of philoſophers for a long time. It was obſerved by Lemery in 1719, and examined by Epinus in 1770. Pliny indeed mentions a reddiſh or purple-coloured ſtone, which being heated or rubbed, attracts light bodies. This is ſuppoſed to have been the tourmaline. This property is ſuſceptible of various modifications. The electricity of the tourmaline may be conveniently exhibited by heating two cryſtals, ſuſpending the one by a thread, and preſenting ſucceſſively to its extremities the extremities of the other cryſtal. The extremities which poſſeſs the ſame kind of electricity will be repelled, while thoſe which poſſeſs a different kind will be attracted. If a cryſtal of tourmaline be broken while it is electrified, the fragments immediately preſent electrical poles, ſituated in the ſame direction as thoſe of the entire cryſtal.

The extremity of the cryſtals of tourmaline which has the greateſt number of faces, exhibits poſitive electricity, while the extremity having the ſmaller number of faces exhibits negative electricity. The proper degree of heat for exciting the electricity of tourmaline is from 100° to the boiling point of Fahrenheit. When heated beyond this point, it is deprived of its electricity, and recovers it only in cooling; but if the temperature be increaſed ſtill more, the cryſtal becomes again electric, but the poles are reverſed. The electric poles may be alſo reverſed, by heating a cryſtal of tourmaline unequally, by means of a burning glaſs.

Localities, &c.—The tourmaline is found in almoſt all primitive mountains; the fineſt cryſtals are brought from Ceylon, Madagaſcar, Saxony, the Tyrol, Spain, and Brazil. The tourmaline of the Tyrol is found in a talcky rock mixed with chlorite, mica, and hornblende. Thoſe of Saxony and Spain are found imbeded in gneis, but thoſe of Brazil and Ceylon are in ſeparate cryſtals. In Bohemia they are found in mines. The tourmaline is alſo a native of France, Sweden, Norway, and Britain.

24. Species. PISTAZITE.

Glaſſy actynolite, Kirwan i. 168 *Delphinite*, Sauſſure Voyages, N° 1918. *Acanticone*, *Arendalite*, D'Andrada, Nich. Jour. 4to. v. 193. *La Rayonnante Vitreuſe*, Brochant, i. 510. *Epidote*, Hauy iii. 102.

Eſſen. Char.—Diviſible parallel to the faces of a rhomboidal priſm of $114\frac{1}{2}^{\circ}$, and $65\frac{1}{2}^{\circ}$.

Extern. Char.—Piſtazite is found maſſive or cryſtallized in flattened four-ſided priſms, terminated by four-ſided pyramids, and alſo ſometimes in regular ſix-ſided priſms; the ſummit of the pyramid almoſt always truncated, as well as the lateral edges. The cryſtals are ſometimes acicular and ſtreaked longitudinally. Internal luſtre ſhining. Fracture foliated or radiated. Fragments wedge-ſhaped and ſplintery.

Colour deep green, olive green, or greeniſh yellow. Tranſlucent, ſometimes tranſparent. Hard, eaſily ſcratches glaſs, and is brittle. Spec. gr. 3.45. Powder greeniſh yellow or whitiſh.

Chem. Char.—Fuſible by the blow-pipe, and is converted into a brown ſlag, which blackens by continuing the heat.

Conſtituent Parts.

	Vauquelin.	Deſcotils.
Silica,	37	37
Alumina,	21	27
Lime,	15	14
Oxide of iron,	24	17
——— manganeſe,	1.5	1.5
Loſs,	1.5	3.5
	100.0	100.0

Localities, &c.—Piſtazite is found in Dauphiny, on the ſurface and in the fiſſures of an argillaceous rock, accompanied by quartz, amianthus, and feldſpar, and in the Pyrenees in limeſtone; near Arendal in Norway; and in argillaceous ſchiſtus, north end of the iſland of Arran in Scotland.

25. Species. ZOYSITE.

This mineral, which was diſcovered by Baron de Zoys, and therefore bears his name, is conſidered by Hauy as a variety of Epidóte.

It appears in priſms which are deeply furrowed or rhomboidal, and very much flattened. They are of a gray colour, or grayiſh yellow, with a pearly luſtre.

Localities.—Zoyſite is found particularly in Carinthia, and alſo in the Tyrol and in the Valais *.

26. Species. AXINITE, or THUMERSTONE.

Id. Kirw. i. 273. *La Pierre de Thum*, Brochant, i. 236. *Axinite*, Hauy, iii. 22.

Eſſen. Char.—Diviſible parallel to the faces of a rhomboidal priſm of $101\frac{1}{2}^{\circ}$, and $78\frac{1}{2}^{\circ}$.

---

* *Brongniart*, ii. 400.

Siliceous genus.

Exter. Char.—Thumerſtone is found in maſſes, diſſeminated and cryſtallized. The primitive form of its cryſtals is a right-angled priſm, whoſe baſes are oblique angled parallelograms, having their angles of 101° 32′, and 78° 28′. The integrant molecule is an oblique-triangular priſm. The moſt common form of its cryſtals is a quadrangular priſm, ſo oblique and flattened, that its angles become as ſharp as the cutting part of a hatchet. The faces of the cryſtals are longitudinally ſtriated, but the truncated faces are ſmooth. Externally luſtre ſplendent; internal ſhining and vitreous. Fracture vitreous, ſometimes rough and ſplintery. Fragments indeterminate, ſharp edged. Maſſive thumerſtone is compoſed of ſeparate teſtaceous, thin, and ſlightly curved concretions, with a ſmooth ſurface, which is ſomewhat irregularly ſtriated.

The colour is clove brown, varying to violet blue, yellowiſh, and greeniſh gray. Maſſive thumerſtone is only tranſlucent. The cryſtals are ſemitranſparent, and ſometimes tranſparent. It is harder than feldſpar, but leſs ſo than quartz; gives fire with ſteel, and diffuſes an odour ſimilar to what is produced by flint. Brittle. Spec. grav. 3.213 to 3.300.

Chem. Char.—Thumerſtone froths up under the blow-pipe, and is converted into a grayiſh enamel, and with borax into a fine olive green enamel.

Conſtituent Parts.

	Klaproth.	Vauquelin.
Silica,	52.70	44
Alumina,	25.79	18
Lime,	9.39	19
Oxide of iron,	8.63	14
——— manganeſe,	1.	4
Loſs,	2.49	1
	100.00	100

Localities, &c.—Thumerſtone, which is hitherto a rare mineral, has been only found in veins and fiſſures of primitive rocks, and chiefly in rocks with a baſe of ſerpentine. It is uſually accompanied with aſbeſtus, rock cryſtal, and ſometimes calcareous ſpar. It was firſt diſcovered at Thum in Saxony, from which it derives its name; but has been ſince found in the Pyrenees, in France, at Mount Atlas in Africa, in Norway, and in Cornwall in Britain.

27. Species. Quartz.

Eſſen. Char.—Diviſible into a rhomboid, which is ſlightly obtuſe.

Quartz, which is found, either maſſive, cryſtallized, or in rounded pieces, is one of the moſt abundant mineral ſubſtances. The primitive form of its cryſtals is a ſlightly obtuſe rhomboid, of 94° 4′, and 85° 56′. The integrant molecule is a regular tetrahedron.

On account of the variety of forms and appearances, quartz has been divided into ſubſpecies; into five by Werner; by others only into two, viz. rock-cryſtal and common quartz. We ſhall nearly follow the former ſubdiviſions, which are, amethyſt, rock-cryſtal, milk-quartz, common quartz, and praſe, including alſo ferruginous quartz.

Subſpecies 1. Amethyst.

Id. Kirw. i. 264. *L'Amethyſte, Quartz-hyalin Violet*, Hauy, ii. 417.

Exter. Char.—The amethyſt is found frequently cryſtallized, but it is alſo found maſſive and in rounded pieces. 1. The form of its cryſtals is a regular ſix-ſided priſm, terminated by a ſix-ſided pyramid, the ſides of which correſpond to thoſe of the priſm. 2. A double ſix-ſided pyramid. Fracture conchoidal, rarely ſplintery or fibrous. Fragments indeterminate, ſometimes wedge-ſhaped. Maſſive amethyſt is compoſed of ſeparate pieces, which are ſometimes granulated, ſometimes ſcopiform when the cryſtals are combined together.

The colour is commonly violet blue of various ſhades, blackiſh brown and greeniſh white. External luſtre reſplendent; internal reſplendent and ſhining vitreous. It varies between tranſparent and tranſlucent. Scratches glaſs. Brittle. Spec. grav. 2.653 to 2.750.

Chem. Char.—Entirely infuſible under the action of the blow-pipe.

Conſtituent Parts. Roſe.

Silica,	97.50
Alumina,	.25
Oxide of iron and manganeſe,	.50
	98.25

Localities, &c.—Amethyſt is found in Bohemia, Saxony, Siberia, very abundant in the Uralian mountains, Hungary, and Auvergne in France. It is uſually met with in the veins of metalliferous mountains, very rarely in granitic mountains. It is frequently met with cryſtallized, lining the cavities of balls of agate; in amygdaloid and porphyry rocks.

Uſes.—When the amethyſt is cut and poliſhed, it aſſumes an agreeable colour and luſtre, ſo that it is employed in jewellery.

Werner has divided the amethyſt into two varieties, the common and fibrous; the latter being chiefly characterized by its fibrous fracture and reſinous luſtre. This latter variety too, is only found maſſive.

Subſpecies 2. Rock Crystal.

Mountain Cryſtal, Kirw. i. 241. *Le Criſtal de roche*, Brochant, i. 243. *Quartz-hyalin Limpide*, Hauy, ii. 417.

Exter. Char.—Rock cryſtal is uſually found cryſtallized, ſometimes in rounded pieces, but rarely maſſive. The form of its cryſtals is, 1. A ſix-ſided priſm, having one of its baſes or both ſurmounted by a ſharp pointed pyramid; the ſides of the pyramid and priſm correſponding. This is its moſt uſual form; but it exhibits many apparent varieties, ariſing from modifications in the magnitude of one or ſeveral of the faces at the expence of the others. 2. A double ſix-ſided pyramid, which is ſometimes perfect, and ſometimes truncated on the edges of the common baſe; and ſometimes too, three alternating faces on each pyramid are larger than the others, giving to the cryſtal the appearance of a cube. 3. A ſimple, very acute pyramid with ſix ſides, having its ſummit, and often alſo its baſe, acuminated with ſix faces; but this is rather an irregularity in the cryſtallization than a new form.

The cryſtals of this mineral are ſometimes very large, and they are alſo found very ſmall. In the rounded pieces the external ſurface is rough, but in the perfect

cryſtals

cryſtals the faces of the priſm are ſtriated tranſverſely; but thoſe of the pyramids and acuminations are ſmooth. The luſtre is reſplendent and vitreous; fracture perfectly conchoidal, ſometimes, however, foliated; fragments indeterminate, very ſharp edged.

Colours of rock-cryſtals are grayiſh white, yellowiſh white, pearl gray, yellowiſh and blackiſh brown. Internally it is ſometimes irideſcent. It is tranſparent, ſometimes ſemitranſparent. By looking acroſs one of the faces of the pyramid, and the oppoſite face of the priſm, double refraction is produced. Scratches glaſs, and gives ſparks with ſteel. Somewhat frangible; ſpec. grav. 2.650 to 2.888.

Chem. Char.—Entirely infuſible before the blowpipe.

Conſtituent Parts.	Bergman.
Silica,	93
Alumina,	6
Lime,	1
	100

Phyſical Char.—It is ſometimes phoſphoreſcent; two cryſtals, by being rubbed together, exhibit a little light in the dark, and give out a peculiar odour, which is ſomewhat empyreumatic.

Localities, &c.—Rock-cryſtal is moſt commonly found in veins of primitive rocks, and particularly in granite; in druſes lining the cavities of theſe rocks. The fineſt cryſtals are now brought from Madagaſcar, but it is a very frequent mineral in moſt countries, as in the mountains of Switzerland, where it was formerly dug out of the faces of lofty precipices by the inhabitants. It is alſo found in Bohemia, Saxony, Hungary, and in Cornwall in England, and different parts of Scotland, as in the iſland of Arran, in the cavities of the granite mountains, and in Cairngorm in Aberdeenſhire, the two latter, which are well known by the name of Arran ſtones and Cairngorms, are uſually of a ſmoky colour, owing, it is ſuppoſed, to iron or mangancſe; probably to the latter, for from ſome experiments which we have made, the colour entirely diſappears by expoſing the cryſtal to a ſtrong heat, and from other obſervations it appears that the colouring matter is alſo deſtroyed by the action of light.

Rock cryſtal ſometimes contains ſchorl, amianthus, actynolite, mica, and titanium. Cryſtals are alſo ſometimes met with in cavities containing a drop of water, and a ſmall quantity of air.

Uſes.—Rock cryſtal, on account of its luſtre and tranſparency, is employed in jewellery, and particularly when it is coloured, as thoſe from Cairngorm in the north of Scotland, many of which are held in high eſtimation.

Subſpecies 3. ROSY RED or MILKY QUARTZ.

Roſy Red Quartz, Kirw. i. 245. *Quartz, laiteux*, Brochant, i. 246. *Quartz-hyalin laiteux*, Hauy, ii. 420.

Exter. Char.—This mineral is always found maſſive. It is indeed ſaid by Emmerling, that it has been found cryſtallized, in ſmall ſix-ſided priſms, terminated by a ſix-ſided pyramid, at Rabenſtein in Bavaria. Internally, its luſtre is ſhining, rarely reſplendent; reſinous; fracture perfectly conchoidal, and fragments indeterminate. It varies between ſemitranſparent and tranſlucent.

Siliceous genus.

The colour is ſometimes milk white; but its principal colour, it is ſaid, is pale roſe red. In its other characters it agrees with rock cryſtal.

It is ſuſpected that this mineral is compoſed of ſilica and oxide of mangancſe, to the latter of which the colour is owing.

Localities, &c.—Milk quartz forms beds in primitive mountains; at Rabenſtein in Bavaria it is met with in a large grained granite. It is alſo found in Finland, Greenland, Saxony, Siberia, and the weſtern part of Inverneſsſhire in Scotland.

Uſes.—The ſemitranſparence, the fine colour, and the poliſh of which it is ſuſceptible, have introduced this mineral to be employed in jewellery.

Subſpecies 4. COMMON QUARTZ.

Quartz, Kirw. i. 242. *Le Quartz commune*, Brochant, i. 248. *Quartz hyalin amorphe*, Hauy, ii. 425.

Exter. Char.—Common quartz is found in various forms, maſſive, diſſeminated, in grains, and rounded pieces. It is ſometimes ſtalactitical, globular, kidney-form, tuberculated, cellular, perforated, and corroded; ſometimes alſo it is cryſtallized, and the cryſtals are either true, or ſuppoſititious. The true cryſtals are grouped together in reniform, rounded, or radiated maſſes; the form is the ſame as that of rock cryſtal. The pſeudo cryſtals derive their figure from the ſubſtances on which they are formed, as the cube from fluor ſpar, the octahedron from the ſame, the ſix ſided table from barytes, the acute ſix-ſided pyramid from calcareous ſpar. The ſurface of the true cryſtals is ſimilar to that of rock cryſtal, but that of the pſeudo cryſtals is rough, and the luſtre is dull. Fracture of common quartz is ſmall, conchoidal; ſometimes large, ſplintery, and ſometimes imperfectly foliated, or fibrous, with large parallel fibres. Fragments indeterminate, with ſharp edges, very rarely rhomboidal. It is commonly tranſlucent, rarely ſemitranſparent. The colour is milk white, ſnow white, reddiſh white, and blood and fleſh red, with many ſhades of theſe colours. Scratches glaſs. Spec. grav. 2.640 to 2.654.

Chem. Char.—Infuſible before the blow-pipe. Silica forms the principal conſtituent part; but among the numerous varieties of common quartz, there are no doubt ſlight differences in the nature and quantity of the materials which enter into its compoſition. The different ſhades of colour are owing to different portions and different ſtates of metallic ſubſtances.

Localities, &c.—Common quartz is one of the ſubſtances of moſt frequent occurrence in all kinds of rocks, forming one of the chief component parts of primitive mountains, ſometimes in entire beds, or whole mountains, as in the iſlands of Iſla and Jura in Scotland. It is alſo frequent in veins, very common in ſtratiform rocks, where it conſtitutes the baſe of ſandſtone: in alluvial rocks it is met with in rounded pieces, or in the form of ſand.

Uſes.—Common quartz is employed in the manufacture of glaſs inſtead of ſand; in the fabrication of ſmalt, and as a flux for calcareous ores of iron.

A variety of this, called aventurine, is ſometimes held in conſiderable eſtimation. It is the quartz hyalin

aventuriné

Siliceous genus.

aventuriné of Hauy, and the natural aventuriné of De Liſle. It is of a deep red, gray, green, or blackiſh colour, marked with ſpots ſometimes of a yellowiſh, and ſometimes of a ſilvery appearance, which proceed from very thin pieces of pure quartz diſſeminated in the maſs. It ought not to be confounded with quartz mixed with mica, or micaceous quartz, which is a compound rock. On the contrary, the diverſity of colours ſeems to be owing to numerous fiſſures which are arranged nearly in the ſame direction.

Aventurine is found near Vaſles, in the department of Deux Sevres in France, in the form of rounded ſtones, which are reddiſh; at Cape de Gates in Spain, of a whitiſh colour, with ſilvery ſpots; in Arragon, which affords ſeveral varieties; near Madrid, among rounded fragments of granite; at Facebay in Tranſylvania, where it is of a black colour, with very ſmall golden ſpots; and in the neighbourhood of Catharineburg in Siberia.

The name aventurine is derived from the following circumſtance. A workman having dropped by chance, *par aventure*, ſome braſs filings into a vitreous matter in the ſtate of fuſion, gave the mixture this name, of which was afterwards made vaſes and other ornamental objects. Mineralogiſts gave the ſame name to natural ſubſtances which have a ſtriking reſemblance to this artificial production. Hauy, ii. 422.

Subſpecies 5. PRASE.

Praſium, Kirw. i. 249. *La Praſe*, Brochant, i. 252. *Quartz Hyalin Vert obſcure*, ii. 419. *Quartz Praſe*, Brongniart, i. 280.

Exter. Char.—This mineral poſſeſſes all the characters of quartz in general. It is moſt commonly found maſſive, and very rarely cryſtallized. The cryſtals, which are uſually ſmall, have the form of rock cryſtal.

The colour is uſually leek green; the external ſurface is rough and gliſtening; the internal ſhining and vitreous; it is tranſlucent; the fracture imperfectly conchoidal, and ſometimes coarſe ſplintery; fragments ſharp-edged. When it is maſſive, it is compoſed of diſtinct concretions, which are granulated priſmatic, or cuneiform, the ſurface of which is rough and tranſverſely ſtriated.

Localities, &c.—Praſe is found at Brietenbrunn near Schwartzenberg in Saxony, in a metallic vein, accompanied with magnetic pyrites, galena, blende, calcareous ſpar, and actynolite. It is alſo found in Bohemia, in Finland, near lake Onega, and in Siberia.

Uſes.—As it is ſuſceptible of a fine poliſh, praſe is employed in jewellery.

This mineral ought not to be confounded with quartz coloured by means of chlorite, which latter is of a brighter green, but opaque.

Subſpecies 6. FERRUGINOUS QUARTZ, or *Iron Flint.*

Le Caillou Ferrugineux, Brochant, i. 248. *Quartz Rubigineux*, Brongniart, i. 281. *Quartz Hyalin hematoide*, Hauy, ii. 420. *Eiſenkieſel* of the Germans.

Exter. Char.—The peculiar character of this mineral ſeems to be owing to a large proportion of oxide of iron, which renders it opaque. It is uſually found maſſive, but it ſometimes alſo aſſumes a cryſtalline form, which is a priſm with ſix equal ſides, acuminated at each extremity with three planes. The colour is of a yellowiſh brown, ſometimes of a browniſh red, and of a bright blood red. It is uſually opaque, or only tranſparent at the edges. External luſtre reſplendent; internal ſhining and vitreous. Fracture imperfectly conchoidal; fragments angular, but not very ſharp-edged. Concretions ſmall grained and diſtinct. It is harder than common jaſper. Not very brittle.

Localities.—This mineral is found in veins of ironſtone in Saxony, and in England, where it is accompanied with ſulphate of barytes.

Ferruginous quartz is diſtinguiſhed from jaſper, to the red variety of which it has a ſtriking reſemblance, by its ſhining fracture, which is alſo vitreous and conchoidal; its property of cryſtallizing; and according to Brongniart, by having no alumina in its compoſition, which he properly conſiders as an eſſential characteriſtic.

28. Species. HORNSTONE.

Hornſtone, Kirw. i. 303. *La Pierre de Corne*, Brochant, i. 254. *Petroſilex*, Hauy, iv. 385.

This mineral is met with in maſſes and alſo in rounded balls. The colour is uſually gray; it is tranſlucent at the edges, the fracture ſplintery or conchoidal; it has little luſtre; is ſo hard as to ſcratch glaſs, and give fire with ſteel; and its ſpec. grav. is from 2.699 to 2.708.

The diverſity of fracture which has been obſerved in hornſtone, has led to the ſubdiviſion of this ſpecies into three ſubſpecies, viz. ſplintery hornſtone, conchoidal hornſtone, and woodſtone.

Subſpecies I. SPLINTERY HORNSTONE.

Hornſtone Ecailleux, Brochant, i. 255. *Petroſilex Squamoſus*, Wallerius, i. 280.

Exter. Char.—This mineral is found maſſive, or in rounded pieces. It has ſcarcely any luſtre; the fracture is fine, ſplintery; fragments ſharp-edged; tranſlucent at the edges. It is ſcarcely ſo hard as quartz; it is brittle.

The colour is bluiſh gray, ſmoke and pearl gray, ſometimes greeniſh and yellowiſh gray, more rarely olive and mountain green. Sometimes there is a mixture of theſe colours, arranged in ſpots and ſtripes. Spec. grav. 2.654. Kirw.

Chem. Char.—According to ſome mineralogiſts, this variety of hornſtone is fuſible before the blow-pipe, but according to others it is infuſible without the addition of borax.

The following are the conſtituent parts of a hornſtone analyzed by Kirwan.

Silica,	72
Alumina,	22
Carbonate of Lime,	6
	100

Localities, &c.—This variety of hornſtone is chiefly found in veins in primitive mountains. It is alſo found in rounded pieces in alluvial rocks, and it conſtitutes the chief baſis of hornſtone porphyry, as at Dannemora and Garpenberg in Sweden. It is met with in veins at Freyberg, Schneeberg, Johann-Georgenſtadt, and Gerſdorf in Saxony.

Siliceous genus.

Subſpecies 2. CONCHOIDAL HORNSTONE.

Petroſilex Equabilis, Wallerius, i. 281. *Le Hornſtein Conchoide*, Brochant, i. 258.

Exter. Char.—This mineral is always found maſſive, and ſeems to approach in its characters very nearly to the preceding variety or ſubſpecies, excepting in the fracture, which is perfectly conchoidal.

Localities, &c.—This ſubſpecies is found in beds and veins, when it is ſometimes accompanied with agate. It has been found accompanying gneis at Goldberg in Saxony, and fine ſpecimens of both ſubſpecies are met with in the iſland of Rona near Sky in Scotland, where it ſeems to form a conſiderable vein, traverſing a gneis rock.

Subſpecies 3. WOODSTONE, or *Petrified Wood.*

Woodſtone, Kirw. i. 215. *Le Holzſtein*, Brochant, i. 259. *Quartz Agathe Hyloide*, Hauy, ii. 439.

This ſubſpecies poſſeſſes more diſtinctive characters than the former; and as it ſeems to be wood, retaining its original texture, converted into hornſtone by ſome petrifying proceſs, it is uſually found in inſulated maſſes, or in rounded pieces. It has the external appearance of wood, for the ſurface is rough and uneven, or longitudinally ſtriated; internally it is gliſtening, but ſometimes dull, having a vitreous luſtre. The fracture moſt frequently exhibits the fibrous texture of the wood. The croſs fracture is ſometimes ſplintery or imperfectly conchoidal. The fragments are indeterminate, and ſlightly ſharp-edged. The moſt common colour is dark gray, aſh gray, grayiſh white, and ſometimes cochineal and blood red. Different colours appear in the ſame mineral, forming ſpots, clouds, or ſtripes. It is commonly tranſlucent at the edges, ſometimes entirely tranſlucent, and ſometimes opaque. It is hard and brittle.

Localities.—Woodſtone is met with in Bohemia, Saxony, and Siberia, and on the banks of Loch Neagh in the north of Ireland, particularly, as we have been informed, near places where ſome of the rivers diſcharge their waters into the lake.

Uſes.—This mineral is generally ſuſceptible of a fine poliſh, and is therefore employed in jewellery.

29. Species. FLINTY SLATE, or *Siliceous Schiſtus.*

This ſpecies is divided into two ſubſpecies or varieties, viz. common ſiliceous ſchiſtus, and Lydian ſtone.

Subſpecies 1. COMMON SILICEOUS SCHISTUS.

Siliceous ſchiſtus, Kirw. i. 306. *Schiſte ſilicieux commun*, Brochant, i. 283.

Exter. Char.—This mineral is found in maſſes or rounded pieces, and it is frequently tranſverſed by veins of quartz of a grayiſh white, or coloured red by means of iron. This, it is ſaid, is a diſtinguiſhing characteriſtic of ſiliceous ſchiſtus which it rarely wants (Brochant). Internally it is dull, very rarely a little glimmering. The fracture in the ſmall is compact, ſometimes ſplintery, and ſometimes imperfectly conchoidal; but in the great or large maſſes it is ſlaty, a character which almoſt always diſappears in the ſmall fragments. The fragments are ſharp edged. The colour is blackiſh, greeniſh, or ſmoke gray. It is commonly opaque, rarely tranſlucent at the edges. It is hard and brittle.

Chem. Char.—Before the blow-pipe, gray ſiliceous ſchiſtus becomes white and friable; the black aſſumes a darker colour, and is a little vitrified at the edges.

Conſtituent Parts. Wiegleb.

Silica,	75
Magneſia,	4.58
Lime,	10.
Iron,	3.54
Inflammable matters,	5.02
Loſs,	1.86
	100.00

Localities, &c.—Siliceous ſchiſtus is met with in Bohemia, Saxony, Switzerland, and Siberia; at Leadhills in Scotland, and alſo at Carlops, near the termination of the great coal field to the ſouth of Edinburgh.

The geological poſition of this ſtone is not preciſely determined. In Scotland it is connected with thoſe rocks which come under the denomination of tranſition rocks; but according to different deſcriptions it ſeems to have been confounded with argillaceous ſchiſtus, with which indeed it poſſeſſes ſome common properties; and ſome mineralogiſts regard it as an argillaceous ſchiſtus, having a larger proportion of ſiliceous earth. In ſupport of this opinion, ſiliceous ſchiſtus has been found in ſituations where it is ſubordinate to argillaceous ſchiſtus.

Subſpecies 2. LYDIAN STONE.

Baſanite, Kirw. i. 307. *La Pierre de Lydie*, Brochant, i. 286. *Roche Corneenne*, Hauy, iv. 434.

This ſtone, which is of a grayiſh, bluiſh, or velvet black, is found in maſſes, and in rounded pieces of a trapezoidal form, which are alſo traverſed with veins of whitiſh quartz. The external ſurface is ſmooth and weakly ſhining; the internal is glimmering. The fracture is even, ſometimes ſlightly conchoidal or uneven, rarely ſplintery; in large maſſes it is ſlaty. The fragments are ſharp-edged, and ſometimes aſſume a cubical form. It is commonly opaque, and rarely tranſlucent at the edges. It is ſcratched by quartz; brittle. Spec. grav. 2.415 to 2.880.

Localities.—Lydian ſtone is found in ſimilar places with the former variety.

Uſes.—This ſtone has been long known under the name of *touchſtone*, becauſe it is employed to aſcertain the purity of gold. From this uſe it obtained the name of βασανος or the *trier*, and it was called Lydian ſtone, becauſe it was found in Lydia. When it is employed as a touchſtone, the gold to be tried is rubbed on its poliſhed ſurface; on the metallic trace which remains nitric acid is poured, and the quantity of alloy is judged of by the degree of change which takes place, this being compared with traces made and treated in the ſame way with needles differently alloyed and prepared for the purpoſe. This teſt, it is to be obſerved, is not perfectly accurate, but is ſufficiently ſo for thoſe who are much employed in the uſe of it. The property which renders this mineral fit for the above purpoſe depends on its degree of hardneſs, while it preſents at the ſame time a ſmooth and even fracture without being perfectly ſmooth. Other ſtones poſſeſſing ſimilar properties,

ties, ſuch as ſeveral varieties of baſalt, are conveniently employed for the ſame purpoſe.

30. Species. Flint.

Flint, Kirw. i. 301. *Pierre à fuſil*, Brochant, i. 263. *Quartz-Agathe Pyromaque*, Hauy, ii. 427.

Exter. Char.—Flint is found maſſive, diſſeminated, in angular fragments, in globular maſſes, tuberculated, and perforated. The ſurface is ſometimes rough, ſometimes uneven, and ſometimes ſmooth. The white cruſt with which it is often covered, is conſidered by ſome mineralogiſts as an incipient decompoſition. The external luſtre is dull or a little glimmering; the internal is weakly ſhining; the fracture is perfectly conchoidal, the fragments ſharp edged. The colour is uſually gray, ſmoke gray, ſometimes perfectly black. Various colours appear in the ſame mineral, preſenting ſpots, ſtripes, and clouds. Commonly tranſlucent at the edges; ſcratches quartz: ſpec. grav. 2.58 to 2.99.

Chem. Char.—Entirely infuſible before the blowpipe.

Conſtituent Parts.

	Klaproth.	Vauquelin.
Silica,	98.	97
Lime,	.50	
Alumina,	.25	1
Oxide of iron,	.25	
	99.00	98

Phyſical Char.—Two pieces of flint rubbed together in the dark, give out, like quartz, a phoſphoric light.

Localities, &c.—Flint is never found in primitive mountains, excepting in very ſmall quantity, and very rarely, in ſome veins; in alluvial rocks it is ſometimes met with in rounded pieces; but it is moſt abundant in ſtratified mountains, particularly in beds of limeſtone, marl and chalk, in which it is diſpoſed in parallel layers. It is met with in Saxony, Denmark, Sweden, Poland, and Spain, and is very abundant in chalk beds in the north of France, and alſo in different parts of England. It is alſo met with diſtributed in layers in the white limeſtone rocks, on the north coaſt of Ireland. In the department of Jura in France, globular maſſes of flint have been found with cavities containing ſulphur.

19 Formation of flints, The ſingular geological relations of this mineral have greatly puzzled naturaliſts, who are fond of ſuch ſpeculations, and are never ſatisfied till they have accounted for every thing, however ſcanty and defective the data may be on which their hypotheſes are formed. It is on this account that the theories which have been propoſed, to explain the formation of flint, offer nothing more than the ſillieſt and moſt groundleſs conjectures; and indeed the ſame remark is equally applicable to theories of the earth in general. It has been already obſerved that flint is regularly diſpoſed in layers, in the beds of chalk or limeſtone in which it is found. In an inſulated maſs of white limeſtone near Port Ruſh on the north coaſt of Ireland, which we had an opportunity of examining, the balls of flint were diſpoſed in this way with great regularity. When the bed of limeſtone is of no great thickneſs, it contains only one layer of flints, but in thicker beds there are two layers of flints, the one near the top, and the other near the bottom of the bed. Thoſe layers of flint, too, it is to be obſerved, have exactly the ſame inclination as the ſtrata of limeſtone. According to one ſet of theoriſts, the flint being in a ſtate of fuſion, was ejected from the bowels of the earth, and depoſited in the places where it is now found. This opinion carries along with it its own abſurdity; for admitting that the flinty matter has been in a ſtate of fuſion, it is impoſſible to ſuppoſe that it could be depoſited with ſo much uniformity and regularity, by being projected according to the conjecture of the philoſophers who maintain this opinion. Had this been the mode of its formation, maſſes of flint would have been found throughout every part of the chalk or limeſtone beds, and not in regular layers, as is really the caſe. 20 by fi

21 by wa According to another opinion, by which the formation of flint is propoſed to be accounted for, cavities were produced, while the chalk and limeſtone were yet in a ſoft ſtate, in conſequence of the air extricated during the evaporation of the water; and the flinty matter in ſolution was introduced into theſe cavities by infiltration from above. But the ſame argument is equally forcible againſt this opinion. It is impoſſible to conceive that the cavities could be ſo regularly and uniformly produced by the extrication of the air. They would have been found through every part of the beds of chalk and limeſtone where flint is met with. And beſides, even allowing that this flinty matter was held in ſolution by water, it might naturally be aſked, why the greateſt proportion of it was not depoſited near the ſurface, when it firſt came in contact with the chalk or limeſtone, rather than to have continued to paſs through the different beds, and form maſſes of ſolid flints at the greateſt depths, in as great quantity as near the ſurface.

22 by mar animals A third opinion, which ſome imagine to be leſs improbable than either of the former, ſuppoſes that flints have been entirely produced by marine animals depoſited during the formation of the ſtrata in which they are contained. This opinion ſeems to derive ſome ſupport from the remains of marine animals, which are not unfrequently found included in nodules of flint. It is no rare occurrence to meet with ſhells thus attached to theſe nodules, and converted into flinty matter, but at the ſame time retaining their original form and appearance in the moſt perfect manner.

Uſes.—The extenſive uſe of this mineral, in conſequence of its property of ſtriking fire with ſteel, as gun flints, is well known. Flints are employed alſo as a ſubſtitute for quartz in the manufacture of glaſs and porcelain, and in the fabrication of ſmalt. The coarſer kinds, or ſuch as are perforated and carious, are applied to the purpoſes of building and millſtones. Sometimes the colours and the poliſh of flint are ſo fine as to have brought it into uſe in jewellery.

23 Manufac ture of g flints. As flints are found in greateſt abundance in France and England, the principal manufactures of gun flints are carried on in theſe countries. A particular account of this manufacture in France has been given by Dolomieu and Salivet, *Jour. des Mines*, N° 33, pp. 693 and 713. The whole proceſs, which according to the deſcription of Dolomieu is divided into four ſtages, is very ſimple.

1. After having fixed upon a maſs of ſtone fit for

for the purpoſe, the firſt part of the operation is to break the ſtone into pieces of convenient ſize. With this view the workman, ſeated on the ground, places the ſtone on his left thigh, and ſtrikes it with ſmall ſtrokes, to divide it into pieces of a pound or a pound and a half weight, having large ſurfaces and ſmooth fractures, and at the ſame time he avoids ſplitting or ſhaking the ſtone by too feeble or too violent ſtrokes.

2. In the next part of the operation the niceſt management and dexterity of hand are required; for by repeated ſtrokes ſplinters of the proper ſize to form gun flints are detached; one is ſeparated at every ſtroke. During this operation he holds the maſs of ſtone in his left hand. The ſplinters are about 1¼ inch broad, 2½ long, and two lines thick in the middle. They are ſlightly convex above, and concave below; thick at one edge, and thin at the oppoſite edge.

3. The flint is brought to a regular ſhape during this part of the operation; and,

4. The edge of the gun flint which ſtrikes fire, is brought to a ſtraight line by placing it on a ſharp iron inſtrument, and giving it five or ſix ſmall ſtrokes with a circular hammer (roulette). This finiſhes the operation, and the whole time of making a flint is not equal to a minute. With maſſes of ſtone that work eaſily, an expert workman will prepare 1000 good ſplinters in a day. It requires another day to bring to the proper ſhape 500; ſo that in three days he can ſplit off from the maſs and completely finiſh 1000 gun flints.

31. Species. CALCEDONY.

This ſpecies has been divided into two ſubſpecies or varieties; common calcedony and carnelian.

Subſpecies 1. Common CALCEDONY.

Id. Kirw. i. 298. *La Calcedoine Commune*, Brochant, i. 268. *Quartz Agathe Calcedoine*, Hauy, ii. 425.

Exter. Char.—This mineral is found maſſive, in rounded pieces, which are globular, reniform, botryoidal, ſtalactitical, cellular; and ſometimes alſo it is cryſtallized in the form of a cube, rhomboid, a ſimple pyramid with three and ſix faces; but theſe are ſuppoſed to be pſeudo cryſtals, or merely a cruſt of calcedony on the cryſtals of other ſubſtances. The external ſurface is moſt commonly uneven, ſometimes rough, and rarely ſmooth. External luſtre is accidental; internal glimmering, rarely a little ſhining; fracture even, ſometimes imperfectly conchoidal or ſplintery; fragments ſharp-edged.

Colour white, grayiſh or bluiſh white, yellowiſh or blackiſh: various colours appear in ſpots, clouds, ſtripes, and veins. Sometimes when it is cut it is irideſcent; commonly tranſlucent, rarely ſemitranſparent. Harder than flint. Brittle. Spec. grav. 2.600 to 2.700.

Chem. Char.—Before the blow-pipe it is infuſible.

Conſtituent Parts.

	Bergman.
Silica,	84
Alumina,	16
A trace of iron,	—
	100

Siliceous genus.

Localities, &c.—Calcedony is moſt uſually met with in globular maſſes in amygdaloid, as at Oberſtein, in the duchy of Duex Ponts. It is found alſo in Saxony, Sileſia, and Siberia, in Iceland and the Faro iſlands; in the north of Ireland; and in ſeveral of the weſtern iſlands of Scotland. The cavities of the balls of calcedony are often lined with cryſtals of quartz and amethyſt.

Uſes.—Calcedony takes a fine poliſh, and is therefore employed in jewellery.

2. Subſpecies. CARNELIAN.

Id. Kirw. i. 300. *La Cornaline*, Brochant, i. 272. *Quartz-Agathe Cornaline*, Hauy, ii. 425.

This mineral is found in maſſes, or diſſeminated, but moſt frequently in rounded pieces of a globular, kidney form, or ſtalactitical ſhape. External ſurface rough and uneven; internal luſtre glimmering, or ſlightly ſhining; fracture perfectly conchoidal; fragments very ſharp-edged; moſt common colour blood red of various ſhades, and ſometimes reddiſh brown or wax and honey yellow; ſemitranſparent, hard, and brittle. Spec. grav. 2.59 to 2.73.

Chem. Char.—Carnelian is infuſible before the blowpipe, but loſes its colour, and becomes white.

Localities, &c.—Carnelian is found in ſimilar circumſtances, and in ſimilar places with common calcedony, but is of leſs frequent occurrence. The fineſt carnelians are brought from the eaſt, and thence they are denominated oriental.

Uſes.—The carnelian is employed for the ſame purpoſes as common calcedony.

Obſervations on Agate.—As common calcedony and carnelian, along with jaſper, conſtitute the baſe of the greater number of agates, it may be here proper to introduce a few remarks on the mineral ſubſtances which are included under this name, and on the theories of their formation.

24 Varieties of agate.

The term agate is of very general application, comprehending numerous varieties, which are chiefly diſtinguiſhed by the arrangement and diſpoſition of the colours with which they are marked, and from which they have derived particular names. The following are ſome of the principal varieties of agate. 1. *Fortification* agate, in which the different coloured ſtripes are arranged in a zigzag manner, preſenting ſomething of the appearance of a fortified town. 2. *Landſcape* agate, in which the colours and ſhades are ſo arranged as to exhibit the appearance of a landſcape. 3. *Band* or *ribbon* agate, in which the various colours are diſpoſed in ſtripes or zones, which are uſually in ſtraight lines, but ſometimes concentric. To this variety of agate, when the zones or ſtripes are arranged parallel to each other, and diſtinctly marked, the name of onyx was given by the ancients. The name *onyx*, which ſignifies the nail of the finger, is derived from the whitiſh colour reſembling that part of the body. They alſo gave the name of *ſarde* to a variety of the ſame ſtone, of a fleſh colour, and afterwards the compound name *ſardonyx* was given to another variety, in which a whitiſh layer of the onyx, having ſome degree of tranſparency, covered another layer of a fleſh red, the colour of which latter appeared through the former in the ſame manner as the colour of the fleſh appears through the nail. But in

Siliceous genus.

in the end, the name of onyx ſeems to have been applied to all ſtones formed of layers of different colours. 4. *Moſs* agate. In ſome varieties of agate filaments of a greeniſh or other colour, having the appearance of ſome ſpecies of confervæ or muſci, are obſerved, and theſe have been denominated *moſs agates*. Some have ſuppoſed that theſe filaments have been real moſſes or confervæ, enveloped by the ſiliceous matter. In ſome alſo delineations of a brown or black colour, exhibit the appearance of trees or ſhrubs. This dendritical appearance is aſcribed by ſome to the infiltration of iron or manganeſe into the natural fiſſures of the ſtone. The fineſt agates of this variety, it is ſaid, are brought from Arabia, by the way of Mocha, on the coaſt of the Red ſea; and hence they are known by the name of *Mocha ſtones*. Beſide theſe varieties, there are ſeveral others, as *tubular* agate, when it is compoſed of calcedony, which ſeems to have been in the form of ſtalactites, and afterwards filled up with a different mineral ſubſtance, or at leaſt of a different colour; *clouded* agate, preſenting the appearance of clouds; *radiated* or *ſtellated*, when the different colours are arranged in rays; *breccia agate*, compoſed of fragments of different kinds of agate, and cemented together by ſiliceous matter, and conſtituting a real breccia; *ſpotted agate*, when the colours are diſpoſed in points or ſpots; *petrified agate*, which ſeems to have been wood penetrated with the matter of agate; *coral agate*, having the appearance of coralloid; *jaſper agate*, in which the predominant part of its compoſition is jaſper.

25 Formation of agate,

The formation of agate has been the ſubject of much controverſy among contending theoriſts; for while one party conceives that it affords the ſtrongeſt proofs of being produced by means of heat, or from a ſtate of fuſion, another party ſeems to be equally convinced that it ſupplies them with the moſt certain evidence of having being formed from an aqueous ſolution.

26 by fuſion

Beſide other ſtrong objections that might be urged againſt the opinion of agate being formed from a ſtate of fuſion, the uniformity and regularity in the arrangement of the different kinds of matter of which it is compoſed, ſeem quite hoſtile to it, and, excepting to thoſe who are previouſly prepoſſeſſed with ſuch an opinion, will, we preſume, appear altogether inſurmountable; for it is inconceivable, that in a maſs of melted matter, whether it have been in a ſtate of fuſion in the place where it is now found, or projected from the bowels of the earth into the ſtrata which are now its repoſitory, while in a ſoft ſtate, could arrange itſelf into layers, ſome of them often extremely thin, and diſpoſed in ſtripes, concentric circles, ſpots, while theſe various kinds of matter exhibit very ſlight ſhades of difference in their conſtituent parts. It cannot even be imagined that all this could have been effected, even by the ſloweſt and moſt gradual proceſs of cooling.

27 by aqueous infiltration.

In accounting for the formation of agate by ſolution in water, it is ſaid that the cavities in the rocks which contain agate, were formed in conſequence of the evolution and extrication of air, while thoſe rocks were in a ſtate of ſoftneſs; and that the matter of which agate is compoſed, was introduced in the ſtate of an aqueous ſolution by means of infiltration. But objections, equally inſurmountable, might eaſily be adduced againſt this theory; and one of the firſt that preſents itſelf is derived from the diverſity of matter depoſited in maſſes of agate. This objection, indeed, is attempted to be obviated by ſuppoſing that the agate compoſed of different kinds of matter was derived from different kinds of ſucceſſive ſolutions: but this is only removing the difficulty a ſtep farther; for, can it eaſily be conceived, that a very thin layer of one kind of matter being depoſited, and this, let it be ſuppoſed, of a white colour, the ſolution was changed, from which proceeded another thin layer; that the ſolution was again changed, and depoſited a third kind of matter; and after another change, a fourth kind, or perhaps that the depoſition of the firſt kind of matter again commenced. But if infiltration from an aqueous ſolution have really been the mode of formation of this mineral, how comes it, it may be fairly aſked, that the depoſitions from the different kinds of ſolution have not been arranged, at leaſt in the larger cavities, in ſtrata or zones parallel to the horizon; becauſe it ſeems natural to ſuppoſe that the depoſition of ſtony matter, from a ſtate of ſolution in water, would be influenced by gravitation, and thus be horizontally arranged? We are aware, indeed, of an objection which may be made to this obſervation. It will be ſaid that the influence of gravity has in this caſe been counteracted by the action of affinity between the ſtony matter in ſolution, and the ſides of the cavity in which the agate is formed; but whatever effect this might have in the ſmaller cavities, its influence would be diminiſhed in thoſe of larger capacity.

To what we have now ſaid on this ſubject, which, it muſt be acknowledged, is more curious than uſeful, we ſhall only add a circumſtance which, ſo far as we know, has not been noticed by geologiſts; but it ſeems to be of conſiderable importance in the eſtabliſhment or ſubverſion of the theory of the formation of agate by means of infiltration in the ſtate of aqueous ſolution. It will be allowed, we preſume, that all agates found in the ſame horizontal poſition, or at the ſame depth from the ſurface, from which the aqueous ſolution is underſtood to have proceeded, were formed from the ſame ſolutions; at leaſt thoſe agates which are contiguous to each other, that is, within the ſpace of a few yards, or even of a ſingle yard. Now, if this be admitted, all the agates which have derived their materials from the ſame ſolutions, ought to be exactly of the ſame kind, becauſe their orign is cotemporaneous, and it is derived from the ſame ſolutions. To aſcertain this point with preciſion, it will be neceſſary to examine agates in their native repoſitories; and although we ſhall not pretend confidently to decide the queſtion, becauſe our obſervations with this view have not been ſufficiently varied and extenſive, yet we ſtrongly ſuſpect, that it will appear, from future inveſtigations, that agates, and even ſuch as are almoſt contiguous to each other, have been formed of very different materials, or of ſimilar materials arranged in a very different manner. To thoſe who are fond of ſuch ſpeculations we recommend this as a ſubject of inveſtigation.

Localities.—Agates are found in great abundance in different parts of the world. They are ſometimes diſtributed indiſcriminately with the rocks which contain them, ſometimes in beds or layers, in interrupted maſſes, and ſometimes in thin beds, where there is ſcarcely any interruption of continuity. This laſt mode of arrangement, however, is rare. Agates are ſometimes found in metallic veins, or are mixed with metallic ſubſtances,

as

as the ſulphurets of lead and ſilver. It would appear, too, that agates alſo exiſt in primitive rocks. Sauſſure has obſerved them in granite, containing nodules of the ſame granite, and penetrated with iron pyrites. He has obſerved alſo at the ſame place, near Vienne, in the department of Iſere, thin layers of calcedony alternating with gneis; but porphyries and ſimilar rocks are the uſual repoſitories of agate. Theſe ſtones are found in great variety and abundance at Oberſtein, in the department of Mont-Tonerre, in France, in a rock of amygdaloid of a peculiar nature, and full of cavities of all ſizes. This rock is conſidered by Dolomieu as a volcanic tufa; but according to other mineralogiſts, and particularly Faujas de St Fond, who has given a minute deſcription of it *, it is conſidered as a porphyry or amygdaloid, with a baſis of trap, which is very ſubject to decompoſition. The globular maſſes of agate are diſpoſed in this rock without any order, and are uſually enveloped with a peculiar greeniſh earth, but which contains no copper. In the geodes of agate found at Oberſtein, jaſper, amethyſt, carbonate of lime in cryſtals, chabaſie, a ſpecies of zeolite, and ſome portion of titanium, have been obſerved; but not the leaſt trace of any organized body. Digging, poliſhing, and forming into a great variety of ornamental objects, conſtitute the chief employment of the inhabitants of Oberſtein.

Agates are found in abundance in different parts of Scotland: but the largeſt and fineſt are met with in the neighbourhood of Montroſe and Stonehaven; in the rocks near Dunbar on the eaſt coaſt, and in the rocks about Dunure, on the ſhore of Carrick in Ayrſhire.

32. Species. HYALITE.

Id. Kirw. i. 296. *Muller's glaſs* of the Germans. *Lava glaſs* of many.

Exter. Char.—This ſubſtance is found in grains or maſſes, or in thin layers on other minerals. It has much the appearance of gum, and is uſually cracked. The luſtre is ſhining and vitreous; fracture conchoidal, ſometimes foliated; fragments ſharp-edged.

Colour grayiſh white or yellowiſh; and, according to Kirwan, pure white. Tranſlucent, ſometimes ſemitranſparent; has conſiderable hardneſs, and is brittle. Spec. grav. 2.110.

Chem. Char.—Infuſible at 150° Wedgwood, but melts with ſoda.

Conſtituent Parts.

Silica,	57
Alumina,	18
Lime,	15
With ſome traces of iron.	

Localities, &c.—Hyalite is found in rocks of amygdaloid, or wacken, near Franckfort on the Maine.

33. Species. OPAL.

This ſpecies is divided into four ſubſpecies or varieties.

Subſpecies 1. PRECIOUS OPAL.

Opal, Kirw. i. 289. *L'Opale Noble*, Brochant, i. 341. *Quartz-reſinite Opalin*, Hauy, ii. 434.

Exter. Char.—This mineral is found maſſive or diſſeminated, and ſometimes in veins; internal luſtre ſplendent and vitreous; fracture perfectly conchoidal; fragments ſharp-edged.

Colour milk-white, clear or pale, and ſometimes bluiſh gray; and by holding it in different lights, a very bright and varied play of colours, the principal of which are golden yellow, ſcarlet red, bright blue, green and gray, is ſeen. It is commonly tranſlucent, rarely ſemitranſparent; pretty hard and brittle. Spec. grav. 2.114.

Siliceous genus

Chem. Char.—The precious opal treated with the blow-pipe ſplits and cracks, and loſes its tranſparency, but is not melted.

Conſtituent Parts. Klaproth.

Silica,	90
Water,	10
	100

Localities.—The fineſt opals are found at Czerwenitza not far from Caſchau in Upper Hungary, in an argillaceous decompoſed porphyry, which according to ſome mineralogiſts is a gray ſtone (grauſtein of the Germans), and are diſpoſed in veins, neſts, and grains. When the opal adheres in ſmall particles cloſely together in the ſtone, it forms what is called *mother* of opal. It is found in the ſame manner in a kind of breccia of this decompoſed porphyry. (Townſon's Travels in Hungary, p. 307.). It is found alſo at Eeibenſtock, Johann-Georgenſtadt, and Freyberg in Saxony. At this latter place the repoſitory of the opal is porphyry. The opal alſo is met with in Iceland.

The opal mines deſcribed by Dr Townſon are ſituated in a hill of ſome miles in extent not far from the village of Czerwenitza. This hill has been opened in ſeveral places, but in three with the greateſt ſucceſs. Guards are placed upon it to prevent any perſon from digging this precious ſtone; for as it is ſituated in part of the royal domain, the peaſants who were formerly permitted to ſearch for it on their own account are now prohibited by the emperor. But even at the time Dr Townſon viſited the mines the work had been diſcontinued for three or four years as unprofitable. The uſual mode of conducting the operations in ſearching for the opal is by quarrying to the depth of three or four yards, rarely deeper. The rock is thus thrown out, broken to pieces, and afterwards examined. In one place the ſearch had been made by mining; but the gallery was only a few yards in length. From this account it appears that the rock containing the opal lies near the ſurface, and ſeldom, it is ſaid, extends deeper than a few fathoms. The opals denominated *oriental* by the lapidaries, a term expreſſive of their value rather than of their origin, are ſuppoſed to be from theſe mines, in which, according to records ſtill in exiſtence, 300 men were employed not leſs than 400 years ago.

Uſes.—On account of the fine play of colours, the opal is held in great eſtimation for the purpoſes of jewellery, and the opals which reflect green colours in moſt abundance are moſt highly valued. The fineſt opals are called oriental; but this epithet is given by the lapidaries to the more perfect precious ſtones, and is not to be underſtood as denoting that they have been brought from eaſtern countries.

Siliceous genus.

The ancients, it would appear from the account of Pliny, attached an immenſe value to this ſtone; for he informs us that a ſenator called Nonius rather ſubmitted to baniſhment than give up an opal which he had in his poſſeſſion to Mark Anthony. This opal was eſtimated at 20,000 ſeſterces. Lib. xxxvii. cap. 6.

Subſpecies 2. COMMON OPAL.

Semi-opal, Kirwan, i. 290. *L'Opale Commune*, Brochant. i. 344. *Quartz reſinite Hydrophane* et *Quartz-reſinite Giraſol*, Hauy, ii. 433.

Exter. Char.—Common opal is found in maſſes, or diſſeminated, ſometimes in rounded or angular pieces, and ſometimes kidney-ſhaped or botryoidal. Internal luſtre ſplendent, and intermediate between vitreous and reſinous. Fracture conchoidal, but ſometimes uneven. Fragments ſharp-edged.

Colour milk-white, and varieties of this colour held in certain directions appear of a wine yellow. The other ſhades of colour are yellowiſh or reddiſh white, and wax or honey yellow. Semitranſparent and ſometimes tranſparent. Specific gravity from 1.958 to 2.015. In other characters the ſame as the precious opal.

Chem. Char.—Infuſible before the blow-pipe, but melts with borax, and without ſwelling up.

Conſtituent Parts. Klaproth.

From Kozemutz.		From Telkobanya.	
Silica,	98.75	Silica,	93.50
Alumina,	0.10	Oxide of iron,	1.00
Oxide of iron,	0.10	Water,	5.00
Loſs,	1.05	Loſs	
	100.00		100.00

Localities, &c.—The common opal is found in veins, chiefly in amygdaloid rocks, and ſometimes alſo, it is ſaid, in granites and porphyries. It is of moſt frequent occurrence in Bohemia; in Saxony, as at Freyberg, Eibenſtock, &c.; in Hungary, in Poland, in Scotland, and the Faroe iſlands. The amygdaloid rocks in the vicinity of the Giants Cauſeway in the north of Ireland alſo afford a repoſitory for this mineral.

Uſes.—It is employed as well as the former for the purpoſes of jewellery, but is eſteemed of inferior value.

It has been obſerved of ſome varieties of common opal that they are hydrophanous, that is, they poſſeſs the property of becoming tranſparent when immerſed in water, a property which it is ſuppoſed depends on the abſorption of the water in the pores of the opal. When ſimilar varieties of opal are dipped in melted wax, they are impregnated with it, and become in like manner tranſparent, but on cooling reſume their opacity. To ſuch varieties De Born has given the name of *Pyrophane*.

Subſpecies 3. SEMI-OPAL.

Id. Kirwan, i. 290. *La Demi-opale*, Brochant, i. 347. *Quartz Reſinite Commune, et Menilite*, Hauy, ii. 433.

Exter. Char.—This mineral is found in maſſes or diſſeminated, in angular fragments, ſtalactitical, botryoidal, or in ſuperficial layers. Luſtre glimmering or ſhining, and intermediate between vitreous and reſinous. Fracture conchoidal, and frequently even. Fragments ſharp edged.

Colours extremely various, but in general duller and leſs vivid than common opal. The moſt predominant are yellowiſh, grayiſh and reddiſh white, more rarely milk white. Various colours are ſometimes diſpoſed in ſpots, ſtripes, and clouds. Tranſlucent at the edges, and ſometimes, but rarely, ſemitranſparent. Pretty hard and brittle. Spec. grav. 2.540.

Chem. Char.—Infuſible before the blow-pipe, but melts with borax and without frothing up.

Conſtituent Parts.	Klaproth.
Silica,	43.50
Oxide of iron,	47.00
Water,	7.50
Loſs,	2.00
	100.00

Localities, &c.—The ſemi-opal is found in the ſame places and in ſimilar rocks with the common opal, as in baſalt and amygdaloid, but chiefly in granite and porphyry, and particularly in the veins of ſuch rocks containing ſilver.

Some varieties of pitch ſtone have been ranked with ſemi-opal by mineralogiſts; and menilite, a mineral to be afterwards deſcribed, has been alſo conſidered merely as a variety of it.

Subſpecies 4. WOOD OPAL.

Ligniform Opal, Kirwan, i. 295. *Opale Ligniforme*, Brochant, i. 350. *Quartz reſinite Xyloide*, Hauy, ii. 439.

Exter. Char.—This variety of opal is found in maſſes of different ſizes, retaining the form and texture of the wood which is ſuppoſed to be penetrated with the ſtony opaline matter. Luſtre internally weakly ſhining, between vitreous and reſinous. Tranſverſe fracture conchoidal, longitudinal fracture ſhows the woody texture. Fragments ſharp-edged.

Colours grayiſh and yellowiſh white, yellowiſh brown and ochre yellow. Different colours are ſometimes arranged in concentric circles, in ſpots, and ſtripes. Often opake, but rarely tranſlucent except at the edges. Intermediate between hard and ſemi-hard. Brittle. Spec. grav. 2.600.

Localities, &c.—The wood opal is found at Pornick near Schemnitz in Hungary, and at Telkobanya in the ſame country.

34. Species. MENILITE.

Pitchſtone, Kirwan, i. 292. Variety of *flint* of ſome, and *Semi-opal* of Klaproth.

Exter. Char.—This mineral is found in tuberoſe maſſes, which have a ſmooth ribbed ſurface, and are ſometimes covered with a whitiſh cruſt. Internal luſtre weakly ſhining. Tranſverſe fracture flat, conchoidal; longitudinal, coarſe, ſplintery. Fragments ſharp edged.

Cheſnut brown colour, and marked with alternating ſtripes of pearl gray and reddiſh brown. Tranſlucent. Pretty hard and brittle. Spec. grav. 2.185.

Conſtituent

Conſtituent Parts, Klaproth.

Silica,	85.50
Alumina,	1.
Oxide of iron,	.50
Lime,	.50
Water and carbonaceous matter,	11.50
Loſs,	1.
	100.00

Localities, &c.—This mineral is found at Menil-Montant, from which it derives its name, near Paris, in nodules diſpoſed in interrupted ſtrata, in the middle of a foliated, argillaceous ſchiſtus, which is interpoſed between the beds of gypſum,

35. Species. JASPER.

Jaſper has been divided into ſix ſubſpecies, 1. Egyptian; 2. Striped; 3. Porcelain; 4. Common; 5. Agate; and, 6. Opal.

Subſpecies 1. EGYPTIAN JASPER.

Egyptian Pebble, Kirwan, i. 312. *Le Jaſpe Egyptien*, Brochant, i. 332.

Exter. Char.—This variety of jaſper is found in rounded pieces, which are generally ſpherical, and have a rough ſurface. External luſtre glimmering or weakly ſhining; internal weakly ſhining. Fracture perfect conchoidal; fragments ſharp-edged.

The colours of this variety are diſpoſed in zones or irregular ſtripes, which are nearly concentric. Theſe colours are yellowiſh brown on a ground of cheſnut brown; uſually opaque, or ſlightly tranſlucent at the edges. Spec. grav. 2.56 to 2.6.

Chem. Char.—Infuſible before the blow-pipe.

Localities, &c.—This mineral, as its name imports, is brought from Egypt, where, as was obſerved by Cordier, it conſtitutes part of a breccia which is entirely compoſed of fragments of ſiliceous ſtones, immenſe ſtrata of which abound in that country, and the deſerts of Africa in the vicinity. The maſſes of jaſper are found among the ſand which has been derived from the decompoſition of this breccia, and particularly near Suez.

Uſes.—This variety, on account of its hardneſs and beautiful colours, is in conſiderable eſtimation for ornamental purpoſes,

Subſpecies 2. STRIPED JASPER.

Id. Kirw. i. 312. *Le Jaſpe Rubané*, Broch. i. 334. *Quartz-Jaſpe Onyx*, Hauy, ii. 436.

Exter. Char.—This variety of jaſper is found maſſive, and ſometimes forms entire beds. It has no luſtre, except from the mixture of extraneous ſubſtances. Fracture conchoidal, ſometimes ſplintery or earthy. Fragments ſharp-edged.

To the variety of colours of this mineral it owes its name. Theſe are pearl gray, yellowiſh and greeniſh gray, with ſhades of red and blue, and theſe different colours are arranged in ſtraight or curved lines; generally opaque, tranſlucent only at the edges.

Siliceous genus.

Localities, &c.—This variety of jaſper abounds in Siberia: it is found alſo in Saxony, in the Hartz, where it repoſes on gray wacken; in Sicily; and in the hills in the vicinity of Edinburgh.

Subſpecies 3. PORCELAIN JASPER.

Porcellanite, Kirw. i. 313. *Le Jaſpe Porcelaine*, Broch. i. 336. *Thermantide Porcellanite*, Hauy, iv. 510.

Exter. Char.—Uſually found in maſſes or angular pieces, in which rents or fiſſures are often obſerved, and alſo in whole beds. Internal luſtre glimmering or weakly ſhining; reſinous. Fracture imperfect conchoidal or uneven. Fragments ſharp-edged.

The colour exhibits great variety; pearl, aſh, yellowiſh and bluiſh gray, with ſhades of yellow, red, and rarely green. The colour is generally uniformly the ſame, but ſometimes it is ſtriped and dotted, flamed and clouded; impreſſions of vegetables of a red colour are obſerved on the blue varieties, and the rents or fiſſures are of a red colour in the grayiſh ſpecimens; is entirely opaque; pretty hard, and eaſily frangible.

Chem. Char.—Melts before the blow-pipe into a black ſlag.

Conſtituent Parts.	Roſe.
Silica,	60.75
Alumina,	27.27
Magneſia,	3.
Potaſh,	3.66
Oxide of iron,	2.50
	97.18
Loſs,	2.82
	100.00

Localities, &c.—This mineral is abundant in different parts of Bohemia; it is met with alſo in Saxony, in the rocks in the vicinity of Edinburgh, and on the coaſt of Fife near Dyſart in Scotland.

This jaſper derives its name from its fracture, which reſembles that of porcelain; and as it is frequently found in places where ſubterraneous fires have exiſted, ſuch as beds of coal which have been kindled by accident, it is aſcribed to their action; and according to Werner, it is nothing more than a ſlaty clay altered by fire.

Subſpecies 4. COMMON JASPER.

Id. Kirw. i. 310. *Jaſpe Commun*, Broch. i. 338.

Exter. Char.—This variety is uſually found maſſive, ſometimes diſſeminated, or alternating in thin layers with other ſtones. Luſtre glimmering or ſhining, between vitreous and reſinous. Fracture more or leſs perfectly conchoidal, ſometimes ſplintery or earthy. Fragments ſharp-edged.

Colours extremely various, exhibiting different ſhades of red, yellow, and black; and ſeveral of theſe are united together, preſenting clouds, ſpots, and ſtripes. Uſually opaque, or ſlightly tranſlucent at the edges. Is ſcratched by quartz. Eaſily frangible. Spec. grav. 2.3 to 2.7.

Chem. Char.—Entirely infuſible before the blow-

Siliceous genus.

pipe. Its conſtituent parts are extremely variable. The following were obtained by the analyſis of Kirwan.

Silica,	75
Alumina,	20
Oxide of iron,	5
	100

Localities, &c.—This jaſper is very common in different parts of the world; in Saxony, Bohemia, Hungary, France, Spain, Italy, Siberia, and alſo in Scotland, as among the baſaltic rocks in the vicinity of Edinburgh, and at Dunbar. It is uſually found in veins, eſpecially ſuch as contain ores of iron. It is often traverſed with veins of quartz, or mixed with pyrites, lithomarga, ſemi-opal, brown ſpar, native and vitreous ſilver. It has been taken for the baſis of ſome porphyries, but theſe turn out to be indurated clay, pitch ſtone, and horn ſtone.

Subſpecies 5. JASPER AGATE.

Exter. Char.—This variety ſeems to be the ſame as that already mentioned under the name of *agate jaſper*, in ſpeaking of agates at the end of the deſcription of calcedony. It is found maſſive, and poſſeſſes no luſtre. Fracture conchoidal, generally opaque, pretty hard, and ſometimes adheres to the tongue. The colours are yellowiſh or reddiſh white, which are diſpoſed in ſtripes and circles.

Localities, &c.—It is met with in many places in agate balls, in amygdaloid rocks.

Subſpecies 6. OPAL JASPER.

Exter. Char.—This variety of jaſper ſeems to poſſeſs many common characters with ſome varieties of opal. It is found maſſive. Internal luſtre between vitreous and reſinous, is ſhining or reſplendent. Fracture conchoidal. Fragments very ſharp-edged.

Colours ſcarlet red, blood red, browniſh red, more rarely yellow. Colours diſpoſed in veins, ſpots, and clouds. Opaque, or tranſlucent at the edges. Brittle, and eaſily frangible.

Localities, &c.—This mineral is found in Hungary, in Siberia, and other places, and is uſually in neſts in porphyry.

Beſide the localities of the different varieties of jaſper already mentioned, we may notice that it is met with in Siberia of a white and bluiſh colour. The hill on which the fortreſs of Orſkaia ſtands on the left bank of the river Jaik, in the government of Orembourg, is entirely compoſed of a pale green and deep red jaſper, diſpoſed in inclined beds; and on the moſt elevated parts of the Altaian mountains, near the ſource of the river Korgou, a jaſper has been diſcovered of an ivory white colour, which is remarkable for being penetrated with black dendrites.

Uſes of Jaſper.—It is valued according to its hardneſs, the degree of poliſh of which it is ſuſceptible, and the beauty and variety of its colours; and it is employed in forming vaſes, handles for ſwords and knives, and other ſmaller ornamental purpoſes.

36. Species. HELIOTROPE, or *Bloodſtone.*

Heliotropium, Kirw. i. 314. *L'Heliotrope*, Broch. i. 276. *Quartz jaſpe Sanguin*, Hauy, ii. 436.

Exter. Char.—Heliotrope is found maſſive or in angular pieces; external luſtre glimmering or ſhining, and reſinous; fracture conchoidal, ſometimes uneven. Fragments very ſharp-edged.

Colour chiefly deep green, but of various ſhades, with ſpots of olive and yellow, but moſt frequently ſcarlet or blood red: tranſlucent at the edges: hard, eaſily frangible. Spec. grav. 2.62 to 2.7.

Chem. Char.—Entirely infuſible before the blow-pipe.

Localities, &c.—This mineral was originally brought from the eaſt, but it has ſince been found in Siberia, in Bohemia, where it is met with in a vein, and in Iceland.

Uſes.—It is employed for ſimilar purpoſes with jaſper or agate.

By many mineralogiſts this mineral is conſidered as a variety of jaſper; hence it has been called oriental jaſper; and it is ſuppoſed by ſome to be a calcedony penetrated with green earth.

37. Species. CHRYSOPRASE.

Chryſopraſium, Kirw. i. 284. *La Chryſopraſe*, Broch. i. 280. *Quartz Agathe Praſe*, Hauy, ii. 426.

Exter. Char.—This mineral is found maſſive, or in angular fragments: internal luſtre rarely glimmering; fracture even, ſometimes ſplintery; fragments ſharp-edged.

Colour apple-green, greeniſh gray, or leek-green; tranſlucent, ſometimes ſemitranſparent; leſs hard than calcedony and flint. Spec. grav. 2.25.

Chem. Char.—Infuſible before the blow-pipe, but loſes its tranſparency, and becomes white.

Conſtituent Parts.	Klaproth.
Silica,	96.16
Alumina,	.08
Lime,	.82
Oxide of iron,	.08
Oxide of nickel,	1.00
Loſs,	1.86
	100.00

Localities, &c.—Chryſopraſe is found at Koſemutz, in Upper Sileſia, in a mountain compoſed of ſerpentine, aſbeſtus, indurated talc, and lithomarga.

Uſes.—It is employed for ſimilar purpoſes as jaſper, and it is greatly eſteemed when it is of a fine apple-green colour. It is ſaid that ſome varieties of this mineral loſe their colour by being expoſed to moiſture, ſo that the jewellers, before uſing them, put them to the teſt, by keeping them for ſome time in a moiſt place.

38. Species. PLASMA.

Id. Broch. i. 278. *Silex Plaſme*, Brongniart, ii. 398.

Exter. Char.—This mineral is found diſſeminated, in rounded pieces, and alſo in angular pieces. Internal luſtre glimmering or weakly ſhining; reſinous. Fracture conchoidal, even, and ſometimes ſplintery. Tranſlucent, and ſometimes even tranſparent in thin pieces.

Colour, various ſhades of green; and ſometimes different colours are diſpoſed in ſpots, ſtripes, and points.

Nearly

Siliceous genus.

Nearly equally hard with calcedony. Brittle, and eaſily frangible.

Chem. Char.—It is infuſible before the blow-pipe, but becomes white.

Localities, &c.—It is ſaid by ſome, that this mineral has only been found among the ruins of Rome, but according to Brongniart and others, it has been found in the Levant, in Upper Hungary, and in Moravia, in a mountain of ſerpentine, where it is accompanied with flint.

Uſes.—It appears that this mineral was much employed by the ancients for ornamental purpoſes.

39. Species. CAT'S EYE.

Id. Kirw. i. 301. *L'Oeil de Chat*, Brochant, i. 292. *Quartz-Agathe Chatoyant*, Hauy, ii. 427.

Exter. Char.—This mineral, as it is brought from its native country, is uſually cut and poliſhed, ſo that its natural form is unknown; but it is ſuppoſed that it is met with in grains or rounded pieces. A maſs deſcribed by Klaproth, which ſeemed to be in its natural ſtate, had a quadrangular form, a rough ſurface, and conſiderable brilliancy. The luſtre is reſplendent and reſinous. The croſs fracture is uneven, the longitudinal fracture imperfectly foliated. Fragments more or leſs ſharp-edged.

The colour is greeniſh yellow and ſmoke gray, of various ſhades, and ſometimes, but rarely, grayiſh or ſilvery white. It is tranſlucent, rarely ſemitranſparent. When it is cut, it reflects different rays of light by changing its poſition, a character by which it is eaſily known. This is aſcribed to ſmall parallel fibres which appear in the interior of the ſtone. It is hard, eaſily frangible. Spec. grav. 2.625 to 2.660.

Chem. Char.—It melts with great difficulty by the action of the blow-pipe. Klaproth ſubjected it to the heat of a porcelain furnace, but it was not melted; it only loſt its hardneſs, luſtre, and tranſparency, and the colour became of a pale gray.

Conſtituent Parts.		Klaproth.
Silica,	95.00	94.50
Alumina,	1.75	2.00
Lime,	1.50	1.50
Oxide of iron,	0.25	0.25
Loſs,	1.50	1.75
	100.00	100.00

Localities.—Cat's eye is brought from Ceylon and the Malabar coaſt, and alſo, it is ſaid, from Egypt and Arabia; but always in the poliſhed ſtate. The only one known in its natural ſtate was that above mentioned, which was preſented to Klaproth by Mr Greville of London.

Uſes.—This mineral is in great eſtimation as a precious ſtone, and it is uſually cut for ring-ſtones.

The name is derived from its poſſeſſing the property of reflecting the light ſimilar to the eye of the cat, and hence the term *chatoyant* among jewellers, which is expreſſive of that effect.

49. Species. OBSIDIAN.

Id. Kirwan, i. 265. *Iceland agate* vulgo. *L'Obſidienne*, Brochant, i. 288. *Lave vitreuſe Obſidienne*, Hauy, iv. 594.

Exter Char.—This mineral is found in maſſes, and ſometimes in rounded pieces. Luſtre reſplendent, vitreous; fracture perfectly conchoidal; fragments very ſharp-edged.

The moſt common colour of obſidian is perfectly black, ſometimes greeniſh and grayiſh, black, blueiſh, greeniſh and ſmoke gray, and yellow and red, according to Humboldt: moſt commonly opaque, but ſometimes tranſlucent on the edges. It is hard and eaſily frangible. Spec. grav. 2.348.

Chem. Char.—Before the blow-pipe obſidian melts into an opaque porous glaſs, of a grayiſh white colour.

Conſtituent Parts.

	Bergman.	Abilgaard.
Silica,	69	74
Alumina,	22	12
Oxide of iron,	9	14
	100	100

	Deſcotils.	Drappier.	
Silica,	72.0	74.	71.0
Alumina,	12.5	14.	13.4
Lime,		1.2	1.6
Oxide of iron and manganeſe,	2.0	3.0	4.0
Potaſh and ſoda,	10.0	3.3	4.0
Loſs,	3.5	4.5	6.0
	100.0	100.0	100.0

Localities, &c.—This mineral is found in Iceland, in Siberia, in the Lipari iſlands, in Hungary, in Madagaſcar, the iſland of Teneriffe, in Mexico, Peru, and ſome of the South ſea iſlands. Humboldt diſcovered a variety of obſidian in New Spain, which was *chatoyant* in a conſiderable degree. The obſidian from Hungary is found in inſulated pieces among detached maſſes of granite, gneiſs and decompoſed porphyry. Obſidian was long ſuppoſed to have a volcanic origin; but it appears from the accounts of thoſe who have viſited Iceland, that it is not only found in the vicinity of Hecla, but everywhere, diſtributed like quartz and flint; and beſides it is not unfrequent in countries where volcanoes were never known to exiſt.

Uſes.—The fine colour and hardneſs of this ſtone have brought it into uſe for ornamental purpoſes. Among the ancient Mexicans and Peruvians it was employed as mirrors, ſome of which, it is ſaid, are ſometimes ſtill found in the tombs of their ancient ſovereigns (*Faujas Miner. des Volcans*, p. 308.); and alſo for cutting inſtruments as knives and even razors. Hernandez ſaw the Mexican cutlers make a hundred knives of obſidian in the courſe of an hour. Obſidian, it is ſaid, has alſo been uſed as mirrors for teleſcopes.

41. Species. PITCHSTONE.

Id. Kirwan, i. 292. *La pierre de poix.* Brochant, i. 353. *Petroſilex reſiniforme*, Hauy, iv. 386.

Exter. Char.—Pitchſtone, which has received its name

Siliceous genus.

name from its reſemblance to pitch, is found maſſive; ſometimes in extenſive beds and veins, and alſo forming entire mountains. Internal luſtre ſhining and reſinous. Fragments ſharp-edged. In coarſe and frequently ſmall granular diſtinct concretions which have a ſmooth ſurface.

The colours are various ſhades of black, green, brown, red, and gray. Tranſlucent, but commonly at the edges only. Brittle, and rather eaſily frangible. Spec. grav. of pitchſtone from Saxony, 2,314; of black pitchſtone from Arran, 2.338; of pitchſtone from Meiſſen, 1.645, Klaproth.

Chem. Char.—Fuſible by the blow-pipe, and is converted into a white porous enamel.

Conſtituent Parts of pitchſtone from Meiſſen of an olive green colour. Klaproth, Tranſl. ii. 207.

Silica,	73
Alumina,	14,50
Lime,	1
Oxide of iron,	1
Oxide of manganeſe,	0.10
Soda,	1.75
Water,	8.50
Loſs,	1.5
	100,00

Localities, &c.—Pitchſtone is found in great abundance in Saxony, in Hungary, and alſo in Siberia. It abounds alſo in Scotland, particularly in the iſland of Arran, where it is met with in beds, but chiefly in veins traverſing the ſtrata in the leſs elevated parts of the iſland. Pitchſtone alſo forms the baſis of a porphyry.

42. Species. PEARLSTONE.

Obſidienne Perlée, Brongniart, ii. 340. *Lave Vitreuſe Perlée*, Hauy, iv. 495. *Volcanic Zeolite*, Fichtel. *Zeolitic Pitchſtone* of others. See Klaproth, Tranſl. ii. 263.

Exter. Char.—Pearlſtone almoſt always forms the ground or baſis of a ſpecies of porphyry which contains roundiſh or longiſh veſicular cavities. Luſtre pearly. Fracture ſeems imperfectly conchoidal; but is not very perceptible. Fragments blunt-edged.

Colour bluiſh, aſh, greeniſh gray. Tranſlucent at the edges. When breathed upon gives out the argillaceous odour. Not brittle, but eaſily frangible. Soft. Spec. grav. 2.340 to 2.548.

Chem. Char.—Before the blow-pipe froths up like zeolite, but is not fuſed.

Conſtituent Parts. Klaproth, ii. 267.

Silica,	75.25
Alumina,	12.
Oxide of iron,	1.60
Lime,	.50
Potaſh,	4.50
Water,	4.50
Loſs,	1.65
	100.00

Localities, &c.—Pearlſtone is found near Tokay in Hungary, in ſtrata alternating with thoſe of argillaceous porphyry, and containing in its veſicles nodules of obſidian; it is alſo met with in Iceland, and in the north of Ireland.

43. Species. PUMICE.

Id. Kirwan, i. 415. *La Pierre ponce*, Brochant, i. 443. *Ponce*, Brongniart, i. 332. *Lave vitreuſe pumicée*, Hauy, iv. 495.

Exter. Char.—This mineral is found maſſive or diſſeminated, and it is always of a porous or veſicular texture.

Luſtre glimmering, or a little ſhining and ſilky. Fracture fibrous; fragments blunt-edged.

Colour grayiſh white, bluiſh, or yellowiſh gray. Opaque, rarely tranſlucent at the edges, ſometimes ſemihard, but generally ſoft, very brittle, and very eaſily frangible. Spec. grav. 0.914.

Chem. Char.—Fuſible before the blow-pipe, and is converted into a white glaſs.

Conſtituent Parts. Klaproth, ii. 208.

Silica,	77.50
Alumina,	17.50
Oxide of iron,	1.75
Soda of potaſh,	3.
Loſs,	.25
	100.00

Localities, &c.—Pumiceſtone has been ſuppoſed to be a volcanic production, becauſe it is found in the vicinity of volcanoes; the Lipari iſlands are almoſt entirely compoſed of it, and there it is accompanied with obſidian. It is alſo found in Iceland and Teneriffe; in Hungary; and on the banks of the Rhine between Andernach and Coblentz.

Uſes.—Pumice is very much employed in poliſhing ſtones, metals, glaſs, ivory, and in the preparation of parchment.

A rare variety of pumice is deſcribed by Brongniart in the form of vitreous filaments as fine as hair; the colour is a deep bottle green, and it melts by heat into a white enamel. This pumice is ſuppoſed to be projected from the volcano in the iſle of Bourbon.

44. Species. PREHNITE.

Id. Kirwan, i. 274. *La Prehnite*, Brochant, i. 295. *Prehnite*, Hauy, iii. 67.

Eſſen. Char.—Diviſible by one diſtinct line only, and pretty clean; electric by heat.

Exter. Char.—Prehnite is found either maſſive or cryſtallized. The principal form of its cryſtals is a four-ſided rhomboidal table, which is either perfect or truncated on all its edges, or a table with ſix faces, and an equal angle, or a large rectangular priſm terminated by a bevelment which is ſomewhat obtuſe. The cryſtals are uſually grouped together, and united by their lateral faces; face of the cryſtals ſmooth; external luſtre ſhining; internal weakly ſhining and pearly; principal fracture foliated, croſs fracture fine-grained uneven; fragments but little ſharp-edged

Colour

Colour green, olive green, mountain green, and greeniſh white; ſemitranſparent, and ſometimes tranſparent. Scratches glaſs ſlightly. Brittle, and eaſily frangible. Spec. grav. 2.609 to 2.696.

Chem. Char.—Fuſible before the blow-pipe, into a white porous enamel.

Conſtituent Parts.	Haſſenfratz.	Klaproth.
Silica,	50.	43.83
Alumina,	20.4	30.33
Lime,	23.3	18.33
Oxide of iron,	4.9	5.66
Water,	.9	1.83
Magneſia,	.5	—
Loſs,	—	0.02
	100.0	100.00

Localities.—Prehnite was brought firſt from the Cape of Good Hope, by Colonel Prehn, whoſe name it now bears. It is alſo found in France, as in Dauphiny, where it exiſts in veins. It is not unfrequent in different parts of Scotland, as among the porphyry rocks ſix miles to the ſouth of Paiſley; in the neighbourhood of Dunbarton; and in the rocks round Edinburgh.

45. Species. ZEOLITE.

This ſpecies has been divided into four ſubſpecies.

Subſpecies 1. MEALY ZEOLITE.

Zeolite, Kirwan, i. 278. *La Zeolite Farineuſe*, Brochant, i. 298. *Meſotype*, Hauy, iii. 151.

Exter. Char.—This variety is found maſſive or diſſeminated, and ſometimes it is branched or coralloidal, and ſometimes alſo it envelopes other zeolites with a thin cruſt. It is dull; fracture earthy; fragments blunt-edged.

Colour uſually reddiſh or yellowiſh white, or fleſh red, opaque, very brittle; does not adhere to the tongue. When ſcratched with the finger nail it gives out a dull ſound.

Conſtituent Parts.	Pelletier.
Silica,	50
Alumina,	20
Lime,	8
Water,	22
	100

Localities, &c.—This variety of zeolite is found in Ireland, the Faro iſlands, and Sweden. It is frequent in different parts of Scotland, as at Dunbar, and ſeveral of the Weſtern iſlands.

Subſpecies 2. FIBROUS ZEOLITE.

Zeolithe Fibreuſe, Brochant, i. 299. *Meſotype*, Hauy, i. 151.

Exter. Char.—This variety is found maſſive, and ſometimes in rounded pieces, compoſed of capillary cryſtals, divergent and radiating; internal luſtre glimmering, or weakly ſhining, pearly or ſilky; fracture fibrous; fibres divergent; fragments wedge-ſhaped.

Siliceous genus.

Colour yellowiſh white, yellowiſh brown, ſnow white, and ſometimes honey yellow, tranſlucent; ſemihard, brittle, and eaſily frangible. Light.

Conſtituent Parts.	Meyer.
Silica,	41
Alumina,	31
Lime,	11
Water,	15
Loſs,	2
	100

Subſpecies 3. RADIATED ZEOLITE.

Zeolithe Rayonnée, Brochant, i. 301. *Meſotype*, Hauy, iii. 151.

Eſſen. Char.—Diviſible parallel to the faces of a rectangular priſm; electric by heat in two oppoſite points.

Exter. Char.—This variety is found maſſive, but moſt frequently cryſtallized: the primitive form is a rectangular priſm with ſquare baſes; its common forms are a rectangular priſm, truncated at each extremity by a four-ſided pyramid, correſponding to the lateral faces; a four-ſided rectangular priſm with two broad and two narrow ſides, and alſo terminated by four-ſided pyramids, or a four-ſided priſm, nearly rhomboidal, the two ſharp lateral edges of which, as well as the two obtuſe terminal angles, are truncated. The cryſtals are united together in bundles; ſo that the acuminations only can be ſeen; the cryſtals are commonly ſmooth and ſhining; the internal luſtre is weakly ſhining and pearly; fracture radiated: the rays broad or narrow; fragments wedge-ſhaped.

Colour yellowiſh, grayiſh, reddiſh, and ſnow-white; tranſlucent, ſometimes tranſparent; ſemihard; ſcratches calcareous ſpar; brittle, and eaſily frangible. Spec. grav. 2.0833.

Chem. Char.—Before the blow-pipe it froths up, gives out a phoſphoreſcent light, and is converted into a porous enamel. With acids it forms a gelatinous ſubſtance.

Conſtituent Parts.	Vauquelin.
Silica,	50.24
Alumina,	29.30
Lime,	9.46
Water,	10.
Loſs,	1.
	100.00

Subſpecies 4. FOLIATED ZEOLITE.

Zeolithe Lamelleuſe, Brochant, i. 302. *Stilbite*, Hauy, iii. 161.

Eſſen. Char.—Fuſible into a ſpongy enamel, but not electric by heat.

Exter. Char.—This variety of zeolite is uſually found in amygdaloidal or globular pieces, and alſo cryſtallized; primitive form of its cryſtals is a rectangular priſm with rectangular baſes: the uſual forms of its cryſtals

Siliceous genus.

are, a ſhort equiangular ſix-ſided priſm with two broad, two narrower, and two very narrow faces; a table with ſix equal faces, and a rhomboidal priſm. Surface of the cryſtals ſmooth and ſhining; internal luſtre ſhining and pearly; fracture foliated; the plates moſt frequently curved with a ſimple cleavage.

Colour ſimilar to the former; it is tranſlucent or ſemitranſparent; ſemihard, and eaſily frangible. Spec. grav. 2.5.

Chem. Char.—Froths up and phoſphoreſces, under the blow-pipe; placed on hot coals, it becomes white and is eaſily reduced to powder. It is not converted into a jelly by acids.

Conſtituent Parts.	Vauquelin.
Silica,	52
Alumina,	17.5
Lime,	9
Water,	18.5
Loſs,	3
	100

Localities, &c.—The different varieties of zeolite are uſually found in amygdaloid rocks, baſalts, porphyry, ſlate, wacken, and green ſtone. They often line the ſides of fiſſures paſſing through theſe rocks, and are accompanied with calcareous ſpar, calcedony, ſometimes with native copper and native ſilver, as in Iceland. The fineſt zeolites are brought from the iſlands of Faroe, Iceland, Ædelfors in Sweden. The different varieties are not unfrequent in Scotland. The fibrous and radiated kinds are met with extremely beautiful in the iſlands of Cannay and Skye; the foliated or ſtilbite in the iſland of Staffa, in Skye, and in the lead veins at Strontian.

46. Species. CUBIZITE.

La Zeolithe Cubique, Brochant, i. 304. *Analcime*, & *Chabaſie*, Hauy, iii. 180.

Eſſen. Char.—Original forms of the cube, fuſible into a glaſs.

Exter. Char.—This mineral is found maſſive or cryſtallized; the form of the cryſtals is a perfect cube, which is its primitive form. This is ſometimes truncated on all its angles by three ſmall triangular faces, or with twenty-four equal and ſimilar trapezoids like the garnet. The external luſtre is reſplendent, vitreous, or pearly. Internal ſhining or weakly ſhining. Fracture imperfectly foliated, almoſt uneven. Fragments imperfect cubes.

Colour white, yellowiſh, grayiſh, or reddiſh white. It is tranſlucent or opaque. Semihard. Spec. grav. about 2 (Hauy). Difficult to produce any ſigns of electricity; hence the name *analcime*, ſignifying want of power, given to it by Hauy.

Chem. Char.—Froths up before the blow-pipe, and melts into a porous glaſs.

Localities, &c.—Cubizite is found in Skye, in Staffa, and in the Saliſbury rocks near Edinburgh. Fine ſpecimens of cubizite are abundant at the Giants cauſeway in the north of Ireland. Chabaſie is found alſo at Oberſtein in Germany.

By many mineralogiſts chabaſie and analcime are conſidered as one ſpecies; but more nearly inveſtigated, as has been done by Hauy and others, they muſt appear very different. The preceding deſcription refers chiefly to analcime. We ſhall ſhortly ſtate the principal characters of chabaſie from Hauy, iii. 176.

Eſſen. Char.—Diviſible into a rhomboid ſlightly obtuſe, and eaſily fuſible by heat.

Exter. Char.—Chabaſie is commonly cryſtallized. Primitive form of the cryſtals is a ſlightly obtuſe rhomboid, whoſe plane angle at the ſummit is about 93½°, ſo that it approaches nearly to the cube; integrant molecule is the ſame. Six of the edges are truncated, the truncations uniting three and three at the two oppoſite angles, and the remaining ſix angles are alſo truncated. It appears alſo in the form of double ſix-ſided pyramids applied baſe to baſe, having the ſix angles at the baſe, and the three acute edges of each pyramid truncated.

Colour whitiſh, ſometimes reddiſh, but this ſeems to be owing to a ſuperficial cruſt. Luſtre ſhining or reſplendent and vitreous. Tranſparent or tranſlucent.

Chem. Char.—Is eaſily fuſible before the blow-pipe, and melts into a whitiſh ſpongy maſs.

47. Species. CROSS-STONE.

Staurolite, Kirwan, i. 282. *Pierre Cruciforme*, Brochant, i. 311. *Harmotome*, Hauy, iii. 191.

Eſſen. Char.—Diviſible into a rectangular octahedron, which may be ſubdivided on the angles contiguous to the ſummits.

Exter. Char.—This mineral is always cryſtallized. Its uſual forms are, a double cryſtal compoſed of two broad priſms, with four rectangular faces, and terminated at each extremity by a four-ſided obtuſe pyramid placed on the lateral edges. Theſe two priſms croſs each other by their broader faces, ſo that the faces of the acumination meet together, and the double cryſtal thus formed having four right-angled re-entering angles, reſembles a croſs. The cryſtals are obliquely ſtreaked. External luſtre ſhining and reſplendent, vitreous. Internal weakly ſhining. Fracture foliated.

Colour grayiſh or milky white, tranſlucent, ſometimes ſemi-tranſparent. Semi-hard, ſcratches glaſs ſlightly. Spec. grav. 2.333 to 3.61.

Chem. Char.—Before the blow-pipe it is fuſible, and froths up. The powder thrown on hot coals is phoſphoreſcent, giving out a greeniſh yellow light.

Conſtituent Parts.

	Klaproth.	Taſſaert.
Silica,	49	47.5
Barytes,	18	16
Alumina,	16	19.5
Water,	15	13.5
Loſs,	2	3.5
	100	100

Localities.—This mineral has been found in veins at Andreaſberg in the Hartz, accompanied by carbonate of lime, from which it is ſometimes called *andreolite*. It is alſo found in the lead veins at Strontian in Scotland, and in balls of agate at Oberſtein. In the latter place, cryſtals are ſingle.

48. Species.

Siliceous genus.

48. Species. Laumonite.

Zeolithe Efflореſcente, Hauy, iv. 410. *Id. Brochant*, ii. 530.

Exter. Char.—This mineral is found in maſſes which are compoſed of irregular groups of cryſtals croſſing each other in all directions. Form of the cryſtals is a four-ſided priſm, nearly rectangular, and terminated by a baſe inclined to one of the lateral edges under an angle of 133°; frequently the acute angle is truncated, and thus terminating in a bevelment placed on the acute lateral edges. The lateral faces are longitudinally ſtreaked, and the luſtre is ſhining. The faces of the ſummit are alſo ſhining, but ſmooth. Fracture foliated, and parallel to the lateral faces.

Colour grayiſh white, ſomewhat pearly. Is tranſlucent, rather ſoft; ſectile, and eaſily frangible.

But all theſe characters are conſiderably different by the action of the air. The whole maſs is gradually ſeparated, and the cryſtals become opaque, falling into friable folia, which are in a ſhort time reduced to a ſnow-white powder, from which it derives the name given to it by Hauy.

Chem. Char.—Fuſible before the blow-pipe, without frothing up, into a white enamel, and forms a jelly with acids.

Localities.—This mineral was found in 1788 by Gillet Laumont, in the lead mines of Huelgoët in Brittany in France, and from him it derives its name. It forms a ſmall vein contiguous to the vein of galena. We have collected ſpecimens of a mineral, whoſe characters correſpond with laumonite, in a vein traverſing a baſaltic rock in the iſland of Skye. After being kept for ſome years it appeared equally liable to diſintegration by expoſure to the air.

49. Species. Dipyre.

Id. Brochant, ii. 508. *Id.* Hauy, iii. 242.

Eſſen. Char.—Diviſible parallel to the faces of a regular 6-ſided priſm. Fuſible with intumeſcence.

Exter. Char.—This mineral is found in ſmall faſcicular maſſes or cryſtals. Luſtre ſhining, vitreous. Longitudinal fracture foliated.

Colour grayiſh or reddiſh white, and ſometimes pale roſe red. Semi-hard; ſcratches glaſs, and is eaſily frangible. Spec. grav. 2.630.

Chem. Char.—Fuſible. The powder thrown on hot coals produces phoſphoreſcence.

Conſtituent Parts.	Vauquelin.
Silica,	60
Alumina,	24
Lime,	10
Water,	2
Loſs,	4
	100

Localities, &c.—This mineral has only been found at Mauleon, in the Pyrenees, in a rock of ſteatites. It was diſcovered by Lelievre and Gillet Laumont, in 1786.

50. Species. Natrolite.

Id. Klaproth. *Id.* Brongniart, i. 370.

Exter. Char.—This mineral is found in maſſes, in a rock of amygdaloid. External ſurface ſomewhat rough; internal luſtre glimmering; fracture fibrous and radiated.

Colour browniſh yellow, inclining to olive, and different colours appear in parallel and waved zones; is tranſlucent at the edges; ſcarcely ſcratches glaſs; is eaſily frangible. Sp. grav. 2.16.

Chem. Char.—Is reduced by the blow-pipe to a white glaſs. Nitric acid produces no efferveſcence, but converts it in a few hours to a thick jelly.

Conſtituent Parts.	Klaproth.
Silica,	48
Alumina,	24
Soda,	16
Water,	9
Oxide of iron,	1.75
Loſs,	1.75
	100.00

Localities, &c.—Natrolite has been found only at Roegau, near the lake of Conſtance in Switzerland, in the cavities of an amygdaloid rock. The name is derived from natron or ſoda, of which it contains ſo large a proportion.

51. Species. Azurite.

Lazulite, Klaproth, Analyt. Eſſays, i. 170. *Le Lazulithe*, Broch. i. 315.

Exter. Char.—This mineral has been found diſſeminated, maſſive, and cryſtallized in rectangular four-ſided priſms. Luſtre glimmering and ſhining. Fracture imperfectly conchoidal.

Colour indigo, Pruſſian, or deep ſmalt blue; ſtreak lighter blue; nearly opaque, or tranſlucent at the edges; hardneſs, nearly that of quartz. Brittle and eaſily frangible.

Chem. Char.—Infuſible before the blow-pipe, but loſes its colour, becomes earthy, and of a clear gray. With borax it produces a bright yellow glaſs. Acids have a very feeble action upon it. Klaproth aſcertained that it is compoſed of ſilica, alumina, and oxide of iron; but the quantity which he operated on was too ſmall to aſcertain the proportions.

Localities, &c.—This mineral has been found at Vorau in Styria, in a rock of micaceous ſchiſtus, where it forms, along with grayiſh quartz and ſilvery white mica, a vein of about half an inch thick.

52. Species. Lazulite.

Lapis Lazuli, Kirw. i. 283. *La Pierre d'Azure*, Broch. i. 313. *Lazulite*, Hauy, iii. 145.

Exter. Char.—This mineral is found maſſive, diſſeminated, and in rounded fragments; internally dull, and rarely glimmering. Fracture earthy, or fine-grained uneven; fragments ſharp-edged.

Colour azure blue; opaque, or tranſlucent on the edges; hard, or ſemihard; brittle and eaſily frangible. Spec. grav. 2.76 to 2.94.

Chem. Char.—It retains its colour at the temperature of 100° Wedgewood; but with a ſtronger heat froths up into a yellowiſh hard coloured maſs. By increaſing the heat, it changes to a white enamel; with acids after calcination, forms a jelly.

Conſtituent Parts

	Klaproth. *Analyt. Eſſ.* i. 169.
Silica,	46
Alumina,	14.5
Carbonate of lime,	28
Sulphate of lime,	6.5
Oxide of iron,	3
Water,	2
	100.0

Localities, &c.—This mineral is found in Perſia, Natolia, and China, and it is ſuppoſed that its repoſitory is among granite. It has been found alſo in Siberia, near the lake Baikal, where it forms a vein along with garnets, feldſpar, and gyrites. It is frequently mixed with pyrites, and a grayiſh white feldſpar.

Uſes.—This ſtone, when it is of a fine blue colour, and free from white ſpots, is held in great eſtimation for various ornamental purpoſes; but it derives its greateſt value from its uſe in painting. The colour which it furniſhes is called *ultramarine.* To prepare it, the ſtone is firſt calcined, and then reduced to an impalpable powder, which is mixed with a paſte compoſed of reſinous matters, of wax and linſeed oil. From this mixture a powder is obtained by waſhing, which being dried affords the colouring matter. This colour, when uſed in painting, is not ſuſceptible of change.

53. Species. HYDRARGILLITE.

Wavellite of Dr Babington and others.

Exter. Char.—This mineral is found cryſtallized. The cryſtals are very minute, and are attached to quartz, in tufts or bundles, which diverge from a common centre. It is alſo found cloſely compacted together, in the form of mammillary protuberances of the ſize of ſmall peas, and adhering to each other. The cryſtals, when magnified, appear to be four-ſided, and, when broken, the ſection ſeems to be rhomboidal. The cryſtals have ſometimes the appearance of fine down, and ſometimes are of the ſize of a hair. Luſtre ſilky.

The colour is white, with a ſhade of gray or green; uſually opaque, and ſometimes ſemitranſparent. The texture is looſe; but the ſmall fragments are ſo hard as to ſcratch agate. Spec. grav. 2.25 to 2.70.

Chem. Char.—Infuſible before the blow-pipe; but the cryſtals, expoſed ſuddenly to ſtrong heat, decrepitate.

Conſtituent Parts.

	Davy, Nich. Jour. xi. 153.	Gregor. ibid. xiii. 247.
Alumina,	70.	58.70
Silica,	–	6.12
Lime,	1.4	·37
Oxide of iron,	–	.19
Water,	26.2	30.75
A portion of fluoric acid,		
	97.6	96.13

Localities, &c.—This mineral was firſt diſcovered by Dr Wavell, in a quarry near Barnſtaple. Mr Hatchett found it, in 1796, filling the cavities and veins of a ſoft argillaceous ſchiſtus. It has ſince been found in Stenna-Gwyn mine, in the pariſh of St Stephen's, Cornwall, where it is accompanied with ſulphuret of tin, copper, and iron.

54. Species. ANDALUSITE.

Adamantine Spar, Kirwan, i. 337. *Spath Adamantin*, Bournon, Jour. de Phyſ. 1789. *Feldſpath Apyre*, Hauy, iv. 362.

Exter. Char.—This mineral is found maſſive, and cryſtallized in rectangular four-ſided priſms, the ſummits of which are obliterated. Luſtre weakly ſhining and reſinous. Longitudinal fracture foliated. Croſs fracture a little ſplintery. Colour reddiſh brown or violet; tranſlucent at the edges. Very hard; ſcratches quartz, and ſometimes even ſpinelle. Difficultly frangible. Spec. grav. 3.165.

Chem. Char.—Infuſible before the blow-pipe.

Localities, &c.—This mineral was firſt diſcovered by Bournon in the granitic rocks of Forez, where it occupies a vein of common feldſpar. It has been found alſo in Spain, where it enters into the compoſition of a granite. It is alſo met with in Aberdeenſhire. When firſt diſcovered, it was ſuppoſed to be a variety of adamantine ſpar or corundum; but its inferior ſpec. grav. and the difference in the ſtructure of its cryſtals, afford ſufficient characteriſtic differences.

55. Species. FELDSPAR.

This ſpecies is divided into the five following ſubſpecies: 1. Adularia. 2. Labradore ſtone. 3. Common feldſpar. 4. Compact feldſpar. 5. Hollow ſpar.

Subſpecies 1. ADULARIA.

Moonſtone, Kirwan, i. 322. *L'Adulaire*, Brochant, i. 371. *Feldſpath Nacré*, Hauy, ii. 606.

Exter. Char.—This mineral is found maſſive or cryſtallized. The forms of its cryſtals are, 1. A four-ſided rhomboidal priſm. 2. A perfect rhomb, more or leſs oblique. 3. A rectangular four-ſided table, with oblique terminal faces. 4. A ſix-ſided priſm. 5. A ſix-ſided table. Surface of the cryſtals ſmooth or longitudinally ſtreaked. Luſtre ſhining or reſplendent. Internal luſtre reſplendent, vitreous, or pearly. Fracture foliated. Cleavage double. Fragments rhomboidal.

Colour yellowiſh, greeniſh, or milk-white: is ſometimes

times chatoyant. Is always tranſlucent; ſometimes ſemitranſparent. Hard; ſcratches common feldſpar. Brittle, and eaſily frangible. Spec. grav. 2.500 to 2.561.

Chem. Char.—Adularia before the blow-pipe cracks and ſplits, and then melts into a white glaſs.

Conſtituent Parts.

	Vauquelin.	Weſtrumb.
Silica,	64	62.50
Alumina,	20	17.50
Lime,	2	6.50
Potaſh,	14	—
Magneſia,	–	6.
Oxide of iron,	–	1.40
Sulphate of barytes,	–	2.
Water,	–	.25
Loſs,	–	3.85
	100	100.00

Localities, &c.—This mineral was firſt found by Pini in one of the ſummits of St Gothard in Switzerland; this ſummit is called Adula, and from this it takes its name. It is ſaid that it forms particular beds, interpoſed between micaceous ſchiſtus and gneis. It is accompanied with quartz, mica, and comon feldſpar.

Subſpecies 2. LABRADORE STONE.

Id. Kirwan, i. 324. *La Pierre de Labrador*, Brochant, i. 369. *Feldſpath Opalin*, Hauy, ii. 607.

Exter. Char.—This mineral is found maſſive, and in rounded pieces. Internal luſtre ſhining, ſometimes reſplendent; pearly, or vitreous. Fracture perfectly foliated, with a double cleavage.

Colour, moſt commonly dark or deep aſh gray; but by varying its poſition it reflects different colours, as blue, green, yellow, brown, and red; and theſe colours exhibit ſtripes, ſpots, and dots. It is ſtrongly tranſlucent. Spec. grav. 2.6 to 2.7.

Chem. Char.—Before the blow-pipe fuſible into a white enamel.

Conſtituent Parts.	Bindheim.
Silica,	69.5
Alumina,	13.6
Sulphate of lime,	12.
Oxide of copper,	.7
Oxide of iron,	.3
Loſs,	3.90
	100.00

Localities, &c.—This ſtone was firſt brought from the iſland of St Paul, near the coaſt of Labradore, whence its name. It has been ſince found in Bohemia, and near the lake Baikal in Siberia. It is rarely found in its native repoſitory, but it is ſuppoſed to belong to primitive rocks; for it is accompanied with ſchorl, mica, and hornblende.

Uſes.—The brilliancy of its colours, and particularly its chatoyant property, have brought it into uſe in jewellery.

Siliceous genus.

Subſpecies 3. COMMON FELDSPAR.

Id. Kirwan, i. 316. *Le Feldſpath Commun*, Brochant, i. 362. *Feldſpath*, Hauy, ii. 590.

Exter. Char.— Feldſpar is found maſſive, diſſeminated, in rounded pieces, or cryſtallized. Its forms are, 1. A broad ſix ſided priſm with unequal angles, terminated at each extremity by an obtuſe bevelment, whoſe faces are placed on the two lateral edges. 2. A four-ſided rhomboidal priſm. 3. A four-ſided rectangular priſm, having the lateral edges ſometimes truncated; and, 4. A ſix-ſided table. Double cryſtals are ſometimes met with. Luſtre ſhining; internal luſtre alſo ſhining, ſometimes reſplendent, vitreous or pearly. Fracture perfectly foliated; fragments rhomboidal.

Colours milk-white, yellowiſh, grayiſh, reddiſh, and greeniſh. Tranſlucent; ſcratches glaſs; brittle, and eaſily frangible. Spec. grav. 2.437 to 2.704.

Chem. Char.—Before the blow-pipe melts into a white glaſs.

Conſtituent Parts.

	Vauquelin.	Kirwan.	Chenevix.
Silica,	62.83	67	64.
Alumina,	17.2	14	24.
Lime,	3.	–	6.25
Oxide of iron,	1.	–	2.
Potaſh,	13.	–	–
Barytes,	–	11	–
Magneſia,	–	8	–
Loſs,	3.15	–	3.75
	100.00	100	100.00

Localities, &c.—Feldſpar is one of the moſt common ſubſtances, and the moſt univerſally diſtributed in nature. It does not exiſt, however, in large maſſes. It forms one of the component parts of granite, gneis, ſyenite and porphyry.

When expoſed to the action of the air, it is very liable to decompoſition, and then it is converted into a white earthy maſs, which is employed in the manufacture of porcelain. This is the kaolin of the Chineſe.

Subſpecies 4. COMPACT FELDSPAR.

Continuous Feldſpar, Kirw. i. 323. *Le Feldſpath Compacte*, Broch. i. 367. *Feldſpath Compacte Bleu*, Hauy, ii. 605.

Exter. Char.—This variety is found maſſive, and alſo in rounded pieces. Luſtre weakly ſhining, or only glimmering. Fracture imperfectly foliated, ſometimes ſplintery. Fragments not very ſharp edged.

Colour bluiſh white, greeniſh or yellowiſh; tranſlucent, but ſometimes only at the edges. Streak white; is ſcratched by quartz.

Chem. Char.—Fuſible before the blow-pipe.

Localities, &c.—Compact feldſpar is found in Saxony, and in the Tyrol. It is not uncommon in Scotland, as in the Grampian mountains, and on the Pentland hills in the neighbourhood of Edinburgh. The cryſtals of feldſpar obſerved in antique green porphyry, are ſuppoſed to belong to this variety.

Siliceous genus.

Subſpecies 5. HOLLOW SPAR, or *Chiaſtolite.*

Macle, Broch. ii. 514. *Id.* Hauy, iii. 267.

Eſſen. Char.—Diviſions parallel to the faces of a priſm, ſlightly rhomboidal. A black ſubſtance ſurrounded by another of a whitiſh colour.

Exter. Char.—This mineral has been found only cryſtallized in four-ſided, nearly rectangular priſms. The ſummit is always broken, by which the arrangement of the two ſubſtances is obſerved. The white part is the outermoſt; the black matter forms in the centre a ſmall priſm, whoſe ſides correſpond with thoſe of the outer cryſtal. From the angles of the central priſm proceed four narrow lines, which extend to each of the angles of the outer priſm; and ſometimes this black ſubſtance forms at the extremity of theſe lines, or in the angles of the large priſm, a ſimilar ſmall priſm of black matter. The black matter is an argillaceous ſchiſtus, ſimilar to the repoſitory of the cryſtals. The white part is ſometimes weakly ſhining; internal luſtre glimmering, reſinous. The black part is nearly dull. Fracture foliated; the black part earthy.

The colour of the white part, yellowiſh, or grayiſh white; that of the black part, grayiſh, or bluiſh black. Opaque, or tranſlucent. Semihard; ſcratching glaſs when foliated. Streak white. Brittle; not very frangible. Spec. grav. 2.944. Communicates to ſealing wax, negative electricity by friction.

Chem. Char.—Before the blow-pipe, the white part melts into a whiter glaſs; the black part into a black glaſs.

Localities, &c.—This mineral has been found in Brittany in France, imbedded in argillaceous ſchiſtus; in the Pyrenees, in a ſimilar rock, lying immediately on granite, near St Jacques de Compoſtella in Spain; and in the mountains of Cumberland, alſo imbedded in argillaceous ſchiſtus.

The name *chiaſtolite* is derived from the appearance of the ſection of the cryſtal, which is ſuppoſed to have ſome reſemblance to the Greek letter χ.

56. Species. SCAPOLITE.

Scapolithe, Brochant. ii. 526. *Id.* Hauy, iv. 393. *Rapidolithe*, Abilgaard.

Exter. Char.—This mineral has been found maſſive, but moſt frequently cryſtallized in rectangular, four-ſided priſms, having the lateral edges truncated. The cryſtals are ſmall, ſometimes acicular, commonly elongated and aggregated. Their ſurface is longitudinally ſtreaked and glimmering. Internal luſtre weakly ſhining, vitreous or reſinous. Fracture foliated.

Colour grayiſh white; tranſlucent, or rarely tranſparent. Scratches glaſs, and is brittle. Spec. grav. 3.68 to 3.70.

Chem. Char.—Froths up before the blow-pipe, and melts into a white enamel.

Localities, &c.—This mineral has been found in the mines of iron ore near Arendal in Norway. The cryſtals are mixed with mica and calcareous ſpar.

57. Species. ARCTIZITE.

Wernerite, Hauy, iii. 119. *Id.* Brochant, ii. 529.

Eſſen. Char.—Spec. grav. 3.6. Phoſphoreſcent by heat, but not by percuſſion.

Exter. Char.—This mineral is found maſſive, or cryſtallized in four-ſided rectangular priſms, terminated by an obtuſe four-ſided pyramid. The lateral edges are truncated, ſo that the priſm appears to be eight-ſided. Cryſtals ſmall; luſtre reſplendent, ſometimes weakly ſhining, and pearly or reſinous. Fracture foliated. Folia curved in two directions.

Colour between piſtachio green and iſabella yellow. Tranſlucent. Scratches glaſs, and ſtrikes fire with ſteel. The powder thrown on hot coals phoſphoreſces in the dark.

Chem. Char.—Before the blow-pipe it froths up, and eaſily melts into an imperfect white, and opaque enamel. Inſoluble in nitric acid.

Localities, &c.—This mineral is found in the iron mines of Northo and Ulrica in Sweden, Bouoen near Arendal in Norway, and at Campo Longo in Switzerland.

58. Species. DIASPORE.

Id. Brochant, ii. 507. *Id.* Hauy, iv. 358.

Exter. Char.—This mineral is of a gray colour. Luſtre ſhining, pearly. Fracture foliated, with the folia a little curved; ſeparates into rhomboids, with angles about 130° and 50°; ſcratches glaſs. Spec. grav. 3.432.

Chem. Char.—A fragment of this ſtone heated for a a little in the flame of a candle decrepitates and diſperſes in all directions; from this property is obtained its name, which ſignifies *to diſperſe*. Heated in a cloſe crucible to prevent the fragments from flying off, they were reduced to white ſhining particles, ſomewhat reſembling boracic acid.

Conſtituent Parts.	Vauquelin.
Alumina,	80
Oxide of iron,	3
Water,	17
	100

Localities, &c.—The repoſitory of this mineral is unknown. It was connected with an argillaceous ochrey rock.

This mineral approaches nearly to hydrargillite or wavellite, deſcribed above, in its conſtituent parts; but the proportions and ſome of the external characters are different.

59. Species. SPODUMENE.

Id. D'Andrada, Jour. de Phyſ. an 8. p. 240. *Triphane*, Hauy, iv. 407. *Id.* Brochant, ii. 528.

Exter. Char.—This mineral is found in ſmall maſſes, which preſent ſome appearances of cryſtallization. Luſter ſhining, pearly. Fracture in the maſs radiated, of ſingle

Siliceous genus.

ſingle cryſtals foliated and diviſible in three directions, which ſometimes afford an oblique angled priſm of about 100° and 80°. Croſs fracture dull, rough, and ſplintery. In larger maſſes the fracture is radiated. Luſtre ſhining pearly. Scratches glaſs.

Colour greeniſh white or leek green. Tranſlucent at the edges. Brittle. Spec. grav. 3.192 to 3.218.

Chem. Char.—Before the blow-pipe it ſeparates at firſt into ſmall yellowiſh plates, and then melts into a grayiſh white tranſparent glaſs.

Conſtituent Parts.	Vauquelin.
Silica,	56.5
Alumina,	24
Lime,	5
Oxide of iron,	5
Loſs,	9.5
	100.0

Localities, &c.—This mineral has been found in the mines of Utoe near Dalero in Sweden. Its repoſitory ſeems to be a vein, where it is accompanied with quartz and black mica.

The name triphane has been given to this mineral by Hauy from its peculiar three-fold natural diviſions. It received the name ſpodumene, which ſignifies *covered with aſhes* from D'Andrada.

60. Species. MEIONITE.

Id. Hauy, ii. 586. *Id.* Brochant, ii. 519.

Eſſen. Char.—Diviſible parallel to the faces of a priſm with ſquare baſes. Eaſily fuſible into a ſpongy white glaſs.

Exter. Char.—It is found cryſtallized in four-ſided rectangular priſms whoſe lateral edges are always truncated. It is terminated by an obtuſe four-ſided pyramid ſet on the lateral edges. Sometimes the lateral edges are doubly truncated, thus forming a ſixteen-ſided priſm. The cryſtals are ſmall, adhering laterally and arranged in rows to the matrix. Luſtre ſhining, vitreous. Longitudinal fracture foliated, and parallel to the four faces of the priſm. Croſs fracture ſlightly conchoidal.

Colour grayiſh white. Semi-tranſparent. Scratches glaſs.

Chem. Char.—Melts very eaſily before the blow-pipe with conſiderable intumeſcence accompanied with a hiſſing noiſe.

Localities, &c.—This mineral has only been found on Veſuvius near Mount Somma. The cryſtals are uſually attached to fragments of foliated limeſtone.

61. Species. SOMMITE.

Nepheline, Hauy, iii. 186. *Id.* Brochant, ii. 522.

Eſſen. Char.—Diviſible parallel to the ſides and baſes of a regular ſix-ſided priſm. With difficulty ſcratches glaſs.

Exter. Char.—This mineral is found diſſeminated in grains or in ſmall cryſtals, which are commonly perfect ſix-ſided priſms. The lateral faces are ſmooth and ſhining with a vitreous luſtre. Longitudinal fracture foliated. Croſs fracture conchoidal and ſhining. Colour grayiſh white. Tranſlucent, rarely ſemitranſparent. The ſharp points ſcratch glaſs, the others leave only a white trace. Eaſily frangible. Specific gravity 3.2441.

Chem. Char.—Fuſible into a glaſs by long continued heat. Becomes opake in nitric acid, hence the name *nepheline*, ſignifying *cloudy*, given to it by Hauy.

Conſtituent Parts.	Vauquelin.
Silica,	46
Alumina,	49
Lime,	2
Oxide of iron,	1
Loſs,	2
	100

Localities, &c.—This mineral is found lining the cavities of rocks on Mount Somma, from whence its name *ſommite*. It is accompanied with veſuvian and black ſchorl, all which are ſuppoſed by ſome to be ejected matters from Veſuvius.

62. Species. ICHTHYOPHTHALMITE.

Id. D'Andrada. *Ichthyophthalme*, Brochant, ii. 552. *Apophyllite*, Hauy. *Id.* Brongniart, i. 385.

Exter. Char.—This mineral is found maſſive, and cryſtallized in rhomboids which approach nearly to the cube; in thick ſix-ſided tables, and in rectangular four-ſided tables, with truncated edges. Luſtre ſhining, pearly. Fracture foliated; cleavage ſingle; croſs fracture fine grained uneven, and weakly ſhining.

Colour yellowiſh or greeniſh white; tranſlucent or ſemitranſparent. Scratches glaſs; not eaſily frangible. Spec. grav. 2.46.

Chem. Char.—Expoſed to the blow-pipe, is with difficulty reduced to a white enamel. In nitric and muriatic acids it forms a jelly.

Conſtituent Parts.	Fourcroy and Vauquelin.
Silica,	51
Lime,	28
Potaſh,	4
Water,	17
	100

Localities, &c.—This mineral is found in the iron mine of Utoe in Sweden, imbedded in a violet-coloured limeſtone, and accompanied with greeniſh hornblende and oxide of iron.

IV. ARGILLACEOUS GENUS.

1. Species. NATIVE ALUMINA.

Native Argil, Kirw. i. 175. *L'Alumine Pure*, Brochant, i. 318.

Exter Char.—This mineral is found in kidney-form maſſes; it has no luſtre; fracture earthy; fragments blunt edged.

Colours ſnow or yellowiſh white; opaque; ſtains a little; tender or friable; adheres a little to the tongue, feels meagre; gives out an earthy ſmell when breathed on. Spec. grav. 1.305 to 1.66.

Chem.

Argillaceous genus.

Chem. Char.—Before the blow-pipe is abſolutely infuſible, but diſſolves almoſt entirely in acids.

Conſtituent Parts. Fourcroy.

Alumina,	45
Sulphate of lime,	24
Water,	27
Lime and ſilica,	4
	100

But according to the analyſis of others, it is compoſed almoſt entirely of pure alumina, mixed only with a ſmall proportion of lime and ſilica.

Localities, &c.—It is found at Halle in Saxony, in part of the garden belonging to the college, immediately under the ſoil; but being only in ſmall quantity, and in the neighbourhood of a large laboratory, has led to the ſuppoſition that it is an artificial production. It is ſaid that it has been alſo found at Magdeburg in Lower Saxony, in Sileſia, near Verona, and in England.

2. Species. PORCELAIN EARTH.

Porcelain Clay, Kirw. i. 178. *La Terre Porcelaine*, Brochant, i. 320. *Argile Kaolin, et Feldſpath Argilliforme*, Hauy, ii. 616.

Exter. Char.—This mineral is found maſſive, or diſſeminated; has no luſtre; ſtains ſtrongly; has little coherence; adheres a little to the tongue.

Colour reddiſh, yellowiſh, or grayiſh white.

Chem. Char.—Infuſible in the ſtrongeſt heat of a furnace.

Conſtituent Parts. Vauquelin.

Silica,	55.	71.15
Alumina,	27.	15.86
Lime,	2.	1.92
Oxide of iron,	.5	
Water,	14.	6.73
Loſs,	1.5	4.34
	100.0	100.00

Localities, &c.—This mineral is found in conſiderable abundance in beds and veins, in granite and gneis, eſpecially when the proportion of feldſpar is conſiderable. It abounds in China and Japan, where it is known by the name of kaolin; in Bohemia, Saxony, Denmark, and particularly in many places of France, as at Limoges and Bayonne, and in Cornwall in England. In many caſes it ſeems to be owing to the decompoſition of granite.

Uſes.—Porcelain earth, as its name imports, is employed either as it is found native, or mixed in certain proportions with other earths, in the manufacture of porcelain. That from Limoges in France is employed without any addition.

3. Species. COMMON CLAY.

This ſpecies is divided into five ſubſpecies: 1. loam; 2. pipe clay; 3. potters clay; 4. variegated clay; and, 5. ſlaty clay.

Claſſification.

Subſpecies 1. LOAM.

Exter. Char.—This mineral is found maſſive and in great abundance; has no luſtre; fracture uneven or fine earthy; fragments very blunt-edged; has little coherence; ſtains.

Colour yellowiſh-gray, or ſpotted with yellow and brown, feels ſomewhat greaſy, and adheres ſtrongly to the tongue.

Localities, &c.—Loam is found in great abundance every where, and perhaps it ought to be conſidered as a mixture of different ſubſtances, rather than as a ſimple mineral.

Subſpecies 2. PIPE CLAY.

Exter. Char.—This variety is found in great maſſes; has ſcarcely any luſtre; fracture fine earthy, or fine grained uneven; fragments ſharp-edged; has ſome coherence.

Colour grayiſh or yellowiſh white; ſtreak ſhining; feels greaſy, adheres ſtrongly to the tongue, and is eaſily frangible.

Localities, &c.—It is very abundant in moſt countries, and is uſually found in alluvial land.

Subſpecies 3. POTTERS CLAY.

Id. Kirw. i. 180. *Argile à Potier*, Brochant, i. 322.

Exter. Char.—This variety is alſo found maſſive, and in great abundance. It is intermediate between ſolid and friable; has no luſtre; fracture fine grained earthy, ſometimes coarſe grained uneven; fragments blunt-edged.

Colour yellowiſh, greeniſh, or grayiſh white; ſometimes reddiſh or ochrey yellow of various ſhades. It is opaque, ſtains a little; ſtreak a little ſhining; very brittle, and eaſily frangible; is ſomewhat ductile; adheres a little to the tongue, and feels greaſy.

Chem. Char.—Is differently affected by the blow-pipe, according to the proportion of the different ſubſtances of which it is compoſed; but in general is difficult of fuſion. Effervefces with acids when the proportion of lime is conſiderable.

Conſtituent Parts. Vauquelin.

Silica,	43.5
Alumina,	33.2
Lime,	3.5
Oxide of iron,	1.
Water,	18.
Loſs,	.8
	100.0

The proportions of ſilica and lime vary conſiderably; the ſilica is very often the predominant ingredient. Kirwan examined a potters clay, in which he found 63 parts of ſilica.

Localities, &c.—Potters clay is found in great abundance in moſt countries, and in ſimilar ſituations with the former. It often forms thick beds in alluvial land, alternating with beds of ſand.

Subſpecies 4. VARIEGATED CLAY.

Exter. Char.—This mineral is found maſſive. Has an ſſification.

Argillaceous genus.

an earthy fracture, a ſhining ſtreak, and is ſoft or friable.

The colour is white, red, or yellow, and theſe different colours are ſometimes in ſtripes, veins and ſpots. Adheres a little to the tongue, and feels ſomewhat greaſy. It is ſectile and light.

As this variety of clay forms with water a leſs tenacious maſs than ſome of the other varieties, it probably contains a greater proportion of ſiliceous earth.

Localities, &c.—This mineral is found in Upper Luſatia.

Subſpecies 5. SLATY CLAY.

Slate Clay, Shale, Kirwan, i. 182. *L'Argile Schiſteuſe*, Brochant, i. 327. *Argile Schiſteuſe Impreſſionée*, Hauy, iv. 448.

Exter. Char.—This ſubſpecies is found maſſive; internally dull, when free from mica; fracture ſlaty or earthy; fragments in tables.

Colour grayiſh, yellowiſh, or blackiſh, ſometimes reddiſh or browniſh; opaque; ſoft, ſectile, and eaſily frangible. Adheres to the tongue; feels meagre. Sp. grav. 2.6 to 2.68.

Localities, &c.—Uſually accompanies coal, ſo that it abounds in all coal countries. It is ſometimes mixed with ſand, mica, and iron pyrites. It is known in this country under the name of *ſhale*, and in Scotland particularly by that of *till*, or deſcribed under the more general denomination of one of the coal metals. Slaty clay is ſtill farther diſtinguiſhed by impreſſions of ferns, reeds, or graſſes. When it is of a black colour, it ſeems to be owing to a greater proportion of coaly matter.

4. Species. CLAY STONE, or INDURATED CLAY.

Indurated Clay, Kirwan, i. 181. *L'Argile Endurcie*, Brochant, i. 325.

Exter. Char.—Indurated clay is always found maſſive; it is dull; fracture compact, or fine earthy; but ſometimes ſplintery or even, and alſo ſometimes ſlaty. Fragments more or leſs ſharp edged, and ſometimes in tables.

Colour uſually bluiſh, yellowiſh, or greeniſh gray, and ſometimes pearl gray, grayiſh red, whitiſh, and browniſh. Theſe colours are often mixed, and are arranged in ſpots and ſtripes. Opaque, ſoft, rather brittle; eaſily frangible; adheres ſlightly to the tongue; feels greaſy. Spec. grav. inconſiderable. Gradually falls to pieces in water, or crumbles into powder. Has but little ductility.

Localities, &c.—Indurated clay is very common. It is found in veins, and ſometimes in very extenſive beds. It conſtitutes the baſis of many porphyries, eſpecially in Saxony, where it is abundant. It is found in many parts of Scotland, as on the Pentland hills in the neighbourhood of Edinburgh.

Stourbridge clay, according to Mr Kirwan, may be included under this variety. It is of a gray colour; does not adhere to the tongue; part is ſoon diffuſed in water, and another part falls into powder. Mr Kirwan found it to contain 12.5 of moiſture, 12 of a coarſe white ſand, 30 of a fine browniſh ſand, and even the remaining or argillaceous part was not entirely freed from ſand but by boiling in acids.

5. Species. ADHESIVE SLATE.

Le Schiſte à Polir, Brochant, i. 376. *Schiſte à Polir*, Hauy, iv. 449. *Poliſhing Slate*, Klaproth, i. 455. Analyt. Eſſ. Tranſl.

Exter. Char.—This mineral is found maſſive; is always internally dull; has a ſlaty or fine earthy fracture; fragments ſlaty or in tables.

Colour clear gray, whitiſh or reddiſh; opaque or ſlightly tranſlucent at the edges; gives a ſhining ſtreak; is ſectile, ſoft, and very eaſily frangible; adheres ſtrongly to the tongue: feels meagre. Specific gravity 2.08.

Chem. Char.—Immerſed in water, adheſive ſlate abſorbs it greedily, air bubbles being rapidly diſengaged and with noiſe; but does not become tenacious. When reduced to powder and calcined, it loſes about one-fifth of its weight. Expoſed to ſtrong heat, it is converted into a dark gray or yellowiſh and porous ſlag. (Brochant).

Conſtituent Parts. Klaproth.

Silica,	66.5	62.5
Alumina,	1.	.7
Magneſia,	1.5	8.
Lime,	1.25	.3
Oxide of iron,	2.5	4.
Carbone,	22.	.7
Water and air,	19.	22.
Loſs,	2.25	1.8
	100.00	100.0

Localities, &c.—Adheſive ſlate forms conſiderable beds at Menil-Montant near Paris. In theſe beds menilite already deſcribed is found.

6. Species. POLISHING SLATE.

Le Polierſchiefer, Brochant, i. 376.

Exter. Char.—This mineral is found maſſive; internally it is dull. Fracture ſlaty, but in ſome directions earthy. Fragments ſlaty or in tables.

Colour yellowiſh gray or white; and different colours appear diſpoſed in ſtripes; is ſoft; adheres to the tongue; feels meagre, and is rather light.

Localities, &c.—This mineral has been found only, it is ſaid, in Bohemia, near pſeudo volcanoes, and it is ſuppoſed, that it is nothing more than indurated coal aſhes. It approaches ſo near in the characters that are given of it to the following, that it might be included under the ſame ſpecies, or conſidered as a variety of it.

7. Species. TRIPOLI.

Id. Kirw. ii. 202. *Le Tripoli*, Broch. i. 379. *Quartz Aluminifere Tripoléen*, Hauy, iv. 467.

Exter. Char.—This mineral is found maſſive; is dull internally; has a coarſe earthy fracture, ſometimes ſlaty; fragments blunt edged.

Colour yellowiſh gray, and ſometimes browniſh red. Is ſoft and ſomewhat friable; meagre to the feel, but does not adhere to the tongue.

Chem. Char.—It is almoſt infuſible before the blowpipe.

pipe. It melts with borax without frothing up. It does not form a paſte with water.

Conſtituent Parts. Haaſſe.

Silica,	90
Alumina,	7
Oxide of iron,	3
	100

Localities, &c.—This ſubſtance was formerly brought to Europe from Tripoli; hence the name; but it has ſince been found in many other places, as in Bavaria, Saxony, and Bohemia; in Ruſſia and in England. It is found in the neighbourhood of baſalts, ſometimes forming veins; at Potſchappel it is diſpoſed in beds among the ſtrata of coal, and near thoſe places where ſtrata of coal have been on fire.

Uſes.—Tripoli is employed in poliſhing metals, precious ſtones, and glaſſes for optical inſtruments.

8. Species. FLOATSONE.

Exter. Char.—This mineral has been found in tuberoſe porous maſſes; it is dull, has an earthy fracture, and blunt-edged fragments.

The colour is yellowiſh gray or grayiſh white. It is ſoft and brittle; rough to the feel, and gives out a creaking ſound. It is very light, from which it has its name.

Localities, &c.—Has been only found at St Omers near Paris.

9. Species. ALUM STONE.

La Pierre Alumineuſe, Broch. i. 381.

Exter. Char.—This ſtone is found maſſive; is generally dull, rarely a little glimmering; fracture uneven, ſometimes ſplintery; fragments not very ſharp-edged.

Colour grayiſh or yellowiſh white: it is ſoft, and ſometimes ſemihard; ſtains a little, and adheres to the tongue.

Chem. Char.—This mineral does not effervеſce with acids; but after being heated and diſſolved in water, it affords alum. According to Bergman it contains 43 of ſulphur, 35 of alumina, and 22 of ſilica; but the following is the reſult of Vauquelin's analyſis.

Conſtituent Parts.

Alumina,	43.92
Silica,	24.
Sulphurous acid,	25.
Sulphate of potaſh,	3.08
Water,	4.
	100.00

Localities, &c.—This mineral has been long known under the name of the *ſtone of Tolfa,* from the name of the place where it is found near Rome, and where it forms a mountain which is traverſed by veins of whitiſh gray quartz. It is from this ſtone that the Roman alum, ſo celebrated in commerce, is manufactured; and it has been ſuppoſed that the excellence of the alum is owing to the mineral containing within itſelf all the ingredients neceſſary in the formation of that triple ſalt.

10. Species. ALUMINOUS SCHISTUS.

This is divided into two varieties or ſubſpecies; 1. common; and, 2. ſhining.

Subſpecies 1. COMMON ALUMINOUS SCHISTUS.

Le Schiſte Alumineux, Broch. i. 386.

Exter. Char.—This mineral is found in maſſes, which often contain pieces of a globular form. It is ſometimes glimmering, and ſometimes dull; fracture commonly flaty, and ſometimes a little earthy; fragments in tables; ſtreak the ſame as the colour of the mineral, a little ſhining.

Colour grayiſh black or browniſh; is ſoft; meagre to the feel, and eaſily frangible.

Chem. Char.—When expoſed to the air for ſome time it ſeparates, and yields alum by lixiviation.

Localities, &c.—Aluminous ſchiſtus is abundant in Saxony, Bohemia, France, England, and ſome parts of Scotland. It is diſpoſed in beds among ſtratiform rocks, and in tranſition rocks, and it is often traverſed by veins of quartz. Being mixed with pyrites, the decompoſition is thus promoted when expoſed to the air.

Uſes.—This mineral is dug out for the purpoſe of extracting alum, firſt by expoſing it to the air or heat, and then by lixiviation.

Subſpecies 2. SHINING ALUMINOUS SCHISTUS.

Le Schiſte Alumineux Eclatant, Broch. i. 388.

Exter. Char.—This mineral approaches very nearly to the former in moſt of its characters, but in the direction of its principal fracture the external ſurface is ſmooth; luſtre ſhining, or reſplendent, reſinous, and even ſomewhat metallic; in the oppoſite directions it is dull. Fracture commonly ſlaty, and ſomewhat curved; fragments in tables.

Colour intermediate between bluiſh and grayiſh black, and ſometimes iron black. Colours in the rents irideſcent.

In other characters and circumſtances it reſembles the former.

11. Species. BITUMINOUS SCHISTUS.

Le Schiſte Bitumineux, Broch. i. 289. *Bituminous Shale,* Kirw. i. 183.

Exter. Char.—This mineral is found maſſive; luſtre glimmering; fracture moſt commonly thin, rarely thick; fragments in the form of tables, ſometimes trapezoidal.

Colour browniſh black, ſometimes gray, or blackiſh brown; ſoft, and eaſily frangible; adheres ſlightly to the tongue; ſtreak ſhining; feels greaſy.

Chem. Char.—When placed on burning coals it gives out a pale flame with a ſulphureous odour, becomes white, and loſes a good deal of its weight.

Localities, &c.—This mineral is peculiar to coal countries, which it always accompanies, and alternates with

with ſlaty clay and coal. It is not unfrequent in Bohemia, Poland, England, and Scotland.

12. Species. DRAWING SLATE.

Black Chalk, Kirwan, i. 195. *Le Schiſte, à Deſſiner*, Broch. i. 391. *Argile Schiſteuſe Graphique*, Hauy, iv. 447.

Exter. Char.—This mineral is found maſſive, uſually dull; but in the direction of the principal fracture a little glimmering; fracture in certain directions curved ſlaty; in others fine grained earthy; fragments ſplintery or tabular.

Colour grayiſh or bluiſh black; opaque; ſtains black; ſoft; meagre to the feel.

Chem. Char.—Before the blow-pipe it becomes covered with a kind of varniſh.

Conſtituent Parts.	Wiegleb.
Silica,	64.50
Alumina,	11.25
Carbone,	11
Oxide of iron,	2.75
Water,	7.50
Loſs,	3
	100.00

Localities, &c.—Drawing ſlate frequently accompanies aluminous ſchiſtus. It forms along with it beds which are ſubordinate to clay ſlate. It is found in Italy, where it is an object of commerce. It is alſo found in Spain, France, and ſome parts of Scotland.

Uſes.—As its name indicates, it is employed like black chalk in drawing.

13. Species. WHET SLATE.

Novaculite, Kirw. i. 238. *Le Schiſte à Aiguiſer*, Brochant, i. 393. *Argile Schiſteuſe Novaculaire*, Hauy, iv. 448.

Exter. Char.—This mineral is found maſſive; is ſcarcely glimmering; fracture in large maſſes ſlaty, in ſmall pieces ſplintery; fragments tabular.

Colour commonly greeniſh gray, or ſmoke gray, Sometimes mountain green: tranſlucent at the edges; ſemihard, but varying between hard and ſoft; rather eaſily frangible; ſtreak grayiſh white; feels greaſy; does not adhere to the tongue. Specific gravity 2.722.

Chem. Char.—Does not efferveſce with acids, and is infuſible before the blow-pipe.

Localities, &c.—Whet ſlate is found in primitive mountains, where it forms beds which are ſubordinate to clay ſlate. It was originally brought from the Levant; but has ſince been diſcovered in Bohemia, Saxony, in Bayreuth, where it is wrought, and in Siberia. An effloreſcence has been obſerved on the ſurface, which is found to be ſulphate of magneſia; from which it is naturally ſuppoſed that the baſe of that ſalt forms one of its conſtituent parts.

Uſes.—Whet ſlate, as its name imports, is cut and poliſhed for the purpoſe of ſharpening knives and other inſtruments; and, reduced to powder, is employed in poliſhing ſteel.

14. Species. CLAY SLATE.

Argillite, or *Argillaceous Schiſtus*, or *Slate*, Kirwan, i. 234. *Le Schiſte Argilleux*, Brochant, i. 395. *Argile Schiſteuſe Tegulaire*, Hauy, iv. 447.

Exter. Char.—Clay ſlate is found maſſive, or diſſeminated, or in rounded pieces; internally it is a little ſhining or glimmering; rarely dull; the more the ſtructure is foliated, the greater is its luſtre. Luſtre ſometimes ſilky, pearly, or ſemimetallic. Fracture more or leſs ſlaty, ſometimes curved and waved, ſometimes earthy or ſplintery; fragments tabular, rarely ſplintery; ſometimes cubic or rhomboidal.

Colour chiefly gray of various ſhades; but ſometimes it is reddiſh, browniſh, or yellowiſh, or reddiſh brown. Different colours are ſo diſpoſed as to appear ſtriped, waved, ſpotted, or dendritic. It is in general ſoft; ſometimes ſemihard, ſectile, and eaſily frangible. Gives a grayiſh white ſtreak; feels greaſy. Spec. grav. 2.67 to 2.88.

According to Kirwan, clay ſlate is compoſed of ſilica, alumina, lime, magneſia, and iron, with ſome bituminous particles.

Localities, &c.—Clay ſlate belongs equally to the primitive, tranſition, and ſtratiform rocks, and frequently forms entire mountains. Primitive clay ſlate is ſometimes mixed with quartz, mica, hornblende, garnets, limeſtone, pyrites, cinnabar as at Idria; in general it abounds with metallic ores, either in veins or in beds.

Clay ſlate is very abundant in moſt countries; it is not unfrequent in many parts of Scotland; but the ſlate of Eaſdale, and the contiguous iſlands on the weſt coaſt, has long maintained a decided ſuperiority and preference to all others in this country.

Uſes.—Clay ſlate is in extenſive uſe for covering houſes, and then it is known in this country by the ſingle word *ſlate*. It is alſo employed in large plates for writing on, or tracing characters that are afterwards to be effaced.

15. Species. LEPIDOLITE.

Id. Kirwan, i. 208. *Id.* Hauy, iv. 375. *La Lepidolithe*, Brochant, i. 399.

Exter. Char.—Lepidolite is found maſſive, and diſſeminated in ſmall plates, which might be taken for mica. It is uſually glimmering, rarely ſhining. Luſtre ſemimetallic. Fracture fine grained uneven, rarely foliated. Fragments blunt edged.

Colour lilac blue, grayiſh and reddiſh brown; tranſlucent. Semihard; ſometimes ſoft; eaſily frangible; and feels meagre. Is eaſily ſcraped with the knife; but is with difficulty reduced to powder by trituration. The powder rubbed between the fingers has a greaſy feel. Spec. grav. 2.816 to 2.854.

Chem. Char.—Froths up under the blow-pipe, and melts into a tranſparent colourleſs globule; but with the addition of a little nitre it becomes violet.

Conſtituent Parts.

	Klaproth.	Vauquelin.
Silica,	54.5	54
Alumina,	38.25	20
Potaſh,	4.	18
Fluate of lime,	–	4
Oxide of iron and mangane ſe,	.75	1
Water and loſs,	2.5	3
	100.00	100

Localities, &c.—This mineral was firſt diſcovered in the mountain Gradiſko near Roſena in Moravia, where it is found in conſiderable maſſes included in blocks of granite. It is found alſo in Sweden. Sometimes it is diſſeminated in quartz rock.

The name, from λεπις, "a ſcale," is derived from its ſcaly ſtructure. Lepidolite was at firſt taken for fluate of lime or zeolite. A red coloured variety of ſchorlite was alſo ſuppoſed to be cryſtallized lepidolite.

16. Species. MICA.

Id. Kirw. i. 21. *Id.* Broch i. 402. *Id.* Hauy, iii. 208.

Exter. Char.—Mica is moſt commonly diſſeminated in thin tables, rarely maſſive or cryſtallized. The primitive form of its cryſtals is a rectangular priſm, whoſes baſes are rhombs with angles of 120° and 60°; the integrant molecule is the ſame. The uſual forms of its cryſtals are, a ſix-ſided table with equal angles, ſometimes very thick, which produces a ſix-ſided priſm, and the want of two of the faces produces the table with four rhomboidal faces; but the moſt common form of mica is in thin plates or ſcales of no determinate figure. The lateral faces of the baſes of the tables are ſmooth and reſplendent; luſtre metallic; fracture foliated, ſometimes curved or waved, and ſometimes radiated; fragments in the form of plates.

Colour uſually gray, aſh, yellowiſh, greeniſh, and blackiſh gray; in thin plates ſemitranſparent, or even tranſparent; otherwiſe, only tranſlucent on the edges; ſemihard, very eaſily frangible; flexible and elaſtic. Sp. grav. 2.79 to 2.93.

Phyſical Char.—Mica rubbed on Spaniſh wax communicates to it negative electricity.

Chem. Char.—Before the blow-pipe it is with difficulty fuſible into a whitiſh gray or green enamel. Black mica yields a black enamel, which is attracted by the magnet.

Conſtituent Parts.

	Vauquelin.	Bergman. Muſcovy Glaſs.	Kirwan. Colourleſs Mica.
Silica,	50.	40	38
Alumina,	35.	45	28
Lime,	1.33		
Magneſia,	1.35	5	20
Oxide of iron,	7.	9	14
Loſs,	5.32		
	100.00	100	100

Localities, &c.—Mica is one of the moſt common minerals, forming one of the conſtituent parts of granite, gneis, micaceous ſchiſtus, and other primitive rocks, and in ſome of them ſometimes forms particular ſmall veins. Mica alſo enters into the compoſition of ſtratiform rocks, as green ſtone, baſalt, wacken.

Cat gold and cat ſilver are varieties of mica of a gold or ſilver colour, which have a conſiderable luſtre, but inferior to that of theſe metals. It may be eaſily diſtinguiſhed by the ſtreak, which in the mica affords a whitiſh powder without any luſtre.

Uſes.—When mica is obtained in large and thin plates, it is employed as a ſubſtitute for glaſs, and for this purpoſe it has been uſed for windows of men of war, as on account of its elaſticity it is leſs ſubject to be broken from the concuſſion produced by the firing of cannon.

17. Species. PINITE.

Micarelle, Kirw. i. 212. *La Pinite*, Broch. i. 456.

Exter. Char.—This mineral has been uſually found cryſtallized in ſix-ſided priſms, having all the lateral edges truncated, or only three alternating edges, or in four-ſided rhomboidal priſms. The ſurfaces of the cryſtals ſmooth and a little glimmering; internally it is dull, ſometimes a little ſhining in the croſs fracture; the fracture is fine grained, uneven, or ſmall conchoidal; fragments blunt-edged.

Colour reddiſh or blackiſh brown; opaque; the brown variety is ſlightly tranſparent; ſo ſoft as to be cut with a knife, when it becomes of a bluiſh black; powder bright gray; adheres a little to the tongue; feels greaſy; ſp. grav. 2.98.

Conſtituent Parts.	Klaproth.
Alumina,	63.75
Silica,	29.50
Oxide of iron,	6.75
	100.00

Localities, &c.—Pinite is found only near Schneeberg in Saxony, in the mine called *Pini;* hence its name. It is accompanied by quartz, feldſpar and mica, which conſtitute a ſmall grained granite.

18. Species. POTSTONE.

Id. Kirw. i. 155. *La Pierre Ollaire*, Broch. i. 405. *Talc Ollaire*, Hauy, iii. 257.

Exter. Char.—Potſtone is found maſſive; internally it is dull, ſometimes glimmering or a little ſhining, pearly; fracture curved ſlaty, rarely foliated or waved; fragments blunt edged, in the form of tables or ſcales.

Colour greeniſh gray, ſometimes reddiſh or yellowiſh; opaque, rarely tranſlucent on the edges; ſoft, ſectile, and mild, feels greaſy; by being breathed upon it emits the argillaceous ſmell. Spec. grav. 2.76 to 2.86.

Chem. Char.—Infuſible before the blow-pipe; ſome varieties abſorb a little water.

Conſtituent

Conſtituent Parts.	Wiegleb.
Silica,	38.12
Magneſia,	38.54
Alumina,	6.66
Lime,	.41
Oxide of iron,	15.02
Fluoric acid ?	.41
Loſs,	.84
	100.00

Localities, &c.—Potſtone is found at Chiavenna, in the Valteline, from which the ſpecimen above analyzed was obtained; at Como, in Switzerland, hence called *Como ſtone.* It is alſo found in Saxony, Hungary, and on the banks of Loch Fine oppoſite to Inverary in Scotland. Potſtone forms entire beds, and is uſually accompanied by ſerpentine, or it is in neſts; it is rarely pure, but mixed with chlorite, talc, aſbeſtus, &c.

Uſes.—On account of the refractory nature of this ſtone, it is employed in the conſtruction of furnaces where great heat is required; and as it may be cut or turned on the lathe, it has been formed into utenſils for the kitchen, and hence the name *potſtone.*

19. Species. CHLORITE.

Id. Kirw. i. 147. *La Chlorite,* Broch. i. 408. *Talc Chlorite,* Hauy, iii. 257.

Chlorite is divided into four ſubſpecies: 1. earthy; 2. common; 3. foliated; 4. ſchiſtoſe or ſlaty.

Subſpecies 1. EARTHY CHLORITE.

Exter. Char.—This mineral is compoſed of ſmall, ſcaly, thin, and ſlightly glimmering particles, cohering together, rarely in the form of powder.

Colour intermediate between mountain green and dark leek green; ſometimes browniſh; does not ſtain; feels greaſy, but does not adhere to the tongue; gives an earthy ſmell by breathing on it.

Chem. Char.—Melts before the blow-pipe into a gray or black enamel.

Conſtituent Parts.	Vauquelin.
Silica,	26.
Alumina,	18.50
Magneſia,	8.
Muriate of ſoda,	2.
Oxide of iron,	43.
Water,	2.
Loſs,	.50
	100.00

Localities, &c.—Earthy chlorite is always found in primitive mountains, forming beds which are ſubordinate to clay ſlate. It is found in Saxony, Switzerland, Savoy, and in Scotland.

Subſpecies 2. COMMON CHLORITE.

Exter. Char.—This is found maſſive and diſſeminated, or in thin ſuperficial layers on other ſtones; internal luſtre ſlightly glimmering, reſinous; fracture earthy, or foliated; fragments blunt-edged; ſoft, ſometimes ſemi-hard.

Colour ſimilar to the former, and ſometimes grayiſh white; is opaque, eaſily frangible; gives a light green ſtreak without luſtre.

Conſtituent Parts.	Hoepfner.
Silica,	41
Magneſia,	39
Alumina,	6
Lime,	1
Oxide of iron,	10
Loſs,	3
	100

Localities, &c.—Common chlorite is found in the ſame places with the former, and indeed it is ſuppoſed to be earthy chlorite indurated. At Altenberg in Saxony, it is mixed with pyrites of copper and arſenic, and common hornblende.

Subſpecies 3. FOLIATED CHLORITE.

Exter. Char.—This variety is found maſſive, diſſeminated, and cryſtallized in the form of a ſix-ſided table ſomewhat elongated; ſeveral of theſe tables being united together, frequently form globular, kidney-form, or botryoidal groups. External luſtre glimmering or weakly ſhining; internal ſhining, reſinous, or pearly; fracture foliated; folia curved; cleavage ſimple; fragments in tables.

Colour intermediate between leek and dark green; opaque, or tranſlucent at the edges; ſtreak light green; is ſoft, ſectile, eaſily frangible, and feels a little greaſy.

Conſtituent Parts.	Lampadius.
Silica,	35.
Magneſia,	29.9
Alumina,	18.
Oxide of iron,	9.7
Water,	2.7
Loſs,	4.7
	100.0

Localities, &c.—This mineral has been only found on St Gothard in Switzerland; it lines the ſides of a vein which traverſes micaceous ſchiſtus. It is accompanied by cryſtals of green mica, adularia, and quartz.

Brochant ſuggeſts that foliated chlorite may perhaps be nothing elſe than a cryſtallized mica.

Subſpecies 4. SCHISTOSE CHLORITE.

Exter. Char.—This variety is found maſſive; internal luſtre weakly ſhining, ſometimes ſhining, reſinous; fracture curved ſlaty, ſometimes waved, or a little ſplintery; fragments tabular.

Colour green; is ſoft, ſectile, and eaſily frangible; ſtreak light green; feels a little greaſy; gives the earthy ſmell by breathing.

Localities, &c.—Slaty chlorite is found in Norway, Sweden, Switzerland, in different parts of Scotland, as on the banks of Loch Lomond, and in the iſlands of

Bute and Arran. Sometimes it forms very extenſive beds in mountains of clay ſlate, to which it is ſubordinate; and it is frequently accompanied by garnets and magnetic iron, cryſtallized in octahedrons. The name is derived from the Greek word which ſignifies green.

20. Species. HORNBLENDE.

This is divided into four ſubſpecies; 1. common; 2. baſaltic; 3. labradore; and, 4. ſchiſtoſe.

Subſpecies 1. COMMON HORNBLENDE.

Hornblende, Kirw. i. 163. *Hornblende Commune*, Broch. i. 415. *Amphibole*, Hauy, iii. 58.

Exter. Char.—Hornblende is found maſſive or diſſeminated, and ſometimes cryſtallized. The forms are a four-ſided priſm, of which the acute oppoſite lateral edges are ſtrongly truncated; a ſix-ſided priſm with four broad and two narrow faces, ſlightly truncated on the lateral edges; a ſimilar ſix-ſided priſm, ſhort, and having the extremities bevelled; an eight-ſided priſm, having at its extremities, a convex bevelment. Sometimes the cryſtals are acicular and in groups; internal luſtre ſhining, vitreous, or pearly; fracture foliated, ſometimes radiated, and ſometimes fibrous; ſurface of the fracture longitudinally ſtreaked; fragments ſharp-edged, ſometimes rhomboidal.

Colour deep black, greeniſh black, or greeniſh gray; uſually opaque. The green varieties tranſlucent at the edges Soft or ſemihard; not eaſily frangible; ſtreak greeniſh gray; gives an earthy ſmell by breathing on it: ſp. grav. 3.6 to 3.88.

Chem. Char.—Before the blow-pipe it melts eaſily into a grayiſh black glaſs.

Conſtituent Parts.

	Kirwan.	Hermann.
Silica,	37	37
Alumina,	22	27
Magneſia,	16	3
Lime,	2	5
Oxide of iron,	23	25
Loſs,		3
	100	100

Localities, &c.—Hornblende is one of the conſtituent parts of primitive rocks, as in ſienite; and it ſeems alſo to be an accidental ſubſtance, as in gneiſs, primitive limeſtone, porphyries, and micaceous ſchiſtus. It is found alſo in maſſes or entire beds, as in Saxony; and is very common in moſt countries, as in Norway, Hungary, and Britain.

Uſes.—Sometimes employed as a flux for ores of iron.

Subſpecies 2. BASALTIC HORNBLENDE.

Baſaltine, Kirw. i. 219. *Horblende Baſaltique*, Roch. i. 424.

Exter. Char.—This mineral is moſt frequently found cryſtallized in equal ſix-ſided priſms, variouſly modified or with equal ſides; having two narrow and four broad; or four narrow and two broad; or three broad and three narrow alternately. The cryſtals are imbedded, inſulated, or grouped. Surface ſmooth, ſhining; internal luſtre reſplendent, in the croſs fracture weakly ſhining, vitreous; fracture foliated; croſs fracture ſmall grained, uneven, or conchoidal. Fragments nearly rhomboidal.

Colour velvet black, and ſometimes with a ſhade of green; opaque; ſtreak grayiſh white; ſemihard; earthy ſmell by expiration. Spec. grav. 3.22 to 3.33.

Chem. Char.—Before the blow-pipe melts leſs eaſily than the preceding, into a black glaſs.

Conſtituent Parts.	Bergman.
Silica,	58
Alumina,	27
Lime,	4
Magneſia,	1
Oxide of iron,	9
Loſs,	1
	100

Localities, &c.—This mineral, as its name imports, is uſually found in baſalt. It is alſo met with in wacken, and in the lava of Veſuvius. It is not uncommon in the baſaltic rocks of Sileſia, Saxony, and Bohemia, as well as in thoſe of this country. As it is leſs liable to decompoſition than the rocks which contain it, detached cryſtals are frequently found among decayed baſalt.

Subſpecies 3. LABRADORE HORNBLENDE.

La Hornblende du Labrador, Broch. i. 419.

Exter. Char.—This mineral is found maſſive, diſſeminated, in rounded pieces, and very rarely cryſtallized in four-ſided rectangular priſms. Internal luſtre ſhining, ſomewhat metallic; fracture foliated, ſometimes curved.

Colour blackiſh green, or greeniſh black; ſometimes bronze yellow; ſcarcely tranſlucent at the edges; ſemihard; not difficultly frangible; ſtreak greeniſh. Spec. grav. 3.28.

Localities, &c.—This mineral is found in the iſland of St Paul on the Labradore coaſt, but nothing is known of the nature of its repoſitory.

Subſpecies 4. SCHISTOSE HORNBLENDE.

Id. Kirw. i. 222. *La Hornblende Schiſteuſe*, Broch. i. 428.

Exter. Char.—This variety is found maſſive; internal luſtre weakly ſhining; fracture in maſſes ſlaty; in ſmall pieces radiated, ſometimes fibrous; fragments in plates.

Colour greeniſh, or grayiſh black; opaque; ſemihard; ſtreak greeniſh gray; rather difficultly frangible; breathed on, gives the earthy ſmell.

Localities, &c.—Schiſtoſe hornblende forms extenſive beds in primitive mountains, to which it is ſubordinate. It ſeems to be common hornblende more or leſs mixed with quartz. It is found in Bohemia, Norway, Sweden, in the iſle of Skye, and other places of Scotland.

21. Species. BASALT.

Figurate Trap, Trap, Whinſtone, &c. Kirw. i. 225—233. *Le Baſalte*, Broch. i. 430. *La Lithöide Priſmatique*, Hauy, iv. 474.

Exter. Char.—Baſalt forms entire mountains, in the neighbourhood of which it is found in rounded pieces, or in large globular maſſes; internally it is dull; ſometimes glimmering from a mixture of hornblende; fracture uneven, ſometimes fine ſplintery or conchoidal; fragments not very ſharp-edged. It is moſt frequently in diſtinct concretions, which are priſmatic or columnar, more or leſs regular; ſometimes alſo in globular diſtinct concretions.

Colour grayiſh or bluiſh black, ſometimes browniſh on the ſurface; opaque; ſemihard; brittle, and very difficultly frangible; ſtreak light aſh gray; gives a ringing ſound under the hammer. Spec. grav. 2.86 to 3.

Chem. Char.—Melts very eaſily before the blowpipe into an opaque black glaſs which acts on the magnet.

Phyſical Char.—Many baſalts affect the magnetic needle, reverſing the poles when it is brought near them. This is aſcribed to the great proportion of iron which enters into their compoſition.

Localities, &c. Baſalt is not uncommon in every part of the globe, and in many places it is very abundant. It is found in regular columns in ſeveral of the Hebrides on the weſt coaſt of Scotland, as in Cannay, Eigg, the Schant iſles, but particularly beautiful in Staffa. Pretty regular columns are obſerved alſo at Dunbar, and on the ſouth-weſt ſide of Arthur's ſeat near Edinburgh; but the Giant's cauſeway and the rocks about Fairhead on the north coaſt of Ireland, exhibit the fineſt and moſt extenſive ranges of columnar baſalt in the world.

Baſalt, beſides being in the columnar form, is often diſpoſed in beds and veins; both of which are very common in different places in Scotland, particularly on the weſtern coaſt, and in the weſtern iſlands. See Dr Millar's edition of *Williams's Mineral Kingdom.*

No ſubject, in geological ſpeculation, has produced more controverſial diſcuſſion than the origin of baſalt; one party aſſerting that it is the effect of fuſion, while another contends that it muſt have been depoſited from an aqueous ſolution. Our limits preclude us even from barely ſtating the arguments which have been propoſed by naturaliſts in ſupport of the theories which different parties have embraced. For an account of ſome of them, ſee GEOLOGY *Index*; and for the conſtituent parts of baſalt, and ſome other facts connected with its natural hiſtory, ſee BASALT.

Uſes.—Baſalt is ſometimes employed as a touchſtone, as a flux for ores of iron, and in the manufacture of common bottles. It is alſo employed for millſtones. The ancients employed it in ſculpture, for it would appear that ſome of their vaſes and ſtatues were formed of it.

22. Species. WACKEN.

Id. Kirw. i. 223. *La Wakke*, Broch. i. 434.

Exter. Char.—Wacken is found maſſive; it is frequently veſicular, and the cavities are often filled with other minerals; internal appearance dull; fracture even or earthy; fragments rather blunt-edged.

Colour grayiſh green, grayiſh black, reddiſh, or browniſh; opaque; ſtreak a little ſhining; ſoft or ſemihard; eaſily frangible; feels a little greaſy. Spec. grav. 2.53 to 2.89.

Chem. Char.—Fuſible like baſalt.

Localities, &c.—Wacken belongs to the ſtratiform rocks. It contains ſometimes petrified wood, and the bones of animals. It conſtitutes beds ſometimes in the middle of baſalt, but is oftener in the form of veins, and is the baſis of amygdaloid, the cavities of which are filled with green earth, calcareous ſpar, &c. Wacken is met with in Saxony, Bohemia, Sweden, and many places of Scotland.

23. Species. PHONOLITE, or *Clinkſtone.*

Id. Daubuiſſon, Jour. de Phyſ. lx. 74. *La Pierre Sonnante*, Broch. i. 437. *Klingſtein* and *Porphyrſchiefer* of the Germans.

Exter. Char.—This mineral is always found maſſive; internal luſtre glimmering; fracture ſlaty, ſometimes uneven or conchoidal; fragments ſharp-edged; compoſed of diſtinct concretions, which are either in the form of tables, or are columnar, and ſomewhat regularly grouped together.

Colour gray, aſh, greeniſh, or bluiſh gray; the colours ſometimes have a dendritical appearance; opaque, or tranſlucent at the edges; ſemihard, or hard; not difficultly frangible; in thin plates it emits a ſound when ſtruck with a hammer, and hence its name. Spec. grav. 2.575.

Chem. Char.—Melts before the blow-pipe into a colourleſs glaſs.

Conſtituent Parts.

	Klaproth.	Bergman.
Silica,	57.25	58.
Alumina,	23.5	24.5
Lime,	2.75	3.5
Oxide of iron,	3.25	4.5
——— manganeſe,	.25	—
Soda,	8.1	6.
Water,	3.	2.
Loſs,	1.9	1.5
	100.00	100.0

The ſtone analyzed above by Bergman, was from Puy in Velay, in France, and is conſidered by Dolomieu as volcanic. The other by Klaproth, is from Bohemia. Excepting the ſmall proportion of manganeſe detected in the latter, the coincidence of the two analyſes is very ſtriking.

Localities, &c.—Phonolite is not uncommon in many parts of the world. It is met with in Scotland, in the iſland of Lamlaſh near Arran; and it conſtitutes the greater part of Traprene Law in Eaſt Lothian; in both places it is columnar.

24. Species. LAVA.

Id. Kirw. i. 400. *La Lave*, Broch. i. 440. *La Scorifiee*, Hauy, iv. 497.

Exter. Char.—This mineral is generally of a porous texture, with cavities of different ſizes; luſtre glimmering

Argillaceous genus.

ing or a little ſhining, vitreous; fracture imperfectly conchoidal; fragments not very ſharp-edged.

Colour blackiſh gray, perfect black, or browniſh black, ſometimes greeniſh, and rarely white; opaque; ſemihard; brittle; not difficultly frangible; light.

Chem. Char.—Lava is very fuſible, and yields a compact black glaſs.

Conſtituent Parts.	Bergman.
Silica,	49
Alumina,	35
Lime,	4
Oxide of iron,	12
	100

Localities, &c—Lava being a volcanic product, is only found in the vicinity of volcanoes.

Uſes—Lavas are employed for the purpoſes of building; their lightneſs, ariſing from the numerous cavities, renders them proper for the conſtruction of vaults.

25. Species. GREEN EARTH.

Id. Kirw. i. 196. *La Terre Verte*, Brochant, i. 445. *Talc Chlorite Zographique*, Hauy, iii. 257.

Exter. Char.—Green earth is found maſſive, or diſſeminated, or in ſuperficial cruſts on balls of agate; internally it is dull; fracture earthy; fragments blunt-edged.

Colour celadon green, or blackiſh green; opaque; ſoft; feels ſlightly greaſy; adheres a little to the tongue; ſtreaks weakly ſhining.

Chem. Char.—Before the blow-pipe it becomes black, but is infuſible. It is not acted on by acids, and abſorbs water.

Conſtituent Parts.	Klaproth.
Silica,	53.
Alumina,	12.
Lime,	2.5
Magneſia,	3.5
Oxide of iron,	17.
Water,	12.
Loſs,	1.
	100.00

Localities, &c.—Green earth is found at Verona, where it is wrought, and conſtitutes an article of commerce; and it is met with in all amygdaloid rocks.

Uſes.—Green earth is employed as a colouring matter in painting.

26. Species. LITHOMARGA.

Id. Kirw. i. 187. *La Moelle de Pierre*, Brochant, i. 447. *Argile Lithomarge*, Hauy, iv. 444.

This is divided into two ſubſpecies, chiefly diſtinguiſhed by their coheſion. Theſe are, 1. friable; 2. indurated.

Subſpecies 1. FRIABLE LITHOMARGA.

Exter. Char.—This is found maſſive or diſſeminated; is ſlightly glimmering; adheres ſtrongly to the tongue; feels greaſy.

Colour yellowiſh white, ſnow white, ſometimes reddiſh; the particles have very little coheſion.

Claſſification.

Subſpecies 2. INDURATED LITHOMARGA.

Exter. Char.—This is alſo found maſſive or diſſeminated; is dull; has a fine grained earthy fracture, ſometimes conchoidal; blunt-edged.

Colour white, yellowiſh, or reddiſh white; browniſh red, and ſeveral ſhades of yellow. Different colours are diſpoſed in ſpots, veins, dots, ſtripes, or clouds; opaque; very ſoft; ſtreak ſhining; adheres to the tongue; feels greaſy.

Chem. Char.—Infuſible before the blow-pipe; falls to pieces in water without forming a paſte. According to ſome analyſes, it contains a large propertion of magneſia.

Phyſical Char.—Some varieties when rubbed with a feather in the dark, give a little light.

Localities, &c.—Lithomarga or ſtone marrow, derives its name from its being found in nodules in amygdaloid rocks; it occupies veins or ſmall fiſſures in porphyry, gneis, and ſerpentine. It is found in Bohemia, Saxony, France, England, and at the Giant's cauſeway in Ireland. A variety of lithomarga, which exhibits many fine colours, particularly violet or lavender blue, is found in beds repoſing on coal at Planitz, near Zwickau in Saxony. It has been called, from its beautiful appearance, *wonder earth* of Saxony (Terra miraculoſa).

27. Species. MOUNTAIN or ROCK SOAP.

Le Savon de Montagne, Brochant, i. 453.

Exter. Char.—This mineral is found maſſive; is dull internally; has an earthy, and ſometimes an imperfectly conchoidal fracture; fragments blunt-edged.

Colour browniſh black, ſpotted ochrey yellow. Opaque; very ſoft; eaſily frangible; ſtreak ſhining, and reſinous; ſtains and writes on paper; feels greaſy, and adheres ſtrongly to the tongue.

Localities, &c.—This mineral is rare; has been found at Olkutſch in Poland, and alſo, it is ſaid, in England.

28. Species. UMBER.

Exter. Char.—This mineral is found maſſive; fracture conchoidal; fragments blunt-edged.

Colour browniſh, of various ſhades; ſoft; adheres a little to the tongue, and has a meagre feel.

Localities, &c.—Umber is found diſpoſed in beds, in the iſland of Cyprus; and it is employed as a pigment.

29. Species. YELLOW EARTH.

Id. Kirw. i. 194. *La Terre Jaune*, Broch. i. 455.

Exter. Char.—Yellow earth is found maſſive; it is dull, or in the principal fracture, which is ſlaty, glimmering; croſs fracture earthy; fragments very blunt-edged.

Colour ochrey yellow; very ſoft; ſtreak ſhining; feels greaſy, and adheres a little to the tongue.

Localities, &c.—It has only been found in ſmall beds in ſtratified mountains, at Wehraw in Upper Luſatia,

ſatia, and it is ſaid, in the cavities of gray wacken, and in the fiſſures of a ſandſtone rock.

Uſes.—It is employed in the arts as a pigment.

V. MAGNESIAN GENUS.

1. Species. NATIVE MAGNESIA.

Magneſie Native, Brochant, ii. 449.

Exter. Char.—Native magneſia is found maſſive, tuberous or carious. Surface uneven and dull. Fracture flat, conchoidal, ſplintery or earthy. Fragments ſharp-edged.

Colour yellowiſh gray, with ſpots and dendritic delineations of black or blackiſh brown. Opaque, ſoft and eaſily frangible. Feels greaſy; adheres to the tongue, and is rather light.

Conſtituent Parts.

Carbonic acid,	51.
Magneſia,	47.4
A trace of iron,	
Loſs,	1.6
	100.0

Localities, &c.—This mineral was diſcovered by Dr Mitchell in a ſerpentine rock at Roubſchitz in Moravia.

A mineral in many reſpects ſimilar to this has been analyzed by Giobert*. It was long known under the name of *porcelain earth*, and was ſucceſsfully employed in that manufacture. Giobert ſuppoſes that the external characters, and particularly the colours, of the mineral found in Moravia, ſeem to indicate the exiſtence of other ſubſtances beſide thoſe detected by Dr Mitchell's analyſis.

Exter. Char.—The mineral deſcribed by Giobert is found maſſive or in mammillary fragments, ſome of which are tuberculated. Surface dull. Fracture conchoidal or uneven.

Colour pure white. Opaque. Spec. grav. variable. Hard, ſometimes ſoft. Feels greaſy; adheres ſlightly to the tongue. The ſofter varieties abſorb water greedily and with a hiſſing noiſe.

Chem. Char.—Infuſible before the blow-pipe.

Conſtituent Parts.

Magneſia,	68.
Carbonic acid,	12.
Silica,	15.6
Sulphate of lime,	1.6
Water,	3.
	100.2

Localities, &c.—This mineral is found at Baudiſſero, in a vein which traverſes a ſteatitic rock of which the mountain is compoſed.

2. Species. BOLE.

Id. Kirw. i. 190. *Le Bol*, Broch. i. 459. *Argile Ochreuſe*, Hauy, 445.

Exter. Char.—Found maſſive and diſſeminated; ſurface dull, ſometimes a little glimmering; fracture conchoidal; fragments ſharp-edged.

Magneſian genus.

Colour yellowiſh brown or reddiſh, with ſpots and dentritical figures of black; opaque, rarely tranſlucent at the edges; very ſoft; eaſily frangible; adheres to the tongue; feels greaſy; ſtreak ſhining: ſp. grav. 1.4 to 2.

Chem. Char.—Before the blow-pipe it becomes black or gray, and melts into a greeniſh gray ſlag. Falls to pieces in water with a crackling noiſe, and without forming a paſte.

Conſtituent Parts. Bergman.

Silica,	47.
Alumina,	19.
Magneſia,	6.2
Lime,	5.4
Oxide of iron,	5.4
Water,	17.
	100.0

Localities, &c.—The chief places which yield bole are the iſland of Lemnos, hence called *Lemnian earth*; Sienna in Italy, and Strigau in Sileſia, in which latter place it is depoſited on indurated clay; in Upper Luſatia it forms neſts in baſalt.

Uſes.—Bole and ſimilar earths were formerly employed in medicine; it is now only uſed in the preparation of colours.

CIMOLITE.

This is a mineral which in many of its characters is cloſely connected with the preceding.

Exter. Char.—It is found maſſive; fracture earthy uneven, or ſlaty; colour grayiſh white, pearl gray, and expoſed for ſome time to the air, reddiſh; opaque; does not ſtain; adheres ſtrongly to the tongue; is ſoft, and difficultly frangible: ſp. grav. 2.

Chem. Char.—Before the blow-pipe it becomes at firſt of a deep gray colour, but afterwards white.

Conſtituent Parts. Klaproth.

Silica,	63.
Alumina,	23.
Oxide of iron,	1.25
Water,	12.
Loſs,	.75
	100.00

Localities, &c.—This mineral was brought by Mr Hawkins from the iſland of Argentiers, formerly Cimolo, from whence it has its name. Olivier found a ſimilar ſubſtance in the iſland of Milo, but which was very friable.

Uſes.—This ſubſtance is employed in whitening woollen ſtuffs. It is deſcribed by Pliny under the name Cimolia, as being applied to the ſame purpoſe, and alſo as a medicine in his time.

It is to be obſerved that cimolite contains, according to the above analyſis, no magneſia.

3. Species. SEA FROTH.

Keſſekill. Kirw. i. 144. *L'Ecume de Mer*, Broch. i. 462. *Argile glaiſe*, Hauy, iv. 443. *Meerſchaum* of the Germans.

Exter.

---

* Jur. de Ph lx. 249

Magneſian genus

Exter. Char—This mineral is found maſſive, diſſeminated, or in ſuperficial layers. Surface dull Fracture fine earthy, ſometimes ſlaty. Fragments ſharp edged.

Colour yellowiſh white. Opaque. Very ſoft Eaſily frangible. Streak ſhining. Feels greaſy; and adheres to the tongue. Sp. gr. 1.6

Chem. Char.—Infuſible before the blow-pipe.

Conſtituent Parts. Klaproth.

Silica,	50.5	41.
Magneſia,	17.25	18.25
Lime,	.5	.5
Water,	25.	39.
Carbonic acid,	5.	
Loſs,	1.75	1.25
	100.00	100.00

Localities, &c.—Sea froth is found in Natolia, in the Crimea, in Spain and ſome other places. It appears to be diſtributed in low grounds in thin beds; and it is ſaid to be in the ſtate of ſoft paſte which hardens in the air.

Uſes.—It is employed in Turkey, in the manufacture of the heads of tobacco pipes; and as a deterſive ſubſtance, like fullers earth, by the Tartars.

4. Species. FULLERS EARTH.

Id. Kirw. i. 184. *La Terra à Foulon*, Broch. i. 464. *Argile Smectique*, Hauy, iv. 443.

Exter. Char.—Found maſſive. Surface dull. Fracture fine-grained earthy, conchoidal or ſlaty. Fragments blunt-edged.

Colour olive green, yellowiſh or reddiſh. Colours ſometimes mixed and diſpoſed in ſpots or ſtripes; opake; ſoft or friable. Streak ſomewhat ſhining. Sometimes adheres to the tongue; feels greaſy.

Chem. Char.—Does not efferveſce with acids; melts into a brown ſpongy clay; falls to pieces in water without forming a paſte, and does not froth up like ſoap.

Conſtituent Parts. Bergman.

Silica,	51.8
Alumina,	25.
Lime,	3.3
Magneſia,	.7
Oxide of iron,	3.7
Water,	15.5
	100.00

Localities, &c.—Fullers earth is found in Sweden, Saxony, and France, forming beds; but the beſt fullers earth is found between ſtrata of ſandſtone in Hampſhire and ſome other places of England.

Uſes.—Fullers earth is of great importance in woollen manufactures, on account of its deterſive properties. It is extenſively employed in the proceſs of fulling or cleanſing woollen ſtuffs from greaſy matters.

5. Species. STEATITES.

La Pierre de Lard, ou Steatite, Broch. i. 474. *Semi-indurated and Foliated Steatites*, Kirw. i. 151, and 154. *Talc Steatite*, Hauy, iii. 256.

Claſſification.

Exter. Char.—Steatites is found maſſive, diſſeminated, and cryſtallized. Forms of the cryſtals, a ſix-ſided priſm terminated by a ſix-ſided pyramid; a rectangular and rhomboidal four-ſided priſm; and a double ſix-ſided pyramid. The cryſtals are ſmall, generally imbedded in the maſſive variety; but they are very rare; and it is ſuppoſed, with ſome probability, that they are pſeudo-cryſtals. Surface of the cryſtals ſmooth and ſhining. Internally dull; fracture coarſe ſplintery, rarely earthy or ſlaty. Fragments blunt-edged.

Colour greeniſh, yellowiſh, reddiſh or grayiſh. Colours ſometimes mixed, and ſpotted or dendritical. Tranſlucent at the edges. Soft, ſometimes friable. Streak ſhining. Feels greaſy. Sp. gr. 2.614.

Chem. Char.—Infuſible before the blow-pipe; but becomes white and very hard.

Conſtituent Parts. Klaproth.

	From Cornwall.	From Bayreuth.
Silica,	48.	59.5
Magneſia,	20.5	30.5
Alumina,	14.	
Oxide of iron,	1.	2.5
Water,	15.5	5.5
Loſs,	1.	2.
	100.0	100.0

Localities, &c.—Steatites is found in primitive mountains, forming beds and veins in ſerpentine rocks; ſometimes in metallic veins, as in the tin mines near Freyberg. It is alſo imbedded in wacken, as in the iſland of Skye, and in veins of ſerpentine at Portſoy in Scotland. Steatites is alſo found in Cornwall in England, and in Sweden, Norway, Saxony, and France.

Uſes.—Steatites is ſometimes employed in the manufacture of porcelain, and ſome varieties of it anſwer for the ſame purpoſe as fullers earth.

6. Species. FIGURE STONE.

La Pierre à Sculpture, Broch. I. 451. *Le Bildſtein* of the Germans.

Exter. Char.—This mineral is found maſſive. Internal luſtre ſometimes glimmering, ſometimes dull, greaſy. Fracture ſlaty; croſs fracture ſplintery.

Colour, olive green, greeniſh gray, yellowiſh brown, ſometimes reddiſh, and veined. Semitranſparent, or tranſlucent at the edges, and ſometimes opake. Soft; ſectile; feels greaſy. Sp. gr. 2.78 to 2.81.

Conſtituent Parts. Klaproth.

	Tranſlucent.	Opaque Figure Stone.
Silica,	54.	62.
Alumina,	36.	24.
Lime,	—	1.
Oxide of iron,	.75	.5
Water,	5.5	10.
Loſs,	3.75	2.5
	100.00	100.0

Localities, &c.—This mineral is brought from China, and is always cut into various, often ſingular, figures; and hence the name *bildſtein*, or *ſculpture ſtone*.

7. Species.

7. Species. NEPHRITE, or *Jade*.

Jade, Kirw. i. 171. *Le Nephrite*, Broch. i. 467. *Jade*, Hauy, iv. 368.

This ſpecies is divided into two ſubſpecies.

Subſpecies 1. COMMON NEPHRITE.

Exter. Char.—This variety is found maſſive, diſſeminated, or in rounded pieces. The ſurface is ſmooth, glimmering, and unctuous; internally it is dull; fracture ſlaty or coarſe ſplintery, rarely fibrous; fragments ſharp-edged.

Colour leek green, ſometimes inclining to blue, greeniſh or yellowiſh white; tranſlucent, ſometimes only at the edges; hard; very difficultly frangible; feels greaſy. Sp. grav. 2.97 to 4.38.

Chem. Char.—Fuſible before the blow-pipe, and melts into a ſemitranſparent white glaſs.

Conſtituent Parts.	Hoepfner.
Silica,	47
Magneſia,	38
Alumina,	4
Lime,	2
Oxide of iron,	9
	100

Localities, &c.—The repoſitory of nephrite is unknown. It was originally brought from the Levant, Eaſt Indies, and China. It is found alſo in the Alps, in Switzerland, and in Piedmont. The water-worn pebbles which are collected on the banks of the lake of Geneva, often contain this mineral. It is found alſo in a ſimilar form at a particular place on the ſhores of Iona, one of the Hebrides, in Scotland.

Uſes.—Oriental nephrite, long known under the name of *Jade*, is held in conſiderable eſtimation on account of its hardneſs and tenacity. It is employed by the Turks for the handles of knives and ſabres, and frequently by others for various ornamental purpoſes.

The property of curing diſeaſes of the kidneys is aſcribed to this mineral by ancient authors, and hence the name *nephritic ſtone*, or *nephrite*.

Subſpecies 2. AXE STONE.

La Pierre de hache, Brochant, i. 470. *Beilſtein* of the Germans.

Exter. Char.—This is alſo found maſſive, but moſt frequently in rounded pieces; luſtre glimmering, or weakly ſhining; fracture in large maſſes, ſlaty; in ſmall, ſplintery; fragments in the form of plates.

Colour deep meadow-green, ſometimes olive green; tranſlucent; ſemihard, and ſometimes hard; not very brittle; more difficultly frangible than the preceding variety.

Localities, &c.—This mineral is found in China, the Eaſt Indies, and South America, on the banks of the river Amazons. It is found alſo in ſome of the iſlands in the South ſea, as well as in Corſica, Switzerland and Saxony.

Uſes.—Axe ſtone is employed as hatches and other cutting inſtruments by the natives of thoſe countries where iron is little known.

8. Species. SERPENTINE.

Id. Kirw. i. 156. *La Serpentine*, Brochant, i. 481. *Roche Serpentineuſe*, Hauy, iv. 436.

This ſpecies is divided into two ſubſpecies.

Subſpecies 1. COMMON SERPENTINE.

Exter. Char.—This mineral is found maſſive, very rarely diſſeminated; internal luſtre ſlightly glimmering, or only dull; fracture ſplintery, or fine grained uneven, rarely conchoidal; fragments ſharp-edged.

Colour blackiſh green, leek green, grayiſh, greeniſh, or bluiſh gray; in ſome varieties, red of various ſhades. Theſe colours are mixed and diſpoſed in ſpots, ſtripes, veins, and dots. Tranſlucent at the edges, or opaque; ſemihard; not difficultly frangible; feels greaſy. Spec. grav. 2.57 to 2.7.

Chem. Char.—Infuſible before the blow-pipe.

Conſtituent Parts.	Kirwan.
Silica,	45
Alumina,	18
Magneſia,	22
Oxide of iron,	3
Water,	12
	100

Localities, &c.—Serpentine belongs to the claſs of primitive rocks, and it conſtitutes entire mountains. It is found in Saxony, Bohemia, Italy, Corſica, and Siberia; in Cornwall in England, where it contains native copper, and at Portſoy in the north of Scotland, where it is known by the name of *Portſoy marble*. Common ſerpentine is frequently mixed with ſteatites, talc, aſbeſtus, garnets, and magnetic iron, but never contains limeſtone. This variety, in the language of Werner, is of a newer formation than the following ſubſpecies.

Uſes.—Serpentine is ſuſceptible of a fine poliſh; on account of which, and its beautiful colours, it is employed for various ornamental purpoſes.

Subſpecies 2. PRECIOUS SERPENTINE.

Exter. Char.—This alſo is found maſſive or diſſeminated; internal luſtre glimmering, rarely weakly ſhining, reſinous; fracture conchoidal, even or ſplintery; fragments ſharp-edged.

Colour dark leek green of various ſhades; tranſlucent; ſemi-hard; eaſily frangible; feels ſlightly greaſy.

Localities, &c.—This ſubſpecies is found in ſimilar places with the preceding. It is diſtinguiſhed from it by being always connected with limeſtone. The ſtones known in Italy by the name of *verde di Prato*, *verde Antico*, *verde di Suza*, which are very often accompanied by limeſtone, may be included under precious ſerpentine.

9. Species. SCHILLER STONE.

Schillerſpath, or *Spath Chatoyant*, Brochant, i. 421. *Schiller Spar*, Kirw. 221.

Magneſian genus.

Exter. Char.—This mineral is found diſſeminated in thin plates, which aſſume a cryſtallized form, as in that of a table with ſix ſides, or a ſhort ſix-ſided priſm; luſtre ſhining, ſometimes reſplendent, and ſemi-metallic; fracture foliated.

Colour olive green, bronze yellow, or ſilvery white; ſoft; eaſily frangible; ſomewhat elaſtic; feels greaſy.

Chem. Char.—Before the blow-pipe it melts with borax, into a glaſs which becomes opaque on cooling.

Conſtituent Parts.	Heyer.
Silica,	52
Alumina,	23.33
Magneſia,	6
Lime,	7
Oxide of iron,	11.67
	100.00

Localities, &c.—Schiller ſtone is found at Baſta in the Hartz, in Moravia, the Tyrol, in Corſica, and in Cornwall. It is uſually imbedded in ſerpentine, and is accompanied by quartz, mica, and copper pyrites. It is ſuppoſed by ſome to be cryſtallized ſerpentine.

10. Species. TALC.

This ſpecies is divided into three ſubſpecies; 1. earthy, 2. common, and 3. indurated talc.

Subſpecies 1. EARTHY TALC.

Talcite, Kirw. i. 149. *Le Talc Terreux*, Broch. i. 486. *Talc Granuleux*, Hauy, iii. 255.

Exter. Char.—Earthy talc is found diſſeminated in kidney-form maſſes, or in ſuperficial layers; luſtre glimmering, pearly; friable; the particles ſcaly, pulverulent, or ſlightly cohering.

Colour greeniſh, reddiſh, or ſilvery white; ſtains; feels greaſy, and is light.

Localities, &c.—This mineral is found in Piedmont, Saxony, Bohemia, and in the weſtern parts of Inverneſsſhire in Scotland, where it exiſts in veins or cavities of primitive rocks.

Subſpecies 2. COMMON TALC.

Id. or *Venetian Talc*, Kirw. i. 150. *Le Talc Commun*, Broch. i. 487. *Talc Laminaire*, Hauy, iii. 255.

Exter. Char.—This mineral is found maſſive, diſſeminated, and rarely cryſtallized in very ſmall ſix-ſided tables; luſtre ſhining or reſplendent, pearly or metallic; fracture ſtraight or curved foliated; fragments wedge-ſhaped.

Colour greeniſh white, pale apple green, reddiſh or yellowiſh white; tranſlucent or ſemitranſparent, in thin plates tranſparent; ſoft, flexible, but not elaſtic; feels greaſy. Spec. grav. 2.7 to 2.8

Chem. Char.—Infuſible before the blow-pipe, which diſtinguiſhes it from chlorite; does not effervеſce with acids.

Conſtituent Parts.	Hoepfner.
Silica,	50
Magneſia,	44
Alumina,	6
	100

Claſſification.

Localities, &c.—Common talc is always found in ſerpentine rocks, where it accompanies actynolite, ſteatites, and indurated talc. What is called Venetian talc is brought from the mountains of Saltzburg and the Tyrol.

Uſes.—Talc is ſometimes employed as a ſubſtitute for chalk, enters into the compoſition of crayons, and is mixed with ſome kinds of paint.

Subſpecies 3. INDURATED TALC.

Le Talc Endurci, Broch. i. 489.

Exter. Char.—This is found maſſive, and ſometimes, it is ſaid, cryſtallized; luſtre ſhining and reſplendent, reſinous or pearly; fracture curved foliated, or ſlaty; fragments blunt-edged, tabular.

Colour greeniſh white, ſnow white, or apple green; tranſlucent; in thin plates ſemitranſparent; very ſoft; ſmooth, and greaſy to the feel.

Localities, &c.—Indurated talc forms beds in mountains of argillaceous ſchiſtus, gneis, and ſerpentine, in the Tyrol, Italy, and Switzerland, and alſo in the weſtern parts of Scotland.

Uſes.—It is applied to the ſame purpoſes as the preceding.

11. Species. ASBESTUS.

This is divided into four ſubſpecies: 1. mountain cork; 2. amianthus; 3. common aſbeſtus; and, 4. ligniform aſbeſtus.

Subſpecies 1. MOUNTAIN CORK.

Suber Montanum, Kirw. i. 163. *Le Liege de Montagne*, Broch. i. 492. *Aſbeſte Treſſé*, Hauy, iii. 247.

Exter. Char.—This mineral is found maſſive, often in ſmall plates, which are ſometimes thin, and are then denominated *mineral paper;* ſometimes thick, and then called *mineral leather;* more rarely in porous or cellular pieces, when they are denominated *mineral fleſh;* ſometimes it is marked with impreſſions; the luſtre is weakly glimmering or dull; fracture to appearance compact and uneven, but it is fibrous, and the fibres are ſometimes parallel, and ſometimes interwoven; fragments very blunt-edged.

Colour yellowiſh or grayiſh white; opaque; very ſoft, extremely difficult to break; in thin plates flexible and elaſtic; creaks when handled; feels meagre. Spec. grav. 0.68 to 0.993.

Chem. Char.—Melts before the blow-pipe with difficulty.

Conſtituent Parts.	Bergman.
Silica,	56.2
Magneſia,	26.1
Alumina,	2
Lime,	12.7
Oxide of iron,	3
	100.0

Localities, &c.—This mineral is found in thin veins in ſerpentine rocks: it is often mixed with quartz, talc, and ſilver ores, as in Saxony. It is alſo found in Sweden, Norway, Siberia, Hungary, and in the lead veins at Leadhills in Scotland.

Subſpecies 2. AMIANTHUS.

Id. Kirw. i. 161. *L'Amianthe*, Broch. i. 494. *Aſbeſte Flexible*, Hauy, iii. 247.

Exter. Char.—This variety is alſo found maſſive, more rarely diſſeminated, and in ſmall detached bundles; luſtre glimmering, or a little ſhining and ſilky; fracture fibrous ſtraight or parallel.

Colour greeniſh or ſilvery white, yellowiſh white, or greeniſh gray; opaque; rarely tranſlucent at the edges; very flexible, and even elaſtic in thin fibres; feels greaſy.

Chem. Char.—Melts with difficulty before the blow-pipe, into a white, gray, yellow, and ſometimes black enamel.

Conſtituent Parts.	Bergman.		Chenevix.
Silica,	64	64	59.
Magneſia,	17.2	18.6	25.
Alumina,	2.7	3.3	3.
Lime,	13.9	6.9	9.25
Barytes,		6.	
Oxide of iron,	2.2	1.2	2.25
Loſs,			1.50
	100.0	100.0	100.00

Localities, &c.—Amianthus is uſually found in primitive rocks, but particularly thoſe of ſerpentine. It is found in Saxony, Bohemia, Italy, Spain, France, Sweden, and in the weſtern parts of Scotland; but the fineſt ſpecimens of amianthus are brought from the iſland of Corſica.

Uſes.—On account of the flexibility of this ſubſtance it is ſpun into threads; for this purpoſe it is mixed with lint, to render the threads leſs brittle in working them into cloth, which is afterwards paſſed through the fire that the vegetable matter may be conſumed, and the amianthus, which is infuſible, remains; and thus an incombuſtible cloth is obtained. The ancients manufactured this cloth for the purpoſe of wrapping round their dead bodies, that their aſhes might be preſerved unmixed with the wood employed in burning them.

Subſpecies 3. COMMON ASBESTUS.

Aſbeſtus, Kirw. i. 159. *L'Aſbeſte Commune*, Brochant, i. 497. *Aſbeſte Dur*, Hauy, iii. 247.

Exter. Char.—This alſo is found maſſive; luſtre ſhining and weakly ſhining, ſilky or reſinous; ſurface fibrous, the fibres being parallel, ſtraight, or curved; the fibres are more ſtrongly united than in amianthus, and hence ſometimes a ſplintery fracture.

Colour leek green, greeniſh, or yellowiſh gray; tranſlucent at the edges; ſoft, or ſemihard; rather eaſily frangible; little flexible; feels greaſy; ſpec. grav. 2.54 to 2.99.

Chem. Char.—Melts with difficulty before the blow-pipe, into a dark gray ſlag.

Conſtituent Parts.	Wiegleb.
Silica,	46.66
Magneſia,	48.45
Oxide of iron,	4.79
Loſs,	.1
	100.00

Localities.—It is found in ſimilar ſituations with the preceding, in Saxony, Ruſſia, Sweden, and in the weſtern parts of Scotland.

Subſpecies 4. LIGNIFORM ASBESTUS.

Id. Kirw. i. 161. *Le Bois de Montagne*, Brochant, i. 499. *Aſbeſte Ligniforme*, Hauy, iii. 248.

Exter. Char.—This alſo is found maſſive; luſtre glimmering, ſilky; fracture in large maſſes, curved ſlaty; in ſmall pieces fibrous, and having the appearance of a woody texture; fragments in elongated plates.

Colour yellowiſh brown of different ſhades; opaque; ſoft; not difficultly frangible; in thin fragments a little flexible, but not elaſtic; feels meagre; adheres to the tongue; ſtreak ſhining.

Chem. Char.—Before the blow-pipe is only fuſible at the edges.

Localities, &c.—This variety is found in the Tyrol, where it is accompanied by galena, black blende, and a grayiſh white quartz.

12. Species. CYANITE.

Id. Kirw. i. 209. *La Cyanite*, Broch. i. 501. *Sappare*, *Sauſſ.* § 1900. *Diſthene*, Hauy, iii. 220.

Exter. Char.—This mineral is found maſſive, diſſeminated, or cryſtallized, in four-ſided priſms, of which two are broad and two narrow, and having the four lateral edges, or only the two oppoſite edges, truncated. This priſm is often ſo flattened, as to have the appearance of a table. The broad faces of the cryſtals are ſmooth and ſhining, the narrow faces ſtreaked and only glimmering, almoſt dull. Internal luſtre ſhining and pearly; fracture curved radiated; that of the cryſtals foliated; fragments tabular, ſometimes ſplintery, or imperfectly rhomboidal.

Colour blue of various ſhades, ſometimes bluiſh and pearl gray; and different colours are arranged in ſtripes, ſpots, or clouds; tranſlucent, or when cryſtallized ſemitranſparent, or tranſparent; ſemihard, and ſometimes ſoft; eaſily frangible; feels greaſy. Spec. grav. 3.51 to 3.62.

Chem. Char.—Entirely infuſible before the blow-pipe, on which account this mineral was employed by Sauſſure as a ſupport for other ſubſtances in experiments with that inſtrument.

Conſtituent Parts.	Sauſſure.
Silica,	29.2
Alumina,	55.
Lime,	2.25
Magneſia,	2.
Oxide of iron,	6.65
Water and loſs,	4.9
	100.00

Localities, &c.—Cyanite is found on St Gothard in Switzerland, in cryſtals mixed with quartz, garnets, and granite, and imbedded in indurated talc. It is alſo found in Spain, France, Carinthia, Bavaria, Siberia, and in the north of Scotland, and always in primitive mountains.

13. Species. ACTYNOLITE.

This is divided into three ſpecies; 1. aſbeſtous, 2. common, and 3. glaſſy.

Subſpecies 1. ASBESTOUS ACTYNOLITE.

Amianthinite, Kirw. i. 164. and *Metalliform Aſbeſtoid*, ibid. 167. *La Rayonnante Aſbeſtiforme*, Broch. i. 504. *Actinote Aciculaire*, Hauy, iii. 75.

Exter. Char.—This mineral is found maſſive, and rarely cryſtallized in rhomboidal ſix-ſided priſms, two of which are about 124° 30′, and four about 117° 45′; luſtre glimmering; internal luſtre weakly ſhining, ſometimes ſhining, pearly; fracture radiated; fragments wedge-ſhaped.

Colour white, or greeniſh, reddiſh, or yellowiſh gray; commonly opaque; ſometimes traſlucent at the edges; ſtreak greeniſh white; ſoft, rarely ſemi-hard; rather difficultly frangible. Specific gravity 2.58 to 3.33.

Chem. Char.—Fuſible before the blow-pipe into a black ſlag, or grayiſh white enamel.

Localities, &c.—Found in the neighbourhood of Bayreuth and the Bannat, in beds of ſerpentine and ſteatites.

Subſpecies 2. COMMON ACTYNOLITE.

Aſbeſtinite, Common, Aſbeſtoid, and *Schorlaceous Actynolite*, Kirw. i. 165—168. *La Rayonnante Commune*, Broch. i. 507. *Actinote Hexaëdre*, Hauy, iii. 74.

Exter. Char.—Maſſive, diſſeminated, cryſtallized in elongated, very oblique, ſix-ſided priſms, having the acute lateral edges truncated. The cryſtals are acicular, and longitudinally ſtreaked; luſtre ſhining and vitreous; fracture radiated, parallel or divergent, ſtellated; fragments rather blunt-edged.

Colour olive green, piſtachio green, reddiſh brown; cryſtals tranſlucent or ſemitranſparent; ſemihard; diſficultly frangible; rarely feels greaſy. Spec. grav. 3 to 3.31.

Chem. Char.—Fuſible before the blow-pipe into a black ſlag, a white tranſparent glaſs, or a grayiſh white enamel.

Conſtituent Parts.	Bergman.
Silica,	64
Magneſia,	20
Alumina,	2.7
Lime,	9.3
Oxide of iron,	4
	100.0

Localities, &c.—It is found in Saxony, Switzerland, Norway, and weſt ſide of Inverneſs-ſhire in Scotland. Its repoſitory is in primitive mountains, where it is accompanied with ores of lead and iron, as well as with quartz and brown blende.

Subſpecies 3. GLASSY ACTYNOLITE.

Id. Kirw. i. 168. *La Rayonnante Vitreuſe*, Broch. i. 510. *Thallite*, Lametherie, ii. 319. *Epidote*, Hauy, iii. 102.

Exter. Char.—Found maſſive or cryſtallized in thin ſix-ſided priſms, whoſe ſurface is ſmooth and reſplendent; internal luſtre ſhining, vitreous; fracture radiated or wedge-ſhaped, fibrous; fragments ſplintery.

Colour olive green, leek green, and aſparagus green; tranſlucent, or ſemitranſparent; ſemihard, or hard; very brittle, and very eaſily frangible. Spec. grav. 2.95 to 3.49.

Localities, &c.—This variety is found in ſimilar repoſitories, and in ſimilar places with the preceding.

14 Species. TREMOLITE.

This is alſo divided into three ſubſpecies; 1. aſbeſtous, 2. common, and 3. glaſſy.

Subſpecies 1. ASBESTOUS TREMOLITE.

La Tremolithe Aſbeſtiforme, Broch. i. 514. *Grammatite*, Hauy, iii. 227.

Exter. Char.—Found maſſive, diſſeminated, and cryſtallized; and the cryſtals are capillary or acicular; luſtre weakly ſhining, ſilky or pearly; fracture radiated or fibrous; fragments ſplintery and wedge-ſhaped.

Colour yellowiſh white, reddiſh, greeniſh, or grayiſh; opaque; tranſlucent at the edges; very ſoft; eaſily frangible.

Subſpecies 2. COMMON TREMOLITE.

La Tremolithe Commune, Broch. i. 515.

Exter. Char.—Maſſive, or cryſtallized in rhomboidal priſms, with angles of 126° 52′ 12″, and 53° 7′ 48″. The cryſtals are deeply ſtriated longitudinally; external luſtre reſplendent; internal ſhining, pearly; fracture radiated, either parallel, divergent, or promiſcuous; ſurfaces of the fracture longitudinally ſtreaked; fragments ſplintery.

Colour greeniſh white, reddiſh, or yellowiſh; rarely pearl gray; always tranſlucent; in cryſtals ſemitranſparent; ſemihard; brittle; eaſily frangible; meagre to the feel.

Subſpecies 3. GLASSY TREMOLITE.

La Tremolithe Vitreuſe, Broch. i. 516.

Exter. Char.—Maſſive, or cryſtallized in long needle or awl-ſhaped priſms; internal luſtre ſhining, and ſometimes reſplendent; vitreous or pearly; fracture radiated; croſs fracture even, and a little oblique; fragments ſplintery.

Colour greeniſh or yellowiſh white; tranſlucent; cryſtals ſometimes tranſparent; ſemihard; brittle; eaſily frangible; feels meagre. Spec. grav. 2.92 to 3.2, Hauy.

Chem. Char.—Before the blow-pipe it melts into a porous white ſlag.

Conſtituent

Conſtituent Parts.

	Klaproth.	Laugier.	
		White.	Gray Tremolite.
Silica,	65.	35.5	50
Lime,	18.	26.5	18
Magneſia,	10.33	16.5	25
Oxide of iron,	.16		
Carbonic acid and water,	6.5	23.	5
Loſs,	.01	—	2
	100.00	101.5	100

Phyſical Char.—By percuſſion or friction in the dark, a reddiſh phoſphoreſcent light appears; and the powder thrown on burning coals yields a greeniſh light.

Localities, &c.—Tremolite is found imbedded in limeſtone, in primitive mountains. It was firſt diſcovered in the valley of Tremola by Pini, and hence its name. It is alſo found in Hungary, Bohemia, and Carinthia, and in the mountains ſix miles ſouth of Paiſley in Scotland, where it is accompanied with prehnite.

15. Species. SMARAGDITE.

Id. Sauſſure Voy. § 1313. *Diallage*, Hauy, iii. 125. *Id.* Brochant, i. 423. and ii. 506.

Exter. Char.—Smaragdite has been found maſſive and diſſeminated. Internal luſtre ſhining. Fracture foliated. Cleavage ſingle. Fragments rather ſharp edged.

Colour, graſs or emerald green. Slightly tranſlucent. Semi-hard or ſoft. Brittle. Spec. grav. 3.

Chem. Char.—Before the blow-pipe melts into a gray or greeniſh enamel.

Conſtituent Parts.	Vauquelin.
Silica,	50.
Alumina,	11.
Lime,	13.
Magneſia,	6.
Oxide of iron,	5.5
——— chromium,	7.5
——— copper,	1.5
Loſs,	5.5
	100.0

Localities, &c.—This mineral was found by Sauſſure in the vicinity of Turin, imbedded in nephrite clouded white and blue. It has alſo been found near the lake of Geneva among the rounded pebbles, and in Corſica in primitive rocks. In Italy, tables and ornamental pieces of furniture are made of ſmaragdite; and the Italian marble-cutters call it *verde di Corſica.*

16. Species. SAHLITE.

Id. D'Andrada, Jour de Phyſ. An. 8. p. 241. *Malacolithe*, Hauy, iv. 379. *Id.* Brochant, ii. 518.

Exter. Char.—Found maſſive or cryſtallized in ſix-ſided priſms, having two oppoſite lateral edges truncated. Luſtre ſlightly glimmering, reſinous, Fracture foliated. Cleavage threefold. Fragments ſometimes rhomboidal.

Colour grayiſh green or bluiſh gray. In thin plates tranſlucent. Scarcely ſcratches glaſs. Very ſoft to the touch, from which it has the name *malacolite.* Spec. grav. 3.2307 to 3.2368.

Chem. Char.—Fuſible before the blow-pipe into a porous glaſs.

Conſtituent Parts.	Vauquelin.
Silica,	53
Lime,	20
Magneſia,	19
Alumina,	3
Iron and manganeſe,	4
Loſs,	1
	100

Localities, &c.—This mineral was diſcovered by D'Andrada in the ſilver mines of Sahla in Sweden, and hence it derived its name. It was found by the ſame naturaliſt at Buſen in Norway. It appears from the obſervations of Hauy that ſahlite and augite are very cloſely allied, not only in ſtructure and external characters in general, but alſo in their conſtituent principles; the only difference in their compoſition is in the proportions of the lime and magneſia, which are ſmaller in augite than in ſahlite; but the proportion of iron in the former is conſiderably greater than in the latter.

17. Species. SCHALSTONE, or TABULAR SPAR.

Exter. Char.—This mineral is found maſſive; luſtre ſhining and pearly; fracture foliated or ſplintery, and coarſe fibrous; conſiſts of ſeparate large-grained pieces implicated in each other; and according to Karſten, are very regular.

Colour milk white, yellowiſh or reddiſh white; tranſlucent; ſemi-hard; brittle.

Conſtituent Parts.	
Silica,	50
Lime,	45
Water,	5
	100

Localities, &c.—This mineral was firſt noticed by Stutz. It is found in the bannet of Temeſwar, and is accompanied by cryſtallized garnets and calcareous ſpar.

VI. CALCAREOUS GENUS.

1. Species. AGARIC MINERAL, or *Mountain Milk.*

Id. Kirwan, i. 76. *Id.* Brochant, i. 519. *Chaux Carbonaté Spongieuſe*, Hauy, ii. 167.

Exter. Char.—This mineral is compoſed of fine pulverulent particles, ſlightly united together, and nearly friable.

Colour yellowiſh white, or ſnow white; ſtains ſtrongly;

Calcareous genus.

ly; feels meagre; does not adhere to the tongue; nearly floats on water.

Chem. Char.—Efferveſces with acids, and is entirely diſſolved, ſo that it is chiefly compoſed of lime and carbonic acid.

Localities, &c.—This mineral is found in the fiſſures and cavities of calcareous mountains, and it is ſuppoſed that it originates from the deſtruction of the rocks, the particles of which are carried down to the fiſſures and cavities by rain water. Abundant in Switzerland.

2. Species. CHALK.

Id. Kirwan, i. 71. *La Craie*, Brochant, i. 521. *Chaux Carbonaté Crayeuſe*, Hauy, ii. 166.

Exter. Char.—Found maſſive; has a dull appearance; fracture earthy, and fragments blunt edged.

Colour uſually ſnow or yellowiſh white, ſometimes gray or brown; opaque; ſtains and writes; very ſoft, and eaſily frangible; feels meagre; adheres a little to the tongue. Spec. grav. 2.31 to 2.65.

Chem. Char.—Efferveſces with acids; before the blow-pipe is calcined, and converted to quicklime. It is almoſt entirely compoſed of lime and carbonic acid, with a mixture of a little oxide of iron and ſome other ſubſtances.

Localities, &c.—Chalk forms peculiar ſtratiform mountains which contain many petrifactions, the matter of which is almoſt always ſiliceous. They contain alſo flints arranged in regular ſtrata. No metallic ſubſtances are found in chalk. A great body of chalk traverſes France from ſouth to north, extending from Champagny to Calais, and continued to England, in the ſouth of which it forms extenſive beds. Chalk is alſo found in the iſland of Zealand, in the Baltic, in Poland and many other places.

3. Species. LIMESTONE.

This is divided into four ſubſpecies, which are, 1. compact, 2. foliated, 3. fibrous, and 4. pea ſtone.

Subſpecies 1. COMPACT LIMESTONE.

This ſubſpecies is again divided into two ſections; the firſt including common compact limeſtone, and the ſecond roe-ſtone.

A. *COMMON COMPACT LIMESTONE.*

Id. Kirw. i. 82. *Id.* Broch. i. 523. *Chaux Carbonaté Compacte*, &c. Hauy, ii. 164.

Exter. Char.—Found maſſive; external form frequently figured from the numerous petrifactions which it contains; internally dull; rarely glimmering; fracture compact, ſplintery, uneven or earthy; fragments not very ſharp-edged.

Colour uſually gray, ſometimes reddiſh or yellowiſh; different colours exhibit ſpots, ſtripes, veins, and dendritical figures; tranſlucent at the edges; ſemihard; brittle; eaſily frangible; feels meagre; gives a grayiſh white ſtreak. Spec. grav. 2.6 to 2.7.

Chem. Char.—Diſſolves in acids with efferveſcence.

Claſſification.

The conſtituents of limeſtone are carbonate of lime, with variable proportions of other earths, and particularly alumina and ſilica. The following are the conſtituent parts of magneſian limeſtone examined by Mr Tennant.

Lime,	29.5
Magneſia,	20.3
Carbonic acid,	47.2
Alumina and oxide of iron,	.8
Loſs,	2.2
	100.0

Localities, &c.—Forms very extenſive ſtratiform mountains, and is uſually met with along with coal and ſandſtone. It is very abundant in Saxony, Bohemia, Sweden, France, Switzerland, and Britain. The magneſian limeſtone is abundant in Yorkſhire and Nottinghamſhire.

Uſes.—The uſes of limeſtone for the purpoſes of building, and when reduced to the ſtate of quicklime, to form the baſis of mortar, as well as in various arts, are well known.

This variety of limeſtone, when ſuſceptible of a poliſh, furniſhes *marbles;* which name, although it be applied to very different ſtones which are ſuſceptible of a poliſh, and are fit for ſculpture, or ornamental architecture, is frequently applied to limeſtone of this deſcription.

B. *OOLITE*, or *ROE STONE.*

Id. Brochant, i. 529. *Oviform Limeſtone*, Kirw. i. 91. *Chaux Carbonaté Globuliforme*, Hauy, ii. 171.

Exter. Char.—This is found maſſive; internally dull; fracture compact; fragments blunt-edged.

Colour yellowiſh, ſmoke gray, hair, or reddiſh brown; opaque; rarely tranſlucent at the edges; ſemihard; conſiſts of ſmall globular, diſtinct concretions: the ſize of the concretions very various. Spec. grav. 2.4 to 2.5.

Localities, &c.—Roe ſtone is found in Sweden, Switzerland, Saxony, and in the ſouth of England.

The ketton ſtone of England, and the celebrated Portland ſtone, belong to this variety, Of the latter ſome of the principal public buildings in England and Ireland are conſtructed.

Uſes.—It is employed as a building ſtone; and when of a fine grain, it is poliſhed and employed as marble.

Subſpecies 2. FOLIATED LIMESTONE.

Of this there are two varieties, granularly foliated, and calcareous ſpar.

A. *GRANULARLY FOLIATED LIMESTONE.*

Pierre Calcaire Grenue, Broch. i. 531. *Chaux Carbonaté Saccharoïde*, Hauy, ii. 164.

Exter. Char.—Found only maſſive; luſtre ſhining, or ſtrongly glimmering; between pearly and vitreous; fracture ſtraight foliated; fragments rather blunt-edged; in granular, diſtinct concretions, ſmall or fine grained.

Colour uſually ſnow white, grayiſh, yellowiſh, greeniſh, and rarely reddiſh white, and ſometimes it is ſpotted, veined, or ſtriped; uſually tranſlucent; ſemihard; feels meagre; brittle, and eaſily frangible. Spec. grav. 2.7 to 2.8.

Chem. Char.—Effervefces with acids, and is almoſt entirely diſſolved. Some varieties, however, from an admixture of other ſubſtances, are very ſlowly acted on by acids.

Localities, &c.—Granularly foliated limeſtone belongs almoſt excluſively to the primitive and tranſition mountains, repoſing on gneis, micaceous ſchiſtus, and clay ſlate, containing, beſide other mineral ſubſtances, various metallic ores.

It is found in Italy, Saxony, Bohemia, Sweden, Norway, France, and Britain.

Uſes.—This variety of limeſtone is applied to the ſame purpoſes as the former.

Of Marbles.—In the language of the architect and ſtatuary, all ſtones come under the name of marble which are harder than gypſum, are found in large maſſes, and are ſuſceptible of a good poliſh.

On this principle many varieties of limeſtone, granite alſo and porphyry, ſerpentine, and even fine-grained baſalts, are denominated marbles. But the word among mineralogiſts is taken in a more reſtricted ſenſe, and confined to ſuch varieties of dolomite, ſwineſtone, and compact and granularly foliated limeſtone, as are capable of receiving a good poliſh. The moſt valuable of the calcareous marbles, for hardneſs, durability and colour, are brought from Italy, the Greek iſlands, and from Syria. When the ancient Romans were at the height of their civilized luxury, they obtained ſome varieties of marble from Numidia and other countries, which were very much eſteemed.

The ſculptors of ancient Greece and modern Europe have always held the white granularly foliated limeſtone in the higheſt eſtimation, both on account of its pure colour, delicate tranſlucence, and granular texture, which make it much eaſier to work than compact limeſtone. The ſpecies called dolomite is ſofter, and of a finer grain, ſo that it is even more manageable under the chiſſel, and therefore many of the ſmaller works of the Greek ſculptors are of this ſtone; but Paros and Carrara furniſh Europe with the greateſt quantity of ſtatuary marble. The Parian marble, which conſiſts almoſt entirely of carbonate of lime, is the pureſt, ſofteſt, and has ſome degree of tranſparency; that of Carrara is often mixed with granular quartz in conſiderable proportion. The following are the architectural marbles which are held in greateſt eſtimation.

1. The marble called *bardiglio*, from Carrara, is of a deep blue colour, and ſeems to be the ſame with the white ſtatuary marble of that place, with the addition of ſome colouring matter.

2. That variety of marble called *cipolin*, is ſtatuary marble traverſed by veins of mica.

3. *Lumachella marble.* This is a compact limeſtone of a browniſh gray colour, containing ſhells which often retain the original pearly luſtre. To this variety belongs the fire marble of Bleyberg in Carinthia, in which the imbedded ſhells are beautifully irideſcent.

4. *Florentine marble.* This is a grayiſh, compact, argillaceous limeſtone, exhibiting deſigns of a yellowiſh brown colour, and reſembling the ruins of houſes: hence it is called *ruin marble.*

5. The marbles of Syria, Sienna, and Arragon, are of a yellow colour, and are in conſiderable eſtimation.

6. *Brocatello marble.* This is a breccia limeſtone, compoſed of fragments of a yellowiſh red and purple colour, which are cemented by ſemitranſparent, white calcareous ſpar.

7. The marbles known by the names of *verde antiche*, *verde di Corſica*, are compoſed of limeſtone, calcareous ſpar, ſerpentine, and aſbeſtus.

8. The Britiſh iſlands afford many fine marbles, of which that of Tiree is the fineſt and moſt beautiful. It has often a delicate fleſh coloured ground, ſpotted with green; but its colours, it is ſaid, are apt to fade. Marbles have alſo been found in the iſland of Skye, and in the counties of Roſs and Sutherland. For a particular account of theſe, ſee *Williams's Mineral Kingdom.* Marble is not uncommon in different parts of England; and in particular Devonſhire and Derbyſhire afford varieties which are held in conſiderable eſtimation on account of their beauty.

Elaſtic marble. Some varieties of granular limeſtone, when cut into thin plates, poſſeſs a certain degree of elaſticity. The marble in which this property was obſerved, was in the Borgheſe palace at Rome. It was got from an ancient building. Dolomieu ſuppoſed that marble acquired this property by being deprived of moiſture, and Fleuriau de Bellevue confirmed this opinion, by ſubjecting certain marbles to heat. He found alſo a natural elaſtic marble in Mount St Gothard.

B. *CALCAREOUS SPAR.*

Common Spar, Kirw. i. 86. *Le Spath Calcaire*, Broch. i. 536. *Chaux Carbonatée*, Hauy, ii. 127.

Eſſen. Char.—Diviſible into a rhomboid of 101½° and 78½°; ſoluble with effervefcence in nitric acid.

Exter. Char.—Calcareous ſpar is found maſſive, or diſſeminated in various forms, as globular, kidneyform, cellular, and ſtalactitical; but it is moſt frequently cryſtallized. The primitive form of its crſtals is an obtuſe rhomboid, whoſe angles are 101° 32′ 13,″ and 78° 27′ 47″; integrant molecule the ſame. The variety of forms of calcareous ſpar is very great. Werner reduces them to three principal or prevailing forms, and from theſe he deduces the variations and modifications which take place. His principal forms are, 1. The ſix-ſided pyramid; 2. The ſix-ſided priſm; and, 3. The three-ſided pyramid. But according to others following the ſame method, the principal forms are the five following: 1. The ſix-ſided pyramid; 2. The ſix-ſided priſm; 3. The ſix-ſided table; 4. The three-ſided pyramid; and, 5. The hexahedron, including the rhomboid and cube.

1. The ſix-ſided pyramid is either ſimple or double.

A. Simple. Simple pyramids are the ſummits of other pyramids, or of priſms, and they are variouſly modified in being equal ſided, acute, or obtuſe, having the angles at the baſe truncated, or having an obtuſe three-ſided ſummit ſlightly convex.

B. Double; in which two pyramids are obliquely united, and variouſly modified, by having the angles at the baſe truncated, or the faces of the ſummit a little convex.

2. The ſix-ſided priſm, is alſo variouſly modified, by having at each extremity a ſix-ſided acute ſummit, or a ſecond obtuſe ſummit of three ſides, placed alternately on three edges of the firſt.

3. A ſix-ſided table, which is either perfect with equal or unequal ſides, or rounded, or lenticular.

4. The three-ſided pyramid, which is either ſimple or double, and is alſo variouſly modified.

5. The hexahedron, which includes the rhomboid, and this is either perfect, or has convex faces, or has ſix obtuſe edges truncated; and the cube, which is ſomewhat rhomboidal. But for a full account of all the varieties and modifications in the cryſtallization of calcareous ſpar, the reader is referred to the treatiſes of Hauy and Brochant.

The cryſtals of calcareous ſpar exhibit alſo a ſimilarity of arrangement. The ſimple ſix-ſided pyramids are frequently diſpoſed in a globular, faſcicular, or ſtellated form. The ſix-ſided pyramids are diſpoſed in rows; the ſix-ſided priſms are often diſpoſed like ſteps of ſtairs, or are faſcicular, or kidney-form; ſome acute three-ſided pyramids of calcareous ſpar have been found hollow, and in ſome priſms the centre has been obſerved of another colour. The ſurface of the cryſtals commonly ſmooth; luſtre ſhining or reſplendent; internal luſtre reſplendent or ſhining, vitreous, and ſometimes pearly; fracture foliated; cleavage threefold; fragments always rhomboidal.

Colour uſually white, grayiſh, reddiſh, greeniſh, or yellowiſh white, rarely violet blue, or yellowiſh brown. Various degrees of tranſparency; when perfectly tranſparent, refraction is double. It was in this ſubſtance that the property of double refraction was firſt obſerved, and hence it was called *double ſpar.* This ſingular property engaged the attention and mathematical ſkill of Newton, Huygens, Buffon, and more lately the celebrated Hauy. Calcareous ſpar is ſemihard, brittle, and eaſily frangible. Sp. grav. about 2.7.

Chem. Char.—Soluble with effervеſcence in nitric acid, and reduced by calcination to quicklime.

Conſtituent Parts.

	Bergman.	Phillips *.
Lime,	55	55·5
Carbonic acid,	33	44·
Water,	11	·5
	100	100.0

Phyſical Char.—Some varieties of calcareous ſpar, and particularly thoſe from Derbyſhire, give out, when heated, a phoſphoreſcent light.

Localities, &c.—Calcareous ſpar is very common in all kinds of rocks, in veins and cavities, and particularly in mineral veins, accompanied with quartz, fluor ſpar, heavy ſpar, and metallic ore. The fineſt ſpecimens of rhomboidal ſpar are brought from Iceland, Derbyſhire, the Hartz, as well as Saxony, France, and Spain.

The cryſtallized ſandſtones of Fontainebleau are real rhomboidal cryſtals of calcareous ſpar, which, during the proceſs of cryſtallization, have been penetrated with particles of ſand.

Subſpecies 3. Fibrous Limestone.

Id. Kirw. i. 88. *La Pierre Calcaire Fibreuſe, ou la Stalactite Calcaire*, Broch. i. 549. *Chaux Carbonatée Concretionnée*, Hauy, ii. 168.

Of this ſubſpecies two varieties have been formed, common fibrous, and calcareous ſinter.

A. *Common Fibrous Limestone.*

Exter. Char.—Found maſſive; luſtre weakly ſhining and pearly; fracture fibrous, ſometimes coarſe and delicate, ſtraight or parallel, and ſometimes radiated; fragments ſplintery.

Colour uſually grayiſh, reddiſh, and yellowiſh white; generally tranſlucent; rarely ſemitranſparent.

Localities, &c.—This variety is found in veins; and ſome of it is ſuſceptible of a fine poliſh, and was known to the ancients under the name of *calcareous alabaſter*, to diſtinguiſh it from gypſeous alabaſter.

Sattin ſpar, a beautiful mineral, which is alſo ſuſceptible of a fine poliſh, and has a ſickly luſtre, from which it derives its name, belongs to this variety. It was firſt diſcovered in Cumberland, and is but rarely met with in other places.

B. *Calcareous Sinter.*

This variety is uſually found ſtalactitical or tuberoſe, and alſo ſometimes kidney-ſhaped, botryoidal, tubular, and coralloidal. Surface uſually rough, or druſy, rarely ſmooth; internal luſtre glimmering, ſometimes weakly ſhining, ſilky, or pearly; fracture fibrous, which is either ſtraight, ſcopiform, or ſtellular; fragments wedge-ſhaped and ſplintery.

Colour ſnow white, grayiſh green, or yellowiſh white, and theſe are ſometimes arranged in ſtripes or veins; tranſlucent, ſometimes only at the edges; rarely ſemitranſparent; between ſemihard and ſoft; brittle and eaſily frangible. Sp. grav. 2.728.

Localities, &c.—This mineral ſeems to be a depoſition of calcareous particles, formed by the gradual infiltration of water into the cavities and fiſſures of limeſtone mountains. They are either depoſited in layers on the floor, or ſuſpended from the roof of thoſe grottoes, and in this latter caſe they aſſume a great variety of imitative forms. It is found therefore in the celebrated grottoes of Auxelles, Arcy, and Antiparos, and in the cavities of mineral veins at Leadhills.

The ſingular mineral ſubſtance, known by the name of *flos ferri*, belongs to this variety. This is found in the cavities of veins of ſpathoſe iron ore, from which it has derived its name. It is of a branched or coralloidal form.

Subſpecies 4. Pisolite or *Pea-ſtone.*

Oviform Limeſtone, var. Kirw. i. 91. *La Pierre de Pois*, Broch. i. 555. *Chaux Carbonatée Globuliforme*, Hauy, ii. 171.

Exter. Char.—This mineral is found maſſive, and in the cavities in which it is formed, the ſurface is kidney-ſhaped; internally dull; fracture difficult to determine, but appears even; fragments rather ſharp-edged.

Colour white, ſnow white, grayiſh, reddiſh or yellowiſh white; opaque; rarely tranſlucent at the edges; ſoft, and brittle.

Localities, &c.—Piſolite is found at Carlſbad in Bohemia, where it has been long known, and where an entire bed was diſcovered in digging the foundations for a church. Each of the grains of piſolite contains for a nucleus a particle of ſand. Theſe have been incruſted with the carbonate of lime held in ſolution by water,

---

[*] Phil. Mag. xiv. 290.

water, and particularly by the warm ſprings of Carlſbad. New concentric layers being depoſited, they at laſt fall to the bottom, and are there united into larger maſſes by new depoſitions of the ſame calcareous matter. Piſolites are alſo found in Hungary and in Sileſia.

4. Species. Calcareous Tufa.

Exter. Char.—This mineral has uſually the form of the ſubſtance on which the calcareous matter has been depoſited, as that of moſs which is moſt common, graſs or leaves; internally dull, or weakly glimmering; fracture uneven or earthy; fragments blunt-edged.

Colour yellowiſh gray of various ſhades; opaque, or tranſlucent at the edges; ſoft, ſectile, and eaſily frangible; light; almoſt ſwims on water.

Localities, &c.—This ſubſtance is found in all limeſtone countries, through the ſtrata of which water paſſes, thus forming ſprings impregnated with carbonate of lime, which is afterwards depoſited on plants or other ſubſtances. This mineral, therefore, is found in alluvial land, and the proceſs of its formation is conſtantly going on.

5. Species. Foam Earth.

Silvery Chalk, Kirw. i. 78. *L'Ecume de Terre*, Broch. i. 557.

Exter. Char.—This mineral is found maſſive, diſſeminated, or in ſcaly particles, which are ſomewhat friable; internal luſtre ſhining or ſemimetallic; the ſolid varieties have a curved foliated fracture; fragments blunt-edged.

Colour yellowiſh or greeniſh white, ſometimes ſilvery white; opaque; ſtains; very ſoft or friable; feels a little greaſy or ſilky.

Chem. Char.—Efferveſces and diſſolves in acids,

Conſtituent Parts.

Lime,	51.5
Carbonic acid,	39.
Silica,	5.7
Oxide of iron,	3.2
Water,	1.
	100.5

Localities, &c.—This mineral has been found in mountains of ſtratified limeſtone at Jena in Miſnia, and at Eiſleben in Thuringia.

This is conſidered by ſome as belonging to the following ſpecies, and by others as merely a variety of agaric mineral.

6. Species. Slaty Spar.

Argentine, Kirw. i. 105. *Le Spathe Schiſteux*, Broch. i. 558. *Schiefer Spath of the Germans*. *Id.* Phillips, Phil. Mag. xiv. 289, and 293.

Exter. Char.—Found maſſive or diſſeminated; internal luſtre ſhining, pearly; fracture curved foliated; fragments wedge-ſhaped, or blunt-edged.

Colour grayiſh, reddiſh, or yellowiſh white; tranſlucent; ſoft; brittle; feels greaſy. Spec. grav. 2.723.

Chem. Char.—Efferveſces briſkly with acids.

Conſtituent Parts.

Carbonate of lime,	98.11
Silica,	.05
Oxide of iron,	.8
Loſs,	1.04
	100.00

Localities, &c.—This mineral is found in Saxony, in a bed of limeſtone, where it is accompanied with galena; in Norway; and in Cornwall in England.

7. Species. Arragonite.

Arragon Spar, Kirw. i. 87. *L'Arragonite*, Broch. i. 576. *Id.* Hauy, iv. 337.

Exter. Char.—This mineral is always found cryſtallized in ſix-ſided equiangular priſms, or with two oppoſite faces broader, to which correſpond the two faces of an acute bevelment, which terminates the priſm. The edges of the bevelment are alſo truncated. The cryſtals are variouſly grouped, and commonly in the form of a croſs; cryſtals ſtreaked longitudinally; luſtre ſhining or reſplendent, vitreous; fracture foliated.

Colour grayiſh or greeniſh white; tranſlucent and ſemitranſparent; refraction double; hard, ſcratches calcareous ſpar; brittle, and eaſily frangible. Specific gravity 2.946.

Chem. Char.—Efferveſces with acids, and is entirely diſſolved. The conſtituent parts, according to numerous and accurate analyſes, are the ſame as thoſe of calcareous ſpar; but its ſuperior hardneſs, diverſity of form, and other external characters, have long puzzled chemical philoſophers; and it ſtill remains undetermined to what that diverſity is owing in this mineral.

Localities, &c.—Arragonite was firſt found imbedded in foliated and fibrous gypſum, in the province of Arragon in Spain, from which it derives its name. It has been alſo found in France, the Pyrenees, in Saltzburg, ſometimes in an argillaceous ſchiſtus, and ſometimes in quartz, accompanied by calcareous ſpar and pyrites.

8. Species. Brown Spar.

Sidero-Calcite, Kirw. i. 105. *Le Spath Bruniſſant*, Broch. i. 563. *Chaux Carbonatée Ferrifére Perlée*, Hauy, ii. 179.

Exter. Char.—Found maſſive or diſſeminated, or in kidney-ſhaped, globular, or carious pieces; very often cryſtallized. The forms are lenſes or rhomboids, which latter have either convex or concave faces; double pyramids compoſed of two pyramids with three obtuſe faces: ſimple three-ſided pyramids, and oblique ſix-ſided pyramids. The ſurface of the cryſtals druſy, rarely ſmooth; luſtre weakly ſhining or ſhining; internal luſtre ſhining, pearly, or vitreous; fracture foliated; fragments rhomboidal.

Colour milk-white, grayiſh, yellowiſh, or reddiſh white; bright or browniſh red; tranſlucent at the edges;

Calcareous genus.

edges; ſemihard; brittle, eaſily frangible; ſtreak grayiſh white. Spec. grav. 2.83.

Chem. Char.—Becomes black and hard before the blow-pipe, and unleſs reduced to powder, efferveſces ſlowly with acids.

Conſtituent Parts.	Bergman.
Carbonate of lime,	50
Oxide of iron,	22
Oxide of mangañeſe,	28
	100

Localities, &c.—Brown ſpar is found in Bohemia, Saxony, France, Sweden, and Britain. It is uſually found in metallic veins.

9. Species. DOLOMITE.

Id. Kirw. i. 111. *Dolomie*, Brochant, i. 534. *Chaux Carbonatée Aluminifere*, Hauy, ii. 173.

Exter. Char.—Found maſſive; fracture appears to be foliated; fragments blunt-edged.

Colour grayiſh or yellowiſh white; tranſlucent on the edges; ſemihard; rather difficultly frangible; feels meagre. Spec. grav. 2.85.

Conſtituent Parts.	Sauſſure.
Lime,	44.29
Alumina,	5.86
Magneſia,	1.4
Oxide of iron,	.74
Carbonic acid,	46.
Loſs,	1.71
	100.00

Chem. Char.—Efferveſces ſlowly in nitric acid.

Phys. Char.—Phoſphoreſces in the dark by the percuſſion of a hard body.

Localities, &c.—This ſtone was firſt obſerved by Dolomieu, among the ancient monuments of Rome; and afterwards he diſcovered ſimilar ſtones in the mountains of the Tyrol, and the Alps. It is found abundantly on St Gothard and other primitive mountains. Dolomieu's attention was firſt attracted to it by its ſuperior hardneſs and ſlow efferveſcence in acids, and analyſis ſhews that it is different from limeſtone in its compoſition.

10. Species. RHOMB or BITTER-SPAR.

Cryſtallized Muricalcite, Kirw. i. 92. *Le Spath Magneſien*, Brochant, i. 560. *Chaux Carbonatée Magneſifere*, Hauy, ii. 187.

Exter. Char.—Found maſſive or diſſeminated in rhomboidal pieces, which have a cryſtallized appearance; luſtre ſhining or reſplendent, and vitreous or pearly; fracture foliated; cleavage threefold; fragments rhomboidal.

Colour grayiſh white, yellowiſh or reddiſh brown; tranſlucent at the edges; ſemihard; brittle; ſtreak ſnow-white. Spec. grav. 2.48.

Chem. Char.—Becomes gray or brown before the blow-pipe without ſplitting or fuſion. Efferveſces a little with acids.

Claſſification.

Conſtituent Parts.	Klaproth.	
Carbonate of lime,	52	73
——— magneſia,	45	25
Oxide of iron and mangañeſe,	3	2
	100	100

Localities, &c.—Found in the Tyrol and Saltzburg, and in Sweden. It is always accompanied with aſbeſtus, talc, and tremolite, and imbedded in chlorite ſchiſtus, ſerpentine, and indurated talc.

11. Species. SWINE STONE.

Id. Kirw. i. 89. *La Pierre Puante*, Brochant, i. 567. *Chaux Carbonatée Fœtide*, Hauy, ii. 288.

Exter. Char.—Found maſſive; internal luſtre glimmering or dull; fracture ſplintery, ſometimes earthy or foliated; fragments ſplintery.

Colour grayiſh black, or blackiſh brown; opaque, rarely tranſlucent at the edges; ſtreak grayiſh white; ſemihard, ſometimes ſoft; eaſily frangible. Spec. grav. 2.71.

Phys. Char.—When rubbed with a hard body, it gives out a very fœtid odour of rotten eggs.

Chem. Char.—Soluble with efferveſcence in nitric acid; before the blow-pipe is deprived of its odour, which is ſuppoſed to be owing to ſulphurated hydrogen.

Localities, &c.—Forms entire beds in ſtratiform limeſtone rocks, as in France, Saxony, and Sweden.

12. Species. MARL.

This is divided into two ſubſpecies; 1. earthy; and, 2. indurated.

Subſpecies 1. EARTHY MARL.

Id. Kirw. i. 74. *La Marne Terreuſe*, Brochant, i. 569. *Argile Calcarifere*, Hauy, iv. 455.

Exter. Char.—This variety is compoſed of looſe or ſlightly coherent particles; ſtains a little; feels meagre and rough; is light; almoſt ſwims on water.

Colour yellowiſh gray, or grayiſh white.

Localities, &c.—Found in many places of France and Germany, as well as in different places of England and Scotland, forming beds in limeſtone countries, and often immediately under the ſoil.

Uſes.—It is ſometimes employed in the manufacture of pottery, but its principal uſe is for the purpoſes of agriculture.

Subſpecies 2. INDURATED MARL.

Id. Kirw. i. 95. *La Marne Endurcie*, Brochant, i. 571.

Exter. Char.—Found maſſive; dull, or ſlightly glimmering; fracture earthy, ſplintery, or ſlaty; fragments blunt-edged.

Colour yellowiſh, or ſmoke gray; opaque; ſtreak grayiſh white; ſoft; not very brittle; eaſily frangible. Spec. grav. 1.6 to 2.8.

Claſſification.

Chem. Char.—Melts before the blow-pipe into a grayiſh black ſlag; efferveſces briſkly with acids.

Marl is conſidered as a mixture of carbonate of lime and alumina; and according to the different proportions of theſe ingredients, it is denominated calcareous marl or clay marl, and ſometimes it is known in agriculture by the names of ſoft and hard marl.

Localities, &c.—Found in Bohemia, Saxony, Sweden, Italy, France, and Britain, in ſtratiform mountains, ſometimes in extenſive beds, frequently accompanying limeſtone, coal, and baſalt.

Uſes.—It is employed in agriculture for improving the ſoil, ſometimes for building, and ſometimes as a limeſtone. It ſerves alſo as a flux for ſome ores of iron.

13. Species. BITUMINOUS MARL SLATE.

Marno-bitumineux, Brochant, i. 574. *Chaux Carbonatée Bituminifere*, Hauy, ii. 189.

Exter. Char.—Found maſſive; ſurface rough, dull, rarely glimmering; or when divided into curved plates, ſmooth and ſhining; fracture ſlaty; ſtraight or waved; fragments tabular.

Colour grayiſh or browniſh black; opaque; ſtreak ſhining; ſoft; eaſily frangible; feels rather meagre.

Chem. Char.—Efferveſces with acids; inflames before the blow-pipe; gives out a bituminous odour, and then melts into a black ſlag.

Localities, &c.—Found in different places of Thuringia, in mountains of ſtratiform limeſtone, forming particular beds, which repoſe frequently on a ſpecies of ſandſtone. It is frequently mixed with different ores of copper, ſo that it is ſometimes wrought as a copper ore. In this bituminous ſchiſtus, petrified fiſhes and marine plants are frequently found, diſpoſed in regular order, from which ſome have conjectured that they muſt have died a violent death; or, according to others, that they have been poiſoned by the copper with which it abounds.

14. Species. APATITE.

Phoſpholite, Kirw. i. 128. *L'Apatite Commune*, Brochant, i. 580. *Chaux Phoſphatée*, Kauy, ii. 234.

Exter. Char.—Found almoſt always cryſtallized, rarely diſſeminated. The forms of its cryſtals are, 1. A regular ſix-ſided priſm; 2. The ſame priſm truncated on its lateral edges; 3. Alſo on its angles and terminal edges; 4. Bevelled on each of the lateral edges; 5. With an obtuſe and regular ſix-ſided pyramid, and one or both extremities, the ſummit being ſlightly truncated; 6. A three-ſided priſm with the lateral edges bevelled, and the terminal edges truncated; 7. A ſix-ſided table, having its terminal edges ſtrongly, and the lateral edges ſlightly truncated. Lateral faces of the priſms longitudinally ſtreaked; faces of the pyramid ſmooth; luſtre ſhining and reſplendent; internal luſtre ſhining, between reſinous and vitreous. Croſs fracture foliated; in other directions fine grained, uneven, or conchoidal. Fragments rather ſharp-edged.

Colour green of various ſhades, blue, ſometimes pearl gray, and greeniſh gray; ſemitranſparent, ſometimes tranſparent, or only tranſlucent; ſemihard; is ſcratched by fluor ſpar; brittle, and eaſily frangible. Spec. grav. 2.8 to 3.2.

Calcareous genus.

Chem. Char.—Thrown on hot coals it gives out a greeniſh phoſphoreſcent light; infuſible before the blow-pipe, but loſes its colour. It is almoſt entirely ſoluble in nitric acid.

Conſtituent Parts.	Klaproth.
Lime,	55
Phoſphoric acid,	45
	100

Phyſ. Char.—Becomes electric by friction, but not by heat.

Localities, &c.—Apatite is found in different places of Germany, chiefly in tin mines, where it is accompanied by fluor ſpar, quartz, and metallic ores. It is alſo found in Cornwall in ſimilar circumſtances.

15. Species. ASPARAGUS STONE.

La Pierre d'Aſperge, Broch. i. 586. *Chaux Phoſphatée*, Hauy, ii. 234.

Exter. Char.—This mineral has been only found cryſtallized in equiangular ſix-ſided priſms, terminated by a ſlightly obtuſe ſix-ſided pyramid; lateral edges ſometimes truncated; lateral faces longitudinally ſtreaked, the others ſmooth; external luſtre ſhining or reſplendent; internal, reſplendent and reſinous; fracture foliated, croſs fracture imperfectly conchoidal; fragments not very ſharp-edged.

Colour aſparagus green, greeniſh white; commonly tranſparent, often only ſemitranſparent, or even tranſlucent; ſemihard. Spec. grav. 3.09.

Chem. Char.—Infuſible before the blow-pipe; ſoluble with efferveſcence in nitric acid, but thrown on hot coals does not phoſphoreſce.

Conſtituent Parts.	Vauquelin.
Lime,	53.32
Phoſphoric acid,	45.72
Loſs,	.96
	100.00

Localities, &c.—This ſtone has been found at Caprera, near Cape de Gates in Spain, and alſo, it is ſaid, near Arendal in Norway.

16. Species. PHOSPHORITE.

L'Apatite Terreuſe, Broch. i. 584. *Chaux Phoſphatée Terreuſe*, Hauy, ii. 239.

Exter. Char.—Found maſſive, and having little coherence; dull; fracture earthy, or fine grained uneven; fragments blunt-edged, ſometimes wedge-ſhaped.

Colour yellowiſh or grayiſh white; opaque; ſemihard; often friable; eaſily frangible; feels meagre. Spec. grav. 2.82.

Chem. Char.—Before the blow-pipe it phoſphoreſces, and according to ſome, melts into a white glaſs, but according to others, infuſible. Soluble in acids, and with ſulphuric acid gives out white vapours.

Conſtituent Parts.	Pelletier.
Lime,	59.
Silica,	2.
Phoſphoric acid,	34.
Fluoric acid,	2.5
Carbonic acid,	1.
Muriatic acid,	.5
Oxide of iron,	1.
	100.0

Localities, &c.—This mineral is found in the north of Scotland, and in the province of Eſtremadura in Spain, where it forms an entire mountain. It is mixed with quartz; has been long known by the inhabitants of the country for its property of phoſphoreſcing when thrown on hot coals.

17. Species. FLUOR.

This has been divided into three ſubſpecies: 1. earthy; 2. compact; and, 3. fluor ſpar.

Subſpecies 1. EARTHY FLUOR.

Sandy or *Earthy Fluor*, Kirw. i. 126. *Le Fluor Terreux*, Broch. i. 593. *Chaux Fluatée Amorphe*, Hauy, ii. 260.

Exter. Char.—Is compoſed of particles which are ſlightly cohering; dull, or ſcarcely glimmering.

Colour greeniſh white, ſometimes bluiſh green; ſtains a little; feels rough.

Chem. Char.—Thrown on hot coals, it gives out a bluiſh green light.

Localities, &c.—Has been found in Hungary, in a vein accompanied with quartz.

Subſpecies 2. COMPACT FLUOR.

Id. Kirw. 127. *Id.* Broch. i. 594.

Exter. Char.—Is found maſſive; dull, luſtre ſometimes glimmering, vitreous; fracture even, conchoidal, and rarely ſplintery; fragments ſharp-edged.

Colour greeniſh gray, or greeniſh white; ſometimes different colours are diſpoſed in ſpots; tranſlucent; ſtreak ſhining; hard, and brittle.

Chem. Char.—Phoſphoreſces on hot coals.

Localities, &c.—This mineral is found in the Hartz, in Sweden, and Siberia, always accompanying fluor ſpar.

Subſpecies 3. FLUOR SPAR.

Foliated or *Sparry Fluor*, Kirw. i. 127. *Le Spath Fluor*, Broch. i. 595. *Chaux Fluatée*, Hauy, ii. 247.

Eſſen. Char.—Inſoluble in water, and diviſible into a regular octahedron.

Exter. Char.—Fluor ſpar is found maſſive or diſſeminated, but moſt frequently cryſtallized. Primitive form a regular octahedron, which is eaſily obtained by mechanical diviſion; integrant molecule a regular tetrahedron. The uſual forms are, 1. The cube, which is either perfect, or with truncated edges or truncated angles, or with the edges bevelled, having on each of its angles a three-ſided pyramid, correſponding to the faces of the cube. 2. The octahedron, which is either perfect, or has it angles or its edges, or both, truncated. Surface of the cryſtals ſmooth, ſhining or reſplendent, ſometimes druſy; internal luſtre ſhining, reſplendent, and vitreous or pearly; fracture foliated, ſtraight or curved; cleavage fourfold, in the direction of the faces of the regular octahedron; fragments tetrahedral, or rhomboidal.

Colours of fluor ſpar extremely various and beautiful. The principal are, greeniſh white, grayiſh, or yellowiſh; blue, green, brown, and red, of various ſhades; and different colours are ſometimes arranged in ſtripes and ſpots. Moſt commonly tranſlucent, ſometimes tranſparent, or only tranſlucent at the edges. Semihard; brittle; eaſily frangible. Spec. grav. 3.09 to 3.19.

Chem. Char.—Fuſible before the blow-pipe into a tranſparent glaſs; decrepitates when heated. The powder thrown on hot coals gives out a bluiſh or greeniſh phoſphoreſcent light; and two pieces rubbed againſt each other, ſhine in the dark.

Conſtituent Parts.	Scheele.
Lime,	57
Fluoric acid,	16
Water.	27
	100

Localities, &c.—Fluor ſpar is ſometimes found in beds, but moſt frequently in mineral veins. It is very common in many places of the world, particularly in Cornwall and Derbyſhire, and alſo in the counties of Durham and Cumberland in England; at Chamouni in Savoy, the octahedral variety of a roſe red colour is found. Fluor ſpar is found alſo in the interior part of Aberdeenſhire in Scotland.

Uſes.—This mineral is ſucceſsfully employed as a flux for different metallic ores. As it is ſuſceptible of a fine poliſh, it is cut and formed into a great variety of ornamental objects, as pyramids, vaſes, &c. which, on account of the beauty of the colours, are greatly eſteemed.

18. Species. GYPSUM.

This ſpecies is divided into four ſubſpecies: 1. earthy; 2. compact; 3. foliated; and, 4. fibrous.

Subſpecies 1. EARTHY GYPSUM.

Farinaceous Gypſum, Kirw. i. 120. *Le Gypſe Terreux*, Broch. i. 601. *Chaux Sulphatée Terreuſe*, Hauy, ii. 278.

Exter. Char.—This is compoſed of particles which are more or leſs cohering; dull, in ſome places weakly glimmering; feels meagre and rough.

Colour white, gray, or yellowiſh.

Localities, &c.—This ſubſtance is rare; it is only found in the fiſſures and cavities of gypſum rocks, and is ſuppoſed to be a depoſition of looſe particles of gypſum, carried along by water. Found in Saxony, and Mont Martre near Paris.

Subſpecies 2. COMPACT GYPSUM.

Id. Kirw. i. 121. *Id.* Broch. i. 602. *Id.* Hauy, ii. 278.

Exter. Char.—Found maſſive; luſtre weakly glimmering, almoſt dull; fracture compact, even, or ſplintery; fragments blunt edged.

Colour yellowiſh and grayiſh white, ſometimes reddiſh; and different colours exhibit ſtripes; tranſlucent at the edges; ſoft, and eaſily frangible. Spec. grav. about 2.3.

Localities, &c.—Found in Italy, Germany, France, Spain, and England.

Subſpecies 3. FOLIATED GYPSUM.

Granularly Foliated Gypſum, Kirw. i. 123. *Id.* Broch. i. 606.

Exter. Char.—Found maſſive or diſſeminated, and ſometimes, it is ſaid, cryſtallized in ſix-ſided priſms, obtuſely bevelled at each extremity; luſtre glimmering or ſhining, between vitreous and pearly; fracture foliated, ſometimes radiated; fragments blunt-edged.

Colour uſually ſnow white, grayiſh, yellowiſh, or reddiſh white; and ſeveral colours are arranged in ſpots, ſtripes, and veins. Tranſlucent, rarely ſemitranſparent; refraction double; very ſoft; eaſily frangible. Spec. grav. 2.27 to 2.31.

Foliated gypſum has ſome reſemblance to granular limeſtone, but may be readily diſtinguiſhed from it by its ſoftneſs.

Subſpecies 4. FIBROUS GYPSUM.

Id. Kirw i. 122. *Id.* Broch. i. 604. *Id.* Hauy, ii. 278.

Exter. Char.—This is found maſſive, but in thin layers; luſtre ſhining, or weakly ſhining, pearly; fracture fibrous; in ſome varieties the longitudinal fracture is foliated; croſs fracture fibrous; fragments long, ſplintery.

Colour ſnow white, grayiſh, yellowiſh, or reddiſh white; tranſlucent; very ſoft; eaſily frangible.

Chem. Char.—The different varieties of gypſum poſſeſs nearly the ſame chemical characters. When pure, there is no efferveſcence with acids. Before the blowpipe gypſum immediately becomes white, is converted into a white enamel, which, at the end of 24 hours, falls into powder.

Localities, &c.—Gypſum, in general, conſtitutes mountains or beds, which are ſubordinate to ſandſtone, or limeſtone. It is found in all kinds of rocks. Gypſum is found in great abundance in the neighbourhood of Paris, in ſeveral parts of England, but ſparingly in Scotland.

Uſes.—Gypſum is employed along with lime as a cement. It is alſo very extenſively employed under the name of plaſter of Paris, for making caſts and models. With this view it is expoſed to a ſtrong heat, to drive off the water of cryſtallization. It is then in the ſtate of powder, which being again mixed with water, is put into the mould in the form of paſte; and, from its ſtrong affinity for water, it ſoon becomes ſolid.

19. Species. SELENITE.

Broad Foliated Gypſum, Kirw. i. 123. *La Selenite*, Broch. i. 609. *Chaux Sulfatée*, Hauy, ii. 266.

Eſſen. Char.—Diviſible into ſmooth plates, which break under angles of 113° and 67°.

Exter. Char.—Selenite is found maſſive; and frequently alſo cryſtallized. The primitive form of its cryſtals is a four-ſided priſm, whoſe baſes are obliquely parallelograms; the integrant molecule is the ſame. The uſual forms are, a ſix-ſided priſm, having two broad and two narrow faces, and terminated by an oblique bevelment, whoſe ſides correſpond to the broad ſides of the priſm; a ſimilar priſm terminated by a four-ſided pyramid; double cryſtals compoſed of two of the former united by their ſmaller lateral faces, ſo that the ſummits united form on one ſide a ſalient angle, and on the other a re-entering angle; another form is a ſpheroidal or conic lens. Theſe cryſtals are often grouped, divergent, faſcicular, or ſtellated; and of the ſix ſides of the priſm, the two oppoſite are ſmooth, and the four others longitudinally ſtreaked; luſtre reſplendent or ſhining, between vitreous and pearly; fracture foliated, ſtraight or curved; cleavage threefold; fragments rhomboidal, with two faces ſmooth and ſhining, and two others ſtreaked.

Colour uſually white, grayiſh, yellowiſh, or ſnow white, ſometimes irideſcent; tranſparent, ſometimes only tranſlucent; very ſoft; in thin plates, flexible, but not elaſtic; eaſily frangible. Spec. grav. 2.32.

Chem. Char.—Before the blow pipe more eaſily fuſible than gypſum, and ſplits into thin plates.

Conſtituent Parts.	Bergman.
Lime,	32
Sulphuric acid,	46
Water,	22
	100

Localities, &c.—Selenite is found among beds of gypſum, and particularly among thoſe which alternate with clay and ſand-ſtone. It is alſo found in neſts in clay. It is not uncommon in many places, as among the gypſum rocks near Paris, in different parts of England, and at Lord Glaſgow's coal works in Scotland, where it is found among clay, and in the cavities or on the ſurface of the limeſtone which repoſes on the ſtrata of coal.

Uſes.—Selenite alſo, after calcination, is employed in modelling; but it is ſaid that it poſſeſſes leſs ſolidity than what is obtained from gypſum.

20. Species. ANHYDRITE.

Chaux Salfatée Anhydre, Hauy, iv. 348.

Exter. Char.—This mineral is found maſſive; luſtre ſhining or weakly ſhining, and pearly; fracture curved foliated, ſometimes radiated, and fine ſplintery: fragments ſharp-edged; tranſlucent; ſemihard; not very brittle, rather eaſily frangible. Spec. grav. 2.964.

Chem. Char.—Before the blow-pipe it neither exfoliates nor becomes white, like ſelenite.

Conſtituent Parts.

	Vauquelin.	Klaproth.
Lime,	40	42.
Sulphuric acid,	60	57.
Oxide of iron,	–	.1
Silica,	–	.25
Loſs,	–	.65
	100	100.00

Localities, &c.—This mineral has been found in Switzerland, in the ſalt pits in the canton of Berne.

21. Species. CUBE SPAR.

Chaux Sulfatée Anhydre, Hauy, iv. 348. *Saude Muriatée Gypſifere*, Id. ii. 365. *Muriacite*, Klaproth.

Exter. Char.—This mineral is found maſſive, and alſo cryſtallized, in four-ſided priſms, which are nearly cubical; two of the oppoſite lateral faces are broader than the other two. The lateral edges are ſometimes truncated, and hence ariſes an eight-ſided priſm: ſometimes alſo the truncations are ſo great as to deſtroy the narrow lateral faces, and form again a ſix-ſided priſm. External luſtre of the broad faces reſplendent and pearly; of the narrow, ſhining. Internal luſtre ſhining and pearly; fracture foliated; cleavage threefold; fragments cubical.

Colour milk-white, grayiſh, yellowiſh, and reddiſh white; ſometimes pearl gray; tranſlucent; ſemihard. Spec. grav. 2.92 to 2.96.

Conſtituent Parts.	Klaproth.
Sulphate of lime,	57.8
Carbonate of lime,	11.
Muriate of ſoda,	31.2
	100.0

Localities, &c.—Found in the ſalt pits at Halle in the Tyrol, where it is called *ſplintery gypſum.*

22. Species. DATHOLITE.

Chaux Datholite, Brochant, ii. 397. *Chaux Boratée Siliceuſe*, Haüy.

Exter. Char.—This mineral has only been found cryſtallized; the primitive form is a rectangular priſm, with rhomboidal baſes, whoſe angles are 109° 18′ and 70° 42′; luſtre ſhining, vitreous; fragments conchoidal.

Colour grayiſh or greeniſh white; tranſlucent; ſcratches fluor ſpar. Spec. grav. 2.98.

Chem. Char.—In the flame of a candle it becomes dull white, and is eaſily reduced to powder. Before the blow-pipe it melts into a glaſs of a pale roſe-red colour.

Conſtituent Parts.	Klaproth.
Lime,	35.5
Silica,	36.5
Boracic acid,	24.
Water,	4.
	100.0

Localities, &c.—Found near Arendal in Norway, and ſome ſpecimens are accompanied by greeniſh-coloured, foliated talc.

VII. BARYTIC GENUS.

1. Species. WITHERITE, or *Carbonate of Barytes.*

Barolite, or *Aerated Barytes*, Kirw. i. 134. *La Witherite*, Brochant, i. 613. *Baryte Carbonatée*, Haüy, ii. 308.

Eſſen. Char.—Forming a white precipitate in weak nitric acid before ſolution.

Exter. Char.—Found maſſive, or diſſeminated, rarely cryſtallized; forms of its cryſtals are, a ſix-ſided priſm, with a ſix-ſided pyramid ſet on the lateral faces; the ſame priſm having all the angles truncated; a double ſix-ſided pyramid. The cryſtals, which are ſmall, are uſually imbedded in the mineral itſelf; ſometimes grouped in bundles, or croſſing each other. Surface ſmooth; luſtre of the principal fracture ſhining, or weakly ſhining, reſinous; fracture between radiated and foliated; croſs fracture fine grained uneven; fragments wedge-ſhaped.

Colour yellowiſh gray, grayiſh, or yellowiſh white; tranſlucent, or ſemitranſparent; ſemihard, or ſoft; brittle; eaſily frangible. Spec. grav. 4.3 to 4.33.

Chem. Char.—Infuſible according to Hauy, before the blow-pipe; but according to Brochant, melts before the blow-pipe to a white enamel.

Conſtituent Parts.

	Pelletier.	Vauquelin.
Barytes,	62	74.5
Carbonic acid,	22	25.5
Water,	16	—
	100	100.0

Conſtituent Parts according to Klaproth.

Carbonate of barytes,	98.246
Carbonate of ſtrontites,	1.703
Alumina iron,	.043
Carbonate of copper,	.008
	100.000

Localities, &c.—This mineral was diſcovered by Dr Withering at Angleſark in Lancaſhire, in lead veins, which traverſe the coal ſtrata, and it is accompanied with heavy ſpar and blende.

Uſes.—Barytes acts as a ſtrong poiſon on the animal economy. It has been long employed at Angleſark for the purpoſe of deſtroying rats. It has alſo been tried as a medicine in ſcrofula, but ſeemingly with little effect; and it ought to be had recourſe to with extreme caution.

2. Species. HEAVY SPAR, or *Sulphate of Barytes.*

This ſpecies has been divided into eight ſubſpecies; earthy, compact, granular, foliated, common, columnar, priſmatic, and bolognian.

Subſpecies 1. EARTHY HEAVY SPAR.

Earthy Baroſelenite, Kirwan, i. 138. *Le Spath Peſant Terreux*, Brochant, i. 617.

Exter.

Exter. Char.—Found maſſive; luſtre ſcarcely glimmering, or dull; conſiſts of earthy particles, which are ſlightly cohering; ſtains a little; feels meagre.

Colour ſnow white, grayiſh, yellowiſh, or reddiſh white.

Localities, &c.—This a rare mineral. It has been found in Saxony, covering maſſes of heavy ſpar, and alſo in Derbyſhire and Staffordſhire in England.

Subſpecies 2. COMPACT HEAVY SPAR.

Compact Baroſelenite, Kirw. i. 138. *Baryte Sulfatée Compacte*, Hauy, ii. 303. *Id.* Broch. i. 618.

Exter. Char.—Found maſſive, ſometimes in kidney-form or globular pieces, with cubical impreſſions; luſtre glimmering, ſometimes dull, and ſometimes weakly ſhining; fracture coarſe earthy, ſometimes uneven; fragments not very ſharp-edged.

Colour yellowiſh, grayiſh white, ſometimes pale fleſh red; opaque, or tranſlucent at the edges; ſoft; not very brittle; eaſily frangible; feels meagre.

Localities, &c.—Found in mineral veins in Saxony, and in England; in clay ſlate, in Savoy; and we have found it in ſand ſtone in Northumberland.

Subſpecies 3. GRANULAR HEAVY SPAR.

Exter. Char.—This alſo is found maſſive; luſtre glimmering, nearly ſhining, and pearly; fracture foliated, or ſplintery; fragments blunt-edged.

Colour ſnow-white, milk-white, yellowiſh, or reddiſh; tranſlucent; ſoft; not very brittle; eaſily frangible. Spec. grav. 3.8.

Conſtituent Parts. Klaproth.

Barytes	60
Sulphuric acid,	30
Silica,	16
	100

Localities, &c.—Found in mineral veins in Saxony, along with galena, and in Siberia, accompanied by copper and ſilver ores.

Subſpecies 4. FOLIATED HEAVY SPAR.

Exter. Char.—Found maſſive, and in kidney-ſhaped, globular, and cellular pieces, compoſed of four-ſided tables, or lenſes, with a druſy ſurface; luſtre glimmering or ſhining, between pearly and vitreous; fracture curved foliated, ſometimes ſplintery; fragments not very ſharp-edged, ſometimes wedge-ſhaped.

Colour yellowiſh, reddiſh, or grayiſh white, ſometimes fleſh or browniſh red; tranſlucent; ſoft; not very brittle; eaſily frangible.

Localities, &c.—Is not uncommon in mineral veins; ſometimes alſo in beds, in many countries. It is alſo found in Britain.

Subſpecies 5. COMMON HEAVY SPAR.

Foliated Baroſelenite, Kirw. i. 140. Broch. i. 624.

Exter. Char.—This mineral is found in maſſes, or diſſeminated, and very often cryſtallized. Its principal forms are, 1. A double four-ſided pyramid; 2. A four-ſided priſm, rectangular or oblique; 3. A four-ſided table, rectangular or oblique; 4. A ſix-ſided priſm; 5. A ſix-ſided table; and, 6. A long eight-ſided table. Theſe forms are variouſly modified by truncations and bevelments, and they are differently grouped together; the priſms croſs one another; the tables are attached by their lateral faces, and form globular or kidney-ſhaped groups; ſurfaces ſmooth, ſometimes rough and druſy. Luſtre reſplendent, ſhining, glimmering, or only dull: internal luſtre ſhining or reſplendent, between pearly and reſinous: fracture ſtraight foliated; cleavage threefold; fragments ſomewhat rhomboidal.

Colour commonly white, ſnow-white, milk-white, grayiſh, yellowiſh, or reddiſh; in maſſes tranſlucent; in cryſtals tranſparent or ſemitranſparent; refraction double; ſoft; brittle. Spec. grav. 4.29 to 4.47, and 4.5.

Chem. Char.—Fuſible before the blow-pipe into a ſolid white enamel, which being moiſtened, gives out the odour of ſulphurated hydrogen. Does not efferveſce with acids.

Conſtituent Parts.

	Withering.	Bergman.
Barytes,	67.2	84
Sulphuric acid,	32.8	13
Water,	–	3
	100.0	100

Localities, &c.—This is a very common mineral, and particularly in metallic veins that traverſe primitive mountains. It accompanies ores of ſilver, copper, lead, and cobalt, as well as fluor ſpar, calcareous ſpar, and quartz.

Subſpecies 6. COLUMNAR HEAVY SPAR.

Le Spath Peſant en Barres, Broch. i. 631. *Baryte Sulphatée Bacillaire*, Hauy, ii. 302.

Exter. Char.—Found always cryſtallized: 1. In oblique four-ſided priſms; 2. The ſame priſm terminated by an acute bevelment; 3. The ſame priſm terminated by a four-ſided pyramid placed on the lateral edges; and, 4. A ſix-ſided priſm bevelled at the extremity. The cryſtals are acicular, and are grouped together in bundles; ſurface ſhining, or weakly ſhining; internal luſtre ſhining; longitudinal fracture radiated; croſs fracture even. Fragments rhomboidal.

Colour ſilvery, grayiſh, or greeniſh white; tranſlucent; ſoft, and brittle.

Localities, &c.—Found in Saxony, and Derbyſhire in England, accompanied by other varieties of heavy ſpar, quartz, and fluor ſpar.

Subſpecies 7. PRISMATIC HEAVY SPAR.

Exter. Char.—Found maſſive, and frequently cryſtallized. The uſual forms are, 1. An oblique four-ſided priſm, bevelled at the extremities; 2. An oblique four-ſided priſm, terminated by a four-ſided pyramid placed on the lateral edges; 3. An elongated octahedron; and, 4. A ſix-ſided priſm. Luſtre ſhining or reſplendent, between reſinous and pearly; fracture foliated; cleavage threefold.

Strontian genus.

Colour yellowiſh, greeniſh, or pearl gray, ſometimes pale blue, and rarely fleſh red; tranſlucent; when cryſtallized, tranſparent; ſoft, and not very brittle; very eaſily frangible.

Localities, &c.—Sometimes found in mineral veins, as in Saxony.

Subſpecies 8. Bolognian Heavy Spar.

Le Spath de Bologne, Brochant, i. 633. *Striated* or *fibrous heavy ſpar*, Kirwan, i. 141. *Baryte ſulfatée radiée*, Hauy, ii. 302.

Exter. Char.—This is found in rounded pieces; external ſurface uneven, dull, or glimmering; internal luſtre ſhining, or weakly ſhining, between adamantine and pearly; fracture radiated, parallel, diverging, or fibrous, ſometimes foliated; fragments ſplintery, ſometimes rhomboidal.

Colour, ſmoke or yellowiſh gray; tranſlucent, ſoft, very brittle, and eaſily frangible.

Chem. Char.—This mineral has been long known by its property of ſhining in the dark, after being heated. Other heavy ſpars, indeed, have a ſimilar property.

Conſtituent Parts. Arvidſon.

Sulphate of barytes,	62.
Silica,	15.
Alumina,	14.75
Gypſum,	6.
Oxide of iron,	.25
Water,	2.
	100.00

Localities, &c.—This mineral is found at Monte Paterno near Bologna in Italy, in rounded maſſes, which have an uneven ſurface: they are imbedded in an argillaceous or marly rock, which is a kind of amygdaloid, and from which they are detached by the action of the waters.

VIII. STRONTIAN Genus.

1. Species. Strontites, *Carbonate.*

La Strontianite, Brochant, i. 637. *Id.* Kirw. i. 332. *Strontiane Carbonatée*, Hauy, ii. 327.

Eſſen. Char.—Soluble in nitric acid with effervescence; paper dipped in the ſolution, and dried, burns with a purple flame.

Exter. Char.—Found maſſive, and ſometimes cryſtallized in needles, which are grouped together; form of the cryſtals a regular ſix-ſided priſm; luſtre weakly ſhining, or only glimmering; internal luſtre ſhining, and weakly ſhining, between reſinous and pearly; fracture radiated, ſtraight, diverging, or fibrous; croſs fracture fine grained, uneven, or ſplintery; fragments wedge-ſhaped, or ſharp-edged.

Colour aſparagus green, greeniſh, whitiſh, or yellowiſh gray; tranſlucent; ſemihard, brittle and eaſily frangible; feels a little greaſy. Spec. grav. 3.4 to 3.67.

Chem. Char.—Before the blow-pipe whitens without fuſion, and afterwards expoſed to the air, falls to powder.

Claſſification.

Conſtituent Parts.

	Klaproth.	Pelletier.
Strontites,	69.5	62
Carbonic acid,	30.	30
Water,	.5	8
	100.0	100

Localities, &c.—This mineral has been hitherto found only at Strontian in Scotland, in a lead vein which traverſes a gneiſs rock. It is ſaid alſo to have been found at Leadhills.

2. Species. Celestine, *Sulphate of Strontites.*

La Celeſtine, Brochant, i. 640. *Strontiane ſulfatée*, Hauy, ii. 313.

Eſſen. Char.—Diviſible into a rhomboidal priſm, with angles of about 105° and 75°; gives a light red colour to the blue part of the flame produced by the blow-pipe.

Exter. Char.—Primitive form of its cryſtals a rectangular priſm, whoſe baſes are rhombs; integrant molecule a triangular priſm with ſquare baſes. The forms under which it generally appears are four or ſix-ſided priſms, which are terminated by a two-ſided bevelment, a four-ſided, or an eight-ſided pyramid.

This ſpecies has been divided into two ſubſpecies: 1. fibrous; and, 2. foliated.

Subſpecies 1. Fibrous Celestine.

Exter. Char.—Found maſſive or cryſtallized; luſtre of the longitudinal fracture ſhining; that of the croſs fracture, weakly ſhining between pearly and reſinous. Longitudinal fracture foliated; croſs fracture fibrous, curved; fragments ſplintery; rather blunt-edged.

Colour indigo blue, bluiſh gray, and ſometimes with whitiſh bands, or with yellowiſh brown ſpots; tranſlucent; ſoft, and eaſily frangible. Spec. grav. 3.83.

Conſtituent Parts. Klaproth.

Strontites,	58
Sulphuric acid and oxide of iron	42
	100

Localities, &c.—Has been found in Pennſylvania in America, and near Toul in France.

Subſpecies 2. Foliated Celestine.

Exter. Char.—This is alſo found maſſive and cryſtallized; luſtre weakly ſhining, or ſhining; that of the cryſtals reſplendent; fracture foliated, ſtraight, or radiated; cleavage threefold.

Colour milk-white, grayiſh, and bluiſh-white: ſemitranſparent, or tranſlucent; ſemi-hard; very eaſily frangible.

The following are the conſtituent parts of a variety of ſulphate of ſtrontites, which is found at Mont Martre near Paris.

Sulphate of ſtrontites,	91.42
Carbonate of lime,	8.33
Oxide of iron,	.25
	100.00*

Localities,

---

* *Vauquelin, Jour. de Mines*, N° 53. p. 355.

Localities, &c.—This variety is found in great abundance near Briſtol in England, where the ſulphate of ſtrontites was firſt diſcovered by Mr Clayfield. It has been ſince found in Sicily, where it is accompanied with fibrous gypſum and native ſulphur.

SECOND CLASS. *SALTS.*

I. Genus. SULPHATES.

1. Species. Native Vitriol.

Mixed vitriol, or *ſulphate of iron, copper and zinc.* Kirwan, ii. 24. *Vitriol Natif*, Brochant, ii. 2.

Exter. Char.—This mineral is found maſſive or diſſeminated, and alſo in a ſtalactitical, cylindrical, and capillary form; internal luſtre ſhining, or weakly ſhining, between ſilky and vitreous; external ſurface rough and uneven; fracture uſually fibrous, ſometimes foliated.

Colour grayiſh, or yellowiſh white, ſometimes different ſhades of ſky blue; the colour varies by expoſure to the air. Soft; ſemi-tranſparent or tranſlucent; taſte ſour and aſtringent.

Chem. Char.—Theſe are different, according to the proportions of the conſtituent parts. Before the blow-pipe, ſulphurated hydrogen gas is given out; the iron is detected by giving a black colour to the ſolution of nut galls; the copper, by immerſing a plate of iron; and the zinc, by a white efflореſcence, which appears when the native ſalt is expoſed to the air.

This ſubſtance is a mixed ſalt, compoſed of the ſulphates of iron, zinc and copper, in variable proportions, ſo that its appearance and characters muſt alſo be variable.

Localities, &c.—Native vitriol is not uncommon in mountains of clay ſlate which contain metallic ores, and particularly thoſe of copper and iron pyrites, and blende; by the decompoſition of which it is formed. It is found in Bohemia, Saxony, and Hungary, as well as in the mines of Britain, where ſuch metallic ores abound.

The native ſulphate of iron is common in coal mines which contain iron pyrites, as in many of the coal mines of Britain. This ſubſtance is very abundant in the earl of Glaſgow's coal mines near Paiſley, where the manufacture of copperas, by purifying and cryſtallizing the native ſalt, has been long carried on.

Uſes.—The mixed ſubſtance, native vitriol, can only be employed to any uſeful purpoſe, by obtaining the different ſalts in a ſeparate form. The uſes of theſe ſalts are well known in various arts, but particularly in dyeing, and ſome of them in medicine.

2. Species. Native Alum.

Alum, Kirwan, ii. 13. *L'Alun Natif*, Brochant, ii. 6. *Alumine Sulfatée alkaline*, Hauy, ii. 387, 388.

Exter. Char.—Native alum is uſually found in ſmall capillary cryſtals, ſometimes adhering to other minerals, and very rarely in ſtalactitical maſſes. The form of the cryſtal of alum is the regular octahedron, which is uſually obtained artificially. Externally it is dull, or ſlightly glimmering, but internally ſhining, with a ſilky or vitreous luſtre; fracture fibrous; very ſoft; taſte aſtringent.

Chem. Char.—Before the blow-pipe melts eaſily in its water of cryſtallization, then froths up, and becomes a white ſpongy maſs.

Alum is a triple ſalt, a ſulphate of alumina and potaſh. It rarely happens that all the three ingredients exiſt together in nature. The potaſh is uſually added during the preparation of artificial alum.

According to the examination of native alum by Klaproth, from the alum cavern at Cape Miſeno near Naples, it appears that from 1000 lbs. of the material furniſhed by nature, 470 lbs. may be obtained, having the requiſite quantity of potaſh; and by an addition of potaſh to promote the cryſtallization, 290 lbs. more may be obtained. *Analyt. Eſſ.* i. 268. The following is the analyſis of the aluminous ſchiſtus from Freyenwalde by the ſame chemiſt.

Alumina,	15.25
Oxide of iron,	7.50
Potaſh,	.25
Sulphuric acid and water of cryſtallization,	77.
	100.00*

Localities, &c.—Native alum is found in thoſe places where the aluminous ſtones, already deſcribed, abound, as in the neighbourhood of volcanoes, and in coal mines. An extenſive alum manufactory has been carried on for ſeveral years with great ſkill and ſucceſs, at Lord Glaſgow's coal work near Paiſley, mentioned above. The materials are obtained from the rubbiſh in the old waſtes, which conſiſts of the aluminous ſchiſtus from the roof and pavement of the coal. Theſe mines alſo abound with iron pyrites; and from the decompoſition of all theſe ſubſtances the native vitriol and native alum are obtained.

Uſes.—The uſes of alum in various arts are too well known to require any enumeration.

3. Species. Mountain Butter.

La Beurre de Montagne, Broch. ii. 10.

Exter. Char.—Found maſſive; internal luſtre ſtrongly glimmering, waxy; fracture foliated; fragments blunt-edged.

Colour grayiſh white, ſulphur yellow, or yellowiſh brown; tranſlucent at the edges; feels greaſy; taſte aſtringent.

Localities, &c.—This ſpecies is found in ſimilar ſituations with the former. In its native repoſitory it is nearly as ſoft as butter, and has ſomething of the appearance, from which it has its name. Perhaps it ought to be conſidered merely as a variety of the former. The ſame remark may be applied to another variety called *plumoſe alum.*

4. Species. Capillary Salt. *Sulphate of Magneſia.*

Le Sel Capillaire, Broch. ii. 8. *Haar Salz*, or *Hair Salt*, of the Germans.

Exter. Char.—This ſalt is always found in fine capillary cryſtals, ſo cloſely united together as to form a compact maſs; luſtre ſhining, or weakly ſhining, ſilky; fracture fibrous.

---

* *Analyt. Eſſ.* ii. 78.

Colour white, ſometimes greeniſh, grayiſh, or yellowiſh; tranſlucent, friable; taſte aſtringent.

Conſtituent Parts.—This ſalt was ſuppoſed to be a plumoſe or native alum; but it appears from the analyſis of Klaproth, to be a ſulphate of magneſia, with a ſmall proportion of iron. We have examined a ſimilar capillary ſalt from the coal mines near Paiſley, which alſo appeared to be a ſulphate of magneſia, but with a greater proportion of ſulphate of iron.

Localities, &c.—This native ſalt is found in ſimilar ſituations with the former ſpecies.

5. Species. NATIVE EPSOM SALT, or *Sulphate of Magneſia.*

Le Sel amer Natif, Broch. ii. 11. *Epſom Salt*, Kir. ii. 12.

Exter. Char.—The characters already given of the former ſpecies are equally applicable to this, excepting that it is ſaid to exiſt ſometimes in an earthy form, when it has a dull appearance.

Localities, &c.—Found in a ſtate of eﬄoreſcence on limeſtone, porphyry, ſandſtones; and it exiſts in ſolution in many mineral waters, as in that of Epſom in England, from which it has its name. This ſalt alſo conſtitutes part of the eﬄoreſcence which is obſerved on walls built with lime.

6. Species. NATIVE GLAUBER SALT, or *Sulphate of Soda.*

Glauber Salt, Kirw. ii. 9. *Le Sel de Glauber Natif*, Broch. ii. 14.

Exter. Char.—This ſalt is ſometimes found maſſive or earthy, rarely ſtalactitical or cryſtallized. The cryſtals are often acicular, or in irregular, ſix-ſided priſms, terminated by a three-ſided pyramid, placed on the lateral edges or ſides. Luſtre ſhining, vitreous; but expoſed to the air becomes dull. Fracture uneven; that of the cryſtals conchoidal. Fragments blunt-edged.

Colour yellowiſh or grayiſh white; opaque or tranſparent; brittle; taſte cooling or bitter.

Localities, &c.—This ſalt is uſually found in the neighbourhood of mineral ſprings which hold common ſalt in ſolution, from the decompoſition of which, and the combination of its baſe with ſulphuric acid, it is obtained. It is not unfrequent on the banks of ſalt lakes, and in a ſtate of eﬄoreſcence on ſandſtone, marl, ſometimes on the ſurface of the ground, and ſometimes on walls built with ſtone and mortar. It is found in moſt countries in the world.

II. GENUS. NITRATES.

1. Species. NATIVE NITRE, or *Nitrate of Potaſh.*

Nitre, Kirw. ii. 25. *Le Nitre Natif*, Broch. ii. 17. *Potaſſe Nitratée*, Hauy, ii. 346. *Saltpetre.*

Eſſen. Char.—Does not deliqueſce, and detonates with a combuſtible body.

Exter. Char.—This ſalt is commonly found ſuperficial, in acicular cryſtals, rarely maſſive, and more rarely cryſtallized in ſix-ſided priſms; luſtre ſhining, vitreous; fracture conchoidal; fragments ſharp-edged.

Colour ſnow white, grayiſh or yellowiſh white; tranſlucent; ſoft; eaſily frangible or friable; taſte ſaline cooling.

Conſtituent Parts.	Klaproth.
Nitrate of potaſh,	42.55
Muriate of potaſh,	.20
Sulphate of lime,	25.45
Carbonate of lime,	30.40
Loſs,	1.40
	100.00*

Exter. Char. &c.—Native nitre is found in Italy near Molfetta, in Naples, from which that analyzed by Klaproth was obtained, and which is diſpoſed in ſmall beds, or more rarely in veins, on limeſtone. Native nitre is alſo not uncommon in Hungary, Spain, France, and Peru, in which latter country, and in the Eaſt Indies, where it is very abundant, it is found eﬄoreſcent on the ſurface of the ground at certain ſeaſons of the year.

Uſes.—The uſes of nitre for ſome economical purpoſes, in various arts, in medicine, but particularly in the manufacture of gunpowder, are well known.

III. GENUS. MURIATES.

1. Species. ROCK SALT.

Common Salt, Sal Gem, Kirw. ii. 31. *Le Sel de Cuiſine*, Broch. ii. 20. *Soude Muriatée*, Hauy, ii. 356.

Eſſen. Char.—Soluble in water, and diviſible into cubes.

This ſpecies is divided into two ſubſpecies: 1. foliated, and 2. fibrous rock ſalt.

Subſpecies 1. FOLIATED ROCK SALT.

Le Sel Gemme Lamelleux, Broch. ii. 21. *Lamellar Sal Gem*, Kirw. ii. 32. *Soude Muriatée, Amorphe*, Hauy, ii. 359.

Exter. Char.—Uſually found maſſive in conſiderable beds, ſometimes diſſeminated in large maſſes, or kidney-form, ſtalactitical, or cryſtallized in perfect cubes; ſurface of the cryſtals ſmooth; luſtre ſhining, vitreous; fracture foliated; cleavage threefold and rectangular; fragments cubic.

Colour grayiſh, yellowiſh, or reddiſh white, fleſh or browniſh red; tranſparent or tranſlucent; ſoft; ſtreak grayiſh white; taſte ſaline.

Chem. Char.—This ſalt decrepitates violently when thrown on burning coals.

Conſtituent Parts.

	Kirwan.	Bergman.
Soda,	35	42
Muriatic acid,	40	52
Water,	25	6
	100	100

The above are the analyſes of pure ſalt; for as it is found in nature, it contains ſeveral other ingredients.

Localities, &c.—Foliated rock ſalt conſtitutes a peculiar kind of ſtratiform mountain, in which it uſually

---

* *Analyt. Eſſ.* i. 270.

Claſſification.

ally alternates with beds of clay, which are more or leſs penetrated with ſalt. It is alſo accompanied with gypſum, ſandſtone, limeſtone. It is ſometimes alſo found in veins.

Rock ſalt is found in moſt countries of the world; the moſt celebrated mines are thoſe of Wiliczka, which have been wrought for 500 years. There are mines of this mineral in Poland, Sileſia, and in Bavaria and Siberia; at Cordova in Spain it conſtitutes an entire mountain, four or five hundred feet high. Rock ſalt is alſo found in abundance in Cheſhire in England. It is found alſo in Africa, Aſia, as well as in North and South America.

Subſpecies 2. FIBROUS ROCK SALT.

Fibrous Sal Gem, Kirw. ii. 32. *Le Sel Gemme Fibreux*, Broch. ii. 25. *Soude Muriatée Fibreuſe*, Hauy, ii. 359.

Exter. Char.—This variety is found maſſive, in ſmall wedge-ſhaped veins; luſtre glimmering, rarely weakly ſhining; fracture fibrous, curved parallel or divergent; fragments wedge-ſhaped, with ſharp edges.

Colour grayiſh white, yellowiſh or pearl gray, lavender blue, violet blue, or fleſh red; varies between tranſlucent and ſemitranſparent. The other characters of fibrous rock ſalt correſpond with thoſe of the preceding ſubſpecies, and it is found in ſimilar ſituations accompanying it.

2. Species. SEA SALT.

This ſalt can perhaps ſcarcely be conſidered as a ſeparate ſpecies. It is found on the ſhores of the ocean, or of ſalt lakes during the dry ſeaſons of the year, in conſequence of the evaporation and diminution of the water which holds it in ſolution.

Uſes.—The various uſes of ſalt in domeſtic economy and many of the arts are well known.

3. Species. NATIVE SAL AMMONIAC.

Sal Ammoniac, Kirw ii. 33. *Le Sel Ammoniac Natif*, Broch. ii. 27. *Ammoniaque Muriatée*, Hauy, ii. 380.

Eſſen. Char.—Entirely volatile by the application of heat.

Exter. Char.—Moſt commonly found in ſuperficial layers, or effloreſcent; ſometimes alſo maſſive or ſtalactitical, and rarely cryſtallized. Primitive form of its cryſtals a regular octahedron; integrant molecule a regular tetrahedron. The cryſtals are deſcribed to be in the form of cubes, ſix ſided pyramids, and dodecahedral; luſtre ſhining, often only glimmering or dull and vitreous. Fracture even; fragments ſharp-edged.

Colour white, grayiſh, or yellowiſh; ſoft, and often friable; taſte ſaline, pungent, and bitter.

Chem. Char.—Very ſoluble in water, producing a conſiderable degree of cold; rubbed with lime, gives out a pungent odour of ammonia.

Conſtituent Parts.	Klaproth.
Muriate of ammonia,	77.5
Sulphate of ammonia,	2.5
	100.0

Salts.

Localities, &c.—This ſalt is a volcanic production, and found depoſited in the cavities of lava, as on Veſuvius and Ætna, and in the Lipari iſlands. It is alſo met with in Iceland, in Perſia, and different places of Aſia. The ſubſtance analyzed by Klaproth was from Tartary. This ſalt has alſo been diſcovered in the neighbourhood of coal mines in Britain, which have been accidentally on fire. Sal ammoniac from Egypt may be conſidered rather as an artificial production.

IV. GENUS. CARBONATES.

1. Species. NATIVE SODA, or *Carbonate of Soda.*

Natron, Kirw. ii. 6. *L'Alkali Mineral*, Broch. ii. 30. *Soude Carbonatée*, Hauy, ii. 373.

Eſſen. Char.—Soluble in water, and efferveſces with nitric acid.

Exter. Char.—Found in ſmall particles, which are uſually in the ſtate of powder; is dull and meagre to the touch.

Colour grayiſh white, or yellowiſh gray; taſte ſharp alkaline.

Chem. Char.—Very fuſible before the blow-pipe; the ſolution renders vegetable blues green.

The following are the conſtituent parts of Egyptian natron or ſoda, analyſed by Klaproth.

Carbonate of ſoda,	32.6
Sulphate of ſoda,	20.8
Muriate of ſoda,	15.
Water,	31.6
	100.0

Localities, &c.—Native ſoda is found on the ſurface of the ſoil, or on the borders of lakes which evaporate during the ſummer, in Egypt, where it has been long collected, and known under the name of *natron*. In the neighbourhood of Debreczin in Hungary, it is found effloreſcent on a heathy ſoil; in Bohemia, on a decompoſed gneiſs rock, where it is annually collected in conſiderable quantity in the ſpring of the year. Natron is alſo found near Naples, in Perſia, Bengal, and China. It exiſts alſo in ſolution in many mineral waters.

Uſes.—This ſalt is very extenſively employed in many arts.

Another variety of native ſoda has been deſcribed. This is in the form of radiated maſſes, which are compoſed of acicular cryſtals. It ſeems to be a purer carbonate of ſoda. The following are the conſtituent parts according to the analyſis of Klaproth.

Soda,	37.
Carbonic acid,	38.
Water,	22.5
Sulphate of ſoda,	2.5
	100.0

2. Species. NATIVE MAGNESIA, or *Carbonate of Magneſia.*

A pretty pure carbonate of magneſia, diſcovered by Dr Mitchell; and another which contains an admixture of of ſilica diſcovered by Giobert, has been already deſcribed under the magneſian genus, ſpecies 1. which ſee.

V. Genus. BORATES.

1. Species. Borax.

Id. Kirw. ii. 37. *Borax Natif*, Broch. ii. 33. *Soude Boratée*, Hauy, ii. 366.

Eſſen. Char.—Taſte ſweetiſh; fuſible with conſiderable intumeſcence into a vitreous globule.

Exter. Char.—This ſalt is found maſſive and diſſeminated, but moſt frequently cryſtallized; the forms are a ſix-ſided priſm with the two oppoſite faces broader; the ſame priſm having its lateral edges truncated, or having its too narrow terminal edges truncated; the cryſtals are uſually imbedded in an earthy maſs; ſurface a little rough, ſometimes ſmooth, and uſually covered with a white earthy cruſt; luſtre ſhining, waxy; fracture foliated.

Colour grayiſh white, yellowiſh or greeniſh; ſemitranſparent, or only tranſlucent; refraction double; ſoft; brittle; greaſy to the feel. Spec. grav. 1.740.

Conſtituent Parts.—When borax is purified, it is a compound of ſoda and boracic acid; but in its native ſtate it is always contaminated with earthy matters.

Localities, &c.—Borax is brought from Perſia and Thibet. According to ſome travellers, it is got from the waters of a lake by evaporation in the open air; but according to others it is ready formed on the borders of the lake, where common ſalt is alſo collected.

Uſes.—Borax is ſtill farther purified after it is brought to Europe, for the purpoſes of employing it in the arts, particularly as a flux in metallurgical operations.

2. Species. Boracite, or *Borate of Magneſia.*

Boracite, Kirw. i. 172. *Id.* Brochant, i. 589.

Exter. Char.—Always found cryſtallized: 1. In cubes, having the edges and four of the angles truncated; 2. The cube, having all the edges and angles truncated. When theſe truncations are increaſed on the edges, a dodecahedron is nearly formed, or when they increaſe on the angles, the reſulting form is an octahedron. Surface of the cryſtals ſmooth, ſometimes rough; luſtre ſhining or reſplendent; internal luſtre ſhining, reſinous; fracture conchoidal; fragments ſharp-edged.

Colour aſh or yellowiſh gray, grayiſh or greeniſh white; ſemitranſparent or tranſlucent, oftener opaque; ſemihard; rather eaſily frangible. Spec. grav. 2.56.

Chem. Char.—Melts before the blow-pipe, froths up, and yields a yellowiſh enamel, on which ſmall rough points appear, and are thrown off like ſparks by continuing the heat.

Conſtituent Parts. Weſtrumb.

Magneſia,	13.5
Lime,	11.
Silica,	2.
Alumina,	1.
Oxide of iron,	.7
Boracic acid,	68.
Loſs,	3.8
	100.0

Phys. Char.—Boracite has the property of becoming electric by heat, and exhibiting both kinds of electricity by oppoſite points. Theſe electric poles are the extremities of the axes of the cube, each axis giving out at one extremity poſitive, and at the other negative electricity.

Localities, &c.—This mineral has been only found at Lunebourg in Lower Saxony, in a mountain compoſed almoſt entirely of foliated gypſum, in which the detached cryſtals are imbedded.

VI. Genus. FLUATES.

1. Species. Cryolite, or *Fluate of Soda and Alumina*

Id. Brochant, ii. 505. *Alumine Fluatée Alkaline*, Hauy, ii. 398.

Exter. Char.—Found maſſive; luſtre ſhining, vitreous; fracture foliated; fragments cubical.

Colour grayiſh white; tranſlucent; immerſed in water, tranſparent; ſemihard; ſtreak ſnow-white. Spec. grav. 2.94.

Chem. Char.—Melts in the flame of a candle, and from its eaſy fuſibility it derives its name. It then becomes hard, and is changed into a ſlag, which is ſomewhat cauſtic. Soluble with efferveſcence in ſulphuric acid, and gives out white vapours that corrode glaſs.

Conſtituent Parts.

	Klaproth.	Vauquelin.
Soda,	36.	32
Alumina,	23.5	21
Fluoric acid and water,	40.5	47
	100.0	100

Localities, &c.—Cryolite was brought to Copenhagen from Greenland, but nothing is known of its repoſitory (b).

THIRD CLASS. *COMBUSTIBLES.*

I. Genus. SULPHUR.

1. Species. Native Sulphur.

Id. Kirwan, ii. 69. *Le Soufre Natif*, Brochant, ii. 37.

This ſpecies is divided into two ſubſpecies; 1. Common; 2. Volcanic native ſulphur.

Subſpecies

(b) Boracite and cryolite do not certainly poſſeſs all the characters that entitle them to a place among the ſalts; but as magneſia is the predominant baſe of the one and ſoda of the other, it was thought better to introduce them here than to multiply diviſions.

Subſpecies 1. Common Native Sulphur.

Eſſen. Char.—The ſulphurous odour when heated; colour yellow.

Exter. Char.—Sulphur is found maſſive, diſſeminated in ſuperficial layers, or cryſtallized. Primitive form of its cryſtals is an octahedron, whoſe ſides are ſcalene triangles; the integrant molecule is an irregular tetrahedron. The uſual forms of the cryſtals are, 1. That of the primitive form, in which two four-ſided oblique-angled pyramids are joined baſe to baſe, of which the common baſe is a rhomb, whoſe two diagonals are as 5 to 4; 2. The ſame form having its ſummits truncated; 3. The firſt form having its ſummit ſurmounted by an obtuſe four-ſided acumination, ſet on the lateral faces; 4. Or, having the common caſe truncated; or, 5. Having its obtuſe lateral edges truncated; or, 6. Having the obtuſe angles of the common baſe truncated. The cryſtals are of various ſizes, moſt frequently grouped: ſurface ſmooth; luſtre reſplendent; internal luſtre ſhining, or weakly ſhining, between reſinous and adamantine; fracture fine grained, uneven, ſometimes conchoidal or ſplintery; fragments ſharp edged.

Colour yellow, greeniſh, or grayiſh yellow; tranſlucent or ſemitranſparent; refraction double; ſoft; brittle, and very eaſily frangible; gives out by rubbing a ſulphureous ſmell. Spec. grav. 1.99 to 2.03.

Chem. Char.—Burns with a peculiar blue flame, and gives out a pungent odour, which is well known.

Native ſulphur is not always pure; it is often contaminated with earthy matters.

Phys. Char.—Sulphur becomes electric by friction, and its electricity is negative.

Localities, &c.—Native ſulphur is moſt commonly found in ſtratiform mountains, chiefly in thoſe of gypſum, marl, and compact limeſtone, and there it exiſts in the form of nodules. Found alſo, but rarely, and in ſmall quantity, in the veins of primitive mountains. Sulphur is found in many countries of the world, as in Poland, Hungary, Switzerland, Spain, and Sicily, where the fineſt cryſtals yet known are found.

Subſpecies 2. Native Volcanic Sulphur.

Exter. Char.—Found maſſive, in rounded pieces, ſtalactitical, cellular, or in thin ſublimed layers, ſometimes alſo cryſtallized in confuſed groups; internal luſtre weakly ſhining or ſhining; fracture uneven; fragments blunt-edged.

Colour the ſame as the former, but inclining ſometimes a little towards gray; tranſlucent; in other characters it reſembles the preceding.

Localities, &c.—As its name imports, this variety is found near volcanoes, where it is ſublimed among the lava. The ſulphur of Ætna and Veſuvius chiefly, and alſo that of Iceland, and of ſome of the iſlands in the Weſt Indies, is collected, and forms a very important article in commerce.

Uſes.—Sulphur is one of the moſt valuable ſubſtances in various arts. It is employed in the bleaching of woollen ſtuffs and ſilks; it forms an eſſential ingredient in gunpowder, and it is the baſe of ſulphureous and ſulphuric acid, which are ſo extenſively employed in tanning, hat-making, dyeing, and other arts and manufactures.

II. BITUMINOUS Genus.

1. Species. Petroleum, or *Mineral Oil*.

Le Naphte, and *L'Huile Minerale Commune*, Broch. ii. 59. and 60. *Naphtha* and *Petrole*, Kirwan, ii. 42. and 43. *Bitume Liquide Brune, ou Noiratre*, Hauy, iii. 312.

Exter. Char.—Found fluid and ſomewhat viſcid.

Colour blackiſh or reddiſh brown; almoſt opaque; feels very greaſy; exhales a ſtrong bituminous odour; taſte pungent, acid. Spec. grav. 0.708 to 0.854.

Chem. Char.—Burns eaſily with a denſe ſmoke, and leaves ſome earthy reſidue. When expoſed to the air it becomes thicker and leſs fluid.

Its conſtituent parts are carbone, hydrogen, and a ſmall portion of oxygen.

Localities, &c.—Petroleum is generally found in the vicinity of coal, riſing to the ſurface of the water which flows from coal ſtrata. It is not uncommon in different parts of the world. It is found in Lancaſhire in England, and at St Catharine's well near Libberton, in the vicinity of Edinburgh.

Naphtha, which is conſidered merely as a purer kind of mineral oil, is found in conſiderable abundance in different parts of Perſia, on the ſhores of the Caſpian ſea, in Calabria, Sicily, and America. In 1802, a ſpring of naphtha of a topaz yellow colour, burning eaſily, and leaving little reſidue, with a ſpecific gravity of 0.83, was diſcovered in the ſtate of Parma in Italy, and afforded ſuch a quantity as to be ſufficient to illuminate the ſtreets of Genoa.

Uſes.—Naphtha has been ſometimes employed in the compoſition of varniſh, in that of fire-works, for the purpoſe of heating rooms, when it is mixed with a ſmall quantity of earth; and in Perſia and other countries it is burnt in lamps as a ſubſtitute for oil. Formerly it was employed in medicine as a vermifuge.

2. Species. Mineral Pitch.

This is divided into three ſubſpecies; 1. elaſtic; 2. earthy; and, 3. flaggy.

Subſpecies 1. Elastic Mineral Pitch.

Mineral Caoutchouc, Kirw. ii. 48. *La Poix Minerale Elaſtique*, Broch. ii. 64. *Bitume Elaſtique*, Hauy, iii. 313.

Exter. Char.—Found in maſſes of different ſizes, diſſeminated, ſometimes ſuperficial, or ſtalactitical; luſtre dull, rarely glimmering; internal luſtre ſhining, reſinous.

Colour browniſh black, hair-brown, often veined yellow; tranſlucent at the edges; ſoft conſiſtence like elaſtic gum, and alſo elaſtic. It gives out the ſmell of leather. Spec. grav. 0.902 to 1.23.

Localities, &c.—This mineral was diſcovered in 1785 in the mine of Odin in Derbyſhire in England, where it is accompanied with galena, calcareous ſpar, heavy ſpar, fluor ſpar, and blende.

This ſubſtance effaces the marks of black lead on paper, like elaſtic gum; but ſtains the paper.

Subſpecies 2. EARTHY MINERAL PITCH.

Semicompact Mineral Pitch, or *Maltha*, Kirw. ii. 46. *La Poix Minerale Terreuſe*, Broch. ii. 65.

Exter. Char.—Found maſſive; internally dull; fracture earthy, ſometimes uneven; fragments blunt-edged.

Colour blackiſh brown, ſometimes clove brown; ſtreak ſhining, and darker coloured; very ſoft; feels greaſy; ſmell bituminous.

Chem. Char.—Burns with much flame and ſmoke; exhales a ſtrong odour, and leaves carbonaceous and earthy matter.

Localities, &c.—Found in the principality of Neufchatel in Switzerland.

Subſpecies 3. SLAGGY MINERAL PITCH.

Compact Mineral Pitch, Kirw. ii. 46. *La Poix Minerale Scoriacée*, Broch. ii. 66. *Bitume Solide*, Hauy, iii. 313. *Aſphaltum*, or *Jews Pitch*, of others.

Exter. Char.—Found maſſive and diſſeminated, ſuperficial or ſtalactitical; luſtre reſplendent, reſinous; fracture conchoidal; fragments ſharp-edged.

Colour perfect black, ſometimes browniſh black; opaque, rarely tranſlucent at the edges; luſtre remains in the ſtreak; ſoft; feels greaſy; by rubbing gives out a bituminous odour. Spec. grav. 1.07 to 1.6.

Localities, &c.—This variety frequently accompanies the preceding. It is found at Morsfeld in the Palatinate, at Neufchatel in Switzerland. It is found floating on the ſurface of the lake Aſphaltum in Judea, from which it derives its name of *Jews pitch.* It is there collected by the inhabitants of the country as an object of commerce, and at the ſame time, it is ſaid to diminiſh the quantity of noxious vapours which it exhales—ſo noxious that birds flying over it drop down dead, whence it has the name of *Dead ſea.* This variety of mineral pitch is found in other places, ſometimes connected with coal and limeſtone ſtrata, and ſometimes with mineral veins. But the iſland of Trinidad furniſhes the greateſt quantity of this ſubſtance. In that iſland there is a pitch lake of about four miles in circumference; but it appears from the information of Mr Spon, in a letter to Mr Tobin of Briſtol, by whom this information was communicated, along with a number of ſpecimens to Mr Hatchett, that the ſubſtance formerly ſuppoſed to be mineral pitch, is nothing more than a porous ſtone impregnated with that ſubſtance; ſo that what was ſuppoſed to be an immenſe lake of mineral pitch or aſphaltum, is only the ſtone of the country impregnated with bitumen. Mr Hatchett thinks this ſtone may be arranged in the argillaceous genus *.

3. Species. AMBER.

Id. Kirw. ii. 65. *Le Succin*, Broch. ii. 69. *Id.* Hauy, ii. 327.

This is divided into two ſubſpecies.

Subſpecies 1. WHITE AMBER.

Exter. Char.—Found maſſive, and in rounded pieces; luſtre ſhining or weakly ſhining; fracture conchoidal; fragments ſharp-edged.

Colour yellowiſh white, or ſtraw-yellow; ſlightly tranſlucent; ſoft; eaſily frangible; by friction, or reducing to powder, it gives out an agreeable odour. Spec. grav. 1.07 to 1.08.

Chem. Char.—Burns with a yellow flame, without melting, giving out at the ſame time a peculiar odour; leaves very little reſidue.

Subſpecies 2. YELLOW AMBER.

Exter. Char.—Alſo found in rounded pieces of various ſizes; ſurface rough and uneven; dull, ſometimes glimmering; internal luſtre reſplendent, reſinous; ſometimes tranſparent. In its other external and chemical characters, it reſembles the preceding.

Phyſ. Char.—Amber becomes ſtrongly electric by friction, a property known to the ancients. From the Greek and Latin word *electrum*, the term electricity is derived.

Conſtitutent Parts.—Amber is compoſed of a large proportion of oil, and of a peculiar acid, the ſuccinic, which is obtained by diſtillation.

Localities, &c.—Amber is found in the vicinity of bituminous wood, but moſt commonly in the ſand on the ſhores of the ocean, and chiefly on the ſhores of the Baltic. It is found alſo in Sweden, France, Italy, and on the eaſt coaſt of England. Amber frequently contains ſmall parts of vegetables, and entire inſects. Of the origin of this ſubſtance nothing certain is yet known.

Uſes.—The uſes of amber for ornamental purpoſes, are well known. In this country it was formerly in higher eſtimation than at preſent. It ſtills forms an important article of commerce in eaſtern countries.

4. Species. MELLITE, or HONEY STONE.

Id. Hauy, iii. 335. *La Pierre de Miel*, Broch. ii. 73. *Mellilite*, Kirw. ii. 68.

Exter. Char.—Found uſually cryſtallized, in double four-ſided pyramids; the ſurface ſmooth and ſhining; internal luſtre reſplendent, between reſinous and vitreous; fracture conchoidal; fragments rather ſharp-edged.

Colour honey yellow, ſometimes hyacinth red; tranſparent or tranſlucent; refraction double; ſoft; brittle. Spec. grav. 1.58 to 1.66.

Chem. Char.—Becomes white before the blow-pipe, and is reduced to aſhes, without flame.

Conſtituent Parts.	Klaproth.
Alumina,	16
Mellitic acid,	46
Water,	38
	100

Phyſ. Char.—Becomes ſlightly electric by friction.

Localities, &c.—This mineral is hitherto rare. It has been found only in Switzerland, accompanied with mineral pitch, and at Arten in Thuringia, attached to bituminous wood.

5. Species. BROWN COAL.

This is divided into five ſubſpecies; 1. common; 2. bituminous wood; 3. earthy coal; 4. alum earth; 5. moor coal.

---

* Lin. Tranſ. viii. 251.

Subſpecies 1. COMMON BROWN COAL.

La Houille Brune, Broch. ii. 47.

Exter. Char.—Found maſſive; luſtre ſhining, reſinous; fracture conchoidal; longitudinal fracture ſlaty; fragments rather ſharp-edged.

Colour browniſh black, or blackiſh brown; ſtreak ſhining; ſoft; not very brittle.

Chem. Char.—Burns with a blue-coloured flame, and gives out an odour like that of bituminous wood.

Conſtituent Parts. Hatchett *.

	Grains.
Water which ſoon came over acid, and afterwards turbid by the mixture of bitumen,	60
Thick brown, oily bitumen,	21
Charcoal,	90
Hydrogen, carbonated hydrogen, and carbonic acid gaſes.	29
	200

The above is the analyſis of 200 grains of Bovey coal by diſtillation.

Localities, &c.—This variety is not uncommon in many places of Germany. It is found alſo at Bovey near Exeter in England, from which it is called *Bovey coal*.

Subſpecies 2. BITUMINOUS WOOD.

Carbonated Wood, Kirw. ii. 60. *Le Bois Bitumineux*, Broch. ii. 44.

Exter. Char.—Has a ligneous form, and even ſometimes the appearance of branches and roots of trees; glimmering in the principal fracture, in the croſs fracture, conchoidal; fragments, ſplintery, wedge-ſhaped, or tabular.

Colour commonly light blackiſh brown, ſometimes wood brown; opaque; ſtreak ſhining; ſoft, and eaſily frangible.

Chem. Char.—Burns with a bright flame, and gives out a ſweetiſh, bituminous ſmell.

Localities, &c.—This variety is found in the ſame places with the other varieties of coal, and alſo in places where the more common kinds of coal are rare, or in ſmall quantity, as in the iſland of Iceland, where it is known by the name of *ſurturbrand;* and in the iſland of Skye in Scotland. It is found alſo in the coal fields round Edinburgh, and alſo at Bovey near Exeter, and in various places on the continent.

Subſpecies 3. EARTHY COAL.

Bois Bitumineux Terreux, Brochant, ii. 45.

Exter. Char.—The conſiſtence of this variety is intermediate between ſolid and friable; dull, rarely glimmering; fracture earthy.

Colour blackiſh brown, or liver brown; ſtreak ſhining; ſtains; very ſoft.

Localities, &c.—This is found in Saxony, Bohemia, France, and particularly in the vicinity of Cologne, where it is known by the name of *umber* or *Cologne earth*, which is employed in the fabrication of colours; and from certain varieties which contain pyrites, alum is extracted.

Subſpecies 4. ALUM EARTH.

This has been already deſcribed under the name of *aluminous ſchiſtus*, in the argillaceous genus.

Subſpecies 5. MOOR COAL.

La Houille Limoneuſe, Brochant, ii. 48.

Exter. Char.—This variety is found maſſive, and in extenſive beds; internally glimmering; croſs fracture even, ſometimes flat conchoidal; longitudinal fracture ſlaty; fragments trapezoidal or rhomboidal.

Colour blackiſh brown, and browniſh black; ſtreak ſhining; ſoft, very eaſily frangible.

Localities, &c.—Moor coal is abundant in Bohemia; it is found alſo in Tranſylvania, and chiefly among ſandſtone, limeſtone, and trap rocks. It ſeems to approach nearly to earth coal.

6. Species. BLACK COAL.

This ſpecies is divided into ſix ſubſpecies; pitch, columnar, ſlaty, cannel, foliated, and coarſe coal.

Subſpecies 1. PITCH COAL.

La Houille Piciforme, Brochant, ii. 49.

Exter. Char.—Found maſſive or diſſeminated; and ſometimes parts of vegetables, ſuch as the branches of trees, are obſerved. Luſtre ſhining, reſplendent, reſinous; fracture conchoidal; fragments ſharp-edged.

Colour perfect black, and the longitudinal fracture ſometimes browniſh; ſoft; eaſily frangible. Specific gravity 1.3.

Localities, &c.—This is one of the moſt common varieties of coal, and therefore is found in all coal countries.

Uſes.—As it is ſuſceptible of a fine poliſh, it is employed for various ornamental purpoſes. The ſubſtance known by the name of *jet*, belongs to this variety.

Subſpecies 2. COLUMNAR COAL.

La Houille Scapiforme, Brochant, ii. 15.

Exter. Char.—Found maſſive; in its fracture ſhining or weakly ſhining, reſinous; fracture more or leſs perfectly conchoidal; fragments indeterminate.

Colour perfect black, or browniſh black. It is compoſed of diſtinct concretions, which are columnar, parallel, ſlightly curved, whoſe ſurfaces are ſmooth and ſhining; is ſoft, and eaſily frangible.

Localities, &c.—This is a very rare variety of coal. It is found in the Meiſner, near Almerode, in Heſſia, in a baſaltic mountain.

Subſpecies 3. SLATY COAL.

La Houille Schiſteuſe, Brochant, ii. 52.

Exter. Char.—Found maſſive in entire beds; luſtre ſhining, ſometimes only weakly ſhining or glimmering, reſinous; principal fracture ſlaty; croſs fracture imperfect conchoidal; fragments in the form of tables; not very ſharp-edged.

Colour

---

* *Phil. Tranſ.* 1804. p. 399.

Colour perfect black, often alſo grayiſh, rarely browniſh black; ſtreak ſhining; ſoft, or ſemi-hard; eaſily frangible. Specific gravity 1.25 to 1.37.

Localities, &c.—This is the prevailing coal in Britain, as at Newcaſtle and Whitehaven in England, and in the coal country both in the eaſt and weſt of Scotland.

Subſpecies 4. CANNEL COAL.

La Houille de Kilkenny, Brochant, ii. 55. *Id.* Kirwan, ii. 52.

Exter. Char.—Found maſſive; luſtre weakly ſhining, reſinous; fracture commonly conchoidal, ſometimes even and foliated; fragments ſometimes rhomboidal or cubical.

Colour grayiſh black; ſtreak ſhining; ſoft; eaſily frangible. Spec. grav. 1.23 to 1.27.

Localities, &c.—This coal accompanies the former in many places of England and Scotland, as at Whitehaven and Wigan in Lancaſhire in England; in the neighbourhood of Edinburgh; and at Muirkirk, and other places in Ayrſhire in Scotland. The coal at Kilkenny in Ireland belongs alſo to this variety; and from the places where it is found, is called Wigan or Kilkenny coal.

Uſes.—Beſide being employed as fuel with other kinds of coal, this variety, being ſuſceptible of a fine poliſh, is cut and formed into various uſeful and ornamental purpoſes. It is ſaid that the choir of the cathedral church of Litchfield is covered with plates of this coal alternating with black marble.

Subſpecies 5. FOLIATED COAL.

Le Charbon Lamelleux, Brochant, ii. 54.

Exter. Char.—Found maſſive; principal fracture reſplendent; croſs fracture ſhining; principal fracture more or leſs foliated; croſs fracture ſomewhat uneven; fragments rhomboidal.

Colour perfect black, and on the ſides of the fiſſures ſuperficial colours appear, like the colours of tempered ſteel, or thoſe of the peacock's tail; eaſily frangible.

Localities, &c.—This coal is found at Liege, in Saxony, near Dreſden, and in ſome parts of France.

Subſpecies 6. COARSE COAL.

La Houille Groſſiere, Brochant, ii. 55.

Exter. Char.—Found maſſive; is weakly ſhining, reſinous; fracture uneven, or more or leſs ſlaty; fragments blunt-edged.

Colour grayiſh black, ſometimes browniſh black; ſtreak ſhining; ſoft; eaſily frangible.

Localities, &c.—Accompanies the other kinds of coal, whoſe localities have been already mentioned.

7. Species. COAL BLENDE.

This is divided into two ſubſpecies, conchoidal and ſlaty.

Subſpecies 1. CONCHOIDAL COAL BLENDE.

La Houille Eclatante, Brochant, ii. 50. *Glanz-kohle* of the Germans.

Exter. Char.—Found maſſive, rarely diſſeminated; luſtre ſhining or reſplendent, approaching to metallic; fracture perfectly conchoidal; fragments not very ſharp-edged.

Colour iron black, inclining to brown, or exhibiting the ſuperficial colours like tempered ſteel; ſoft; eaſily frangible.

Chem. Char.—Burns without any flame, leaving a white aſh.

Localities, &c.—This variety of coal is very rare. It is found at Newcaſtle, and at Meiſſiner in Heſſia, along with the other varieties of coal.

Subſpecies 2. SLATY COAL BLENDE.

Native Mineral Carbone, Kirw. ii. 49. *La Blende Charbonneuſe*, Brochant, ii. 57. *Anthracite*, Hauy, ii. 307.

Exter. Char.—Found maſſive and diſſeminated; internal luſtre ſhining, or reſplendent, and between metallic and vitreous; fracture more or leſs perfectly ſlaty; croſs fracture flat conchoidal; fragments ſometimes cubic, and ſometimes in tables.

Colour perfect black, approaching more or leſs to iron black, or grayiſh or bluiſh black; opaque; ſtains, but does not write; ſoft; rather brittle; very eaſily frangible. Spec. grav. 1.3 to 1.8.

Chem. Char.—Reduced to powder, and heated in a crucible, this coal gives neither a ſulphureous nor bituminous ſmell, and neither ſulphur nor bitumen can be obtained from it. After being long expoſed to heat, it conſumes ſlowly without flame, and loſes during the proceſs about two-thirds of its weight. The reſidue is of a blackiſh gray colour, which ſhows that the combuſtion has not been complete.

Conſtituent Parts.

	Panzenberg.	Dolomieu.
Pure carbone,	90	72.05
Silica,	2	13.19
Alumina,	5	3.29
Oxide of iron,	3	3.47
Loſs,		8.
	100	100.00

Localities, &c.—This variety has been found in a vein at Schemnitz in Hungary, in Pais de Vaud, in a tranſported rock, which ſeems to be intermediate between granite and breccia; at Konigſberg in Norway, where it is accompanied with native ſilver; in Saxony it forms an entire bed in a mountain of clay ſlate; alſo found in the iſland of Arran, and near Kilmarnock in Scotland.

III. GRAPHITE GENUS.

1. Species. GRAPHITE, or BLACK LEAD.

Plumbago, Kirw. ii. 58. *Le Graphite*, Broch. ii. 76. *Fer Carburé*, Hauy, iv. 98.

This ſpecies is divided into two ſubſpecies, ſcaly and compact.

Subſpecies 1. SCALY GRAPHITE.

Exter. Char.—Found maſſive and diſſeminated; luſtre glimmering or ſhining, metallic; fracture foliated, conchoidal, Claſſifica-tion.

choidal, ſometimes uneven or ſlaty; fragments blunt-edged, ſometimes trapezoidal; commonly appears in diſtinct granular concretions, which are ſmall or fine grained, with a ſplintery aſpect.

Colour intermediate between bluiſh black and light iron black; ſometimes ſteel gray, or browniſh black; opaque; ſtreak ſhining; ſtains and writes; ſoft; eaſily frangible; feels greaſy.

Subſpecies 2. COMPACT GRAPHITE

Exter. Char.—This ſubſpecies approaches ſo near to the former in its characters, that it ſeems difficult to diſtinguiſh it. The following characters and circumſtances connected with the natural hiſtory of graphite, refer to both. Specific gravity 1.987 to 2.456.

Chem. Char.—When expoſed to heat in a furnace, it gives out, during combuſtion, a great proportion of carbonic acid, leaving a reſiduum of red oxide of iron.

Conſtituent Parts.

	Berthollet.	Scheele.	Vauquelin.
Carbone,	90.9	90	23 *
Iron,	9.1	10	2
Silica,	–	–	38
Alumina,	–	–	37
	100.0	100	100

Of the above analyſis it muſt be obſerved, that the two firſt by Berthollet and Scheele muſt have been very pure ſpecimens of graphite; and, on the contrary, the ſpecimens analyzed by Vauquelin muſt have been very impure, containing ſo large a proportion of earthy matters, and ſo ſmall a proportion of the proper ingredients of that mineral.

Localities, &c.—This mineral, which is not very common, is found chiefly in primitive mountains. It is met with in Spain, France, Bavaria, and Hungary. In England at Borrowdale near Keſwick in Cumberland; and at Craigman, near New Cumnock, in Ayrſhire in Scotland, where it is found in detached maſſes among rocks nearly ſimilar to thoſe which accompany coal.

Uſes.—Graphite or black lead is employed for making pencils. The coarſer parts are employed in making crucibles. It is alſo employed for covering caſt iron, ſuch as grates, to defend them from ruſt; and on account of its unctuous property, it is applied to thoſe parts of machines which are ſubject to friction, for the purpoſe of diminiſhing it.

2. Species, MINERAL CHARCOAL.

This ſubſtance, which accompanies the other varieties of coal already deſcribed, is of a woody texture, and has therefore a fibrous fracture, with ſomewhat of a ſhining and ſilky luſtre. It is uſually found in thin layers with the other varieties of coal, and perhaps it might be conſidered as coal leſs perfectly formed; but in its characters it agrees ſo much with the varieties of coal blende, that it ſeems quite unneceſſary to make it a ſeparate ſpecies.

Metallic Ores.

FOURTH CLASS. *METALLIC ORES.*

I. PLATINA GENUS.

Species. NATIVE PLATINA.

Id. Kirw. ii. 103. *Le Platine Natif*, Broch. ii. 86. *Platine Natif Ferrifere*, Hauy, iii. 368.

Eſſen. Char.—Of a ſilver white colour, and infuſible.

Exter. Char.—Platina is found in the form of ſmall flat or rounded grains; ſurface ſmooth, with ſhining metallic luſtre; ſtreak reſplendent.

Colour light ſteel gray, or ſilver white; ſemi-hard; ductile; flexible in thin plates. Spec. grav. 15.601 to 17.7; but when purified, and hammered, 23, and according to ſome, 24.

Chem. Char.—Is almoſt infuſible without addition, in the focus of a burning glaſs, or expoſed to the action of oxygen gas. It does not amalgamate with mercury, and is only ſoluble in nitro-muriatic acid.

Localities, &c.—Platina was firſt brought to Europe by Don Ulloa in 1748. The repoſitory of this metal is not known, and it has been found only in South America, till lately that it was diſcovered in gray ſilver ore from the mine of Guadalcanal in Spain. In the analyſis of this ore, Vauquelin found the platina to be in the proportion of $\frac{1}{10}$.

Uſes.—Platina is one of the moſt valuable mineral ſubſtances, as, on account of its hardneſs and infuſibility, it may be applied to many of the purpoſes of gold and iron; and from its properties of being leſs liable to change when expoſed to the air, or to the action of other chemical agents, it anſwers thoſe purpoſes in a ſuperior degree.

Platina in its crude ſtate is allowed with other metallic ſubſtances. It has been long known that it is accompanied with particles of iron, gold, and ſome other ſubſtances. It contains alſo an ore of one of the new metals. This is iridium, which is alloyed with oſmium, another new metal, both which were diſcovered by Mr Tennant. This ore is compoſed of plates; it is not malleable; its ſpecific gravity is 19.5, and it is not acted on by nitro-muriatic acid, which diſſolves platina. Rhodium and palladium, two other new metals, are alloyed with platina.

II. GOLD GENUS.

Species. NATIVE GOLD.

This ſpecies is divided into three ſubſpecies; 1. golden yellow; 2. braſs yellow; and, 3. grayiſh yellow.

Subſpecies 1. GOLDEN-YELLOW GOLD.

L'Or Natif, Jaune d'Or, Broch. ii. 89. *Native Gold*, Kirw. i. 93.

Exter. Char.—Gold is found moſt frequently diſſeminated, ſuperficial, or in grains; reticulated, dendritical, capillary, or cellular, often in ſmall plates, more rarely cryſtallized. The forms of its cryſtals which have been obſerved, are ſmall perfect cubes, regular octahedrons, dodecahedrons, double eight-ſided pyramids, terminated by four-ſided ſummits, placed on the four

---

* *Jour. des Mines*, N° xii. p. 16.

four lateral edges of the pyramids alternately; but the cryſtals are ſmall and ill defined; the ſurface is ſmooth and reſplendent; that of the ſmall plates druſy and ſhining; that of the grains only ſtrongly glimmering; internal luſtre weakly ſhining, metallic; fracture hackly.

This variety preſents the perfect colour of gold. It is ſoft; perfectly ductile, flexible, but not elaſtic; ſtreak reſplendent. Spec. grav. of pure gold 19.25 to 19.64.

Subſpecies 2. BRASS-YELLOW GOLD.

L'Or Natif d'un jaune de laiton, Broch. ii. 91.

Exter. Char.—This variety is almoſt always found diſſeminated in ſmall particles, or ſuperficial; ſometimes alſo capillary, in ſmall plates, or cryſtallized in thin ſix-ſided tables.

The colour is that of braſs of various ſhades, according to the proportion of alloy. In other characters it reſembles the former, excepting in the ſpecific gravity, which is inferior, owing to the greater proportion of other metals with which it is alloyed.

Subſpecies 3. GRAYISH-YELLOW GOLD.

L'Or Natif d'un jaun griſatre, Broch. ii. 92.

Exter. Char.—This variety is alſo found diſſeminated in ſmall flattened grains; ſurface is not very ſmooth; almoſt uneven, and weakly ſhining.

Colour ſteel gray, approaching to that of braſs: ſpec. grav. of this variety is greater than the laſt, but inferior to the firſt. In other external characters they are the ſame.

Chem. Char.—Native gold is only ſoluble in nitro-muriatic acid; platina is alſo ſoluble in the ſame acid, but it is not like gold, precipitated from its ſolution by ſulphate of iron.

Conſtituent Parts.—Native gold is not always found pure. It is frequently alloyed with ſilver or copper, or with both, and ſometimes alſo, it is ſaid, with platina. To theſe alloys the difference of colour, which is the foundation of the diviſion into three varieties, is owing. The firſt variety is the pureſt, containing only a ſmall proportion of ſilver or copper; the ſecond has a greater proportion of theſe metals; and the third, it is ſuppoſed, is alloyed with a ſmall portion of platina.

Uſes.—Gold (on account of its indeſtructible nature, and its remarkable malleability and ductility), is one of the moſt important and valuable of the metals for many purpoſes; but its uſes, whether as money, or articles of luxury, are too well known to require enumeration. As pure gold has no great degree of hardneſs, it is neceſſary to alloy it with a portion of copper. This is not leſs than $\frac{1}{24}$ and never more than $\frac{1}{4}$.

Localities, &c.—Gold is chiefly found in primitive mountains, and there it is uſually in veins, ſometimes diſſeminated in the rock itſelf. The accompanying ſubſtances are quartz, feldſpar, limeſtone, heavy ſpar, pyrites, red ſilver, vitreous ſilver, and galena. Gold is alſo mixed with mangancſe, gray cobalt, nickel, and malachite. Gold has alſo been found, it is ſaid, in foſſil ſubſtances, as in petrified wood, penetrated with ſiliceous earth, a maſs of which was dug out at the depth of 50 fathoms, in an argillaceous breccia, or, as is ſuppoſed by ſome, a porphyry with an argillaceous baſis, in Tranſylvania. This is conſidered as a proof of the more recent formation of gold, as well as the diſcovery of Patrin, who found native gold ſurrounded by muriate of ſilver, in the mine of Zmeof in Siberia. Muriate of ſilver is ſuppoſed to be comparatively a late production.

But gold is perhaps more common to alluvial ſoil; there it is diſſeminated in grains, along with ſiliceous, argillaceous, and ferruginous ſand, of which certain ſoils are compoſed; and alſo in the ſand of many rivers: and it is obſerved that the gold is moſt abundant when the waters are at the loweſt, and eſpecially ſoon after floods, which ſhews that the gold is carried down along with the earthy matters which are ſwept away by the violence of the current. It has been ſuppoſed too, that the gold found in the bed of rivers, has been detached, by the force of the waters, from the veins and primitive rocks traverſed by theſe currents; and according to this opinion, attempts have been made to trace the ſource of theſe auriferous ſands, in the hope of diſcovering the native repoſitory of this precious metal; but theſe attempts have uſually failed, for it has been found that the gold is peculiar to the alluvial ſoil through which the ſtream is carried, and in which the gold is collected. This point ſeems to be eſtabliſhed by the obſervations of naturaliſts. 1. The ſoil of thoſe plains frequently contains, to a certain depth, and in particular places, particles of gold, which may be ſeparated by waſhing. 2. The bed of the rivers and auriferous ſtreams yields a greater proportion of gold, after the plains which are traverſed by thoſe rivers have been flooded, than in any other circumſtances. 3. It has always been obſerved, that gold is found in the ſand of rivers in a very limited ſpace. By examining the ſand of theſe rivers higher up, and nearer to their ſource, no gold is found; ſo that if this metal were derived from the rocks, which are ſwept by the currents, the quantity would be greateſt neareſt to their ſources; but obſervation has proved the contrary. Thus the river Orco contains no gold, but from Pont to the place where it joins the Po. The Teſin affords no gold till it has traverſed Lake Major, where its courſe muſt have been retarded, and where all the heavy particles of matter which it carried along with it from the primitive mountains, muſt have been depoſited. The quantity of the gold collected on the Rhine near Straſburg, is greater than what is found near Baſle, which is more in the vicinity of the mountains. No gold has been diſcovered in the ſands of the Danube during the firſt part of its courſe. Thoſe ſands become only auriferous below Efferding. The ſame remark may be applied to the Ems. The ſands of the upper part of this river, which traverſes the mountains of Stiria, contain no gold; but from the place where it enters the plain at Steyer, till it joins the Danube, its ſands are auriferous, and ſufficiently rich to be waſhed with advantage.

The moſt of the auriferous ſands in all parts of the world, are of a black or reddiſh colour, and conſequently ferruginous. From this circumſtance, connected with the gold of alluvial land, ſome naturaliſts have inferred, that it is owing to the decompoſition of auriferous pyrites. It was obſerved by Reaumur, that the ſand which accompanies gold in moſt of the rivers, and particularly in the Rhone and the Rhine, is like that of Ceylon

Ceylon and Expailly, compoſed of iron and ſmall grains of rubies, corundum, hyacinth. Titanium alſo has been diſcovered. It has been obſerved beſides, that the gold of alluvial ſoil is purer than that which is immediately obtained from rocks, from which it is ſuppoſed that it has a different origin. It does not appear to be certainly aſcertained, that gold is found in volcanic ſoil.

Such are the general facts relative to the repoſitories of gold. We ſhall now briefly mention the more remarkable places where gold has been found and collected, beginning with thoſe of Europe.

28 Gold mines of Spain. Spain formerly had mines of gold; the richeſt was in the province of Aſturias, where it was dug out from regular veins. Theſe mines, according to ancient hiſtorians, were wrought by the Phœnicians, and afterwards by the Romans; but they have been totally abandoned ſince the diſcovery of America, and the mineral riches of that country. The rivers of Spain, as well as the Tagus in Portugal, contain auriferous ſand.

29 Of France. The only mine of gold which in modern times has been wrought in France, was diſcovered in 1781, at Gardette, in the valley of Oyſans, department of Iſere. This was a regular vein of quartz, traverſing a mountain of gneiſs, and containing auriferous ſulphuret of iron, and ſome fine ſpecimens of native gold; but it was not ſufficiently rich to defray the expence of the operations. Many of the rivers of that country contain auriferous ſand, as the Rhone, the Rhine, the Garonne, and others of ſmaller note; and it is ſaid that gold is alſo found among the black ſand, and particles of moraſſy iron ore, in the neighbourhood of Paris.

30 Of Piedmont. In Piedmont there are ſome mines of gold. At the foot of Mount Roſa, veins of auriferous ſulphuret of iron have been diſcovered, traverſing gneiſs; and although theſe pyrites do not yield more than 10 or 11 grains of gold in the quintal, it has been found worth while to continue the operations. On the ſouth ſide of the Apennine mountains, there are ſeveral auriferous rivers and ſoils.

Some of the rivers of Switzerland alſo contain auriferous ſands. Such are thoſe of the Reuſs and the Aar.

In Germany the only gold mine which is wrought is in Saltſburg, in the chain of mountains which traverſes that country from eaſt to weſt, and which ſeparates it from the Tyrol and Carinthia.

31 Hungary. But Schemnitz and Cremnitz are the moſt remarkable places in Europe for mines of gold and auriferous ſands. The gold of Schemnitz is accompanied by ſilver, lead, and iron pyrites, and the matrix is quartz. Auriferous ſand is found not only in the bed of the river Neva, but this ſand is ſtill richer in the plain through which the river flows. According to De Born, this is a ferruginous ſand, lying below a bed of chalk.

In Tranſylvania the celebrated gold mine of Nagyag is remarkable for having the gold combined with native tellurium. There is alſo another mine at Felſobanya, the ore of which is an auriferous ſulphuret of ſilver, in a vein of a kind of jaſper. The rivers of this country alſo contain gold. The plain on the banks of the river Moros contains an auriferous ſand, which is depoſited between two beds, neither of which yields a particle of gold. The upper ſtratum is vegetable ſoil, and the lower is compoſed of ſchiſtus.

The mines of Hungary are the only gold mines in Europe which are of any importance.

32 Sweden. In Sweden gold is obtained from the mine of Edelfors in the province of Smoland. This mine yields native gold, and auriferous iron pyrites. The veins are compoſed of brown quartz, traverſing a mountain of ſchiſtoſe hornſtone. The gold is ſometimes diſſeminated in the rock itſelf.

33 Greece. In Greece, the iſland of Thaſos in the Archipelago was celebrated in antiquity for its rich mines of gold. The ancients alſo, it is ſaid, found abundance of gold in Thrace and Macedonia.

34 Ireland. The alluvial ſoil in ſeveral places of the Britiſh iſlands, has alſo furniſhed gold. Not many years ago, a conſiderably quantity of gold was collected in a ſandy ſoil, on the mountains of Wicklow in Ireland. Several maſſes of native gold, exceeding an ounce in weight, were found in that ſoil; one weighing 22 ounces was found, which is ſaid to be the largeſt ſpecimen of native gold found in Europe.

35 Scotland. It would appear that gold was collected at a very early period in Scotland, and particularly in the mine field of Leadhills; but the moſt extenſive operations were carried on by Bulmer, an Engliſhman, in the time of Queen Elizabeth. The trenches, heaps of ſoil that had been turned up, and other marks of theſe operations, yet viſible between Leadhills and Elvanfoot, ſtill retain the name of *Bulmer's Workings*, and the place where the gold was waſhed, is ſtill called the *gold ſcour*. At that time, it is ſaid, an immenſe quantity of gold was collected. Not many years ago, ſimilar operations were reſumed by the advice of a German; but ſo far as we underſtand, the quantity of gold collected was ſcarcely equal to the expence. The operations during the laſt attempt were carried on under the ſuperintendance of the late Mr John Taylor, manager of the mines at Wanlockhead; a man of no common ſagacity, by which he was enabled to collect many curious facts with regard to the natural hiſtory of gold. The gold was found in that country immediately under the vegetable ſoil; and the method of conducting the operation was, to direct a ſmall ſtream of water ſo as to carry this ſoil along with it, to baſons or hollow places, where the water might depoſit the matters which had been carried along by its current. The matter depoſited was repeatedly waſhed, till the whole of the earthy ſubſtances were carried off. The gold being heavieſt, ſunk to the bottom, and remained behind. Among other facts which Mr Taylor communicated to us, and which he obſerved during the progreſs of theſe operations he found, that the gold was always moſt abundant near the top of the lead veins which traverſe that country. He was ſo ſatisfied of this fact, that he could tell, merely by the quantity of gold increaſing, when they approached to a vein; and on the other hand the quantity diminiſhing as they receded from the vein. This fact ſhews that there is ſome connection between metallic veins and the formation or depoſition of gold.

Gold is ſtill found in the ſoil of that country; but whether the quantity be leſs than formerly, or the expence of collecting it, from the difference in the price of labour, greater, the produce is by no means equal to the expences, and therefore ſearching for gold is now only the employment of the leiſure hours of ſome of the miners.

36 Aſia. The whole extent of the continent of Aſia furniſhes gold, in greater or ſmaller quantity. Gold is found in ſeveral of the mines of Siberia, and particularly in that of Bereſof, which yields auriferous pyrites partially decompoſed, and diſſeminated in a vein of quartz. In the ſouthern parts of Aſia, many mines, and particularly the ſands of the rivers, contain gold. The Pactolus, a ſmall river of Lydia, was celebrated in antiquity for the quantity of gold which it yielded, and it was ſuppoſed to be the ſource of the riches of Crœſus.

Japan, Formoſa, Ceylon, Java, Sumatra, Borneo, the Philippines, and other iſlands of the Indian Archipelago, are ſuppoſed to be rich in gold at this day.

37 Africa. The greateſt quantity of gold which the ancients poſſeſſed, beſide what was obtained from Spain, was brought from Africa. The gold of Africa, which ſtill forms an important article of commerce, is always in the ſtate of gold duſt; a circumſtance which ſhews that it is chiefly extracted from alluvial ſoil by waſhing. Little gold is found in the northern parts of Africa; three or four places are remarkable for the quantity of gold which they yield. The firſt is that part of the country between Darfour and Abyſſinia. The gold collected there is brought by the Negroes for ſale in quills of the oſtrich and of the vulture. It would appear that this country was known to the ancients, who regarded Ethiopia as a country rich in gold; and Herodotus mentions that the king of that country exhibited to the ambaſſadors of Cambyſes, all the priſoners bound with chains of gold.

The ſecond great ſource of gold duſt in Africa is to the ſouth of the great deſert Zara, in the weſtern part of that country. The gold is collected in that extenſive flat which ſtretches along the foot of the lofty mountains, among which the rivers Senegal, Gambia, and Niger, have their origin. Gold is found in the ſands of all theſe rivers. Bambouk, which lies to the north-weſt of theſe mountains, ſupplies the greateſt part of the gold which is ſold on the weſtern coaſt of Africa; at Morocco, Fez, and Algiers, as well as that which is brought to Cairo and Alexandria in Egypt.

A third region of Africa where gold is abundant, is on the ſouth-eaſt coaſt, oppoſite to Madagaſcar; and it is ſaid that the gold brought from Ophir, in the time of Solomon, was from that part of Africa.

38 America. America is the richeſt country of the world, in modern times, in this precious metal. There it is collected in the alluvial ſoil, and in the beds of rivers, and ſometimes, but more rarely, in veins. In Mexico, gold is chiefly found in the numerous ſilver veins of that country. All the rivers in the province of the Caraccas, about 10° north of the equator, furniſh gold. In the Spaniſh part of America, Chili furniſhes gold from the alluvial ſoil, as well as the province of Choco, where it is more abundant; while that of Peru is obtained from veins of quartz, marked with ferruginous ſpots.

But the greateſt quantity of gold of commerce comes from Brazil, where it is collected in the alluvial ſoil, and in the ſand of rivers, and extracted by waſhing. Gold is found almoſt everywhere in that country, at the foot of the immenſe chain of mountains which is nearly parallel with the coaſt, and which ſtretches from the 5° to the 30° of S. Lat.

III. MERCURY Genus.

1. Species. Native Mercury.

Mercury, Kirw. ii. 223. *Mercure Natif*, Broch. ii. 241. *Id.* Hauy, iii. 423.

Eſſen. Char.—Remains liquid till the temperature be reduced to 40° below 0 Fahrenheit.

Exter. Char.—Native mercury exiſts diſſeminated, in globules of different ſizes, in ſmall cavities of other ores of mercury; luſtre reſplendent, metallic.

Colour ſhining white, or tin white; opaque; perfectly fluid; does not wet the finger; feels very cold. Sp. gr. 13.568 to 13.581.

Chem. Char.—Volatile before the blow-pipe, without diffuſing any perceptible odour.

Native mercury is underſtood to be pure, and having all the properties of that metal; but it is ſometimes amalgamated with a little ſilver, which deſtroys its fluidity in a ſlight degree, and renders it ſomewhat viſcous.

Localities, &c.—Native mercury is uſually found along with the other ores of that metal, as at Idria, in Friouli, and at Almaden in Spain; but the great proportion of the mercury of commerce is obtained by diſtillation from native cinnabar. There is alſo, it is ſaid, a rich mine of native mercury near Guanca Velica in Peru.

Uſes.—For many purpoſes mercury is one of the moſt important of metallic ſubſtances. It is extenſively employed in metallurgy, in extracting gold and ſilver from their ores, by the proceſs to be afterwards deſcribed, called *amalgamation.* The uſes of mercury in gilding, in ſilvering the backs of mirrors, and in medicine, are well known.

2. Species. Native Amalgam.

Natural Amalgam, Kirw. ii. 223. *L'Amalgam Natif*, Broch. ii. 99. *Mercure Argental*, Hauy, iii. 432.

Eſſen. Char.—Communicating to copper a ſilvery colour by friction.

Exter. Char.—This ſpecies is rarely found maſſive, but uſually diſſeminated, or ſuperficial, ſometimes imperfectly cryſtallized. The form of its cryſtals is the octahedron, dodecahedron, but it is uſually found in thin plates or leaves; luſtre reſplendent, or ſhining; fracture conchoidal.

Colour between ſhining or tin white, and ſilvery white, according to the predominance of the mercury or ſilver; ſoft, and partially fluid; brittle, and eaſily frangible.

Chem. Char.—Expoſed to heat the mercury is driven off, and the ſilver remains behind.

Conſtituent Parts.

	Heyer.	Cordier.	Klaproth.
Mercury,	75	73	64
Silver,	25	27	36
	100	100	100

Localities, &c.—This mineral is rare, and is met with, according to De Born, in the mines of mercury, whoſe

whoſe veins are croſſed by veins of ſilver ores. It is found chiefly at Roſenau in Hungary, in Moerſfeld, and Moſchellanſberg, in the duchy of Deux Ponts, and at Sahlberg in Sweden. It is uſually found in a yellowiſh or reddiſh ferruginous clay, and accompanied by other ores of mercury.

3. Species. CORNEOUS ORE OF MERCURY.

Mercury mineralized by the vitriolic and marine acids, Kirw. ii. 229. *La Mine de Mercure cornée*, Broch. ii. 101. *Mercure muriaté*, Hauy, iii. 447.

Eſſen. Char.—Colour pearl gray, volatilized by the blow-pipe.

Exter. Char.—Rarely found maſſive or diſſeminated, but uſually in thin cruſts, or in ſmall globules, compoſed of an aſſemblage of ſmall cryſtals, which are either perfect cubes, or ſix-ſided priſms, terminated by a four-ſided pyramid; a ſix-ſided priſm bevelled at the extremity; or an eight-ſided priſm with four broad and four narrow alternating faces. Cryſtals ſhining, ſometimes reſplendent; internal luſtre ſhining and adamantine; fracture foliated.

Colour ſmoke gray, aſh gray, or grayiſh white; tranſlucent; tender, and eaſily frangible.

Chem. Char.—Entirely volatilized before the blow-pipe, without leaving any reſiduum, and without decompoſition.

The conſtituent parts are about 70 of mercury, 29 of muriatic acid, and a ſmall portion of ſulphuric acid.

Localities, &c.—This mineral has only been known about 13 years, and it is hitherto but rare. It was diſcovered in the mercury mines of the duchy of Deux Ponts by Woulfe, and has been ſince found at Almaden in Spain, and at Horſowitz in Bohemia. The repoſitory is in the cavities of a ferruginous clay, which is mixed with malachite and gray copper ore.

4. Species. LIVER OR HEPATIC ORE OF MERCURY.

Mine de Mercure hepatique, Broch, ii. 104. *Hepatic mercurial ore*, Kirw. ii. 224. *Mercure ſulfuré bituminifere*, Hauy, iii. 446.

This is divided into two ſubſpecies, 1. compact, and 2. ſlaty.

Subſpecies 1. COMPACT LIVER ORE OF MERCURY.

Exter. Char.—Found maſſive or diſſeminated; luſtre glimmering, metallic; fracture even, ſometimes fine-grained uneven; fragments blunt-edged.

Colour between lead gray, and cochineal red; colour of the ſtreak deep cochineal red, and ſhining; tender, and eaſily frangible. Sp. gr. 7.18 to 7.93.

Subſpecies 2. SLATY LIVER ORE OF MERCURY.

Exter. Char.—Found maſſive; luſtre ſhining and reſplendent; in the croſs fracture glimmering; luſtre in general metallic, but ſometimes vitreous; principal fracture ſlaty, in curved thick leaves; croſs fracture compact and even; fragments in plates.

Colour of the preceding, but ſomewhat darker, and approaching to that of iron; opaque; ſtreak ſhining; powder between cochineal and ſcarlet red; tender, and very eaſily frangible.

Localities, &c.—This is the moſt common ore of mercury in Idria, where it forms conſiderable beds, and yields about 60 per cent. of mercury. It is found alſo, along with other ores of mercury, in Spain and Siberia.

Liver ore of mercury conſiſts of cinnabar, or the ſulphuret of mercury, mixed with a portion of indurated bituminous clay. At Idria it is called *branderz*, or coaly earth, on account of the predominance of the bitumen.

5. Species. CINNABAR.

This ſpecies is alſo divided into two ſubſpecies, common and fibrous.

Subſpecies 1. COMMON CINNABAR.

Le Cinnabre Commun, Broch. ii. 107. *Dark Red Cinnabar*, Kirw. ii. 223. *Mercure Sulfuré compacte*, Hauy, iii. 440.

Exter. Char.—Found maſſive or diſſeminated, or in ſuperficial layers, or cellular and kidney-form, and alſo cryſtallized. Forms of the cryſtals are, a double four-ſided pyramid with truncated ſummits; a cube having its oppoſite diagonal angles truncated; a rhomboidal priſm; a three-ſided priſm terminated by a three-ſided pyramid, which alſo is truncated. The cryſtals, which are uſually ſmall, are confuſedly grouped together; ſurface of the rhomboidal priſm tranſverſely ſtreaked, of the others ſmooth; external luſtre ſhining or reſplendent; internal the ſame, or only glimmering, vitreous, or admantine; fracture foliated, uneven, or rarely ſplintery; fragments ſharp-edged.

Colour cochineal red, carmine red, and in ſome varieties lead-gray; opaque, rarely tranſlucent at the edges; cryſtals tranſlucent, or ſemitranſparent; ſtreak ſhining, ſcarlet red; tender, and eaſily frangible. Spec. grav. 6.902 to 7.86.

Chem. Char.—Before the blow-pipe common cinnabar is entirely volatilized with a blue flame, and a ſulphureous odour.

Conſtituent Parts.	Lampadius.
Mercury,	81
Sulphur,	15
Iron,	4
	100

Localities, &c.—This is the moſt common ore of mercury, and may be conſidered as the gangue or matrix of the other ores. Found not only in primitive mountains, where it forms beds in clay and chlorite ſlate, but alſo in ſtratiform mountains, and even in alluvial rocks. The mines of Almaden in Spain, of Idria in Friouli, and thoſe of the duchy of Deux Ponts, have furniſhed the greateſt quantity of common cinnabar. It is alſo found in Bohemia, Saxony, and Hungary, and in ſmall quantity in France.

Subſpecies 2. FIBROUS CINNABAR.

Le Cinnabre d'un Rouge vif, Brochant, ii. 111. *Bright red Cinnabar*, Kirwan, ii. 229. *Mercure ſulfuré fibreux*, Hauy, iii. 440.

Exter. Char.—Found maſſive, diſſeminated, or ſuperficial;

ficial; luſtre glimmering, ſilky, often alſo entirely dull; fracture fine grained earthy, or fibrous; fragments blunt-edged.

Colour bright ſcarlet red, ſometimes crimſon or aurora red; opaque; ſtreak ſhining ſcarlet red; ſtains; very tender or friable, and very eaſily frangible.

Localities, &c.—This variety is very rare in a ſtate of purity. According to Hauy, moſt of the ſpecimens owe their texture to an admixture of radiated ſulphuret of iron. It has been found chiefly at Wolfſtein in the Palatinate, where it is accompanied by brown iron ore and hematites.

Uſes.—Cinnabar is dug out chiefly for the purpoſe of extracting the metallic mercury. It is employed alſo as a colouring matter in painting; but the cinnabar uſed for this purpoſe is chiefly artificial.

Some other varieties of cinnabar, or ſulphuret of mercury, have been noticed by mineralogiſts, as a native ethiops mineral. This is of a black colour, a looſe conſiſtence, and it ſtains the fingers. It appears to be ſome bituminous ſubſtance penetrated with cinnabar. It is found at Idria.

Alkaline cinnabar of De Born is found at the ſame place; is of a bright red colour, foliated fracture, with rhomboidal fragments; and ſuppoſed to be cinnabar penetrated with an alkaline ſulphuret, the odour of which it gives out by friction. Another variety of cinnabar, uſually called native vermilion, is in the form of powder. This ſubſtance is very rare, but is alſo ſometimes found at Idria.

IV. SILVER Genus.

1. Species. Native Silver.

Id. Kirwan, ii. 108. *Id.* Brochant, ii. 114. *Id.* Hauy, iii. 384.

This is divided into two ſubſpecies, common and auriferous.

Subſpecies 1. Common Native Silver.

Exter. Char.—Common native ſilver is uſually found diſſeminated or ſuperficial, under different imitative forms, as dentiform, filiform, capillary, dendritic, reticulated, veined, or in thin plates; and ſometimes cryſtallized, in cubes, octahedrons, rectangular four-ſided priſms, double ſix-ſided pyramids with truncated extremities, double three-ſided pyramids with truncated angles, and hollow four-ſided pyramids. The cryſtals are ſmall and grouped together in rows, or dendritical, or reticulated; ſurface ſmooth; that of the plates druſy, that of dentiform, filiform, and capillary ſilver; longitudinally ſtreaked; external luſtre glimmering or reſplendent; internal always glimmering, metallic; fracture hackly; fragments rather ſharp-edged.

Colour ſilvery white, but ſometimes on the ſurface yellowiſh brown, or grayiſh black; opaque; ſoft; perfectly ductile; flexible, but not elaſtic; ſtreak ſhining, metallic. Spec. grav. 10 to 10.47.

Chem. Char.—Native ſilver is ſoluble in nitric acid, and may be precipitated by muriatic acid, the muriate of ſilver being inſoluble; or by immerſing a plate of copper in the ſolution of nitrate of ſilver, the ſilver is reduced, and appears in the metallic ſtate.

Localities, &c.—Native ſilver is not uncommon in moſt of the mines which furniſh the other ores of that metal. The accompanying ſubſtances are uſually heavy ſpar, quartz, calcareous ſpar, fluor ſpar, pyrites, blende, cobalt, and galena. Native ſilver is very abundant in Mexico and Peru, and it is alſo not uncommon in Siberia, in Germany, France, and was lately diſcovered in the Herland mine in Cornwall.

Subſpecies 2. Auriferous Silver.

Exter. Char.—This variety is rarely found maſſive, but is uſually diſſeminated in ſmall particles, or ſuperficial, or reticulated, or in thin plates; luſtre ſhining or reſplendent; fracture hackly.

Colour between ſilver white and braſs yellow, ſometimes approaching to gold yellow; it is ſoft, perfectly ductile; flexible without being elaſtic, and its ſpecific gravity is greater than common native ſilver in proportion to the quantity of gold with which it is alloyed

Conſtituent Parts.—Auriferous ſilver is a compound of ſilver alloyed with gold, the latter ſometimes in very conſiderable proportion.

Localities, &c.—This mineral is very rare. It is found at Konigſberg in Norway, diſſeminated in maſſive calcareous ſpar, fluor ſpar, and rock cryſtal, accompanied by blende, galena, and pyrites, in a vein which traverſes a rock of ſlaty hornblende. It is alſo found in Siberia, in granular heavy ſpar accompanied by vitreous ſilver ore, vitreous copper ore, and pyrites.

2. Species. Antimonial Silver Ore.

Argent Antimonial, Brochant, ii. 119. *Id.* Hauy, iii. 391. *Antimoniated Native Silver*, Kirwan, ii. 110.

Eſſen. Char.—Colour ſilvery white; brittle.

Exter. Char.—Found maſſive or diſſeminated, kidney-form, or cryſtallized in four-ſided oblique priſms, in ſix-ſided priſms, ſometimes with the lateral edges truncated, in ſix-ſided tables, and in cubes, having ſome of the angles truncated. Surface of the cryſtals longitudinally ſtreaked; luſtre weakly ſhining, or only glimmering; internal luſtre ſhining or reſplendent; fracture foliated.

Colour ſilvery white, ſometimes a ſuperficial colour between yellow, black, and gray, or the colour of tempered ſteel; ſtreak ſhining; ſemihard. Spec. grav. 9.44.

Chem. Char.—Before the blow-pipe it is eaſily reduced; the antimony is driven off and gives out its peculiar odour, while the pure ſilver remains behind incruſted with a brown ſlag, which communicates to borax a green colour.

When antimonial ſilver is diſſolved in nitric acid, a whitiſh cruſt, which is the oxide of antimony, ſoon appears on the ſurface.

This mineral, as its name imports, is an alloy of ſilver and antimony, in which ſometimes a ſmall portion of iron is obſerved. The proportions of the two metals ſeem to be very variable.

Claſſification.

Conſtituent Parts.

	Klaproth.		Vauquelin.
Silver,	76	84	78
Antimony,	24	16	22
	100	100	100

Localities, &c.—This ore of ſilver is accompanied by calcareous ſpar, heavy ſpar, native ſilver, galena, and quartz, in a vein near the duchy of Furſtenberg in Swabia. It has alſo been found in carbonate of lime and heavy ſpar near Guadalcanal in Spain.

3. Species. Arsenical Silver Ore.

Id. Kirw. ii. 111. *Argent Antimonial Arſenifere, et ferrifere*, Hauy, iii. 398.

Exter. Char.—Found maſſive or diſſeminated, kidney-form or globular, and alſo cryſtallized in perfect ſix-ſided priſms; in ſimilar priſms a little flattened, and having the lateral edges rounded; and in acute ſix-ſided pyramids with truncated ſummits. Luſtre weakly ſhining, ſometimes ſhining; internal luſtre ſhining or reſplendent; fracture foliated; fragments ſharp-edged.

Colour tin-white, or lead gray, but expoſed to the air yellowiſh, or ſteel gray; ſtreak ſhining; ſoft; brittle.

Chem. Char.—Before the blow-pipe the arſenic is driven off in fumes, diffuſing the ſmell of garlic; there remains behind an impure globule of ſilver.

Conſtituent Parts.	Klaproth.
Silver,	12.75
Arſenic,	35.
Iron,	44.25
Antimony	4.
Loſs,	4.
	100.00

Localities, &c.—This is a rare mineral, which has been found at Andreaſberg in the Hartz, accompanied by native arſenic, red ſilver ore, galena, brown blende, and calcareous ſpar.

4. Species. Corneous Silver Ore.

Id. Kirwan, ii. 113. *La Mine Corné*, Broch. ii. 127. *Argent Muriaté*, Hauy, iii. 418.

Eſſen. Char.—The colour of horn; fuſible like wax.

Exter. Char.—Rarely found maſſive; ſometimes diſſeminated in globular pieces, often in ſuperficial layers, and very often cryſtallized. The forms are, the perfect cube, capillary or needle-formed cryſtals; the cryſtals are always ſmall, and commonly grouped together. Surface ſmooth, ſhining or weakly ſhining; internal luſtre the ſame; reſinous; fracture uneven, or flat conchoidal; fragments blunt edged.

Colour light pearl gray, violet blue, or lead gray; becomes brown or blackiſh in the air; tranſlucent; ſometimes only at the edges; very ſoft; receives the impreſſion of the nail; ductile, and in thin plates, flexible. Spec. grav. 4.748 to 4.804.

Metallic Ores.

Chem. Char.—Corneous ſilver ore melts very eaſily before the blow-pipe, giving out a diſagreeable ſmell, and the globule of ſilver remains.

Conſtituent Parts.	Klaproth.
Silver,	67.75
Muriatic acid,	21.
Sulphuric acid,	.25
Oxide of iron,	6.
Alumina,	1.75
Lime,	.25
Loſs,	3.
	100.00

Localities, &c.—Muriate of ſilver is always found at the upper part of the vein, and it is ſaid that it ſometimes accompanies organized ſubſtances. Leaves of native ſilver have been found attached to petrifactions, at Frankenberg in Heſſia; it is ſuppoſed that this metallic ſilver is the reſult of the decompoſition of the muriate of ſilver. Corneous ſilver ore is almoſt always accompanied by vitreous ſilver, ſooty ſilver, brown iron ore; more rarely by native ſilver, red ſilver, galena, quartz, and heavy ſpar. It is found in Peru and Mexico, in the mines of Freyberg in Saxony, at Allemont in France, and in Siberia.

Another variety of muriate of ſilver has been deſcribed by ſome mineralogiſts under the name of earthy corneous ſilver ore; or, according to the fanciful German name, *butter-milk earth*. This variety has an earthy fracture, owing to a portion of alumina which is combined with it. It is almoſt friable; the luſtre of the ſtreak is reſinous, and it feels ſomewhat greaſy.

Chem. Char.—Before the blow-pipe it is ſlightly agglutinated without melting, and ſmall globules of ſilver exude from the maſs.

Conſtituent Parts.	Klaproth.
Silver,	25
Muriatic acid,	8
Alumina,	67
With a trace of copper,	—
	100

This variety is found at Andreaſberg in the Hartz. Another variety has been deſcribed under the name of alkaline ſilver ore, which is nothing more than the muriate of ſilver combined with carbonate of lime.

5. Species. Sooty Silver Ore.

Id. Kirw. ii. 117. *L'Argent Noir*, Broch. ii. 132.

Exter. Char.—Found maſſive or diſſeminated, perforated or corroded; in ſuperficial layers upon other minerals, or in rounded pieces, covered by muriate of ſilver; conſiſtence intermediate between ſolid and friable; dull; fracture fine grained earthy; fragments blunt-edged.

Colour bluiſh black, or blackiſh gray; ſtreak ſhining, metallic; ſtains a little; eaſily frangible.

Chem. Char.—Melts eaſily before the blow-pipe into a ſlaggy maſs, which, by continuing the heat, is partially volatilized, and the globule of ſilver remains.

Its conſtituent parts are ſtill unknown; as it is uſually accompanied by vitreous, corneous, and ſome other ſilver ores, it is ſuppoſed to be a mixture of thoſe ores in different proportions.

Localities, &c.—Found in Saxony, in France, and in Hungary.

6. Species. Vitreous Silver Ore.

Sulphurated Silver Ore, Kirw. ii. 115. *L'Argent Vitreux*, Brochant, ii. 134. *Argent Sulphuré*, Haüy, iii. 398.

Exter. Char.—Commonly found maſſive, diſſeminated, or ſuperficial; ſometimes dentiform, filiform, capillary, dendritic, or reticulated, with other forms and impreſſions. It is alſo cryſtallized in cubes, which are either perfect or truncated on the angles or edges; in octahedrons, which are either perfect, or truncated on the angles; in flat, double, three-ſided pyramids, the edges of the one correſponding to the faces of the other; in rectangular four-ſided priſms, terminated by a four-ſided pyramid; in equiangular ſix-ſided priſms, terminated at the two extremities by a three-ſided pyramid; correſponding alternately to three of the lateral edges, forming the garnet dodecahedron, of which all the lateral edges are ſometimes ſlightly truncated; in broad and flat ſix-ſided priſms bevelled at the extremity, and having the angles at the acute lateral edges truncated. The cryſtals are commonly ſmall, and grouped together in rows, or in knots, like the ſteps of a ſtair; the cube and the octahedron are the moſt common, and the cube is ſometimes hollow. The ſurface of the cryſtal is uſually ſmooth, ſometimes rough or druſy; luſtre between ſhining and weakly glimmering; internal luſtre ſhining, metallic; fracture conchoidal, ſometimes foliated; fragments blunt-edged.

Colour dark lead-gray, ſteel-gray, or blackiſh gray, varying by expoſure to the air; ſtreak ſhining; ſoft; ductile; may be cut with a knife; flexible without being elaſtic. Spec. grav. 6.909 to 7.215.

Chem. Char.—Before the blow-pipe vitreous ſilver is reduced to the metallic ſtate, and the ſulphur is driven off. By gradually heating it in a furnace, the ſulphur may be diſſipated without fuſion, and the ſilver is reduced to the metallic ſtate in a dendritical or capillary form, exactly reſembling native ſilver.

Conſtituent Parts.

	Bergman.	Sage.	Klaproth.
Silver,	75	84	85
Sulphur,	25	16	15
	100	100	100

Localities, &c.—Vitreous ſilver is one of the moſt common ſilver ores. It is uſually accompanied by heavy ſpar, calcareous ſpar, and fluor ſpar; along with the other ores of ſilver and lead, cobalt and blende. It is found in Bohemia, Saxony, Norway, Siberia, and South America.

7. Species. Brittle Vitreous Silver Ore.

L'Argent Vitreux Aigre, Brochant, ii. 138.

Exter. Char.—Found maſſive, diſſeminated, ſuperficial, or cryſtallized in equiangular ſix-ſided priſms, the terminal faces being ſometimes plane, and ſometimes convex or concave; the ſame priſm truncated on its terminal edges, or terminated by a ſix-ſided pyramid ſet on the lateral faces, and having its ſummit truncated; in equiangular ſix-ſided tables, or in very flat rhomboids. Cryſtals ſmall, and grouped together; ſurface ſmooth, ſometimes druſy; priſms longitudinally ſtreaked; luſtre ſhining or reſplendent; internal luſtre ſhining, or weakly ſhining; fracture conchoidal, ſometimes uneven; fragments rather ſharp-edged.

Colour iron-black, or ſteel or lead gray; ſoft; brittle. Spec. grav. 7.208.

Chem. Char.—Before the blow-pipe it melts with difficulty; ſulphur, antimony, and arſenic, are partially driven off, and there remains a button of metallic ſilver, which is not very ductile, accompanied by a brown ſlag.

Conſtituent Parts.	Klaproth.
Silver,	66.5
Sulphur,	12.
Antimony,	10.
Iron,	5.
Copper and arſenic,	.5
Earthy matters,	1.
Loſs,	5.
	100.0

Localities, &c.—This is one of the richeſt ſilver ores; and it is uſually accompanied by red ſilver ore, vitreous ſilver ore, ſome other metallic ores, and various earthy ſpars. It is pretty common in Saxony and Hungary, but leſs abundant than vitreous ſilver ore. It is alſo occaſionally met with in moſt other ſilver mines.

8. Species. Red Silver Ore.

Id. Kirw. ii. 122. *Id.* Broch. ii. 143. *Argent Antimonié Sulphuré*, Haüy, iii. 402.

This is divided into two ſubſpecies; dark red, and bright red ſilver ore.

Subſpceies 1. Dark Red Siver Ore.

Exter. Char.—Found maſſive or diſſeminated, ſuperficial, dendritical, or cryſtallized in equiangular ſix-ſided priſms, which is either terminated by a three-ſided pyramid ſet on the lateral edges, or has its terminal edges truncated, or is terminated by an obtuſe ſix-ſided pyramid ſet on the lateral faces, and having the ſummit and lateral edges of the pyramid truncated; ſometimes the ſummit of the pyramid is terminated by a ſecond three-ſided pyramid, and ſometimes the lateral edges of the priſm are bevelled. The cryſtals are ſmall, and variouſly grouped together, commonly ſmooth and reſplendent, rarely ſtreaked; internal luſtre weakly ſhining, or only glimmering, adamantine, often ſemimetallic; fracture uſually uneven, ſometimes conchoidal; fragments rather blunt-edged.

Colour between cochineal red and lead-gray, and ſometimes iron black; cryſtals tranſlucent; in maſſes opaque; ſtreak but weakly ſhining, between cochineal

Claſſification.

red and crimſon red; ſoft; brittle, and eaſily frangible. Spec. grav. 5.56 to 5.58.

Chem. Char.—Before the blow-pipe it decrepitates and flies off before becoming red, and then melts with frothing up; part is volatilized and ſublimes in the form of a yellowiſh white powder, and leaves a button of metallic ſilver.

Its conſtituent parts are ſuppoſed to be nearly the ſame as the following.

Localities, &c.—Found in almoſt all ſilver mines, and is uſually accompanied by other ſilver ores, as well as different metallic ores.

Subſpecies 2. BRIGHT RED SILVER ORE.

Exter. Char.—Found maſſive, diſſeminated, or ſuperficial, and very often cryſtallized. The forms of its cryſtals reſemble ſome of thoſe of the former, or are ſimple ſix-ſided pyramids, or acute ſix-ſided pyramids, having the lateral angles alternately acute and obtuſe, with the ſummit ſurmounted by a three-ſided pyramid placed on the obtuſe edges of the firſt; or ſurmounted by a ſix-ſided pyramid ſet on the lateral faces. The cryſtals are ſometimes acicular, and are combined together in a faſcicular or reticulated form. Surface of the cryſtals ſometimes ſmooth, ſometimes druſy; ſtreaked longitudinally, but the pyramids are ſtreaked tranſverſely or obliquely; luſtre reſplendent or ſhining; internal luſtre ſhining or weakly ſhining and adamantine; fracture conchoidal, or fine grained uneven; fragments rather blunt-edged.

Colour blood red, or light cochineal red, ſometimes bluiſh on the ſurface; cryſtals ſemitranſparent; in maſſes tranſlucent, often opaque; ſtreak aurora red; ſoft, eaſily frangible. Spec. grav. 5.44 to 5.59.

Chem. Char.—Melts before the blow-pipe; blackens, and burns with a bluiſh flame, giving out white fumes with the odour of garlic. A button of nearly pure ſilver remains behind.

Conſtituent Parts.

	Klaproth.	Vauquelin.
Silver,	62.	56.67
Antimony,	18.5	16.13
Sulphur,	11.	15.07
Sulphuric acid and water,	8.5	–
Oxygen,	–	12.13
	100.0	100.00

The garlic ſmell, which was formerly ſuppoſed to be owing to arſenic, ariſes from the antimony, which is volatilized by the action of the blow-pipe; although, according to Prouſt, there are ores of red ſilver which contain ſometimes arſenic and ſometimes antimony ſeparately, and ſometimes the two metals combined. The red colour of this ore is by Thenard aſcribed to the antimony in the ſtate of purple oxide.

Localities, &c.—Red ſilver ore is uſually accompanied by native arſenic, other ores of ſilver, as well as other metallic ores; and it is found in Bohemia, Saxony, France, Spain, and Hungary.

9. Species. WHITE SILVER ORE.

Id. Broch. ii. 150. *Light Gray Silver Ore*, Kirw. ii. 119.

Metallic Ores.

Exter. Char.—Found maſſive and diſſeminated; luſtre ſtrongly glimmering; fracture even; fragments blunt-edged.

Colour bright lead-gray, or ſteel-gray; ſoft; ſtreak ſhining. Spec. grav. 5.322.

Conſtituent Parts.—According to ſome, this mineral is compoſed of ſilver, antimony, and ſulphur; but according to others, minerals which have been reckoned white ſilver ores, contain a very conſiderable proportion of lead, and therefore ought to be arranged among the ores of that metal. Such are the following analyſes by Klaproth.

	Light coloured.	Dark coloured.
Silver,	20.40	9.25
Lead,	48.06	41.
Antimony,	7.88	21.5
Iron,	2.25	1.75
Sulphur,	12.25	22.
Alumina,	7.	1.75
Silica,	.25	–
Loſs,	1.91	2.25
	100.00	100.00

Localities, &c.—The real white ſilver ore has been chiefly found in the mine of Himmelfurſt, near Freyberg in Saxony, in a gangue of quartz, and accompanied by galena, red ſilver, and blende.

10. Species. BLACK SILVER ORE.

Exter. Char.—This ore of ſilver is of a cellular texture; the ſtreak is ſhining and metallic; it is brittle, and of a black colour; but it can only be known to be a ſilver ore by obtaining globules of ſilver under the blow-pipe. It is uſually accompanied by vitreous red ſilver ores. It is ſuppoſed that it is ſome of the other ſpecies of ſilver ores that may have undergone ſome change from chemical agents. The ſilver it contains is in very variable proportions.

Localities, &c.—Found in ſome of the ſilver mines at Freyberg in Saxony, and Allemont in France. It is common in Peru and Mexico, and it is called by the Spaniards, *negrillo*.

Beſide the ſilver ores already deſcribed, other ſpecies have been mentioned by mineralogiſts, the exiſtence of which has not been diſtinctly aſcertained; as the *carbonate* of ſilver of Widenmann and Kirwan, compoſed of 72.5 parts of ſilver, 12 of carbonic acid, and 15.5 of carbonate of antimony and oxide of copper *; the reddiſh and greeniſh black ſilver ore, alſo deſcribed by Kirwan, which is ſuppoſed to be a mixture of native and ſulphurated ſilver †. Light lamellar ſilver ore ‡, compoſed of alumina, ſulphuret of ſilver, oxide of iron and manganeſe.

V. COPPER GENUS.

1. Species. NATIVE COPPER.

Id. Kirw. ii. 128. *Id.* Broch. ii. 158. *Id.* Hauy, iii. 518.

Eſſen. Char.—Colour reddiſh yellow, and malleable.

Exter. Char.—Native copper is found maſſive, diſſeminated, ſuperficial, or in rounded pieces; alſo dendritical and capillary, and very often cryſtallized in per-

* II. 112.

† *Ibid.* 125.

‡ *Ibid.* 116.

fect cubes, or with truncated edges or angles; double four-ſided pyramids; ſimple and acute three-ſided pyramids. Cryſtals ſmall, and grouped in a dendritical or botryoidal form; luſtre ſhining or weakly ſhining; internal luſtre glimmering or weakly ſhining; fracture hackly; fragments blunt-edged.

Colour light copper-red, but expoſed to the air, yellowiſh, blackiſh, or greeniſh; ſtreak ſhining; ſoft, or ſemihard; ductile, and flexible, but not elaſtic. Spec. grav. 7.72 to 8.58.

Chem. Char.—Copper immerſed for ſome time in a ſolution of ammonia, or volatile alkali, changes it to a beautiful blue colour.

Localities, &c.—Native copper is not a very rare mineral; it is found in many copper mines accompanied by the other ores of copper, as in the copper mines of Siberia, Saxony, Hungary, Sweden, and Cornwall in England.

2. Species. VITREOUS COPPER ORE.

Id. Kirw. ii. 144. *Id.* Broch. ii. 162. *Cuivre Sulfuré*, Hauy, iii. 551.

This is divided into two ſubſpecies; compact and foliated.

Subſpecies 1. COMPACT VITREOUS COPPER ORE.

Exter. Char.—Found maſſive or diſſeminated, ſometimes ſuperficial, and rarely cryſtallized in perfect cubes with convex faces; in perfect octahedrons, or in ſix-ſided priſms, terminated by a three-ſided pyramid, ſet on three of the lateral edges. Cryſtals ſmall; ſurface ſmooth and ſhining; internal luſtre ſtrongly glimmering or ſhining; fracture rhomboidal or even, fragments rather ſharp-edged.

Colour lead-gray, iron gray, or yellowiſh, but ſometimes the colour of tempered ſteel when tarniſhed; ſtreak ſhining or reſplendent; ſoft, and eaſily frangible. Spec. grav. 4.81 to 5.338.

Conſtituent Parts.	Klaproth.
Copper,	78.5
Sulphur,	18.5
Iron,	2.25
Silica,	.75
	100.00

Subſpecies 2. FOLIATED VITREOUS COPPER ORE.

Exter. Char.—Always found maſſive or diſſeminated, rarely ſuperficial; fracture foliated; fragments blunt edged.

Colour ſimilar to the former, approaching a little more to fawn or yellowiſh brown.

Conſtituent Parts.	Klaproth.
Copper,	50
Sulphur,	20
Iron,	25
Loſs,	5
	100

Chem. Char.—Vitreous copper ore is often fuſible in the flame of a candle, and it melts eaſily before the blow-pipe, and yields a button of copper enveloped in a blackiſh ſlag; heated with borax, gives it a green colour, and digeſted in a ſolution of ammonia, changes it to a fine blue.

Localities, &c.—Vitreous copper ore is accompanied by quartz, calcareous ſpar, heavy ſpar, and the other ores of copper; and is common in Siberia, Hungary, Norway, Germany, and Cornwall in England.

3. Species. VARIEGATED COPPER ORE.

Purple Copper Ore, Kirwan, ii. 142. *La Mine de Cuivre Panachée*, Brochant, ii. 166. *Cuivre Pyriteux Hepatique*, Hauy, iii. 536.

Exter. Char.—Found maſſive, diſſeminated, or ſuperficial, and ſometimes, it is ſaid, cryſtallized in octahedrons; internal luſtre ſhining; fracture conchoidal, or ſomewhat uneven; fragments rather ſharp-edged.

Colour reddiſh yellow, violet blue, azure blue, and greeniſh; ſeveral colours exiſt on the ſame ſpecimen, giving it a variegated appearance, from which it has the name; ſtreak ſhining; powder reddiſh; ſoft, and eaſily frangible.

Conſtituent Parts.	Klaproth.	
Copper,	63.7	58
Iron,	12.7	18
Sulphur,	19.	19
Oxygen,	4.5	5
Loſs,	.1	
	100.0	100

Localities, &c.—Variegated copper ore is accompanied by quartz, calcareous ſpar, bituminous marly ſchiſtus, and other copper ores; and is found in Saxony, Hungary, Sweden, Siberia, and England.

4. Species. COPPER PYRITES.

Id. Kirwan, ii. 140. *Id.* Brochant. ii. 169. *Id.* Hauy, iii. 529.

Exter. Char.—Found maſſive, diſſeminated, ſometimes ſuperficial, more rarely in imitative forms, as dendritical, &c. but often cryſtallized. Forms are, the tetrahedron, which is either perfect, or with its four angles truncated, giving it the appearance of a ſix-ſided table; the perfect octahedron, the ſummit terminated by a line; a double cryſtal formed of two tetrahedrons baſe to baſe, the angles of the baſes being ſlightly truncated, produce three re-entering angles, and the lateral faces three ſalient angles. Cryſtals are ſmall; ſurface ſmooth, ſhining; internal luſtre ſhining or reſplendent; fracture often uneven, ſometimes conchoidal, fragments rather ſharp-edged.

Colour in the freſh fracture, braſs yellow, ſometimes gold yellow, and ſteel gray; ſometimes with variegated colours; ſoft or ſemi-hard; brittle. Spec. grav. 4.08 to 4.3.

Chem. Char.—Before the blow-pipe it decrepitates; gives out a ſulphureous odour; fuſes into a black globule, and the heat being continued, metallic copper appears. Borax heated with it acquires a green colour.

This

This ore of copper is compoſed of ſulphur, copper, and iron in variable proportions, and ſometimes alſo a ſmall admixture of gold or ſilver.

Localities, &c.—This is a very common copper ore. It is equally found in primitive and ſtratiform mountains, either in veins or in beds, and ſometimes in great abundance; in Saxony, Hungary, Sweden, France, and England.

5. Species. White Copper Ore.

Id. Kirwan, ii. 152. *Id.* Brochant, ii. 173.

Exter. Char.—Found maſſive or diſſeminated; internal luſtre weakly ſhining; fracture fine grained, uneven; fragments rather ſharp edged.

Colour between ſilver white and braſs yellow; ſemihard; brittle. Spec. grav. 4.5.

Chem. Char.—Before the blow-pipe it gives out a white fume, with the ſmell of arſenic, and melts into a grayiſh black ſlag.

This ore is ſaid to be compoſed of copper, iron, arſenic, and ſulphur.

6. Species. Gray Copper Ore.

Id. Kirwan, ii. 146. *Id.* Brochant, ii. 175. *Id.* Hauy, iii. 537.

Exter. Char.—Found maſſive or diſſeminated, ſuperficial, and often cryſtallized in regular tetrahedrons, which are rare; or having all the edges truncated, or bevelled, ſometimes ſlightly, and ſometimes ſtrongly; or having each of its angles ſurmounted by a three-ſided pyramid, ſet on the lateral faces, with ſome other modifications. Cryſtals of various ſizes; ſurface ſmooth, ſhining; internal luſtre between glimmering and reſplendent; fracture uneven, or conchoidal; fragments rather ſharp-edged.

Colour ſteel gray of various ſhades, lead gray, and the tarniſhed colours are often variegated; ſtreak black or brown; ſemi-hard; brittle. Specific gravity 4.44 to 4.86.

Chem. Char.—Before the blow-pipe it decrepitates, and melts into a brittle metallic globule of a grayiſh colour, giving out a white fume, and communicating to borax a yellowiſh red colour.

Conſtituent Parts. Klaproth.

Copper,	16.25	31.36
Sulphur,	10.	11.5
Antimony,	16.	34.09
Silver,	2.25	14.77
Iron,	13.75	3.3
Lead,	34.5	
Silica,	2.5	
Alumina,	–	0.3
Loſs,	4.75	4.68
	100.00	100.00

Localities, &c.—This mineral is moſt frequently found in veins in primitive mountains, accompanied by other ores of copper, as in Germany, France, Sweden, Siberia, and in England.

7. Species. Black Copper Ore.

Id. Kirwan, ii. 143. *Id.* Brochant, ii. 180.

Exter. Char.—Found in the ſtate of powder, with a dull appearance, and little coherence, ſometimes incruſting other ores of copper; uſually friable; ſtains; feels meagre.

Colour browniſh black, ſometimes deep brown.

Chem. Char.—Gives out before the blow-pipe a ſulphureous ſmell, and melts with borax into a greeniſh ſlag.

It is ſuppoſed to ariſe from the decompoſition of vitreous copper ore and copper pyrites, and contains ſometimes from 40 to 50 per cent. of copper.

8. Species. Red Copper Ore.

Id. Kirwan, ii. 135. *Id.* Brochant, ii. 181.

This is divided into three ſubſpecies; compact, foliated and capillary.

Subſpecies 1. Compact Red Copper Ore.

Exter. Char.—Found maſſive, diſſeminated, or ſuperficial; luſtre glimmering, ſemi-metallic; fracture even, or ſlightly conchoidal; fragments rather ſharp edged.

Colour cochineal red, or lead gray; opaque; ſtreak ſhining, of a brick red colour; ſemi-hard, and brittle.

Subſpecies 2. Foliated Red Copper Ore.

Exter. Char.—Found maſſive, diſſeminated, or ſuperficial, often cryſtallized in octahedrons, which are either truncated on the angles or edges; in perfect cubes, which are ſometimes truncated on the angles, and ſometimes on the edges. Cryſtals ſmall, uſually aggregated; ſurface ſmooth, ſhining; internally ſhining, or weakly ſhining, between metallic and adamantine; fracture imperfectly foliated; fragments rather ſharp edged.

Colour ſimilar to the former; opaque, tranſlucent at the edges; cryſtals ſemi-tranſparent.

Subſpecies 3. Capillary Red Copper Ore.

Fibrous Red Copper Ore, Kirwan, ii. 137. *Le Cuivre Oxidé Rouge Capillaire*, Brochant, ii. 184.

Exter. Char.—Found in ſmall capillary cryſtals, which are diſſeminated in ſmall bundles, or ſometimes form a ſuperficial incruſtation; luſtre ſhining and adamantine.

Colour carmine red, cochineal or ſcarlet red; cryſtals tranſlucent.

Chem. Char.—Red copper ore is eaſily reduced before the blow-pipe without any odour; entirely ſoluble in muriatic acid without effervеſcence, but effervеſces in nitric acid; by which means it may be diſtinguiſhed from cinnabar, which is inſoluble, and from red ſilver ore, which diſſolves with effervеſcence.

The conſtituent parts of red copper ore are ſuppoſed to be copper and oxygen, and not a carbonate of copper, as was formerly conjectured.

Localities, &c.—Red copper ore is found in various places accompanying the other ores of the ſame metal, and

and particularly native copper. The cryſtallized varieties are rare.

9. Species. Brick-red Copper Ore.

Id. Kirwan, ii. 127. *Id.* Brochant, ii. 187.

Of this alſo there are two ſubſpecies, earthy and indurated.

Subſpecies 1. Earthy Brick-red Copper Ore.

Exter Char.—Found maſſive or diſſeminated, or ſuperficial, in the fiſſures of other copper ores, compoſed of fine earthy particles ſlightly cohering; dull, friable, and ſtaining.

Colour hyacinth red, reddiſh brown, browniſh red, or yellow.

Subſpecies 2. Indurated Brick-red Copper Ore.

Exter. Char.—Found maſſive, diſſeminated, or ſuperficial; luſtre glimmering, or weakly ſhining; fracture imperfectly conchoidal, even or earthy; fragments rather ſharp edged.

Colour deep hyacinth red, browniſh red, or deep brown; ſtreak ſhining; ſoft, or ſemihard; brittle.

Chem. Char.—Before the blow-pipe it is infuſible and blackens.

The conſtituent parts of this ore are ſuppoſed to be a mixture of red copper ore, or oxide of copper, and brown oxide of iron, in variable proportions.

Localities, &c.—This ore is uſually found accompanying red copper ore.

10. Species. Emerald Copper Ore.

Dioptaſe, Hauy, iii. 136. *Id.* Brochant, ii. 511.

Eſſen. Char.—Diviſible into an obtuſe rhomboid, whoſe plane angles are 111° and 69°.

Exter. Char.—Found cryſtallized in ſix-ſided priſms, terminated by a three-ſided ſummit, placed on the three alternate lateral edges; luſtre ſhining, vitreous; fracture foliated; cleavage threefold, parallel to the lateral edges of the ſummit.

Colour emerald green; tranſlucent, or ſemi-tranſparent; ſemi-hard. Spec. grav. 3.3.

Chem. Char.—Infuſible before the blow-pipe, but becomes brown, and tinges the flame of a candle yellowiſh green.

Conſtituent Parts.	Vauquelin.
Oxide of copper,	28.57
Silica,	28.57
Carbonate of lime,	42.85
Loſs,	.01
	100.00

Localities, &c.—This mineral is found in Siberia, in a matrix covered with malachite.

11. Species. Azure Copper Ore, or *Carbonate of Copper.*

Blue Calciform Copper Ore, Kirwan, ii. 129. *L'Azur de Cuivre*, Brochant, ii. 190. *Cuivre Carbonaté Bleu*, Hauy, iii. 562.

This ſpecies is divided into two ſubſpecies, earthy and indurated.

Subſpecies 1. Earthy Azure Copper Ore.

Exter. Char.—Rarely found maſſive, uſually diſſeminated or ſuperficial; compoſed of fine particles which are dull and ſomewhat coherent; fracture earthy.

Colour ſmalt blue, ſometimes ſky blue; opaque; ſtains a little; ſoft or friable.

Subſpecies 2. Indurated or Radiated Azure Copper Ore.

Exter. Char.—Rarely found maſſive, ſometimes diſſeminated, often ſuperficial, or in imitative forms, as ſtalactitical, botryoidal, &c. and alſo cryſtallized in rectangular four-ſided priſms, terminated by four-ſided acute pyramids ſet on the lateral edges; in oblique four-ſided priſms, with two broad and two narrow faces, with a four-ſided pyramid ſet on the lateral faces; ſometimes the lateral edges are truncated, and the termination is by a ſix-ſided pyramid. Cryſtals uſually ſmall, and variouſly aggregated; broad faces of the priſms tranſverſely ſtreaked; narrow faces longitudinally; luſtre ſhining or reſplendent, vitreous; fracture radiated; fragments blunt-edged, or wedge-ſhaped.

Colour light azure blue, Pruſſian or indigo blue; tranſlucent or ſemi-tranſparent; ſtreak ſky blue; ſoft; brittle. Spec. grav. 3.4 to 3.608.

Chem. Char.—Soluble with effervescence in nitric acid; nearly infuſible before the blow-pipe, but is eaſily reduced with borax, which aſſumes a fine green colour.

Conſtituent Parts.	Pelletier.
Copper,	66
Carbonic acid,	18
Oxygen,	8
Water,	2
Loſs,	6
	100

Localities, &c.—This variety of copper ore is not very abundant; but it accompanies the other ores of copper, and other metallic ores, as thoſe of lead, zinc, and iron. It is found in Bohemia, Norway, Siberia, and in the different mines of lead and copper in Britain.

The earthy variety is found in ſuperficial layers on a ſlaty marl in Heſſia, and it is alſo found ſuperficial on ſandſtone in Thuringia. Sometimes the whole of the ſandſtone is impregnated with this earthy carbonate of copper, there called *copper ſand earth*, or *copper ſandſtone.* A ſimilar ſandſtone, at Gourock near Greenock in Scotland, was a few years ago dug out for the purpoſe of extracting copper.

12. Species. Malachite.

Id. Kirwan, ii. 131. *Id.* Brochant, ii. 197.

This ſpecies is divided into two ſubſpecies, fibrous and compact.

Subſpecies

Subſpecies 1. FIBROUS MALACHITE.

Cuivre Carbonaté Vert Soyeux. Hauy, iii. 573.

Exter. Char.—Rarely maſſive, ſometimes diſſeminated, but often ſuperficial, and in the form of ſmall capillary or acicular cryſtals grouped together in different forms; luſtre ſhining, or when maſſive glimmering; internal luſtre weakly ſhining, ſilky; fracture fibrous, ſtraight, or radiated; fragments blunt edged.

Colour, emerald or apple green; opaque; ſtreak of a lighter colour; ſoft; brittle.

Subſpecies 2. COMPACT MALACHITE.

Exter. Char.—Sometimes found maſſive, diſſeminated or ſuperficial, but moſt frequently globular, botryoidal, ſtalactitical, &c.; ſurface rough or druſy, ſometimes ſmooth, almoſt always dull, and rarely ſhining; internal luſtre dull or weakly ſhining; fracture conchoidal; fragments rather ſharp-edged or wedge ſhaped.

Colour emerald green, apple green, and blackiſh green; opaque; ſoft; brittle. Spec. grav. 3.57 to 3.64.

Chem. Char.—Decrepitates before the blow-pipe, and blackens without fuſion; effervesces with acids; colours borax green, and communicates a blue colour to the ſolution of ammonia.

Conſtituent Parts. Klaproth.

	Compact Malachite.
Copper,	58
Carbonic acid,	18
Oxygen,	12.5
Water,	11.5
	100.0

Localities, &c.—Both the fibrous and compact malachites are uſually found in the ſame repoſitory, and accompanied with other ores of copper. They are found in Germany, but the fineſt ſpecimens are brought from Siberia. Scotland affords fibrous malachite in ſmall quantity, as at Leadhills and in Shetland. Malachite is alſo met with in Cornwall and Derbyſhire in England.

Uſes.—Malachite, when pure, is ſometimes employed as a pigment. The compact variety is ſuſceptible of a fine poliſh; which, with its beautiful and delicate colours, has brought it into much eſtimation for various ornamental purpoſes.

The largeſt and fineſt ſpecimen of compact malachite known, is in the cabinet of Dr Guthrie at Peterſburgh. It is 32 inches long, 17 broad, and two inches thick. It is eſtimated, according to the account of Patrin, who deſcribes it, at 20,000 francs, above 800l. ſterling. If we are rightly informed, this ſplendid maſs of malachite was once offered to ſale in Britain, but, having found no purchaſer, was carried back to Ruſſia.

13. Species. GREEN COPPER ORE.

Mountain Green, Kirw. ii. 134. *Id.* Broch. ii. 203.

Exter. Char.—Found maſſive or diſſeminated, but uſually ſuperficial on other ores; dull; fracture conchoidal or uneven; fragments blunt-edged.

Colour verdigris green, emerald green, ſometimes ſky blue, opaque, or tranſlucent at the edges; ſoft, or friable; brittle.

Chem. Char.—Becomes black before the blow-pipe without fuſion. Colours borax green.

Conſtituent Parts.—Suppoſed to be a mixture of oxide of copper, or according to others, a carbonate, with alumina and lime.

Localities, &c.—It is uſually accompanied by gray copper ore, and ſome other copper ores, particularly with malachite, and ſometimes with iron ochre, alumina, and quartz. Found in Saxony, Hungary, and Siberia.

14. Species. FERRUGINOUS GREEN COPPER ORE.

This is divided into two ſubſpecies; 1. earthy; and, 2. ſlaggy.

Subſpecies 1. EARTHY FERRUGINOUS GREEN COPPER ORE.

Iron-ſhot Mountain Green, Kirw. ii. 155. *Id.* Broch. ii. 205.

Exter. Char.—Found maſſive, but moſt frequently diſſeminated; dull, with an earthy fracture; fragments blunt-edged.

Colour light olive green; ſoft, friable; brittle; meagre to the feel.

Subſpecies 2. SLAGGY FERRUGINOUS GREEN COPPER ORE.

Glaſſy Iron-ſhot Mountain Green, Kirw. ii. 152.

Exter. Char.—Maſſive, or diſſeminated; luſtre ſhining, vitreous; fracture conchoidal; fragments ſharp-edged.

Colour deep olive green, ſometimes black; ſoft; brittle.

Conſtituent Parts.—Seems to be a mixture of oxide of copper with iron ochre, in variable proportions.

Localities, &c.—Found along with other copper ores, and is accompanied by iron ochre, heavy ſpar and quartz. It is a rare mineral. Has been found in Saxony, and it is ſaid in the Hartz.

15. Species. MICACEOUS COPPER ORE, or *Arſeniate of Copper.*

Olive Copper Ore, Kirw. ii. 151. *Le Cuivre Arſenical*, Broch. ii. 208. *Cuivre Arſeniaté*, Hauy, iii. 575. *Arſeniate of Copper*, Bournon, Phil. Tranſ. 1801. p. 193.

This ſpecies is divided into two ſubſpecies, foliated and lenticular.

Subſpecies 1. FOLIATED MICACEOUS COPPER ORE.

Exter. Char.—Found maſſive, diſſeminated, or cryſtallized in oblique four-ſided priſms, in ſix-ſided priſms, in acute rhomboids, or in very ſmall cubes. Theſe cryſtals are alſo variouſly modified; lateral faces ſtreaked longitudinally; luſtre reſplendent, pearly, or adamantine; fracture foliated, ſometimes conchoidal.

Colour olive green, ſometimes emerald green, or verdigris

digris green; tranſlucent; cryſtals ſemitranſparent; ſoft. Spec. grav. 2.54.

Subſpecies 2. LENTICULAR MICACEOUS COPPER ORE.

Exter. Char.—This variety is found cryſtallized in octahedrons, compoſed of two four-ſided pyramids, with iſoſceles triangular faces; cryſtals ſmall; external luſtre ſhining; fracture foliated.

Colour ſky blue, or verdigris green; ſcratches calcareous ſpar; brittle; eaſily frangible. Spec. grav. 2.88.

Chem. Char.—The cryſtals of theſe varieties decrepitate before the blow-pipe, and give out the odour of arſenic. They melt into a grayiſh globule, which being treated with borax, yields a button of copper.

Conſtituent Parts.	Vauquelin.
Oxide of copper,	39
Arſenic acid,	43
Water,	17
Loſs,	1
	100

Localities, &c.—Theſe varieties of copper ores are very rare; and have been hitherto diſcovered only in the Carrarach mine, Cornwall, accompanied by brown iron ore and other copper ores.

Other arſeniates of copper have been deſcribed by Bournon. In many reſpects they reſemble the preceding varieties. The ſpec. grav. which is 4.28, is conſiderably greater, and yet the proportions of the conſtituent parts approach very near.

Conſtituent Parts. Chenevix.

	Hæmatitiform.	Capillary.	Foliated.
Oxide of copper,	50	51	54
Arſenic acid,	29	29	30
Water,	21	18	16
Loſs,	—	2	—
	100	100	100

Count de Bournon has deſcribed another, under the name of cupromartial arſeniate, which is alſo cryſtallized, has a ſpec. grav. 3.3, and the following are its conſtituent parts.

	Chenevix.
Oxide of iron,	27.5
——— copper,	22.5
Arſenic acid,	33.5
Silica,	3.
Water,	12.
Loſs,	1.5
	100.0

16. Species. MURIATE of COPPER, or *Green Sand of Peru*.

Id. Broch. ii. 149. *Id.* Broch. ii. 545.

Exter. Char.—Found maſſive, or cryſtallized in very ſmall ſix-ſided priſms, bevelled at the extremities, or in ſmall oblique four-ſided priſms, alſo bevelled at the extremities, but the ſides correſponding to the obtuſe lateral edges; ſurface of the cryſtals ſmooth and reſplendent; luſtre adamantine; fracture foliated; fragments rather ſharp-edged.

Colour between emerald and leek green; opaque; cryſtals a little tranſparent; ſoft; ſtreak pale apple green. Spec. grav. 3.57 to 4.43.

Chem. Char.—Thrown on burning coals, it communicates a green colour to the flame; ſoluble in nitric acid without efferveſcence.

Conſtituent Parts.

	Prouſt.		Klaproth.
Oxide of copper,	76.6	70.6	73.
Muriatic acid,	10.6	11.4	10.1
Water,	12.8	18.1	16.9
	100.0	100.0	100.0

Localities, &c.—This mineral has been found in the ſand of rivers, accompanied by quartz, ſchorl, copper and iron ores, near Remolinos in Chili. It has alſo been found in a ſimilar ſituation in Peru.

PHOSPHATE OF COPPER.—This mineral has been found maſſive, or cryſtallized in oblique ſix-ſided priſms, with convex faces, lining cavities; luſtre reſplendent, between vitreous and adamantine; internal luſtre ſilky; fracture fibrous.

Colour grayiſh black, but internally emerald green; opaque; ſtreak apple green; ſoft, or ſemihard.

Conſtituent Parts.	Klaproth.
Oxide of copper,	68.13
Phoſphoric acid,	30.95
Loſs,	.92
	100.00

Localities, &c.—This mineral has been found near Bologne, along with malachite, in a white druſy quartz.

COPPER MINES.—In addition to the hiſtory of copper ores now given, we ſhall juſt name ſome of the more celebrated copper mines in the world. The copper mines of Spain are ſituated on the frontiers of Portugal, and yield from veins of conſiderable thickneſs, yellow pyrites. France poſſeſſes copper mines in the Pyrenees, near Lyons, in Voſges, and in the neighbourhood of Savoy, in the department of Mont Blanc. There are extenſive copper mines in Piedmont, which have been wrought to a very conſiderable depth.

The copper mines of Cornwall in England, which are in primitive rocks, have been long celebrated. The moſt abundant ores are copper pyrites, accompanied by native copper, which latter, it is obſerved, is moſt uſually found near the ſurface. The ſame mines yield all the varieties of arſeniate of copper. The Acton copper mines on the borders of the counties of Derby and Stafford are ſituated in limeſtone, in very declining or nearly perpendicular beds; but the richeſt copper mines in England are thoſe of the iſland of Angleſea, where is a maſs of pyritous copper ore of immenſe thickneſs, yielding from 16 to 40 per cent. of copper. Native copper is alſo found near the ſurface, and immediately under the turf.

The mines of Cronebane, in the county of Wicklow in Ireland, are very conſiderable. They are ſituated in a primitive mountain, compoſed of flinty ſlate and argillaceous ſchiſtus, which alternate with beds of ſteatites.

In Germany, Hungary, Sweden, Norway, and Siberia, there are many extenſive and valuable copper mines. In the eaſtern parts of the Aſiatic continent, in the iſland of Japan, in China, and in ſome of the iſlands of the Indian ocean, rich copper ores are abundant.

Africa, in various places of that extenſive region, abounds with ores of copper, as in the mountains to the north of the Cape of Good Hope. On the weſtern coaſt of Africa, the natives dig out copper ore, and are acquainted with the mode of extracting it.

In North America maſſes of native copper have been found, near Hudſon's Bay; but the richeſt copper mines in the world are thoſe of South America, and particularly in Chili, from which maſſes of native copper of immenſe magnitude have been obtained. The copper mines of Peru and Mexico are alſo wrought to great advantage.

VI. IRON Genus.

1. Species. Native Iron.

Id. Kirw. ii. 156. *Id.* Brochant, ii. 215. *Id.* Hauy, iv. 1.

Exter. Char.—Found maſſive or branched; ſurface ſmooth, ſhining; internal luſtre ſhining, metallic; fracture hackly; fragments rather ſharp-edged.

Clour light ſteel gray, or ſilvery white; ſemihard; ſtreak ſhining; perfectly ductile; flexible; but not elaſtic.

Localities, &c.—The exiſtence of native iron as a terreſtrial production ſtill remains doubtful. It is ſaid that it has been found along with other ores of iron, in Saxony and in France. The only inſtances fully eſtabliſhed of the diſcovery of native iron, are thoſe of the immenſe maſs found by Pallas in Siberia, which amounted to no leſs than 1680lb. or 15 cwt. and another of 3 cwt. which was diſcovered by Rubin de Celis in South America; but theſe maſſes correſpond ſo nearly with the ſubſtances which are certainly known to have fallen from the atmoſphere, in their conſtituent parts, that it ſeems extremely probable they have had a ſimilar origin. But for a full account of this curious ſubject, ſee Meteorolite.

2. Species. Iron Pyrites.

Martial Pyrites, Kirwan ii. 76. *Id.* Brochant, ii. 221. *Fer ſulfuré*, Hauy, iv. 65.

Subſpecies 1. Common Iron Pyrites.

Exter. Char.—Found maſſive or diſſeminated, ſuperficial, or in imitative forms, and frequently cryſtallized. The forms are, a perfect cube with plane or convex faces; or with truncated angles, or edges; or having a three-ſided pyramid on each angle; the perfect octahedron, or truncated on all its angles; the dodecahedron with pentagonal faces, or with ſix oppoſite and parallel edges truncated, or truncated on eight of its angles; or the perfect icoſahedron, which is rare.

Cryſtals ſmall, excepting the cube, and grouped together; ſurface ſmooth or ſtreaked; luſtre ſhining, reſplendent; internal luſtre ſhining, metallic; fracture uneven; ſometimes conchoidal; fragments rather ſharp-edged.

Colour bronze yellow, golden yellow, ſometimes ſteel gray; opaque; hard; brittle; rather eaſily frangible. Spec. grav. 4.6 to 4.83.

Chem. Char.—Before the blow-pipe it gives out a ſtrong ſulphureous ſmell, and burns with a bluiſh flame; a browniſh globule is then obtained, which is attracted by the magnet.

Conſtituent Parts. Hatchett.

Sulphur,	52.15	52.5
Iron,	47.85	47.5
	100.00	100.0

Some varieties of common iron pyrites contain a mixture of gold, which is ſuppoſed to be accidental, as the external characters are not affected by it, and it is only recogniſed by chemical analyſis. Theſe varieties are called auriferous pyrites.

Subſpecies 2. Radiated Iron Pyrites.

Exter. Char.—Found maſſive, or in different imitative forms, and alſo cryſtallized in ſmall cubes or octahedrons; ſurface ſmooth or druſy; luſtre ſhining or reſplendent; fracture radiated; fragments wedge-ſhaped.

Colour bronze yellow, lighter than the former; ſometimes ſteel gray, and ſometimes tarniſhed; hard; brittle, and eaſily frangible.

Subſpecies 3. Capillary Iron Pyrites.

Exter. Char.—Found in ſmall, capillary, or acicular cryſtals, having the appearance of flocks of wool; ſometimes the cryſtals are acicular or in a ſtellated form; luſtre ſhining or weakly ſhining, metallic.

Colour bronze yellow, approaching to ſteel gray.

Subſpecies 4. Hepatic Iron Pyrites.

Exter. Char.—Maſſive or diſſeminated, or in different imitative forms, as ſtalactitical, cellular, &c.; ſometimes cryſtallized in perfect ſix-ſided priſms or in ſix-ſided tables, which are either perfect or bevelled on the terminal faces. Cryſtals ſmall; ſometimes ſmooth; ſometimes druſy; internal luſtre glimmering, or weakly ſhining; fracture even, or imperfectly conchoidal; fragments ſharp-edged.

Colour bronze yellow, ſteel-gray, ſometimes browniſh or tarniſhed; ſtreak ſhining; hard; brittle.

Phyſical Char.—By rubbing gives out a ſulphureous odour, and, according to ſome, the ſmell of arſenic.

Conſtituent Parts.—According to ſome mineralogiſts this variety is compoſed of ſulphur and iron, with a portion of arſenic.

Localities, &c.—The firſt variety is univerſally diffuſed; it is found in every kind of rock, and often in great abundance.

The ſecond is rarer; but is not uncommon in veins of lead and ſilver, and ſometimes in neſts in indurated marl. It is found in Saxony and Bohemia, in Derbyſhire

Metallic Ores.

ſhire in England, and at Leadhills and the iſland of Iſlay in Scotland.

This variety is more ſubject than the firſt to decompoſition.

Capillary pyrites is only found in ſmall quantity, as in Saxony, and Andreaſberg in the Hartz.

Hepatic pyrites is only found in veins, particularly thoſe of ſilver and lead, accompanied with quartz, calcareous ſpar, and heavy ſpar, as in Germany and Siberia, and at Wanlockhead in Scotland.

Expoſed to the air, this variety is extremely liable to decompoſition.

3. Species. MAGNETIC PYRITES.

Id. Kirwan, ii. 79. *Id.* Brochant, ii. 232.

Exter. Char.—Maſſive or diſſeminated; internal luſtre ſhining or weakly ſhining; fracture uneven, rarely conchoidal; fragments rather ſharp-edged.

Colour between copper red and bronze yellow; when expoſed to the air it becomes browniſh or tarniſhed; hard, or ſemihard; brittle. Spec. grav. 4.51.

Phys. Char.—This variety of pyrites acts on the magnetic needle, but not very powerfully.

Chem. Char.—Before the blow-pipe it gives out a ſlight odour of ſulphur, and melts eaſily into a grayiſh black globule, which is attracted by the magnet.

Conſtituent Parts.	Hatchett.
Iron,	63.5
Sulphur,	36.5
	100.0

Localities, &c.—Magnetic pyrites has been only found in primitive rocks, as in micaceous ſchiſtus; and is uſually diſpoſed in beds, along with other ores of iron, and accompanied by quartz, hornblende, and garnets. It is found in Saxony, Bavaria, Bohemia, and in Caernarvonſhire in Wales.

Uſes.—This, as well as the former ſpecies, is employed for the purpoſe of extracting ſulphur, or of manufacturing copperas, or ſulphate of iron.

4. Species. MAGNETIC IRON ORE.

Magnetic Ironſtone, Kirwan, ii. 158. *Id.* Brochant, ii. 235. *Fer Oxidulé*, Hauy, iv. 10.

This is divided into two ſubſpecies, common and arenaceous.

Subſpecies 1. COMMON MAGNETIC IRON ORE.

Exter. Char.—Maſſive or diſſeminated, and often alſo cryſtallized in ſix-ſided priſms, having a three-ſided pyramid at each extremity, ſet on three alternate lateral edges; an oblique four-ſided priſm; a double four-ſided pyramid, or perfect octahedron, which is ſometimes truncated on all its edges. Cryſtals of various ſizes; faces ſometimes ſmooth; thoſe of the four-ſided priſm ſtreaked tranſverſely; luſtre ſhining; internal luſtre reſplendent, or weakly glimmering; fracture uneven, ſometimes conchoidal or foliated; fragments rather blunt-edged.

Classification.

Colour iron-black, perfect black, or ſteel-gray; ſtreak browniſh black; ſemihard, or hard; brittle; more or leſs eaſily frangible. Spec. grav. 4.2 to 4.93.

Subſpecies 2. ARENACEOUS MAGNETIC IRON ORE.

Exter. Char.—Found in rounded grains, from the ſize of millet to that of a nut, and ſometimes in ſmall octahedral cryſtals; external ſurface rough or weakly glimmering; internal ſhining or reſplendent; fracture conchoidal; fragments ſharp-edged.

Colour deep iron black, ſometimes aſh gray.

Phys. Char.—Magnetic iron ore, as the name imports, ſtrongly attracts the magnetic needle, and iron filings; to the compact varieties of this ore, in which this property was firſt diſcovered, the name of natural magnet is given.

Chem. Char.—Magnetic iron ore becomes brown before the blow pipe, and colours borax dark green.

Conſtituent Parts.—This is ſuppoſed to be an oxide of iron in conſiderable purity, as it yields from 80 to 90 per cent. of metallic iron.

Localities, &c.—Common magnetic iron ore is very common in primitive mountains, particularly in thoſe of gneiſs and micaceous ſchiſtus, where it forms very powerful beds, and even entire mountains. It is diſſeminated in cryſtals in chlorite ſchiſtus, as in Corſica, and in baſalt and greenſtone, at Taberg in Sweden. Found in Saxony, Bohemia, and Italy, and particularly in the iſland of Elba in the Mediterranean; and indeed is very univerſally diſtributed over every part of the globe.

The ſecond variety, or magnetic ſand, is found in the beds of rivers, in a looſe ſtate, and ſometimes imbedded in baſalt and wacken. It is found in thoſe countries where the other ores of iron abound; and alſo in the ſand of many of the rivers within the torrid zone, as in Jamaica, St Domingo, &c.

Uſes.—Magnetic iron is wrought for the purpoſe of obtaining metallic iron. Moſt of the Swediſh iron ores belong to this variety, and furniſh the iron which is ſo celebrated on account of its ſuperior qualities, throughout Europe.

Magnetic ſand, where it is abundant, is alſo ſmelted as an iron ore.

5. Species. SPECULAR IRON ORE.

Id. Broch. ii. 242. *Id.* Kirw. ii. 162. *Micaceous Iron Ore*, ibid. 284. *Fer Oligiſte*, Hauy, iv. 38.

This ſpecies is divided into two ſubſpecies, common and micaceous.

Subſpecies 1. COMMON SPECULAR IRON ORE.

Exter. Char.—Maſſive or diſſeminated, but moſt frequently cryſtallized in doubled three-ſided pyramids, flattened, and the lateral faces of the one ſet on the lateral edges of the other; the ſame pyramid with the angles at the common baſe truncated; in perfect cubes, having the angles truncated; or the cube conſidered as a double three-ſided pyramid; or as a rhomboid, in which the ſummits are ſurmounted by an obtuſe three-ſided pyramid, ſet on the lateral faces; the ſame cube bevelled at each of the angles of the common baſe; in ſix-ſided tables variouſly modified, or in perfect lenſes.

Surface of the cryſtals ſmooth, reſplendent; internal luſtre weakly ſhining or reſplendent; fracture uneven, ſometimes conchoidal or foliated; fragments ſharp-edged.

Colour ſteel-gray, bluiſh, or reddiſh; ſometimes with tarniſhed colours, which are irideſcent; ſtreak dark cherry-red; hard; opaque; brittle. Spec. grav. 4.79 to 5.21.

Chem. Char.—Before the blow-pipe it is infuſible; but heated on charcoal becomes white, and melts with borax into a dirty yellow ſlag.

Phyſ. Char.—Affects the magnetic needle, but does not attract iron filings.

Conſtituent Parts.—This variety is ſuppoſed to be a pretty pure oxide of iron, yielding from 60 to 80 per cent. of iron.

Of this ſubſpecies two varieties have been formed, compact and foliated, depending probably on the appearance of the fracture.

Subſpecies 2. MICACEOUS IRON ORE.

Exter. Char.—Maſſive or diſſeminated, or in thin ſix-ſided tables, ſo grouped together as to appear cellular; ſurface ſmooth, reſplendent; internal luſtre reſplendent; fracture foliated; fragments in tables.

Colour iron-black, ſteel-gray, or dark red; in thin plates ſlightly tranſlucent; ſtreak dark cherry-red; ſemihard; brittle. Spec. grav. 4.5 to 5.

Localities, &c.—Theſe varieties are found in primitive mountains, in beds or veins, accompanied by other ores of iron, and in ſuch quantity in many places as to be dug out for the purpoſe of manufacture, as in Germany, France, Ruſſia, Sweden, Siberia, and particularly in the iſlands of Corſica and Elba, which furniſh the fineſt ſpecimens of ſpecular iron ore for the cabinet.

The latter variety is found in England, and ſome parts of Scotland.

6. Species. RED IRON ORE.

This is divided into four ſubſpecies; 1. red iron froth; 2. compact; 3. red hæmatites; and, 4. red ochre.

Subſpecies 1. RED IRON FROTH.

Id. Broch. ii. 249. *Red Scaly Iron Ore*, Kirw. ii. 172.

Exter. Char.—Sometimes maſſive, and frequently ſuperficial; luſtre glimmering or ſhining, uſually compoſed of ſcaly friable particles which ſtain ſtrongly; feels greaſy.

Colour dark cherry-red, blood-red, browniſh-red, or ſteel-gray.

Chem. Char.—Blackens before the blow-pipe.

Conſtituent Parts.	Hauy.
Iron,	66.
Oxygen,	28.5
Silica,	4.25
Alumina,	1.25
	100.00*

Localities, &c.—A rare mineral, uſually incruſting other ores of iron. Found in Germany, and in Cornwall and at Ulverſtone in Lancaſhire in England.

Subſpecies 2. COMPACT RED IRON ORE.

Id. Broch. ii. 251. *Id.* Kirw. ii. 170.

Exter. Char.—Maſſive or diſſeminated, in imitative forms, as cellular, &c. or cryſtallized in perfect cubes, or four-ſided pyramids with truncated ſummits. Surfaces of the cube ſmooth; that of the pyramids rough and dull; internal luſtre glimmering; fracture even, ſometimes uneven or conchoidal; fragments rather blunt-edged.

Colour browniſh-red, dark ſteel-gray, ſometimes blood-red; ſemihard; brittle; ſtreak blood-red; ſtains. Spec. grav. 3.4 to 3.8.

Chem. Char.—Infuſible before the blow-pipe.

Conſtituent Parts.	Lampadius.
Oxide of iron,	65.4
Silica,	20.7
Alumina,	9.3
Oxide of mangane ſe,	2.7
Loſs,	1.9
	100.0

Localities, &c.—Found along with other iron ores, abundant in Cumberland and Lancaſhire, and various places of the world.

Subſpecies 3. RED HÆMATITES.

Id. Kirw. ii. 168. *Id.* Broch. ii. 254.

Exter. Char.—Maſſive, and in various imitative forms; ſurface ſmooth or druſy; internal luſtre ſhining, or only glimmering; fracture fibrous; fragments wedge-ſhaped.

Colour browniſh-red, ſteel-gray, or blood-red; ſtreak light blood-red; hard or ſemihard; brittle; ſtains. Spec. grav. 4.7 to 5.

Conſtituent Parts.—It yields from 60 to 70 per cent. of iron, and contains, it is ſuppoſed, a portion of alumina, ſilica, and mangane ſe.

Localities, &c.—This ore of iron is not very common, although in ſome places it is very abundant, as in the weſt of England. It is diſpoſed in veins and beds, accompanied by the former variety.

Subſpecies 4. RED OCHRE.

Id. Kirw. ii. 171. *Id.* Broch. ii. 256.

Exter. Char.—Found maſſive, diſſeminated, or ſuperficial; dull; fracture earthy.

Colour between blood-red and browniſh-red; ſtains much; ſoft; often friable.

Localities, &c.—This variety uſually accompanies the former, and is a very fuſible iron ore.

7. Species. BROWN IRON ORE.

This is divided into four ſubſpecies; 1. brown iron froth; 2. compact; 3. brown hæmatites; and, 4. brown ochre.

Subſpecies 1. BROWN IRON FROTH.

Brown Scaly Iron Ore, Kirw. ii. 166. *Le Eiſenrahm brun*, Broch. ii. 258.

---

* *Nich. Jour.* 4to, iii. 456.

Exter. Char.—Maſſive or diſſeminated, often ſuperficial, or ſpumiform; ſtrongly glimmering or ſhining; fracture foliated or compact.

Colour between brown and dull gray; very ſoft; almoſt friable; ſtains; feels greaſy; nearly ſwims on water.

Chem. Char.—Blackens before the blow-pipe without fuſion.

Localities, &c.—Accompanies other iron ores, as in Saxony, but is rare.

Subſpecies 2. Compact Brown Iron Ore.

Exter. Char.—Maſſive or diſſeminated, ſometimes in different imitative forms; dull, or rarely glimmering; fracture ſmooth, earthy, or conchoidal.

Colour clove brown, or browniſh yellow; ſtreak yellowiſh brown; ſemihard; brittle. Spec. grav. 3.07 to 3.75.

Localities, &c.—In veins or beds, accompanied by other iron ores, in various parts of the world.

Subſpecies 3. Brown Hæmatites.

Id. Kirw. ii. 163. *Id.* Broch. ii. 261.

Exter. Char. Maſſive, but moſt frequently in different imitative forms; ſurface ſmooth, granulated, rough or druſy; luſtre ſhining; internal luſtre glimmering or weakly ſhining; fracture fibrous; fragments ſplintery, or wedge-ſhaped.

Colour clove brown, blackiſh brown, ſometimes yellow, and ſometimes with tarniſhed colours; opaque; ſtreak yellowiſh brown; ſemihard; brittle. Spec. grav. 3.78 to 4.02.

Localities, &c.—Always accompanies the preceding variety, but in ſmaller quantity.

Subſpecies 4. Brown Ochre.

Id. Kirw. ii. 167. *Id.* Broch. ii. 263.

Exter. Char.—Maſſive or diſſeminated; dull; fracture earthy; fragments blunt-edged.

Colour yellowiſh brown, or ochre yellow; ſoft; ſometimes friable; ſtains more or leſs.

Localities, &c.—Always accompanies compact brown iron ore, and is therefore found in ſimilar places.

8. Species. Sparry Iron Ore.

Id. Brochant, ii. 264. *Id.* Kirw. ii. 190.

Exter. Char.—Maſſive, diſſeminated, ſometimes with impreſſions, and often cryſtallized. Its forms are, the rhomboid with plane or convex faces, or having two oppoſite angles ſtrongly truncated; and the lens, the equiangular ſix-ſided priſm, or the ſimple or double four-ſided pyramid. Cryſtals ſmall; ſurface ſmooth, ſometimes druſy, ſometimes a little rough; luſtre ſhining and ſomewhat metallic; internal luſtre ſhining, rarely reſplendent, between pearly and vitreous; fracture foliated; fragments rhomboidal.

Colour yellowiſh gray, grayiſh white, and expoſed to the air, blackiſh brown, or with tarniſhed colours; ſometimes tranſlucent at the edges; thoſe of a dark colour, opaque; ſemihard, or ſoft; brittle. Spec. grav. 3.6 to 4.

Chem. Char.—Before the blow-pipe it blackens without fuſion.

Conſtituent Parts.—According to Bergman, this mineral contains equal parts of carbonate of lime and of iron, with about one-fourth of manganeſe.

Localities, &c.—Found equally in primitive and ſtratiform rocks, and always accompanied by calcareous ſpar, and other ores of iron, as in Saxony, France, Britain, and Ireland.

9. Species. Black Iron Ore.

Id. Kirw. ii. 167. *Id.* Broch. ii. 268.

This ſpecies is divided into two ſubſpecies: 1. compact; and 2. black hæmatites.

Subſpecies 1. Compact Black Iron Ore.

Exter. Char.—Maſſive, or in various imitative forms; ſurface rough or dull; internal luſtre glimmering; fracture flat conchoidal; fragments ſharp-edged.

Colour between ſteel gray and bluiſh-black; ſemihard; brittle.

Subſpecies 2. Black Hæmatites.

Exter. Char.—Maſſive or kidney-form; internal luſtre glimmering and ſhining; fracture fibrous, ſometimes even; fragments wedge-ſhaped.

Colour ſteel gray.

Conſtituent Parts.—This ore is ſuppoſed to contain a larger proportion of manganeſe, with alumina and lime, than other ores of iron.

Localities, &c.—Found in veins in primitive mountains, and ſometimes alſo in ſtratiform mountains, accompanied by brown and ſparry iron ore.

10. Species. Argillaceous Iron Stone.

This is divided into ſix ſubſpecies: 1. red chalk; 2. columnar argillaceous iron ſtone; 3. granular; 4. common; 5. reniform; and, 6. piſiform.

Subſpecies 1. Red Chalk.

Id. Broch. ii. 271.

Exter. Char.—Maſſive; fracture ſlaty; luſtre glimmering; croſs fracture earthy, dull; fragments in plates, or ſplintery.

Colour browniſh red, black or blood red; ſtreak blood red; writes and ſtains; ſoft; adheres to the tongue; feels meagre. Spec. grav. 3.13 to 3.93.

Chem. Char.—Decrepitates, and becomes black when expoſed to a red heat.

Localities, &c.—Uſually accompanies clay ſlate, either in thin beds, or in maſſes, as at Thalitter in Heſſia, where it is dug out in conſiderable quantity. It is alſo found in Bohemia and Saxony.

Uſes.—Employed as crayons in drawing, and for this purpoſe it is dug out, rather than as an ore of iron.

Red chalk, on account of the quantity of alumina and other earths which it contains, was formerly arranged in the argillaceous genus.

Claſſification.

Metallic Ores.

Subſpecies 2. COLUMNAR IRON STONE.

Id. Kirw. ii. 176. *Id.* Broch. ii. 273.

Exter. Char.—Found in angular or rounded pieces; ſurface rough and dull; fracture dull and earthy; compoſed of columnar diſtinct concretions, which are often a little curved, ſometimes ſtraight and articulated, and very eaſily ſeparated; ſurface of the concretions rough and dull.

Colour cherry red, blood or browniſh red; ſtreak blood red, ſometimes yellowiſh brown; ſoft; adheres to the tongue; feels meagre, and is a little rough.

Localities, &c.—Uſually met with in beds of clay, in ſtratiform mountains, and particularly in the neighbourhood of ſubterranean fires, by the effects of which, as it is ſuppoſed, it may have been produced. It is found in Bohemia and ſome other places, where it is wrought as an ore of iron.

Subſpecies 3. GRANULAR IRON STONE.

Id. Broch. ii. 274. *Acinoſe Iron Ore*, Kirw. ii. 177.

Exter. Char.—Maſſive, or conſtituting the baſe of petrifactions; ſtrongly glimmering or weakly ſhining; fracture uneven, ſometimes ſlaty; fragments blunt-edged.

Colour reddiſh and yellowiſh brown, or grayiſh black; ſtreak blood red. or varying according to the colour of the ore, uſually ſoft or ſemihard. Specific gravity 2.673.

Conſtituent Parts.	Lampadius.
Oxide of iron,	64.
Alumina	23.
Silica,	7.5
Water,	5.
Loſs,	.5
	100.0

Localities, &c.—Is found only in ſtratiform mountains, as in Bohemia, Bavaria, and Switzerland.

Subſpecies 4. COMMON IRON STONE.

Id. Kirw. ii. 173. *Id.* Broch. ii. 276.

Exter. Char.—Maſſive or diſſeminated, ſometimes cellular or botryoidal; dull; fracture earthy; fragments rather ſharp-edged.

Colour yellowiſh or bluiſh gray; yellowiſh brown, or browniſh red; ſtreak varies with the colour; ſoft; brittle; adheres to the tongue; feels meagre.

Localities, &c.—A common ore of iron in many places of Saxony and Bohemia, in Norway, and in England. It is connected with ſtratiform mountains, alternating with beds of clay ſlate.

Subſpecies 5. RENIFORM IRON STONE.

Id. Broch. ii. 278. *Nodular Iron Ore*, Kirw. ii 178.

Exter. Char.—Found in rounded or tuberculated pieces, of a kidney-form figure; ſurface rough, covered with earthy particles; internal luſtre glimmering; fracture ſmooth or earthy; fragments rather ſharp-edged; compoſed of lamellar and concentric diſtinct concretions, including a nodule which is uſually moveable.

Colour yellowiſh brown; ſtreak the ſame; ſoft; brittle; adheres to the tongue; feels meagre. Specific gravity 2.57.

Localities, &c.—Found in Bohemia, Saxony, Sileſia, and Poland, and in the coal countries of England and Scotland, and almoſt always in clay beds, ſometimes accompanied with bituminous wood, in ſtratiform mountains.

This variety was formerly called *ætites* or *eagle-ſtone*, as it was ſuppoſed that the eagle carried it to its neſt.

Subſpecies 6. PISIFORM IRON STONE.

Id. Kirw. ii. 178. *Id.* Broch. ii. 280.

Exter. Char.—In ſpherical or flattened particles, which are generally ſmall; ſurface rough, dull; internal luſtre glimmering or weakly ſhining; fracture ſmooth.

Colour between brown and red; ſtreak yellowiſh-brown; ſemihard; brittle. Spec. grav. 5.2.

Conſtituent Parts.	Vauquelin.
Iron,	30
Oxygen,	18
Alumina,	31
Silica,	15
Water,	6
	100

Localities, &c.—This variety is found in conſiderable beds in ſtratiform mountains. It is abundant in France, Switzerland, and ſome parts of Germany.

11. Species. BOG IRON ORE.

This is divided into three ſubſpecies: 1. moraſſy; 2. ſwampy; and 3, meadow.

Subſpecies 1. MORASSY BOG IRON ORE.

Id. Kirw. ii. 183. *Id.* Broch. ii. 283.

Exter. Char.—Sometimes earthy, ſometimes in amorphous, tuberculated, or corroded maſſes; fracture earthy.

Colour yellowiſh-brown; ſtains; ſoft; friable; feels meagre.

Subſpecies 2. SWAMPY IRON ORE.

Id. Kirw. ii. 183.

Exter. Char.—In amorphous maſſes, which are tuberoſe or corroded; dull or ſlightly glimmering; fracture earthy; fragments blunt-edged.

Colour dark yellowiſh-brown, blackiſh brown, or ſteel-gray, ſtreak light yellowiſh brown; very ſoft; brittle; heavier than the former.

Subſpecies 3. MEADOW IRON ORE.

Id. Kirw. ii. 182. *Id.* Broch. ii. 284.

Exter. Char.—In kidney-form, tuberoſe, often corroded maſſes; externally dull or rough; internal luſtre ſhining, reſinous; fracture conchoidal, or earthy when it is dull; fragments rather blunt-edged.

Colour dark blackiſh-brown, or yellowiſh-brown; ſtreak yellowiſh-brown; ſoft and brittle.

Conſtituent Parts.—Bog iron ore is an oxide of iron, combined with the phoſphate of iron, with ſome earthy matters, as alumina and ſilica.

Localities, &c.—Bog iron ore is more abundant in the northern than in the ſouthern parts of Europe. It is not uncommon in Poland, Pruſſia, Sweden, and in the Weſtern iſlands of Scotland, as Jura and Iſlay. It is ſometimes found in extenſive beds, alternating with ſandſtone and clay.

12. Species. BLUE EARTHY ORE.

Id. Broch. ii. 288. *Blue Martial Earth*, Kirw. ii. 185. *Native Pruſſiate of Iron*, of others.

Exter. Char.—Uſually found ſlightly cohering, or looſe, or friable; particles dull; ſtains, and feels meagre.

Colour grayiſh-white, indigo blue, rarely ſmalt-blue.

Chem. Char.—Becomes reddiſh-brown before the blow-pipe; melts into a black globule; eaſily ſoluble in acids.

Conſtituent Parts.—It was ſuſpected by Bergman, that this was a native Pruſſian blue; but according to Klaproth, it is compoſed of iron and phoſphoric acid, with a mixture of alumina.

Localities, &c.—Found in ſmall neſts in beds of clay, or bog iron ore, as in Saxony, Ruſſia, and Siberia.

13. Species. GREEN EARTHY IRON ORE.

Green Martial Earth, Kirw. ii. 188.

Exter. Char.—Found friable and ſuperficial, rarely maſſive; internally dull; fracture earthy.

Colour yellowiſh or olive-green; ſtains; ſoft; feels meagre.

Chem. Char.—Becomes red before the blow pipe, and then dark-brown, but without fuſion.

Conſtituent Parts.—It is conjectured to be a compound ſimilar to the former, but in different proportions.

Localities, &c.—Found in Saxony, in veins, and accompanied with quartz and pyrites.

14 Species. PHOSPHATE OF IRON.

Id. Jour. de Phyſique, lviii. 259. Ann. de Chim. l. 200.

Exter. Char.—Found in rounded pieces, compoſed of capillary cryſtals, which ſeem to be four-ſided priſms; fracture radiated and divergent.

Colour blue, from a blue powder coating the cryſtals, which are otherwiſe colourleſs; ſemitranſparent. Spec. grav. 2 5 to 2.6.

Conſtituent Parts.

	Cadet.	Laugier.
Oxide of iron,	42.1	41.25
Phoſphoric acid,	26.9	19.25
Silica,	3.	1.25
Alumina,	5.8	5.
Lime,	9.1	-
Water,	13.1	31.25
Loſs,	-	2.
	100.0	100.00

Localities, &c.—This mineral is found imbedded in clay in the iſle of France, and in Brazil.

15. Species. PITCHY IRON ORE, or *Phoſphate of Iron and Mangeneſe*.

Id. Broch. ii. 533. Jour. de Mines, N° 64. p. 295.

Exter. Char.—Maſſive; ſurface earthy and dull; internal luſtre weakly ſhining, reſinous; fracture compact or foliated.

Colour dark reddiſh-brown, or black; opaque; ſemihard; brittle; ſtreak dark red. Spec. grav. 3.956.

Chem. Char.—Melts before the blow-pipe into a black enamel.

Conſtituent Parts.	Vauquelin.
Oxide of iron,	31
Oxide of manganeſe,	42
Phoſphoric acid,	27
	100

Localities, &c.—Found near Limoges.

16. Species. CUBE ORE, or *Arſeniate of Iron*.

Id. Phil. Tranſ. 1801. p. 190.

Exter. Char.—Found cryſtallized in ſmall cubes, grouped together in a druſy form; cryſtals ſometimes truncated on their angles; ſurface ſmooth, ſhining; luſtre between reſinous and adamantine; fracture conchoidal.

Colour olive-green, yellow, or brown; tranſlucent; ſemihard; powder yellow. Spec. grav. 3.

Chem. Char.—Before the blow-pipe froths up with the ſmell of arſenic, and melts into a yellowiſh-gray metallic globule.

Conſtituent Parts.

	Vauquelin.	Chenevix.
Oxide of iron,	48	45.5
Oxide of copper,	-	9.
Arſenic acid,	18	31.
Silica,	-	4.
Lime,	2	-
Water,	32	10.5
	100	100.0

Localities, &c.—Found in the copper mines in Cornwall.

17. Species. ARSENIATE OF IRON AND COPPER.

Id. Phil. Tranſ. 1801. p. 219.

Exter. Char.—Cryſtallized in four-ſided rhomboidal priſms, with two edges very obtuſe, and two very acute, terminated by an acute four-ſided pyramid; edges of the priſm are ſometimes truncated.

Colour bluiſh white; cryſtals ſemitranſparent; ſemihard. Spec. grav. 3.4.

Conſtituent Parts.

Oxide of iron,	27.5
Oxide of copper,	22.5
Arſenic acid,	33.5
Silica,	3.
Water,	12.
Loſs,	1.5
	100.0

Localities,

Localities, &c.—Found in Cornwall, in Siberia, and Spain.

18. Species. Chromate of Iron.

Id. Broch. ii. 534. *Id.* Hauy, iv. 129.

Exter. Char.—Maſſive; glimmering or weakly ſhining; fracture compact and uneven, or imperfectly foliated.

Colour grayiſh or blackiſh brown; opaque; ſtreak aſh-gray; ſmell earthy when breathed on; hard. Spec. grav. 4.032.

Chem. Char.—Infuſible before the blow-pipe; melts with borax, and colours it of a beautiful green.

Conſtituent Parts.

Oxide of iron,	35
Chromic acid,	43
Alumina,	20
Silica,	2
	100

Localities, &c.—Diſcovered by Pontier in France, in the department of Var, and found in conſiderable abundance in veins and nodules, in beds of ſerpentine; found alſo in Siberia.

VII. LEAD Genus.

1. Species. Galena.

This is divided into two ſubſpecies; common and compact galena.

Subſpecies 1. Common Galena.

Id. Kirw. ii. 216. *Id.* Broch. ii. 294. *Plomb Sulfuré*, Hauy, iii. 456.

Exter. Char.—Maſſive, diſſeminated, ſuperficial, in imitative forms, or cryſtallized in cubes, octahedrons, ſix-ſided priſms, and ſix-ſided tables; all which are variouſly modified by truncations and bevelments on the edges and angles. Cryſtals grouped or imbedded; ſurface ſmooth, or druſy; luſtre from glimmering to reſplendent; internal the ſame; fracture foliated; fragments cubic, excepting the fine-grained galena.

Colour lead-gray, ſometimes tarniſhed, or irideſcent; ſoft; eaſily frangible; ſtains a little. Spec. grav. 7.22 to 7.58.

Chem. Char.—Decrepitates before the blow-pipe, and fuſes, giving out a ſulphureous odour.

Conſtituent Parts.—Compoſed of ſulphur and lead in variable proportions, and generally a little ſilver, ſometimes antimony. The proportion of lead is from 50 to 80 per cent.

Localities, &c.—This is the moſt common ore of lead, and exiſts in all kinds of rocks, either in beds or veins. In many countries this lead ore is dug out to a great extent, as in Germany, France, and Britain.

Subſpecies 2. Compact Galena.

Id. Kirw. ii. 218. *Id.* Broch. ii. 301.

Exter. Char.—Maſſive, diſſeminated, kidney-form, or ſpecular; luſtre of the ſpecular variety reſplendent; the others only glimmering; internal luſtre glimmering; fracture even or conchoidal; fragments rather ſharp-edged.

Colour lead or ſteel-gray; ſtreak ſhining; ſtains; ſoft. Spec. grav. 7.44.

Localities, &c.—This is a rare mineral. It is found along with common galena, in Saxony, and other parts of Germany; in Derbyſhire, where it is known by the name of *ſlickenſide*, and in the county of Durham, where it is known by the name of *looking-glaſs ore*.

2. Species. Blue Lead Ore.

Id. Kirw. ii. 220. *Id.* Broch. ii. 203.

Exter. Char.—Rarely maſſive, moſt commonly cryſtallized in regular ſix-ſided priſms, which are often a little curved, and ſometimes faſcicularly grouped; ſurface rough; longitudinally ſtreaked; luſtre glimmering; fracture even.

Colour between lead-gray and indigo blue; opaque; ſtreak ſhining; ſoft, eaſily frangible. Specific gravity 5.46.

Chem. Char.—Melts eaſily before the blow pipe; burns with a bluiſh flame, and a ſulphureous odour, leaving a globule of lead.

Its conſtituent parts have not been exactly aſcertained. Suppoſed to be a green lead ore, which has undergone ſome change, but retaining its original form.

Localities, &c.—This ore has only been found in Saxony, and alſo, it is ſaid, in France and Hungary.

3. Species. Brown Lead Ore.

Id. Kirw. ii. 222. *Id.* Broch. ii. 305.

Exter. Char.—Rarely maſſive, commonly cryſtallized in equal ſix-ſided priſms, or the cryſtals are acicular or capillary; luſtre glimmering; internal ſhining; fracture uneven.

Colour reddiſh or clove-brown; tranſlucent at the edges; ſtreak white; ſoft; brittle. Spec. grav. 6.6 to 6.97.

Chem. Char.—No efferveſcence with acids; fuſes readily before the blow-pipe, but is not reduced; cryſtallizes in ſmall needles on cooling.

Conſtituent Parts.	Klaproth.
Oxide of lead,	78.58
Phoſphoric acid,	19.73
Muriatic acid,	1.65
Loſs,	.04
	100.00

Localities, &c.—Found along with white lead ore, quartz, and heavy ſpar, in France and Germany.

4. Species. Black Lead Ore.

Id. Kirw. ii. 221. *Id.* Broch. ii. 307.

Exter. Char.—Maſſive, diſſeminated, cellular, but moſt frequently cryſtallized in ſix-ſided priſms, with equal or unequal ſides, or bevelled at the extremity. Cryſtals ſmall, irregularly grouped; ſmooth, and ſometimes longitudinally ſtreaked; luſtre ſhining; fracture uneven.

Colour grayiſh black; opaque; ſtreak grayiſh black; ſoft; brittle. Spec. grav. 5.7.

Chem. Char.—Decrepitates before the blow-pipe; and is then reduced to the metallic ſtate.

Conſtituent Parts.	Lampadius.
Oxide of lead,	78.5
Carbonic acid,	18.
Carbone,	1.5
Water,	2.
	100.0

Localities, &c.—Found in Saxony, England, and Scotland, frequently accompanying white lead ore.

5. Species. White Lead Ore, or *Carbonate of Lead.*

Id. Kirw. ii. 203. *Id.* Broch. ii. 309. *Plomb Carbonaté*, Haüy, iii. 475.

Exter. Char.—Rarely maſſive, commonly diſſeminated, ſuperficial, or cryſtallized in ſix-ſided priſms; in four-ſided priſms; in double cryſtals, compoſed of two four-ſided priſms; in oblique four-ſided priſms, and in double ſix-ſided pyramids. Theſe are variouſly modified by truncations and acuminations on the edges and angles. They are alſo of various ſizes, and variouſly grouped together: ſurface uſually ſmooth, reſplendent, ſometimes rough or ſtreaked; luſtre ſhining, adamantine; fragments conchoidal, ſplintery, or fibrous.

Colour white, yellowiſh, or grayiſh white; tranſparent or tranſlucent; refraction double. Specific gravity 6.48 to 7.23.

Chem. Char.—Decrepitates before the blow-pipe, becomes yellowiſh or reddiſh, and melts into a metallic globule; effervesces ſtrongly with acids.

Conſtituent Parts.

	Klaproth.	Macquart.
Oxide of lead,	82	73
Carbonic acid,	16	24
Water,	2	3
	100	100

Some carbonates of lead are alſo combined with a ſmall portion of iron and earthy matters.

Localities, &c.—Found in veins, accompanied by galena and other lead ores, in Germany, France, and Britain.

6. Species. Green Lead Ore, or *Phoſphate of Lead.*

Plomb Phoſphaté, Hauy, iii. 490. *Id.* Broch. ii. 314. *Phoſphorated Lead Ore*, Kirw. ii. 207.

Exter. Char.—Maſſive or diſſeminated, botryoidal or reniform, and often cryſtallized in ſix-ſided priſms, truncated on all the edges, or on the terminal edges, or terminated by a ſix-ſided pyramid; in ſix-ſided priſms with the lateral faces converging towards one of the extremities; and in ſix-ſided pyramids; but this laſt is rare. Surface ſmooth, ſhining; internal luſtre weakly ſhining and reſinous; fracture uneven.

Colour olive green, emerald green, yellow or brown; grayiſh, greeniſh, or yellowiſh white; tranſlucent, or only at the edges; ſtreak greeniſh white; brittle. Spec. grav. 6.909 to 6.941.

Chem. Char.—Melts eaſily before the blow-pipe, into a grayiſh polyhedral globule, but without being reduced; ſoluble in acids, without effervescence, but ſometimes with difficulty.

Conſtituent Parts.	Klaproth.	
Oxide of lead,	77.10	80.
Phoſphoric acid,	19.	18.
Muriatic acid,	1.54	1.62
Oxide of iron,	.10	–
Loſs,	2.26	.38
	100.00	100.00

Localities, &c.—Found in veins along with other lead ores, and generally near the top of the vein, in Germany, France, and Leadhills in Scotland.

7. Species. Red Lead Ore, or *Chromate of Lead.*

Id. Broch. ii. 318. *Red Lead Spar*, Kirw. ii. 214.

Exter. Char.—Rarely maſſive, ſometimes diſſeminated or ſuperficial, but moſt frequently cryſtallized in oblique four-ſided priſms with the extremity bevelled, or the lateral edges truncated; and in ſix-ſided priſms, with two broad and two narrow faces; lateral faces longitudinally ſtreaked; external ſurface ſmooth, ſhining; fracture even.

Colour aurora red, or hyacinth red; tranſlucent or ſemitranſparent; ſtreak orange yellow; ſoft; brittle. Spec. grav. 5.75 to 6.02.

Chem. Char.—No effervescence with acids; decrepitates a little before the blow-pipe, and melts into a black ſlag.

Conſtituent Parts.	Vauquelin.
Oxide of lead,	64
Chromic acid,	36
	100

Localities, &c.—Found in veins at Bereſof in Siberia, accompanied by other ores of lead, ſome ores of iron, and native gold.

A ſimilar ore of lead, but of a brown colour, was brought from Mexico by Humboldt.

8. Species. Yellow Lead Ore, or *Molybdate of Lead.*

Id. Broch. ii. 322. *Yellow Lead Spar*, Kirw. ii. 212. Haüy, iii. 498.

Exter. Char.—Rarely maſſive, uſually cryſtallized in rectangular four-ſided tables; in perfect cubes, with plane or convex faces, or truncated on the terminal edges; in four-ſided tables bevelled on the terminal faces, in obtuſe octahedrons, truncated on the ſummit, the lateral angles, or lateral edges. Cryſtals ſmall; ſurface ſmooth and ſhining; internally ſhining; luſtre waxy; fracture conchoidal.

Colour wax yellow, or honey yellow; tranſlucent, or only at the edges; ſoft; brittle. Spec. grav. 5.48 to 5.7.

Chem. Char.—Before the blow-pipe it decrepitates ſtrongly, and then melts into a blackiſh-gray globule, in which are ſeen particles of lead. Soluble in nitric acid, and in fixed alkalies.

Conſtituent Parts.

	Macquart.	Hatchett.
Oxide of lead,	63.5	58.4
Molybdic acid,	28.	38.
Oxide of iron,	–	2.1
Silica,	4.	.28
Carbonate of lime,	4.5	—
Loſs,	—	1.22
	100.0	100.00

Localities, &c.—This ore of lead was firſt diſcovered at Bleyberg in Carinthia; it has been ſince found in Saxony and France.

9. Species. NATIVE SULPHATE of LEAD.

Id. Kirw. ii. 211. Broch. ii. 325. Hauy, iii. 503.

Exter. Char.—Cryſtallized in irregular octahedrons, which are variouſly truncated and bevelled. Cryſtals ſmooth and ſhining; luſtre ſhining and vitreous; fracture compact.

Colour ſnow white, grayiſh or yellowiſh white; tranſlucent; ſemihard. Spec. grav. 6.3.

Chem. Char.—Reduced even in the flame of a candle; inſoluble in nitric acid.

Conſtituent Parts.	Klaproth.
Oxide of lead,	70.5
Sulphuric acid,	25.75
Water,	2.25
Loſs,	1.5
	100.00

Localities, &c.—Found on brown iron ore in the iſland of Angleſea, and on galena in the veins at Leadhills and Wanlockhead in Scotland.

10. Species. EARTHY LEAD ORE.

Id. Broch. ii. 327. *Id.* Kirwan, ii. 105.

This is divided into two ſubſpecies: 1. friable; and, 2. indurated.

Subſpecies 1. FRIABLE LEAD ORE.

Exter. Char.—This is compoſed of fine earthy particles, which are dull, and have little coherence.

Colour ſulphur or ochre yellow, yellowiſh or ſmoke gray; ſtains; feels meagre.

Subſpecies 2. INDURATED LEAD ORE.

Exter. Char.—Maſſive or diſſeminated; dull; fracture uneven or earthy.

Colour of the former; opaque; ſtreak lighter colour; very ſoft and friable.

Chem. Char.—Eaſily reduced before the blow-pipe, into a black ſlag; effervefces a little with acids.

Conſtituent Parts.—Earthy lead ore is ſuppoſed to be a mixture of oxide of lead, with a little oxide of iron, and ſome earthy matters.

Localities, &c.—Found on the ſurface, or in the cavities of other lead ores, in Saxony, France, Siberia, and at Leadhills and Wanlockhead in Scotland.

11. Species. MURIATE of LEAD.

Exter. Char.—Maſſive, or cryſtallized in cubes, or flat ſix-ſided priſms; external ſurface ſhining; internal luſtre reſplendent, adamantine; fracture foliated.

Colour between aſparagus green and wine yellow; ſemitranſparent; ſoft; not brittle; ſtreak dull, white.

Conſtituent Parts. Klaproth.	
Oxide of lead,	55
Muriatic acid,	45
	100

Localities, &c.—Found in Derbyſhire, and alſo, it is ſaid, in the mountains of Bavaria, but not cryſtallized.

12. Species. MURIO-CARBONATE of LEAD.

Id. Bournon and Chenevix, Nich. Jour. 4to. p. 219.

Exter. Char.—Cryſtallized in cubes, which are variouſly modified; luſtre ſhining, adamantine; fracture foliated; croſs fracture conchoidal.

Colour ſtraw yellow, or clear white; ſemitranſparent; ſtreak dull, ſnow white; eaſily ſcratched by carbonate of lead. Spec. grav. 6.065.

Conſtituent Parts. Chenevix.

Oxide of lead,	51	Muriate of lead,	59
Muriatic acid,	8		
Oxide of lead,	34	Carbonate of lead,	40
Carbonic acid,	6		
Loſs,	1		1
	100		100

Localities, &c.—Found in Derbyſhire.

13. Species. ARSENIATE of LEAD.

Id. Broch. ii. 546.

Exter. Char.—Diſſeminated ſometimes in an earthy ſtate, ſometimes in ſilky filaments, and cryſtallized in ſmall, double, ſix-ſided pyramids. Dull, or weakly glimmering; luſtre ſilky.

Colour citron or greeniſh yellow; very ſoft; friable.

Chem. Char.—Before the blow-pipe it melts eaſily into a globule of lead, and gives out the ſmell of garlic.

Conſt. Parts.—Compoſed of oxide of lead and of arſenic, with ſome oxide of iron and earthy matters.

VIII. TIN GENUS.

1. Species. TIN PYRITES.

Id. Kirw. ii. 200. *Id.* Broch. ii. 332.

Exter. Char.—Found maſſive or diſſeminated; luſtre ſhining

ſhining or weakly ſhining; fracture uneven; fragments rather blunt-edged.

Colour ſteel gray, ſometimes braſs or bronze yellow; ſemihard; brittle. Spec. grav. 4.3 to 4.7.

Chem. Char.—Before the blow-pipe it melts eaſily into a black ſlag, but without being reduced, and gives out a ſulphureous ſmell.

Conſtituent Parts.	Klaproth.
Tin,	34
Copper,	36
Iron,	3
Sulphur,	25
Earthy ſubſtances,	2
	100

Localities, &c.—This is a rare mineral, found only in Cornwall, in a vein along with copper pyrites.

2. Species. Common Tinstone, or *Oxide of Tin.*

Id. Kirw. ii. 197. *Id.* Broch. ii. 334. Hauy, iv. 137.

Exter. Char.—Maſſive, diſſeminated, in rounded pieces or grains, and often cryſtallized in rectangular four-ſided priſms, which are variouſly modified by truncations and bevelments; in octahedrons, which are rare; in eight-ſided priſms, or in double octahedrons, which are ſo united by one of their ſummits as to form a re-entering angle. Cryſtals of various ſizes, always grouped together; ſurface ſmooth; luſtre ſhining or reſplendent; internal luſtre ſhining, between vitreous and reſinous; fracture uneven.

Colour browniſh black, blackiſh brown, yellowiſh gray, or grayiſh white; opaque, or ſemitranſparent; ſtreak light gray; hard; brittle. Specific gravity 6.3 to 6.9.

Chem. Char.—Before the blow-pipe it decrepitates, loſes its colour, and is partially reduced to the metallic ſtate.

Conſtituent Parts.	Klaproth.
Tin,	77.5
Iron,	.25
Oxygen	21.5
Silica,	.75
	100.00

Localities, &c.—Found in Germany, in the Eaſt Indies, and particularly in Cornwall in England. It is not very univerſally diſtributed; but where it exiſts, it is depoſited in granite, gneiſs, micaceous ſchiſtus, and porphyry; and either in maſſes, veins, or diſſeminated in the rocks.

3. Species. Grained Tin Ore, or *Wood Tin.*

Id. Broch. ii. 340. *Id.* Kirw. ii. 298.

Exter. Char.—Found only in ſmall pieces, rounded or angular; ſurface rough; weakly ſhining; internal luſtre glimmering; a little ſilky; fracture fibrous; fragments wedge-ſhaped.

Colour hair brown of various ſhades; ſtreak yellowiſh gray; hard and brittle. Spec. grav. 5.8 to 6.4.

Chem. Char.—Becomes browniſh red before the blow-pipe, then decrepitates ſtrongly, but is infuſible.

Conſt. Parts.—According to Klaproth, it is compoſed of 63 of tin in the 100, with a little iron and arſenic.

Localities, &c.—Found in Cornwall, in alluvial land, where it ſeems to have been depoſited in a ſtalactitical form, accompanied by common tin.

IX. BISMUTH Genus.

1. Species. Native Bismuth.

Id. Kirw. ii. 264. *Id.* Broch. ii. 343. *Id.* Hauy, iv. 184.

Exter Char.—Rarely maſſive, but uſually diſſeminated in a plumoſe or reticulated form, and rarely cryſtallized, in ſmall four-ſided tables or cubes; luſtre ſhining or reſplendent; fracture foliated.

Colour ſilvery white, inclining to red; colours commonly tarniſhed; ſoft; almoſt ductile. Specific gravity 9.02 to 9.82.

Chem. Char.—Fuſible almoſt in the flame of a candle; by increaſing the heat it is volatilized; ſoluble with effervеſcence in nitric acid, and precipitated by water in the form of a white powder.

Localities, &c.—Biſmuth is a rare metal, found in veins in primitive mountains, accompanied by calcareous ſpar, heavy ſpar, and quartz, and commonly with gray cobalt, ſometimes alſo with black blende and native ſilver. Found in Saxony, Bohemia, France, and Sweden.

2. Species. Vitreous Bismuth Ore.

Sulphurated Biſmuth, Kirwan, ii. 266. *Id.* Brochant, ii. 346.

Exter. Char.—Maſſive or diſſeminated, rarely cryſtallized in ſmall imbedded capillary priſms; luſtre ſhining or reſplendent; fracture radiated or foliated.

Colour between lead gray and tin white; ſtains a little; ſoft; eaſily frangible. Specific gravity 6.13 to 6.46.

Chem. Char.—Eaſily fuſible before the blow-pipe, with a ſulphureous ordour.

Conſt. Parts.—Compoſed of biſmuth about 60 per cent. and ſulphur with a little iron.

Localities, &c.—Found in Bohemia, Saxony, and Sweden, and is uſually accompanied by native biſmuth.

3. Species. Ochre of Bismuth.

Id. Kirwan, ii. 265. *Id.* Brochant, ii. 348.

Exter. Char.—Rarely maſſive, commonly diſſeminated on the ſurface of other minerals; internally glimmering; fracture uneven or earthy.

Colour yellowiſh gray, aſh gray, or ſtraw yellow, opaque; ſoft; ſometimes even friable. Spec. grav. 4.37.

Chem. Char.—Very eaſily reduced before the blow-pipe to the metallic ſtate; efferveſces with acids.

Conſtituent Parts. Lampadius.

Oxide of biſmuth,	86.3
——— iron,	5.2
Carbonic acid,	4.1
Water,	3.4
Loſs,	1
	100.0

Localities, &c.—This mineral is very rare, and chiefly found near Schneeberg in Saxony, along with native biſmuth ; and alſo in Bohemia and Suabia.

X. ZINC GENUS.

1. Species. BLENDE.

Id. Brochant, ii. 350. *Id.* Kirwan, ii. 237. *Zinc Sulfuré*, Hauy, iv. 167.

This ſpecies is divided into three ſubſpecies ; yellow, brown, and black.

Subſpecies 1. YELLOW BLENDE.

Exter. Char.—Maſſive or diſſeminated, or ſometimes cryſtallized in cubes or octahedrons, but they are ſo confuſed as to prevent the form being eaſily diſcovered. Surface ſmooth, reſplendent ; internal luſtre reſplendent, between adamantine and vitreous ; fracture foliated ; cleavage ſix-fold ; fragments rather ſharp-edged, or aſſume ſometimes a dodecahedral form, which is the reſult of the complete cleavage.

Colour dark ſulphur yellow, olive green, or browniſh red ; tranſlucent, ſometimes ſemitranſparent ; ſtreak yellowiſh gray ; ſemi-hard ; brittle. Spec. grav. 4.04 to 4.16.

Chem. Char.—Decrepitates before the blow-pipe, and becomes gray, but is infuſible.

Conſtituent Parts. Bergman.

Zinc,	64
Sulphur,	20
Iron,	5
Fluoric acid,	4
Water,	6
Silica,	1
	100

Physical Char.—Moſt of the varieties of yellow blende become phoſphoreſcent by friction in the dark.

Localities, &c.—Found in Saxony, Bohemia, Hungary and Norway, accompanied by lead, copper, and iron ores. It is rather a rare mineral.

Subſpecies 2. BROWN BLENDE.

Exter. Char.—Maſſive, diſſeminated, and ſometimes cryſtallized in ſimple three-ſided pyramids, octahedrons, and four-ſided priſms, which are variouſly modified. External luſtre ſhining or reſplendent ; ſurface ſometimes druſy ; internal luſtre ſhining, between vitreous and reſinous ; fracture foliated ; cleavage ſix-fold.

Colour reddiſh, or yellowiſh brown ; colour ſometimes tarniſhed ; tranſlucent, or opaque ; cryſtals tranſparent ; ſtreak yellowiſh gray ; ſemi-hard ; brittle. Spec. grav. 4.

Conſtituent Parts. Bergman.

Zinc,	44
Sulphur,	17
Iron,	5
Silica,	24
Alumina,	5
Water,	5
	100

Localities, &c.—Very common in veins of lead ore, in moſt parts of the world.

Subſpecies 3. BLACK BLENDE.

Exter. Char.—Maſſive, or diſſeminated, or cryſtallized like the former, which it reſembles in moſt of its characters.

Colour perfect black, browniſh black, or blood red ; often irideſcent.

Conſtituent Parts. Bergman.

Zinc,	45
Sulphur,	29
Iron,	9
Lead,	6
Silica,	4
Water,	6
Arſenic,	1
	100

Localities, &c.—Found in the ſame places with the former.

2. Species. CALAMINE.

This is divided into two ſubſpecies, compact and foliated.

Subſpecies 1. COMPACT CALAMINE.

Id. Kirwan, ii. 234. *Id.* Brochant, ii. 361.

Exter. Char.—Maſſive or diſſeminated, cellular, or ſtalactitical ; dull ; fracture compact or earthy.

Colour grayiſh white, yellowiſh, or reddiſh, or milk white ; opaque ; ſemi-hard or friable ; brittle ; ſtains ſometimes. Spec. grav. 3.52, to 4.1.

Chem. Char.—Decrepitates before the blow-pipe when ſuddenly heated ; is infuſible. Forms a jelly with acids, and ſometimes effervesces.

Conſtituent Parts.

	Bergman.	Tennant.
Oxide of zinc,	84	68.3
Silica,	12	25
Iron,	3	–
Alumina,	1	–
Water,	–	4.4
Loſs,	–	2.3
	100	100.0

	Tennant.	
Oxide of zinc,	64.8	65.2
Carbonic acid,	35.2	34.8
	100.0	100.0

Another variety examined by the ſame chemiſt contained,

Oxide of zinc,	71.4
Carbonic acid,	13.5
Water,	15.1
	100.0

From theſe analyſes it appears, that calamines are very different in their compoſition, conſiſting ſometimes of oxide of zinc, ſilica, and water, and this variety forms a jelly with acids; others are compoſed of carbonic acid and oxide of zinc, which efferveſce in ſulphuric acid, but do not form a jelly; a third variety is compoſed of oxide of zinc, carbonic acid, and water, conſtituting a hydro-carbonate of zinc, which is ſoluble with efferveſcence in ſulphuric acid.

Localities, &c.—Uſually accompanied with iron ochre, and very often with galena, white lead, and other metallic ores. Found in Bohemia, Bavaria, France, and Britain, in ſome places in conſiderable abundance.

Subſpecies 2. Foliated Calamine.

Id. Brochant, ii. 364. Kirwan, ii. 236. Hauy, iv. 161.

Exter. Char.—Found maſſive or diſſeminated, ſtalactitical, incruſted, or cryſtallized, in ſmall four-ſided tables, or in very ſmall cubes with plane or convex faces, ſhining, or glimmering; luſtre between pearly and vitreous; fracture radiated.

Colour yellowiſh, or ſmoke gray; grayiſh, or yellowiſh white; tranſlucent or ſemitranſparent; ſemihard; brittle. Specific gravity 3.52.

Chem. Char.—Becomes white before the blow-pipe, but is infuſible, and does not efferveſce with acids.

Phys. Char.—Becomes electric by heat.

Localities, &c.—This variety accompanies the former, lining its cavities, but is leſs common. It is found in the ſame places.

XI. ANTIMONY Genus.

1. Species. Native Antimony.

Id. Brochant, ii. 369. *Id.* Kirwan, ii. 245. *Id.* Hauy, iv. 252.

Exter. Char.—Found maſſive, diſſeminated, or reniform; reſplendent; fracture foliated.

Colour tin white; but expoſed to the air, grayiſh or yellowiſh; ſoft; eaſily frangible. Spec. grav. 6.7.

Chem. Char.—Before the blow-pipe it is very eaſily fuſible into a metallic globule, which gives out fumes with the odour of garlic.

Conſt. Parts.—Native antimony ſometimes contains a ſmall proportion of arſenic.

Localities, &c.—Has only been found in two places: at Sahlberg in Sweden, where it was diſcovered in 1748, in limeſtone; and at Allemont in France, where it is accompanied by other ores of antimony and cobalt.

2. Species. Gray Ore of Antimony.

Id. Brochant, ii. 371. Kirwan, ii. 246. Hauy, iv. 64.

This is divided into four ſubſpecies; compact, foliated, radiated, and plumoſe.

Subſpecies 1. Compact Gray Ore of Antimony.

Exter. Char.—Maſſive or diſſeminated; ſhining; fracture uneven.

Colour lead gray, or ſteel gray; ſoft; not very brittle; ſtains a little; ſtreak ſhining. Spec. grav. 4.36.

Localities, &c.—This variety is rarer than the others, but is met with in Saxony, Hungary, and France.

Subſpecies 2. Foliated Ore of Antimony.

Exter. Char.—Maſſive or diſſeminated; fracture foliated. In other characters it reſembles the other varieties, and is uſually accompanied by the following.

Subſpecies 3. Radiated Ore of Antimony.

Exter. Char.—Maſſive, diſſeminated, and very often cryſtallized in acicular, often in capillary cryſtals, and in ſix and four-ſided priſms variouſly modified; ſurface ſtreaked longitudinally; internal luſtre reſplendent; fracture radiated, ſtraight, parallel, or divergent.

Colour ſimilar to the preceding; ſoft; not very brittle. Spec. grav. 4.1 to 4.5.

Conſtituent Parts.	Bergman.
Antimony,	74
Sulphur,	26
	100

Localities, &c.—This is the moſt common ore of antimony, and is found in Germany, France, and Sweden. There is only one mine of antimony in Britain, which is in the ſouth of Scotland, near Weſterhall, in the neighbourhood of Langholm.

Subſpecies 4. Plumose Ore of Antimony.

Exter. Char.—Uſually found in capillary cryſtals, ſo interwoven, that they form a ſuperficial covering to other minerals: theſe groups are externally weakly ſhining; internal luſtre glimmering; fracture fibrous.

Colour ſimilar to the former, and ſometimes tarniſhed brown or like tempered ſteel; opaque; ſoft; ſometimes almoſt friable; brittle.

Conſt. Parts.—Plumoſe antimony is compoſed of ſulphuret of antimony combined with arſenic, iron, and accidentally a little ſilver.

Chem. Char.—Before the blow-pipe this and the other varieties of gray antimony give out white fumes, with a ſulphureous ſmell, and are almoſt entirely volatilized, or changed into a black ſlag.

Localities, &c.—Plumoſe antimony is found at Freyberg in Saxony, in the Hartz, and in Hungary.

3. Species. Black Ore of Antimony.

Exter. Char.—Found cryſtallized in rectangular four-ſided tables, truncated on the edges or angles; cryſtals ſmooth; luſtre ſhining; fracture conchoidal.

Colour iron black; ſoft.

Localities, &c.—This ſpecies, which is alſo a ſulphuret of antimony, combined probably with ſome other ingredients, is found in Cornwall.

4. Species. Red Ore of Antimony.

Id. Kirwan, ii. 250. *Id.* Brochant, ii. 379. *Antimoine Hydroſulfuré*, iv. 276.

Exter. Char.—Maſſive or diſſeminated, but moſt commonly in capillary cryſtals; luſtre weakly ſhining, vitreous; fracture fibrous.

Colour cherry red, brown, reddiſh, or bluiſh; ſoft, almoſt friable; brittle. Specific gravity 3.7 to 4.

Chem. Char.—Before the blow-pipe it melts eaſily, and in nitric acid a white powder is depoſited.

Conſtituent Parts.	Klaproth.
Oxide of antimony,	78.3
Sulphur,	19.7
Loſs,	2.
	100.0

Localities, &c.—Found in Saxony and France, uſually accompanying gray or native antimony.

5. Species. White Ore of Antimony.

Muriated Antimony, Kirwan, ii. 151. *Antimoine Oxidé*, Hauy, iv. 273.

Exter. Char.—Rarely maſſive, uſually ſuperficial, in divergent fibres, or cryſtallized in rectangular four-ſided tables, cubes, or four-ſided priſms. Cryſtals aggregated; ſmooth; ſtreaked longitudinally; reſplendent; internal luſtre ſhining, between adamantine and pearly; fracture foliated.

Colour ſnow white, yellowiſh white, or grayiſh; tranſlucent; ſoft; brittle.

Chem. Char.—Cryſtals decrepitate before the blowpipe, but in powder is eaſily fuſible.

Conſt. Parts.—Was formerly ſuppoſed to be a muriate of antimony, but according to Klaproth, it is a pure oxide. The white ore of France, according to Vauquelin, contains,

Oxide of antimony,	86
——— lead,	3
Silica,	8
Loſs,	3
	100

6. Species. Ochre of Antimony.

Id. Brochant, ii. 383. *Id.* Kirwan, ii. 252.

Exter. Char.—Maſſive, diſſeminated, or in ſuperficial cruſts, on gray antimony; dull; fracture earthy.

Colour ſtraw yellow, or yellowiſh gray; ſoft; friable.

Chem. Char.—Infuſible before the blow-pipe; becomes white, and emits white fumes. Its conſtituents are unknown.

Localities, &c.—In Saxony and Hungary, accompanying gray and red antimony, and in the antimony mine near Weſterhall, in the ſouth of Scotland.

XII. COBALT Genus.

1. Species. White Cobalt Ore.

Id. Kirw. ii. 382. *Id.* Broch. ii. 386.

Exter. Char.—Maſſive, diſſeminated, reniform, and rarely cryſtallized in ſmall four-ſided tables, or in ſmall cubes or octahedrons. Luſtre weakly ſhining, or ſhining; fracture uneven.

Colour tin white, but on the ſurface variable, and tarniſhed; ſtreak ſhining; hard; brittle.

Chem. Char.—Eaſily fuſible before the blow-pipe, emitting a denſe vapour, with a ſmell of arſenic, and leaves a white metallic globule; colours borax-blue.

Localities, &c.—Found in Norway, Sweden, and Saxony, in beds of micaceous ſchiſtus, along with red cobalt ore, quartz, and hornblende. Its compoſition is not known, but ſuppoſed to be alloyed with ſome other metals.

2. Species. Gray Cobalt Ore.

Id. Kirw. ii. 271. *Id.* Broch. ii. 388.

Exter. Char.—Maſſive, diſſeminated, reniform, and botryoidal; luſtre ſhining; fracture even.

Colour light ſteel gray, or tin white; ſurface ſteel tarniſhed; ſtreak ſhining; ſemi-hard; brittle.

Chem. Char.—Infuſible before the blow-pipe; emitting fumes and the ſmell of arſenic.

Conſtituent Parts.	Klaproth.
Cobalt,	20
Arſenic,	33
Iron,	24
Loſs,	23
	100

It contains alſo ſometimes nickel and ſilver.

Localities, &c.—Found in Saxony, France, Norway, and Cornwall in England, with other ores of cobalt.

3. Species. Shining Cobalt Ore.

Id. Broch. ii. 390. Kirw. ii. 273.

Exter. Char.—Maſſive, diſſeminated, ſuperficial, in various imitative forms, and cryſtallized in cubes and octahedrons, which are variouſly modified; cryſtals ſmall, ſmooth, and reſplendent, rarely druſy; luſtre ſhining; fracture uneven, radiated, or fibrous.

Colour tin white, commonly grayiſh, or yellowiſh tarniſhed; hard; brittle. Spec. grav. 6.3 to 6.4.

Chem. Char.—Before the blow-pipe it burns with a ſmall white flame, and a white vapour, ſmelling ſtrongly of garlic; then blackens, and is almoſt infuſible; ſoluble in nitric acid.

Conſtituent Parts of cryſtallized ſhining cobalt from Tunaberg in Sweden.

	Klaproth.	Taſſaert.
Cobalt,	44.	36.66
Arſenic,	55.5	49.
Sulphur,	5	6.5
Iron,		5.66
Loſs,		2.18
	100.9	100.00

Localities, &c.—This is the moſt common ore of cobalt; and it is uſually accompanied by the other ores, and ſometimes alſo by vitreous, red, and native ſilver. It is found in Bohemia, Saxony, Sweden, and Cornwall in England, and uſually in beds in primitive mountains.

Uſes.—This ore of cobalt is commonly wrought for the purpoſe of employing it in the preparation of the fine blue colour known by the name of *ſmalt*, which is uſed in the manufacture of porcelain, glaſs, and as a pigment.

4. Species. BLACK COBALT OCHRE.

Id. Broch. ii. 396. Kirw. ii. 275. Hauy, iv. 214.

This is divided into two ſubſpecies, friable and indurated.

Subſpecies 1. FRIABLE COBALT OCHRE.

Exter. Char.—Compoſed of particles which are more or leſs cohering; ſtains a little.

Colour browniſh, bluiſh, or grayiſh black; ſtreak ſhining; feels meagre. In other characters it agrees with the following.

Subſpecies 2. INDURATED COBALT OCHRE.

Exter. Char.—Maſſive, diſſeminated, in imitative forms, or marked with impreſſions; dull, or weakly glimmering; fracture earthy.

Colour bluiſh black; ſtreak ſhining, reſinous; ſoft; ſemihard; rather brittle. Spec. grav. 2.01 to 2.42.

Chem. Char.—Before the blow-pipe it gives out an arſenical odour, but is infuſible.

Its conſtituent parts are ſuppoſed to be oxide of cobalt, with ſome iron and arſenic.

Localities, &c.—Both varieties are found together, and accompanied by ores of ſilver, copper, iron, in Saxony, Suabia, and the Tyrol, as well as in France and Spain.

5. Species. BROWN COBALT OCHRE.

Id. Broch. ii. 400.

Exter. Char.—Maſſive, or diſſeminated; always dull; fracture earthy; ſtreak ſhining, reſinous.

Colour light or dark liver brown; ſoft, almoſt friable; very eaſily frangible.

Conſtituent Parts.—Suppoſed to be compoſed of oxide of cobalt and iron.

Localities, &c.—Found at Saalfeld in Thuringia, in ſtratiform mountains, and in Wirtemberg, in primitive mountains, accompanied by other varieties of cobalt ochre.

6. Species. YELLOW COBALT OCHRE.

Id. Kirw. ii. 277. Broch. ii. 401.

Exter. Char.—Maſſive, or diſſeminated, or adhering to the ſurfaces of other minerals; dull; fracture earthy; ſtreak ſhining, reſinous.

Colour dirty ſtraw yellow, or yellowiſh gray; very ſoft or friable.

Chem. Char.—Before the blow-pipe it gives out an odour of arſenic, and is infuſible.

Its conſtituents are ſuppoſed to be oxide of cobalt, and a little arſenic.

Localities, &c.—Found in the ſame places with the former, but is rare.

7. Species. RED COBALT OCHRE, or *Arſeniate of Cobalt.*

Id. Kirw. ii. 278. Broch. ii. *Cobalt Arſeniaté*, Hauy, iv. 216.

This is divided into two ſubſpecies; earthy and radiated.

Subſpecies 1. EARTHY RED COBALT OCHRE.

Exter. Char.—In thin ſuperficial layers, or cruſts; dull, or weakly glimmering; fracture earthy.

Colour peach-bloſſom red, roſe red, or reddiſh white; ſtreak a little ſhining; very ſoft, friable.

Localities, &c.—Found in Bohemia, Saxony, France, and Norway.

Subſpecies 2. RADIATED RED COBALT OCHRE, or *Cobalt Bloom*, or *Flowers of Cobalt.*

Exter. Char.—Maſſive, or diſſeminated, rarely botryoidal or reniform; often ſuperficial, and in ſmall druſy cryſtals, whoſe forms are rectangular four-ſided tables, four-ſided priſms, double ſix-ſided pyramids, with different modifications. Cryſtals ſmall and variouſly aggregated; ſmooth and ſhining, ſometimes reſplendent; fracture radiated; fragments wedge-ſhaped, or ſplintery.

Colour peach bloſſom red, crimſon red, or, expoſed to the air, browniſh, grayiſh, or whitiſh; tranſlucent; cryſtals ſemitranſparent; ſoft; brittle.

Chem. Char.—Before the blow-pipe becomes blackiſh gray, giving out a feeble odour of arſenic, without any fumes, but is infuſible. Colours borax a fine blue.

This ſpecies has not been particularly analyzed, but is conſidered as a compound of cobalt and arſenic acid.

Localities, &c.—The ſame as the former, and alſo in Cornwall in England, and along with copper ores at Alva in Scotland.

8. Species. SULPHATE OF COBALT.

A ſaline ſubſtance in a ſtalactitical form, of a pale roſe red colour and tranſlucent, is found at Herrengrund near Newſohl in Hungary, which was at firſt ſuppoſed to be a ſulphate of mangane ſe, and afterwards a ſulphate of cobalt.

This ſubſtance has been examined by Klaproth, who diſſolved it in water, added an alkali, and obtained a bluiſh precipitate, which coloured borax of a beautiful ſapphire blue; and with muriatic acid he obtained from it a ſympathetic ink.

XIII. NICKEL GENUS.

1. Species. COPPER-COLOURED NICKEL.

Id. Brochant, ii. 408. *Sulphurated Nickel*, Kirw. ii. 286. *Nickel Arſenical*, Hauy, iii. 518. *Kupfernickel* of the Germans.

Exter. Char.—Maſſive or diſſeminated, rarely reticulated;

lated; ſhining, or weakly ſhining; fracture uneven, ſometimes conchoidal; fragments rather ſharp-edged.

Colour pale copper red, whitiſh, or grayiſh; ſemihard; brittle. Spec. grav. 6.64 to 7.56.

Chem. Char.—Before the blow-pipe it gives out the fumes and odour of arſenic; melts with difficulty into a ſlag, mixed with metallic particles. Solution in acids, green.

Conſtituent Parts.	Sage.
Nickel,	75
Arſenic,	22
Sulphur,	2
Loſs,	1
	100

Localities, &c.—Found in veins, in primitive and ſtratiform mountains, almoſt always accompanied with ores of cobalt, and often with rich ſilver ores. It is found in Bohemia, Saxony, France, Spain, and Cornwall in England.

2. Species. Nickel Ochre, or *Oxide of Nickel.*

Id. Kirw. ii. 283. Broch. ii. 411. Hauy, iii. 516.

Exter. Char.—Uſually diſſeminated and efflorefcent on other minerals; compoſed of friable, looſe, and ſlightly agglutinated particles.

Colour apple-green of different ſhades; ſtains; feels meagre.

Chem. Char.—Remains unchanged before the blow-pipe; colours borax yellowiſh red, and is inſoluble in nitric acid.

Conſtituent Parts.	Lampadius.
Oxide of nickel,	67.
——— iron,	23.2
Water,	1.5
Loſs,	8.3
	100.0

Localities, &c.—Found in ſimilar ſituations with the preceding ſpecies.

XIV. MANGANESE Genus.

1. Species. Gray Ore of Manganese, or *Oxide of Manganeſe.*

Id. Brochant, ii. 414. *Id.* Kirwan, ii. 291. *Id.* Hauy, iv. 243.

This ſpecies is divided into four ſubſpecies: 1. radiated; 2. foliated; 3. compact; and, 4. earthy.

Subſpecies 1. Radiated Gray Ore of Manganese.

Eſſen. Char.—Colours borax violet.

Exter. Char.—Maſſive or diſſeminated, or cryſtallized in oblique four-ſided priſms, or in acicular priſms faſcicularly grouped together; the cryſtals are variouſly modified. Faces ſtreaked longitudinally; ſhining or reſplendent; fracture radiated; fragments wedge-ſhaped.

Colour ſteel gray, or iron black; ſtreak black, without luſtre; ſtains; ſoft; brittle. Specific gravity 3.7 to 4.7.

Conſtituent Parts. Cordier and Beaunier *.

	From France,	Germany.	Piedmont.
Oxide of manganeſe,	83.5	82.	86.
Brown oxide of iron,	2.	–	3.
Carbone,	–	–	1.5
Carbonate of lime,	–	7.5	–
Barytes,	1.5	3.	–
Silica,	7.5	7.	5.
Loſs,	5.5	.5	4.5
	100.0	100.0	100.0

Of purer ſpecimens by Klaproth.

Oxide of manganeſe,	99.25	92.75
Water,	.25	7.
Loſs,	.5	.25
	100.0	100.00

Subſpecies 2. Foliated Gray Ore of Manganese.

Exter. Char.—Found maſſive, diſſeminated, or cryſtallized in ſmall, rectangular, four-ſided tables, faſcicularly grouped; luſtre ſhining; fracture foliated.

Colour ſimilar to the former; ſtreak black and dull; ſtains; ſoft, and brittle. Spec. grav. 3.74.

Subſpecies 3. Compact Gray Ore of Manganese.

Exter. Char.—Maſſive or diſſeminated, in angular, or botryoidal, or dendritical forms; luſtre glimmering; fracture uneven, ſometimes even or conchoidal.

Colour ſteel gray, or bluiſh black; ſtains; ſemihard, or ſoft; brittle.

Conſt. Parts—approach pretty nearly to thoſe of the radiated variety.

Subſpecies 4. Earthy Gray Ore of Manganese.

Exter. Char.—Found maſſive, diſſeminated, ſometimes ſuperficial and dendritical; dull; ſometimes a little glimmering; fracture earthy.

Colour between ſteel gray and bluiſh black; ſtains very much; very ſoft, often even friable; feels meagre.

Conſtituent Parts—ſuppoſed to be the ſame as the former, but with a larger proportion of oxide of iron.

Chem. Char.—Gray ore of manganeſe is infuſible before the blow-pipe, but becomes of a blackiſh brown colour; gives a blue colour to borax.

Localities, &c.—All the varieties of this ſpecies are uſually found together, and chiefly in primitive mountains. The earthy ore of manganeſe almoſt always accompanies ſparry iron ore, and other ores of iron. Manganeſe is found in conſiderable abundance in Saxony, Bohemia, France, near Exeter in England, and in Aberdeenſhire in Scotland.

2. Species. Black Ore of Manganese.

Exter. Char—Found maſſive, diſſeminated, or cryſtallized in ſmall four-ſided double pyramids, arranged in

---

* *Jour. des Mines*, No. lviii. p. 778.

in rows; ſurface ſhining; internal luſtre weakly glimmering; fracture imperfectly foliated.

Colour grayiſh black, and browniſh black; ſtreak dull, browniſh red; ſoft; brittle.

Localities, &c.—This ſpecies is of rare occurrence. It has been found in Thuringia, forming a cruſt on gray ore of manganeſe, and alſo, it is ſaid, in Piedmont.

3. Species. Red Ore of Manganese, or *Carbonate of Manganeſe.*

Exter. Char.—Maſſive, diſſeminated, botryoidal, &c. or cryſtallized in flat rhomboids, or in very ſmall pyramids or lenſes. Surface of the cryſtals ſmooth; dull, or weakly glimmering; fracture uneven or ſplintery.

Colour roſe red, or browniſh white; tranſlucent at the edges; ſemihard; brittle. Spec. grav. 3.23.

Chem. Char.—Infuſible before the blow-pipe; becomes grayiſh black, and colours borax violet blue, or crimſon red.

Conſtituent Parts.	Lampadius.
Oxide of manganeſe,	48
——— iron,	2.1
Carbonic acid,	49
Silica,	.9
	100.0

Localities, &c.—This ſpecies of manganeſe, which is rare, is found in Tranſylvania at Offenbanya, and particularly at Nagyag, where it conſtitutes part of the maſſes of an auriferous vein, from which the gold ore of Nagyag is obtained.

XV. MOLYBDENA Genus.

1. Species. Sulphuret of Molybdena.

Id. Brochant, ii. 432. *Id.* Kirwan, ii. 322. *Id.* Hauy, iv. 289.

Exter. Char.—Maſſive or diſſeminated, ſometimes in plates, and rarely cryſtallized in equal ſix-ſided tables; cryſtals ſmall, imbedded, the lateral faces ſhining; internal luſtre ſhining; fracture foliated; fragments rather blunt-edged, ſometimes in plates.

Colour lead gray; opaque; ſtains, and writes; very ſoft, and eaſily frangible; flexible in thin plates, but not elaſtic; feels greaſy. Spec. grav. 4.56 to 4.73.

Chem. Char.—Infuſible before the blow-pipe; gives out a ſulphureous ſmell; nitric acid converts it to a white oxide, which is the molybdic acid.

Conſtituent Parts.

	Pelletier.	Klaproth.
Molybdic acid,	45	60
Sulphur,	55	40
	100	100

Localities, &c.—Always found in primitive mountains, in neſts or nodules, and very commonly in the neighbourhood of tin ores. It is alſo accompanied by wolfram, quartz, native arſenic, and fluor ſpar. It is found in Bohemia, Saxony, Sweden, France, and England.

XVI. ARSENIC Genus.

1. Species. Native Arsenic.

Id. Broch. ii. 435. *Id.* Kirw. ii. 255. *Id.* Hauy, iv. 220.

Exter. Char.—Maſſive, diſſeminated, in imitative forms, or with impreſſions; ſurface rough or granulated; dull, or weakly glimmering; internal luſtre weakly ſhining; fracture uneven, ſometimes imperfectly foliated; fragments rather blunt-edged in plates.

Colour light lead gray, tin-white or grayiſh black when tarniſhed; ſtreak ſhining; ſemihard; very eaſily frangible. Spec. grav. 5.72 to 5.76.

Chem. Char.—Melts readily before the blow-pipe, giving out white vapour, with the ſmell of garlic; then burns with a bluiſh flame, and is diſſipated, leaving only a whitiſh powder, which is the oxide of arſenic.

Conſtituent Parts.—Native arſenic is uſually alloyed with a ſmall portion of iron, and ſometimes alſo with a little gold or ſilver.

Localities, &c.—Found in veins in primitive mountains, accompanied by ores of ſilver, lead, copper, quartz, and earthy ſpars, in Bohemia, Saxony, and France.

2. Species. Arsenical Pyrites.

Id. Broch. ii. 438. *Id.* Kirw. ii. 256. *Fer Arſenical*, Hauy, iv. 56.

This is divided into two ſubſpecies, common and argentiferous.

Subſpecies 1. Common Arsenical Pyrites.

Exter. Char.—Maſſive, diſſeminated, often cryſtallized in oblique four-ſided priſms, acute octahedrons, and lenſes; the priſms being variouſly modified on their angles, faces, and extremities. Cryſtals ſmall; lateral faces ſmooth, ſhining; bevelled faces ſtreaked tranſverſely; luſtre ſhining; fracture uneven.

Colour ſilvery white, but uſually tarniſhed yellow, or bluiſh, and irideſcent; hard; brittle. Specific gravity 5.75 to 6.52.

Phys. Char.—By friction gives out the odour of garlic.

Chem. Char.—Before the blow-pipe gives out a white vapour with the odour of arſenic, the fumes depoſiting a white powder on cold bodies; a reddiſh brown matter, which is infuſible, remains.

Conſtituent Parts.—Compoſed of arſenic, iron, and ſulphur.

Subſpecies 2. Argentiferous Arsenical Pyrites.

Exter. Char.—Rarely maſſive, often diſſeminated, and cryſtallized in ſmall, acicular, four-ſided priſms; luſtre ſhining, or weakly ſhining; fracture uneven.

Colour tin-white, or ſilvery-white, uſually tarniſhed.

Localities, &c.—Arſenical pyrites is found in Bohemia, Saxony, and Sileſia, in veins of primitive mountains, or diſſeminated in the rocks.

The ſecond variety is found in ſimilar places, and differs only from the firſt, in being combined with a ſmall quantity of ſilver, which varies from 1 to 10 per cent.

3. Species. Orpiment.

Id. Kirw. ii. 260. *Id.* Broch. ii. 444. Hauy, iv. 234.

This ſpecies is divided into two ſubſpecies, yellow and red.

Subſpecies 1. Yellow Orpiment.

Exter. Char.—Maſſive, diſſeminated, ſuperficial, and cryſtallized in oblique four ſided priſms, bevelled at the extremity, or terminated by a four-ſided pyramid, or in acute octahedrons. Cryſtals ſmall, and confuſedly aggregated; ſurface ſmooth; that of the bevelment and pyramids finely ſtreaked; internal luſtre reſplendent, between reſinous and adamantine; fracture foliated; fragments in plates.

Colour citron-yellow, golden-yellow, or aurora-red; tranſlucent; in thin plates, ſemitranſparent; ſoft; flexible in thin plates. Spec. grav. 3.31 to 3.45.

Chem. Char.—Gives out a blue flame before the blowpipe, with white vapour, and the ſmell of arſenic and ſulphur.

Conſtituent Parts.

	Kirwan.	Weſtrumb.
Arſenic,	84	80
Sulphur,	16	20
	100	100

Localities, &c.—Uſually found in ſtratiform mountains, accompanied by clay, quartz, and ſometimes by red orpiment, in Tranſylvania, Hungary, and other places.

Subſpecies 2. Red Orpiment.

Exter. Char.—Rarely maſſive, uſually diſſeminated, or ſuperficial, and often cryſtallized in oblique four-ſided priſms, with obtuſe lateral edges, truncated, or bevelled: cryſtals ſmall, ſtreaked longitudinally; ſhining or reſplendent; internal luſtre ſhining between vitreous and reſinous; fracture uneven, or conchoidal.

Colour light aurora-red, ſcarlet-red, orange yellow; tranſlucent, or ſemitranſparent, often opaque; ſtreak orange, or citron-yellow; very ſoft: ſomewhat brittle. Spec. grav. 3.2.

Chem. Char.—Similar to the former.

Conſtituent Parts.—According to ſome, the ſame as the preceding, but with the addition of iron and ſilica, with a ſmaller proportion of ſulphur.

Localities, &c.—Chiefly found in primitive mountains, as in Saxony, Hungary, France, and in the neighbourhood of Ætna and Veſuvius.

4. Species. Native Oxide of Arsenic.

Id. Kirw. ii. 258. *Id.* Broch. ii. 450. *Id.* Hauy, iv. 225.

Exter. Char.—Found ſuperficial, in an earthy form, and friable, on other minerals; rarely indurated, ſometimes botryoidal, or cryſtallized in capillary cryſtals, very ſmall octahedrons, or four-ſided tables; luſtre glimmering or dull; fracture earthy or fibrous.

Colour ſnow-white, yellowiſh white, reddiſh or greeniſh white; opaque; cryſtals tranſlucent; ſoft, or friable. Spec. grav. 3.706.

Chem. Char.—Before the blow-pipe it gives out a white fume, and a garlic odour; burns with a bluiſh flame, and is entirely diſſipated; ſoluble in water and acids.

Conſtituent Parts.—This is a pure oxid of arſenic, with an accidental mixture of earth.

Localities, &c.—A rare mineral, but is found in ſmall quantity, along with native arſenic, and ores of cobalt, in Bohemia and Hungary.

5. Species. Pharmacolite, or *Arſeniate of Lime.*

Id. Broch. ii. 528. *Chaux Arſeniaté*, Hauy, ii. 293.

Exter. Char.—Found in ſmall capillary cryſtals; luſtre glimmering, ſilky; fracture fibrous or radiated.

Colour ſnow-white; tranſlucent; very ſoft. Specific gravity 2.53 to 2.64.

Chem. Char.—Soluble in nitric acid with effervеſcence, and gives out the odour of arſenic before the blow-pipe.

Conſtituent Parts. Klaproth.

Arſenic acid,	50.54
Lime,	25.
Water,	24.46
	100.00*

Localities, &c.—Found in a vein in primitive rocks, accompanied by heavy ſpar and gypſum, near Wittichen in Suabia. It has alſo been found in France.

XVII. TUNGSTEN Genus.

1. Species. Wolfram.

Id. Kirw. ii. 316. *Id.* Broch. ii. 456. *Scheelin Ferruginé*, Hauy, iv. 314.

Exter. Char.—Found maſſive, diſſeminated, or cryſtallized in ſix-ſided priſms, and in rectangular four-ſided tables, which are variouſly modified. Cryſtals not very ſmall, uſually grouped; internal luſtre ſhining or reſplendent; longitudinal fracture foliated; croſs fracture uneven.

Colour browniſh black, or perfect black, ſometimes tarniſhed; opaque; ſtreak dark reddiſh-brown; ſoft; brittle. Spec. grav. 7.11 to 7.33.

Chem. Char.—Before the blow-pipe it decrepitates, but is infuſible.

Conſtituent Parts.

	Delhuyart.	Wiegleb.	Klaproth.	Vauquelin.
Tungſtic acid,	65	35.75	46.9	67.
Oxide of mangancſe,	22	32.	–	6.25
Oxide of iron,	13	11.	31.2	18.
Silica,	–	–	–	1.5
Loſs,	–	21.25	21.9	7.25
	100	100.00	100.0	100.00

Localities, &c.—Wolfram, which is a rare mineral, is found in primitive mountains, accompanied by quartz, and

---

* *Analyt. Eſſ.* ii. 23.

and tin ores, in Bohemia, France, and Cornwall in England.

2. Species. TUNGSTATE OF LIME.

Tungſten, Kirw. ii. 314. *Id.* Broch. ii. 453. *Scheelin Calcaire*, Hauy, iv. 320.

Exter. Char.—Maſſive, diſſeminated, ſometimes cryſtallized in regular octahedrons, which are ſometimes ſlightly bevelled on the edges of the common baſe. Cryſtals uſually ſmall; ſurface ſmooth, reſplendent; bevelled ſurface ſtreaked tranſverſely; internal luſtre ſhining or reſplendent, reſinous or adamantine; fracture foliated.

Colour grayiſh or yellowiſh white; tranſlucent; ſemi-hard; brittle. Spec. grav. 6.06.

Chem. Char.—Before the blow-pipe decrepitates, and loſes its tranſparency, but is infuſible. Reduced to powder, and digeſted with nitric or muriatic acid, it leaves a citron yellow reſiduum, which is tungſtic acid.

Conſtituent Parts. Klaproth.

Oxide of tungſten,	77.75	75.25
——— iron,	–	1.25
——— mangaueſe,	–	.75
Lime,	17.6	18.7
Silica,	3.	1.5
Loſs,	1.65	2.55
	100.00	100.00

Localities, &c.—This is a rare mineral, uſually found in primitive mountains, accompanied by ores of tin, ſome iron ores, quartz, fluor ſpar, &c. in Sweden, Saxony, and Cornwall in England.

XVIII. TITANIUM GENUS.

1. Species. MENACHANITE.

Id. Brochant, ii. 468. *Id.* Kirwan, ii. 326. Hauy, iv. 305.

Exter. Char.—Found in ſmall, detached, rounded grains; ſurface rough, or weakly glimmering; luſtre ſhining, ſemi-metallic; fracture imperfectly foliated.

Colour grayiſh or iron black; ſoft or ſemi-hard; brittle. Spec. grav. 4.4.

Chem. Char.—Infuſible before the blow-pipe; colours borax greeniſh brown.

Conſtituent Parts.

	Chenevix.	Klaproth.
Oxide of titanium,	45.25	40
——— iron,	51.	49
Silica,	3.5	11
Oxide of manganeſe,	2.5	–
	100.00	100

Localities, &c.—This mineral was firſt diſcovered by Mr Gregor, among ſand, in the bed of a rivulet, in the valley of Menachan in Cornwall; hence its name. It has ſince been found in the iſland of Providence, one of the Bahamas, and at Botany Bay in New Holland.

2. Species. OCTAHEDRITE.

Anataſe, Hauy, iii. 129. *Id.* Brochant, ii. 548. *Octahedrite*, Sauſſure, Voyages, § 1901.

Exter. Char.—Found only cryſtallized, in elongated octahedrons with ſquare baſes, and truncated, or acuminated; cryſtals ſmall and imbedded; lateral faces ſtreaked tranſverſely; luſtre reſplendent, vitreous; fracture foliated.

Colour ſteel gray, ſometimes light indigo blue; tranſlucent; ſemi-hard; brittle. Spec. grav. 3.85.

Chem. Char.—Infuſible before the blow-pipe, but melts with borax, which it colours green, and in cooling, cryſtallizes in needles.

Conſt. Parts.—It is chiefly compoſed of oxide of titanium.

Localities, &c.—Has been found lining the cavities of a vein, accompanied by quartz and feldſpar, in a primitive rock, in Dauphiné in France.

3. Species. TITANITE.

Id. Kirwan, ii. 329. *Le Ruthile*, Brochant, ii. 470. *Titane Oxidé*, Hauy, iv. 296. *Red Schorl* of many.

Exter. Char.—Found cryſtallized in oblique four-ſided priſms, the lateral edges truncated; ſometimes theſe cryſtals are double, being united obliquely; alſo in acicular and capillary cryſtals, imbedded and grouped together; ſurface longitudinally ſtreaked, ſhining; internal luſtre ſhining, adamantine; fracture foliated.

Colour blood-red or reddiſh brown; opaque, or tranſlucent; hard; brittle. Spec. grav. 4.1 to 4.24.

Chem. Char.—Infuſible before the blow-pipe, but loſes its tranſparency, and becomes gray.

Conſt. Parts.—Compoſed chiefly of oxide of titanium.

Localities, &c.—Found in Hungary, in gneiſs, and imbedded in quartz. It has been found alſo in Switzerland, Spain, and France.

4. Species. NIGRINE.

Kirwan, ii. 331. Brochant, ii. 474. Hauy, iv. 307.

Exter. Char.—Diſſeminated, ſometimes amorphous, often cryſtallized in oblique four-ſided priſms, variouſly modified by truncations and bevelments. Surface ſmooth; luſtre ſhining, or reſplendent, between reſinous and vitreous; fracture foliated.

Colour dark browniſh black, yellowiſh white or violet brown; opaque, or tranſlucent; ſemi-hard. Spec. grav. 3.51 to 4.6.

Chem. Char.—Infuſible before the blow-pipe.

Conſtituent Parts.

	Klaproth.	Abilgaard.	
Oxide of titanium,	33	58	74
Silica,	35	22	8
Lime,	32	20	18
	100	100	100

Localities, &c.—Found in Bavaria, and at Arendal in Norway.

5. Species.

5. Species. Brown Ore of Titanium.

This ſpecies in its characters ſo nearly reſembles the preceding, that it may be conſidered merely as a variety, as has been done by Brochant and Hauy.

6. Species. Iserine.

Id. Brochant, ii. 478.

Exter. Char.—Found in rounded or angular grains, having a rough and glimmering ſurface; internally ſhining; fracture conchoidal.

Colour iron black, or browniſh; hard; brittle. Spec. grav. 4.5.

Chem. Char.—Melts before the blow-pipe into a dark brown ſlag.

Conſtituent Parts.	Klaproth.
Oxide of titanium,	59.1
——— iron,	30.1
——— uranium,	10.2
Loſs,	.6
	100.0

Localities, &c.—Found in the ſand of a river in Bohemia, called *Iſer*, whence the name is derived.

XIX. URANIUM Genus.

1. Species. Pitchy Ore of Uranium.

Id. Brochant, ii. 460. Kirw. ii. 305. Hauy, iv. 280.

Exter. Char.—Maſſive, diſſeminated, ſometimes cellular; ſhining or glimmering; fracture imperfectly conchoidal; fragments rather ſharp-edged.

Colour velvet black, iron black, or bluiſh, ſometimes ſteel-tarniſhed; ſtreak black; opaque; ſemi-hard; brittle. Spec. grav. 6.5 to 7.5.

Chem. Char.—Infuſible before the blow-pipe; ſoluble in nitric acid.

Conſtituent Parts.	Klaproth.
Uranium a little oxidated,	86.5
Sulphuret of lead,	6.
Oxide of iron,	2.5
Silica,	5.
	100.0

Localities, &c.—Found in Bohemia and Saxony, accompanying galena, copper pyrites, iron ochre, and ſome ores of ſilver and cobalt.

2. Species. Micaceous Uranite.

Id. Brochant, ii. 463. Kirwan, ii. 304.

Exter. Char.—Sometimes in thin layers, but often cryſtallized in rectangular four-ſided tables; in cubes, and ſix-ſided priſms variouſly modified. Cryſtals ſmall, and grouped together; luſtre ſhining, pearly; fracture foliated.

Colour emerald or graſs green of various ſhades, rarely wax yellow; tranſlucent; ſtreak greeniſh white; ſoft; not very brittle. Spec. grav. 3.12.

Chem. Char.—Soluble, without effervescence, in nitric acid, which it colours citron yellow.

Conſt. Parts.—This ſpecies is an oxide of uranium, with a ſmall portion of copper.

Localities, &c.—Found in Saxony, France, and Cornwall in England, accompanied by ſome ores of iron, ſometimes by cobalt.

3. Species. Uranite Ochre.

Id. Broch. ii. 466. *Id.* Kirw. ii. 303.

Exter. Char.—Found maſſive, but uſually diſſeminated, or ſuperficial; is dull, or rarely ſhining; fracture earthy, or foliated; fragments blunt-edged.

Colour citron yellow, aurora red, or ſulphur yellow; opaque; ſoft and friable; brittle; ſtains a little; feels meagre. Spec. grav. 3.15 to 3.24.

Conſtituent Parts.—Compoſed of oxide of uranium, with a portion of iron.

Localities, &c.—Found in ſimilar places with the former.

XX. TELLURIUM Genus.

1. Species. Native Tellurium.

Id. Broch. ii. 480. *Sylvanite*, Kirw. ii. 324. Hauy, iv. 325.

Exter. Char.—Maſſive or diſſeminated; ſhining; fracture foliated.

Colour between tin and ſilvery white; ſoft; not very brittle. Spec. grav. 5.7 to 6.1.

Chem. Char.—Melts eaſily before the blow-pipe.

Conſtituent Parts.	Klaproth.
Tellurium,	92.6
Iron,	7.2
Gold,	.2
	100.0

Localities, &c.—Has been only found at Fatzebay in Tranſylvania, where it exiſts in veins, in mountains of gray wacken and tranſition limeſtone. The ore is dug out for the purpoſe of extracting the gold.

It was called *aurum paradoxum*, and *aurum problematicum*, becauſe its external appearance did not indicate that it contained gold.

2. Species. Graphic Ore of Tellurium.

Id. Broch. ii. 482. Hauy, iv. 327.

Exter. Char.—Maſſive, and cryſtallized in flat four or ſix-ſided priſms, which are arranged in rows, exhibiting ſomething of the appearance of written characters, and hence the name graphic ore. Surface ſmooth, ſhining; longitudinal fracture foliated and reſplendent; croſs fracture uneven.

Colour tin white, yellowiſh, or lead gray; ſoft and brittle. Spec. grav. 5.72.

Chem. Char.—Burns with a greeniſh flame before the blow-pipe.

Metallic Ores.

Conſtituent Parts.	Klaproth.
Tellurium,	60
Gold,	30
Silver,	10
	100

Localities, &c.—Has only been found at Offenbanya in Tranſylvania, in veins traverſing porphyry and granular limeſtone accompanied by iron pyrites and copper ore. It is wrought for the ſake of the gold.

3. Species. Yellow Ore of Tellurium.

Id. Broch. ii. 484. Hauy, iv. 327.

Exter. Char.—Diſſeminated, and cryſtallized in ſmall four-ſided priſms; ſhining, or weakly ſhining; fracture foliated; croſs fracture uneven.

Colour ſilver white, braſs yellow, or gray.

Chem. Char.—Soluble in nitric acid.

Conſtituent Parts.	Klaproth.
Tellurium,	44.75
Gold,	26.75
Lead,	19.5
Silver,	8.5
Sulphur,	.5
	100.00

Localities, &c.—Found only at Nagyag in Tranſylvania.

4. Species. Black or Foliated Ore of Tellurium.

Id. Broch. ii. 486. Hauy, iv. 327.

Exter. Char.—Found in plates, which are united into maſſes, or diſſeminated, rarely cryſtallized in ſix-ſided tables; ſurface ſmooth, ſhining; external luſtre reſplendent; fracture foliated.

Colour between lead gray and iron black; ſtains; ſoft; flexible in thin plates. Spec. grav. 8.91.

Chem. Char.—Before the blow-pipe the ſulphur and tellurium are diſſipated in white fumes, and a metallic globule remains, ſurrounded by a black ſlag.

Conſtituent Parts.	Klaproth.
Tellurium,	33.
Lead,	50.
Gold,	8.5
Silver and copper,	1.
Sulphur,	7.5
	100.0

Localities, &c.—Found only in the ſame place with the preceding.

XXI. CHROMIUM Genus.

1. Species. Needle Ore of Chromium.

Exter. Char.—Found in ſmall cryſtals, which are imbedded; luſtre ſhining; fracture uneven or conchoidal.

Claſſification.

Colour ſteel gray, and uſually covered with a greeniſh effloreſcence; ſoft, or ſemihard; not very brittle.

Conſtituent Parts.—This is ſuppoſed to be an alloy of chromium.

Exter. Char. &c.—Found in the gold mine of Rudnick near Schlangenberg in Suabia, in a matrix of white quartz, containing gold and galena.

2. Species. Ochre of Chromium.

Exter. Char.—Maſſive, diſſeminated, and in thin plates; dull; fracture uneven or earthy.

Colour verdigris green, or yellowiſh; ſoft.

Localities, &c.—Found only in the ſame place, accompanying the former.

The chromates of lead and iron have been already deſcribed among the ores of thoſe metals.

XXII. COLUMBIUM Genus.

Exter. Char.—Maſſive; fracture uneven, or foliated; luſtre ſhining.

Colour dark gray; opaque; not very hard; brittle. Spec. grav. 5.918.

Conſtituent Parts.	
Oxide of columbium,	78
——— iron,	21
Loſs,	1
	100

Localities, &c.—This mineral, of which the only ſpecimen known is in the Britiſh Muſeum, was brought from Maſſachuſſets in America; it was analyzed by Mr Hatchett, and found to contain a new metal, which he denominated *columbium*.

XXIII. TANTALIUM Genus.

Two ſpecies of this mineral have been diſcovered; tantalite, and yttrio-tantalite.

1. Species. Tantalite.

Exter. Char.—Cryſtallized in octahedrons; ſurface ſmooth; fracture compact.

Colour bluiſh gray, or black. Spec. grav. 7.95.

Conſtituent Parts.—Compoſed of tantalium, iron, and manganeſe.

Localities, &c.—Found in Finland, in globular pieces, in a vein of red feldſpar, traverſing a gneiſs rock.

2. Species. Yttrio-Tantalite.

Exter. Char.—Diſſeminated, in pieces of the ſize of a nut; fracture even; luſtre metallic.

Colour dark gray; may be ſcratched with a knife; powder gray. Spec. grav. 5.13.

Conſtituent Parts.—Compoſed of iron, manganeſe, tantalium, and the new earth yttria.

Localities, &c.—Found at Ytterby in Sweden, in the ſame place with gadolinite.

Theſe minerals were analyzed by Eckeberg, who diſcovered in them the new metal tantalium, which is now ſuppoſed to be the ſame with columbium.

XXIV. CERIUM Genus.

1. Species. Cerite.

Exter. Char.—Found maſſive or diſſeminated; luſtre weakly glimmering; fracture fine grained, even.

Colour pale roſe red; opaque; powder grayiſh; ſcratches glaſs. Spec. grav. 4.5 to 4.9.

Chem. Char.—Infuſible before the blow-pipe, and does not colour borax.

Conſtituent Parts.

	Vauquelin.	Klaproth.
Oxide of cerium,	67·	54·5
——— iron,	.02	4·
Silica,	17·	34·
Lime,	.02	
Water and carbonic acid	.12	5·
Loſs,	15.84	2.5
	100.00	100.0

Localities, &c.—This mineral has been found in the copper mine of Baſtnaes, at Riddarhytta, in Sweden, accompanied by copper, molybdena, biſmuth, mica, and hornblende.

The new metal contained in this mineral was diſcovered by Hiſinger and Berzelius, chemiſts at Stockholm.

APPENDIX.

IX. YTTRIAN Genus.

To follow Strontian Genus, p. 209.

Species. Gadolinite.

Id. Brochant, ii. 512. *Id.* Hauy, iii. 141.

Exter. Char.—Found maſſive; ſhining, vitreous; fracture conchoidal.

Colour velvet black, or browniſh black; opaque; hard; ſcratches quartz; brittle. Spec. grav. 4.04.

Chem. Char.—Reduced to powder, and heated in diluted nitric acid, it is converted into a thick yellowiſh gray jelly. Before the blow-pipe it decrepitates and becomes whitiſh red, but remains infuſible.

Conſtituent Parts.

	Eckeberg.	Vauquelin.	Klaproth.
Yttria,	47·5	35·	59·75
Silica,	25·	25·5	21.25
Lime,		2.	
Alumina,	4·5		·5
Oxide of iron,	18.	25·	17·5
——— manganeſe,		2.	
Water and carbonic acid,		10.5	·5
Loſs,	5·		·5
	100.0	100.0	100.00

Localities, &c.—This mineral was examined by Profeſſor Gadolin of Sweden, whoſe name it bears, and found to contain a peculiar earth. It was found near Ytterby in Sweden, and hence the new earth was called *Yttria.*

The unavoidable length to which the firſt part of this treatiſe has extended, and ſome other circumſtances, render it neceſſary for us to introduce in a different part of the work, what we propoſe to lay before our readers in the ſecond part relative to the analyſis of ſtones and metallurgical operations. See Ores, *Reduction of*, and Stones, *Analyſis of.*

EXPLANATION of the PLATES.

Plate CCCLI.

Fig. 1. Repreſents the goniometer or graphometer, an inſtrument invented by Carangeau for meaſuring the angles of cryſtals. MTN is a graduated ſemicircle of braſs or ſilver, furniſhed with two arms or rulers AB, FG, one of which, FG, has a ſlit from *a* to R, excepting the croſs bar at K, which ſtrengthens the inſtrument. This arm is fixed to a braſs ruler at R and *c* placed behind, and which makes part of the ſemicircle. The arm FG is connected with the ruler behind by nails which enter the ſlit and are furniſhed with nuts. The other arm has alſo a ſlit or opening from *x* to *c*, where it is fixed to the firſt by the ſcrew nail which paſſes through both. By ſlackening the ſcrews, the two parts *c* G and *c* B may be ſhortened at pleaſure. The arm AB being only fixed at *c*, which is the centre of the circle, moves round this centre, while the arm GF remains conſtantly fixed in the direction of the diameter which paſſes through the points 0 and 180°. The upper part of the arm AB ſhould be brought to a thin edge from *z* to *s*, and the line of this edge ſhould paſs through the centre *c*; becauſe it is by this edge that the meaſure of the angle on the graduated circumference is indicated.

To diſcover the meaſure of any angle of a cryſtal, the two arms *c* B, *c* G are brought into contact with the ſides containing the angle, and the degree indicated by the line *z s* on the circumference denotes the meaſure of that angle. The inſtrument is ſo contrived that the arms may be ſhortened for the convenience of applying it in different caſes. But it might happen that it could not be applied in caſes where the cryſtals are aggregated or attached to the matrix. This difficulty is obviated by another contrivance. The ſemicircle is furniſhed with a hinge at 90°, by which means it may be diminiſhed at pleaſure to a quadrant, by folding back one half. There is a ſmall bar of ſteel, one end of which is fixed behind the immoveable arm FG, and the other is attached by a notch and ſcrew nail at O. When this nail is unſcrewed, the bar *c* O falls behind the ruler which ſupports FG, and thus one half of the ſemicircle folds back, and any angle not exceeding 90° may be meaſured; but when the angle is greater, it muſt be replaced.

Fig. 2. is an apparatus by which ſmall degrees of

electricity may be obſerved in minerals. A is a ſmall braſs needle with knobs *a b*, and moveable on the pivot at the middle. The mineral whoſe electricity is to be tried, is rubbed on ſilk or woollen, and then preſented to one of the knobs; and by the diſtance at which the knob begins to be attracted, the ſtrength of the electricity may be, in ſome degree, eſtimated. In the ſame way ſubſtances which become electric by heat, ſuch as the tourmaline, are to be tried; the ſame apparatus may be employed. To aſcertain in what part of the mineral the different electricities exiſt, take a ſtick of ſealing wax, at the extremity of which a ſilk thread has been attached, and having rubbed the wax, bring alternately the oppoſite extremities of the ſubſtance, for example, each of the ſummits of a tourmaline, within a ſmall diſtance of the ſilk thread. If the extremity which is brought near the thread poſſeſs negative electricity, the thread will be repelled; on the contrary, it will be attracted. Or the experiment may be made in another way, particularly when the electrical body is ſmall, or its electricity feeble. At B, fig. 2. the tourmaline *t t'* is held by a pair of pincers in ſuch a way that the pole *t* is at a ſmall diſtance from the knob *a* of the needle. C *c* is the ſtick of wax, one of whoſe extremities is placed on a tube of glaſs U *u*, and which acts by its extremity C, on the knob *a*, to excite in it poſitive electricity. In this caſe the wax, after the extremity which has been rubbed is placed in the poſition deſcribed, communicates to the knob of the needle to which it is preſented, an electricity contrary to its own; ſo that the extremity of the tourmaline acted on by poſitive electricity, repels the needle to which it is preſented, and the other extremity, poſſeſſing negative electricity, attracts the needle.

Fig. 3. is a ſpirit of wine blow-pipe, nearly on the plan of that invented by Mr Paul. It is made of braſs, and conſiſts of the following parts.

a Is a hollow oval frame about five inches in its longeſt dimenſion, which ſupports the pillar *d* and the two lamps *b c*, which may burn either oil or alcohol, but the latter is the beſt. The rim *e e* ſlips upon the pillar *d* as low as the ſhoulder of the latter will permit, but the rim may be raiſed at pleaſure and kept faſt by the ſcrew peg *f*. The rim ſupports the boiler *g* which is a ſingle hollow piece of thick braſs containing about an ounce of alcohol, and has four openings, viz. three at top *h*, *i*, *k*, and one at bottom to receive the tube *o*. This latter is long enough to reach the level of the outſide of the top of the boiler, and conſequently the alcohol within the boiler cannot readily boil over into the tube, and the opening *k* which correſponds with it, is cloſely ſhut by a ſcrew ſtopper, hollowed out a little beneath, to allow the free paſſage of the vapour down the tube. Here the vaporized alcohol is prevented from condenſing at the point *o* by the contiguity of the flame of the lamp *b*, and as it paſſes on through the hollow *p q* into the jet tube *r*, it is immediately kindled by the flame of the lamp *c*, and the united flames are compelled ſideways with ſuch violence as to form a long pencil of blue flame, attended with a conſiderable roaring noiſe. This continues as long as any alcohol is left in the boiler, which allows ample time for moſt blow-pipe operations. The boiler is filled at the opening *h*. The centre hole *i* is nicely fitted with a ſmall braſs plug kept down by a thin ſlip of iron *l*, the other end of which ſlips over the top of the upright pillar *d*, and is confined between two flat ſcrew-plates *m n*. The uſe of this is as a ſafety valve to take away all danger of the boiler burſting by the confined vapour not being able to eſcape faſt enough through the jet-pipe *r*, for when the internal preſſure is great, the elaſticity of the iron ſpring *l* allows the valve *i* to riſe ſufficiently to let out part of the encloſed vapour. The ſcrew ſtoppers *h* and *k* are made ſtill tighter by collars of leather, as is the part where the tube *o* joins the boiler. The jet-pipe *r* has a complete rotatory motion, ſo that the flame may be impelled in any direction. This is effected by turning in the form of a ball that part of the pipe which is incloſed in the hollow *p q*.

But this blow-pipe, although an elegant philoſophical apparatus, will not be found to anſwer where a great degree of heat is required to be kept up for a conſiderable time. Other contrivances, therefore, of a ſimpler nature, have been propoſed; and perhaps the beſt of theſe is the blow-pipe which is uſed by the mouth. The following is a deſcription of a blow-pipe of this kind.

Fig. 4. repreſents this blow-pipe. *a* Is a braſs tube, having a circular enlargement *c*, for the purpoſe of condenſing the moiſture which is blown from the lungs; the ſmaller end *d* is moveable round the centre *c*, ſo that any degree of obliquity may be given to the flame. Fig. 5. is a ſeparate jet-pipe with a ſmall opening, which is ſcrewed on the blow-pipe at *d*; and it may be convenient to have two or three jet-pipes of different ſizes, according as a larger and more moderate, or a ſmaller and more intenſe flame is wanted. *b* Is a piece of ivory which ſlips on the larger end, for the purpoſe of being applied to the mouth, as being more agreeable.

The beſt kind of flame for blowing through with the common blow-pipe is a wax or tallow candle with a very large wick, which ſhould be kept ſnuffed moderately low, and the wick turned a little aſide from the pipe. A ſpirit lamp is ſometimes uſed, which makes a perfectly clear flame without ſmoke, but weak when uſed in this way. There is a kind of knack in blowing with the mouth, which is not eaſily deſcribed, and requires a little practice to be performed with eaſe. As the flame muſt often be kept for ſeveral minutes, the act of reſpiration muſt be carried on through the noſtrils without interruption, and the ſtreſs of blowing muſt be performed merely by compreſſion of the cheeks upon the air in the mouth.

The ſubſtance to be heated is placed either on a piece of charcoal or a metallic ſupport. When the former is uſed, a large cloſe well-burnt piece of charcoal muſt be choſen, a ſmall ſhallow hole ſcooped out with a knife, and the ſubſtance laid upon it. The charcoal itſelf kindles all round the hole, and the hole is thus gradually enlarged; and the heat too is kept up round the ſubſtance much more uniformly than when a metal ſupport is uſed. At the ſame time however the chemical effect produced by heated charcoal ſhould not be forgotten, particularly the reduction of metallic oxides, and the deoxygenation of the fixed acids; ſo that, for example, a ſmall heap of minium or litharge heated red-hot on charcoal plana- n of the lates.

charcoal by the blow-pipe, is ſpeedily reduced to a globule of metallic lead; the phoſphates are partially reduced to phoſphurets, &c.

For a metallic ſupport, platina is in general by far the beſt material. A ſmall ſpoon of this metal, the ſhank of which may be ſtuck in a cork when held, and a ſmall ſilver cup, the ſhank of which is fixed into a wooden handle, may be uſed in fuſions with borax or alkaline fluxes. A ſmall forceps lately brought into uſe, and made entirely of two thin pieces of platina joined by rivets, and bent, will be uſeful in holding any ſmall hard ſubſtance in the blow-pipe flame for any length of time, without danger of the points of the forceps melting; and it is alſo found that this metal is ſo much worſe a conductor of heat than any other, that the forceps never gets too hot for the naked fingers to touch at the bend *.

Fig. 6. repreſents a portable pocket blow-pipe, invented by Dr Wollaſton, and of its actual ſize. The interior tube is longer than the exterior, that it may be readily withdrawn; and the upper edge of the large end is turned outward, to diminiſh the effort of the lips requiſite for retaining it in the mouth.

Fig. 7. repreſents the whole apparatus, one half of its real dimenſions, and connected for uſe. The ſmall extremity *a* is placed obliquely at an angle of about 120°, that the flame impelled by it may be carried to a more convenient diſtance from the eye, and thus anſwering the purpoſe of a longer blow-pipe. This oblique piece *a* is compoſed of three parts, the largeſt of which is made ſtronger, that it may not be injured by uſe. One end is cloſed, and into the other is inſerted a ſmall peg of wood, perforated ſo as to receive the tip which is intended to be occaſionally ſeparated, for the purpoſe of paſſing a fine needle into it, to remove obſtructions †.

PLATES CCCLII. and CCCLIII.

Fig. 1. *Diamond*,—ſpheroidal, with 48 convex faces.

Fig. 2. *Zircon*,—the primitive form an octahedron with iſoſceles triangles.

Fig. 3. *Zircon*,—rectangular four-ſided priſm terminated by a four ſided pyramid ſet on the lateral faces.

Fig. 4. *Hyacinth*,—a dodecahedron formed from a rectangular four-ſided priſm terminated by a four-ſided pyramid ſet on the lateral edges.

Fig. 5. *Chryſoberyl*,—double ſix-ſided pyramid flattened, having the ſummits truncated.

Fig. 6. *Chryſolite*,—a compreſſed eight-ſided priſm, terminated by an eight-ſided pyramid, whoſe ſides correſpond to thoſe of the priſm, and whoſe ſummit is truncated by a convex ſurface.

Fig. 7. *Augite*,—the primitive form, an oblique four-ſided priſm with rhomboidal baſes.

Fig. 8. *Common form of augite*,—a ſhort, eight-ſided, compreſſed priſm, terminated by two oblique faces.

Fig. 9. *Piſtazite*,—a ſix-ſided priſm with two broad and four narrow faces, and bevelled at the extremities.

Fig. 10. and 11. other forms in which the priſms are terminated by ſeveral oblique faces with a truncated ſummit.

Fig. 12. *Veſuvian*,—a four-ſided priſm with the edges truncated, and terminated by four oblique and one horizontal face.

Fig. 13. *Garnet*,—primitive form, a rhomboidal dodecahedron.

Fig. 14. *Trapezoidal garnet*,—compoſed of 24 faces, which are equal and ſimilar trapezoids.

Fig. 15. *Grenatite*,—a ſix-ſided priſm with the greater angles at each baſe truncated.

Fig. 16. Two cryſtals of the ſame croſſing each other obliquely. *Staurotide, oblique angle*, of Hauy.

Fig. 17. *Corundum*,—two ſix-ſided pyramids united by the baſes, with the ſummits and angles truncated.

Fig. 18. A ſix-ſided priſm, having the alternate angles at each baſe truncated.

Fig. 19. *Topaz*,—an eight-ſided priſm terminated by an obtuſe four-ſided pyramid at one extremity, and by a different one at the other.

Fig. 20. A ſimilar priſm with ſix of the terminal edges truncated.

Fig. 22. *Tourmaline*,—primitive form, which is an obtuſe rhomboid.

Fig. 23. A nine-ſided priſm, terminated at one extremity by a ſix-ſided ſummit, and by a three-ſided ſummit at the other.

Fig. 24. Same priſm, with a three and a ſeven-ſided ſummit at the extremities.

Fig. 25. *Axinite* or *Thumerſtone*,—primitive form, which is a rectangular four-ſided priſm, whoſe baſes are oblique-angled parallelograms.

Fig. 26. A ſecondary form, ſame priſm, having the alternate lateral and terminal edges truncated.

Fig. 27. *Rock-cryſtal*.—A double ſix-ſided pyramid.

Fig. 28. A ſix-ſided priſm, terminated at each extremity by a ſix-ſided pyramid, having the alternate angles at the oppoſite baſes ſlightly truncated.

Fig. 29. *Feldſpar*,—the primitive form, which is an oblique-angled parallelopiped.

Fig. 30. An oblique four-ſided priſm.

Fig. 31. A ſix-ſided priſm with four of the angles truncated, and the two extremities bevelled.

Fig. 32. The ſame priſm, with four of the terminal edges truncated.

Fig. 33. An oblique four-ſided priſm, bevelled and truncated at the extremities.

Fig. 34. *Chiaſtolite*,—the outer rhomboid marked with black lines parallel to the ſides of the black internal rhomboid.

Fig. 35. *Foliated Zeolite*, or *Stilbite*,—compreſſed four-ſided priſm, terminated by a four-ſided ſummit ſet on the lateral edges.

Fig. 36. A ſix-ſided priſm with two ſolid angles at each extremity, truncated.

Fig. 37. *Cubic Zeolite*, or *Analcime*,—the cube with all the ſolid angles truncated.

Fig. 38. *Cubic Zeolite*, or *Chabaſie*,—compoſed of three rhomboids.

Fig. 39. *Croſs-ſtone*,—a double cryſtal compoſed of two dodecahedrons croſſing each other at right angles.

Fig. 40. *Hornblende*,—primitive form, an oblique four-ſided priſm, whoſe baſe is a rhomboid.

Fig. 41. *Baſaltic Hornblende*,—a ſix-ſided priſm terminated at one extremity by four trapezoidal planes; and at the other by a bevelment, the planes of which are pentagons.

Fig. 42. *Tremolite*,—an oblique four-ſided priſm, having the acute angles truncated and terminated by a dihedral ſummit.

Fig.

Explanation of the Plates.

---

* Aikin's Di. of mistry, &. Appedix.

† Nich. ur. xv.

Explanation of the Plates.

Fig. 43. *Calcareous Spar*, or *Carbonate of Lime*,—primitive form a rhomboid.

Fig. 44. A very obtuſe rhomboid.

Fig. 45. An acute rhomboid.

Fig. 46. Approaching to the cube.

Fig. 47. Double ſix-ſided priſm, known by the name of *Dog-tooth ſpar*.

Fig. 48. A ſix-ſided priſm, terminated at each extremity by a trihedral ſummit whoſe faces are pentagons.

Fig. 49. Alſo a ſix-ſided priſm with trihedral ſummits; but the baſes of the terminal pentagons are enlarged in conſequence of the inclination of the lateral faces.

Figs. 50, 51, 52. Other forms of calcareous ſpar.

Fig. 53. *Sulphate of Lime*,—primitive form.

Figs. 54, 55. Common forms.

Fig. 56. *Sulphate of Barytes*,—primitive form.

Figs. 57, 58, 59. Common forms of ſulphate of barytes.

Fig. 60. *Sulphate of Strontites*,—primitive form.

Fig. 61. Common form.

Fig. 62. *Borate of Soda*,—primitive form.

Fig. 63. One of the common forms.

Fig. 64. *Carbonate of Soda*,—primitive form, an acute octahedron.

Fig. 65. One of the common forms, having two angles at the baſe truncated.

Explanation of the Plates.

Fig. 66. *Nitrate of Potaſh*,—primitive form, a rectangular octahedron.

Figs. 67, 68. Common forms.

Fig. 69. *Sulphate of Magneſia*,—the common form.

Fig. 70. *Borate of Magneſia*,

Fig. 71. *Sulphur*,—primitive form.

Fig. 72. Common form.

Fig. 73. *Mercury, Native Amalgam.*

Fig. 74. *Cinuabar.*

Figs. 75, 76, 77. *Red Silver Ore.*

Figs. 78, 79, 80, 81, 82. *Cryſtals of Copper Ore.*

Figs. 83, 84, 85, 86, 87, 88, 90, 91, 92, 93. *Cryſtals of the Ores of Iron.*

Fig. 94. *Carbonate of Lead.*

Fig. 95. *Sulphate of Lead.*

Figs. 96, 97. *Molybdate of Lead.*

Figs. 98, 99, 100. *Cryſtals of Tin.*

Fig. 101. *Oxide of Zinc.*

Fig. 102. *Sulphuret of Zinc.*

Fig. 103. *Sulphuret of Antimony.*

Figs. 104, 105. *Cryſtals of Cobalt.*

Fig. 106. *Manganeſe.*

Fig. 107. *Sulphuret of Arſenic.*

Fig. 108. *Tellurium*,—primitive form.

Fig. 109. Common form.

Figs. 110, 111, 112, 113. *Cryſtals of Titanium.*

INDEX.

Dolomite,

MINERALOGY. PLATE CCCLI.

Fig. 1.

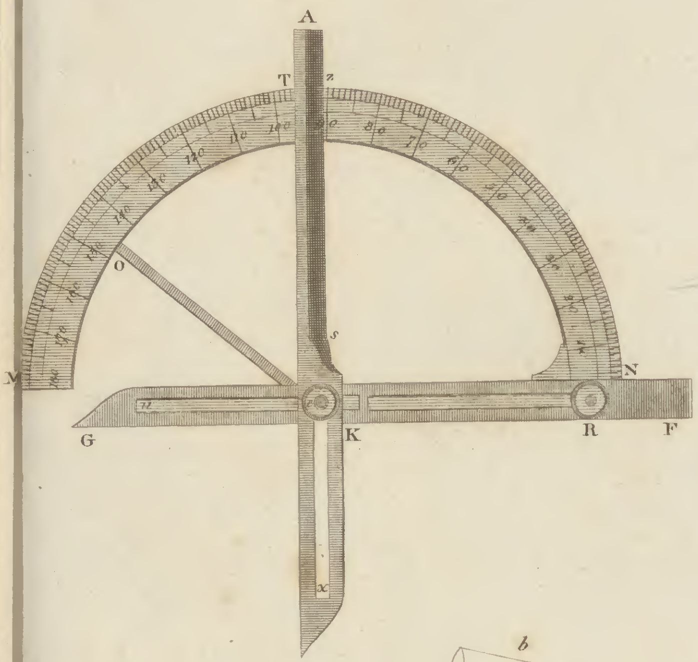


Fig. 3.

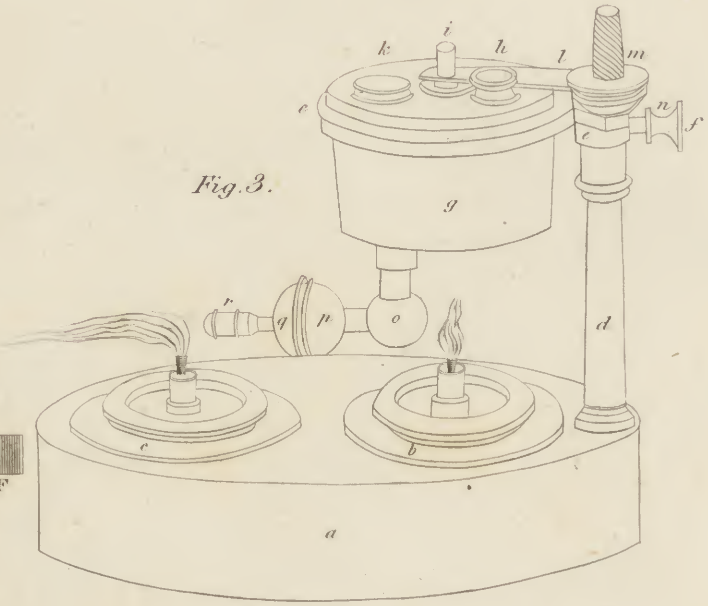


Fig. 4.

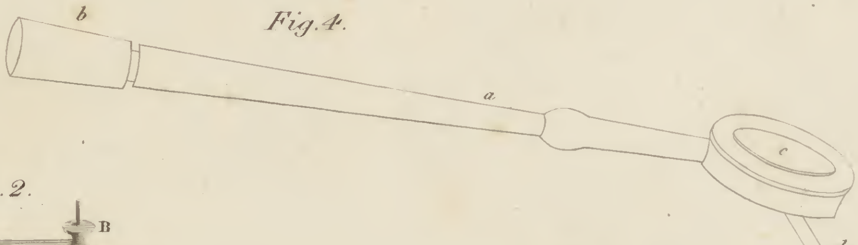


Fig. 2.

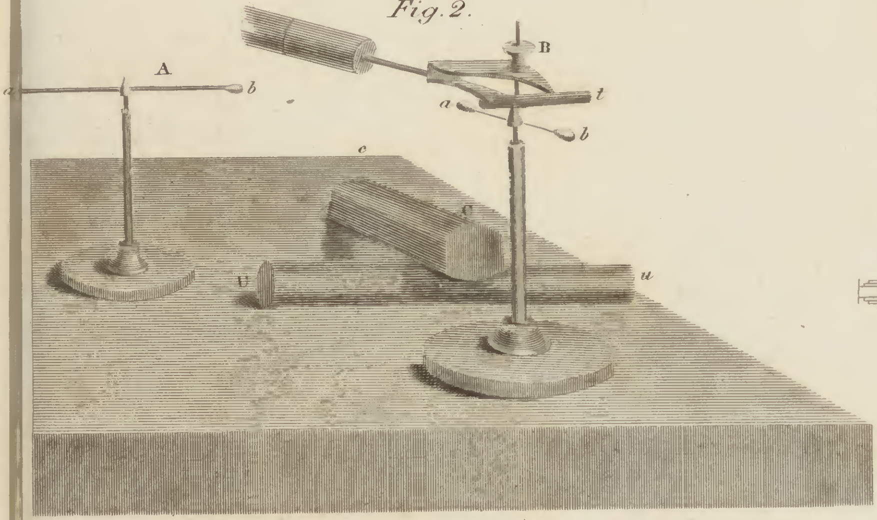


Fig. 5.

Fig. 6.

Fig. 7.

E. Mitchell ſculp.t

MINERALOGY. PLATE CCCLII.

Fig. 1.

Fig. 2.

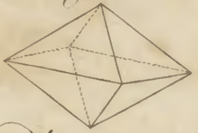


Fig. 3.

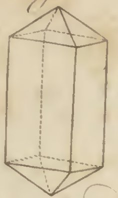


Fig. 4.

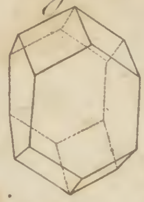


Fig. 5.

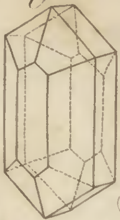


Fig. 6.

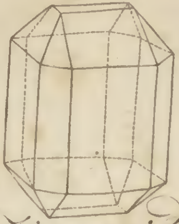


Fig. 7.

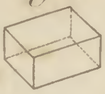


Fig. 8.

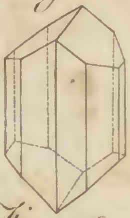


Fig. 9.

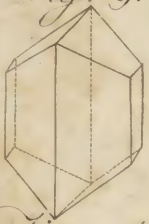


Fig. 10.

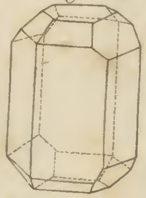


Fig. 11.

Fig. 12.

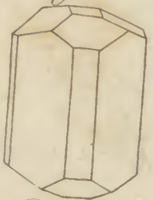


Fig. 13.

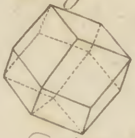


Fig. 14.

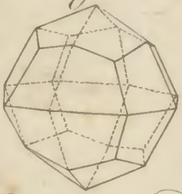


Fig. 15.

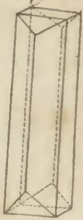


Fig. 16.

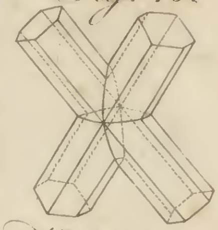


Fig. 17.

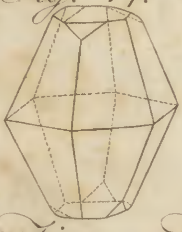


Fig. 18.

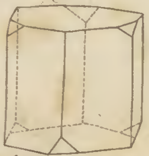


Fig. 19.

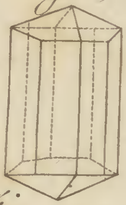


Fig. 20.

Fig. 21.

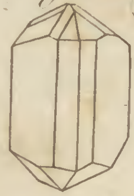


Fig. 22.

Fig. 23.

Fig. 24.

Fig. 25.

Fig. 26.

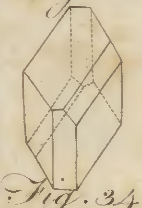


Fig. 27.

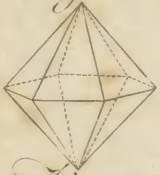


Fig. 28.

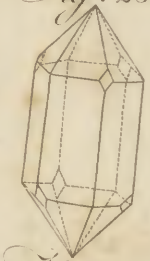


Fig. 29.

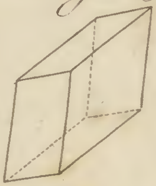


Fig. 30.

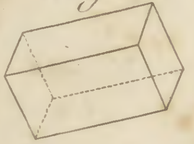


Fig. 31.

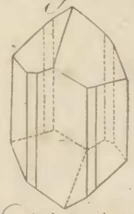


Fig. 32.

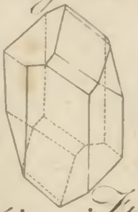


Fig. 33.

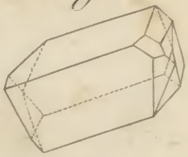


Fig. 34.

Fig. 35.

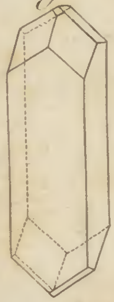


Fig. 36.

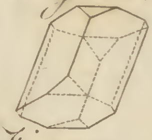


Fig. 37.

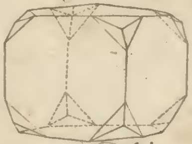


Fig. 38.

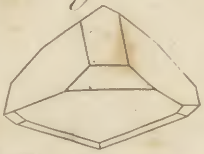


Fig. 39.

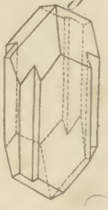


Fig. 40.

Fig. 41.

Fig. 42.

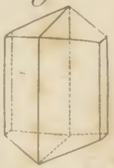


Fig. 43.

Fig. 44.

Fig. 45.

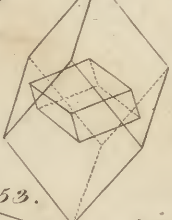


Fig. 46.

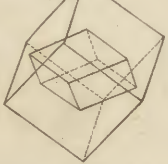


Fig. 47.

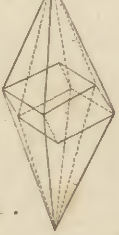


Fig. 48.

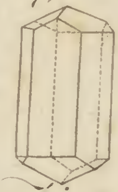


Fig. 49.

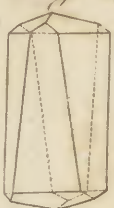


Fig. 50.

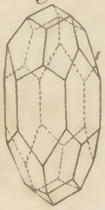


Fig. 51.

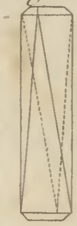


Fig. 52.

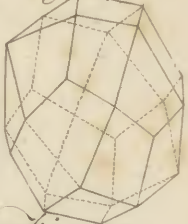


Fig. 53.

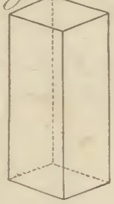


Fig. 54.

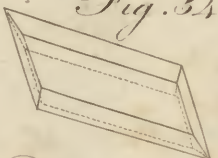


Fig. 55.

Fig. 56.

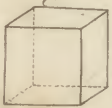


Fig. 57.

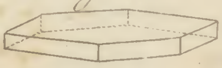


Fig. 58.

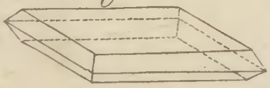


Fig. 59.

Fig. 60.

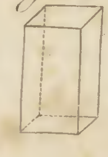


Fig. 61.

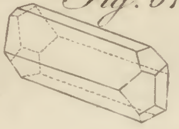
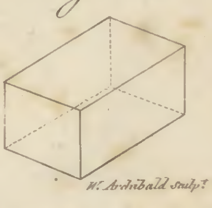


Fig. 62.



W. Archibald Sculpt.

Fig. 63.

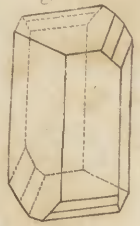


Fig. 64.

Fig. 65.

Fig. 66.

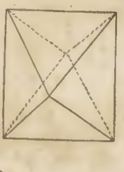


Fig. 67.

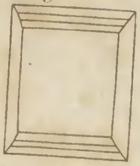


Fig. 68.

Fig. 69.

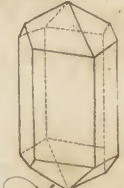


Fig. 70.

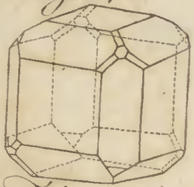


Fig. 71.

Fig. 72.

Fig. 73.

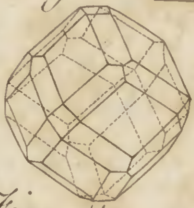


Fig. 74.

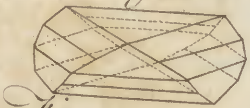


Fig. 75.

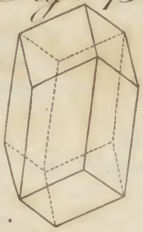


Fig. 76.

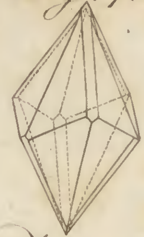


Fig. 77.

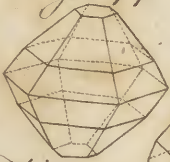


Fig. 78.

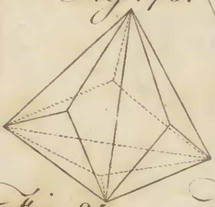


Fig. 79.

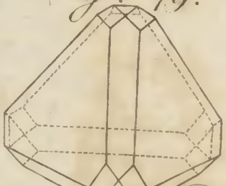


Fig. 80.

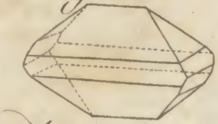


Fig. 81.

Fig. 82.

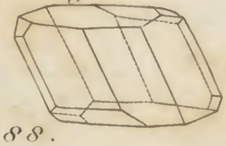


Fig. 83.

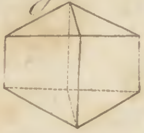


Fig. 84.

Fig. 85.

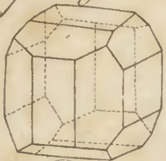


Fig. 86.

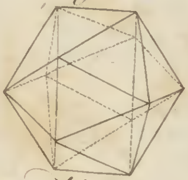


Fig. 87.

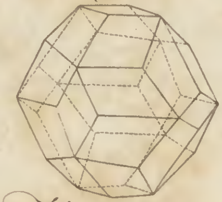


Fig. 88.

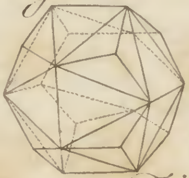


Fig. 89.

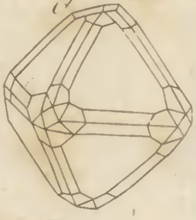


Fig. 90.

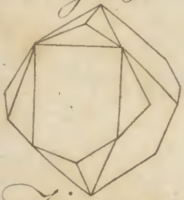


Fig. 91.

Fig. 92.

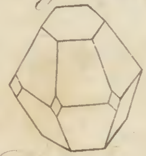


Fig. 93.

Fig. 94.

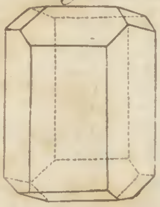


Fig. 95.

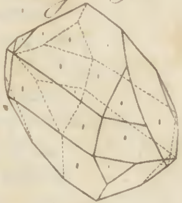


Fig. 96.

Fig. 97.

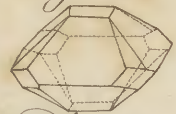


Fig. 98.

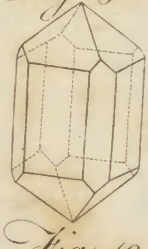


Fig. 99.

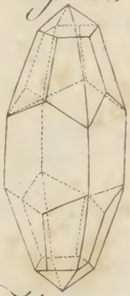


Fig. 100.

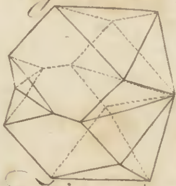


Fig. 101.

Fig. 102.

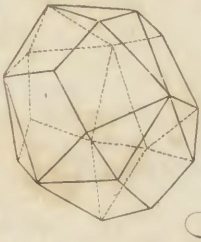


Fig. 103.

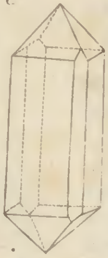


Fig. 104.

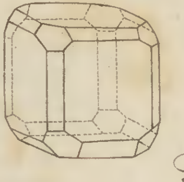


Fig. 105.

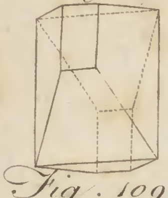


Fig. 106.

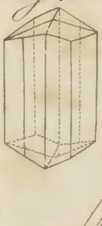


Fig. 107.

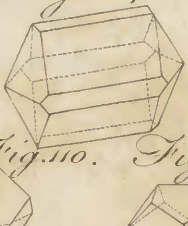


Fig. 108.

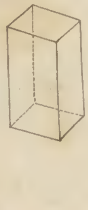


Fig. 109.

Fig. 110.

Fig. 111.

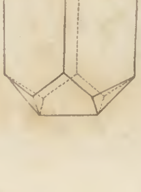


Fig. 112.

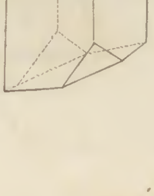
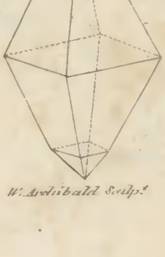


Fig. 113.



W. Archibald Sculpt.

Tremolite,

Minerva || Mingrelia. MINERVA, or PALLAS, in Pagan worſhip, the goddeſs of ſciences and of wiſdom, ſprung completely armed from Jupiter's brain; and on the day of her nativity it rained gold at Rhodes. She diſputed with Neptune the honour of giving a name to the city of Athens; when they agreed that whoſoever of them ſhould produce what was moſt uſeful to mankind, ſhould have that advantage. Neptune, with a ſtroke of his trident, formed a horſe; and Minerva cauſed an olive to ſpring from the ground, which was judged to be moſt uſeful, from its being the ſymbol of peace. Minerva changed Arachne into a ſpider, for pretending to excel her in making tapeſtry. She fought the giants; favoured Cadmus, Ulyſſes, and other heroes; and refuſed to marry Vulcan, chooſing rather to live in a ſtate of celibacy. She alſo deprived Tireſias of ſight, turned Meduſa's locks into ſnakes, and performed ſeveral other exploits.

Minerva is uſually repreſented by the poets, painters and ſculptors, completely armed, with a compoſed but agreeable countenance, bearing a golden breaſtplate, a ſpear in her right hand, and her ægis or ſhield in the left, on which is repreſented Meduſa's head encircled with ſnakes, and her helmet was uſually entwined with olives.

Minerva had ſeveral temples both in Greece and Italy. The uſual victim offered her was a white heifer, never yoked. The animals ſacred to her were the cock, the owl, and the baſiliſk.

MINERVÆ Caſtrum, *Arx Minervæ*, *Minervium*, or *Templum Minervæ*, in *Ancient Geography*, a citadel, temple, and town on the Ionian ſea, beyond Hydrus; ſeen a great way out at ſea. Now *Caſtro*, a town of Otranto in Naples. E. Long. 19. 25. N. Lat. 46. 8.

MINERVÆ Promontorium, in *Ancient Geography*, the ſeat of the Sirens, a promontory in the Sinus Paeſtanus, the ſouth boundary of Campania on the Tuſcan coaſt; ſo called from a temple of Minerva on it; ſituated to the ſouth of Surrentum, and therefore called *Surrentium*. Now *Capo della Minerva*, on the weſt coaſt of Naples, over againſt the iſland Capri.

MINERVALIA, in Roman antiquity, feſtivals celebrated in honour of Minerva, in the month of March; at which time the ſcholars had a vacation, and uſually made a preſent to their maſters, called from this feſtival *Minerval*.

MINGRELIA, anciently COLCHIS, a part of Weſtern Georgia, in Aſia; bounded on the eaſt by Iberia, or *Georgia* properly ſo called; on the weſt, by

the Euxine ſea; on the ſouth, by Armenia, and part of Pontus; and on the north, by Mount Caucaſus. Mingrelia.

Colchis, or Mingrelia, is watered by a great many rivers; as the Corax, the Hippus, the Cyaneus, the Chariſtus, the Phaſis, where the Argonauts landed, the Abſarus, the Ciſſa, and the Ophis, all emptying themſelves into the Euxine ſea. The Phaſis does not ſpring from the mountains in Armenia, near the ſources of the Euphrates, the Araxes, and the Tigris, as Strabo, Pliny, Ptolemy, Dionyſius, and after them Arrian, Reland, Calmet, and Sanſon, have falſely aſſerted; but riſes in Mount Caucaſus; and flows not from ſouth to north, but from north to ſouth, as appears from the map of Colchis or Mingrelia in Thevenot's collection, and the account which Sir John Chardin gives of that country. This river forms in its courſe a ſmall iſland called alſo *Phaſis*: whence the pheaſants, if Iſidorus is to be credited, were firſt brought to Europe, and thence called by the Greeks *Phaſiani*. The other rivers of Colchis are conſiderable.

The whole kingdom of Colchis was in ancient times very pleaſant and fruitful, as it is ſtill where duly cultivated; abounded in all neceſſaries of life; and was enriched with many mines of gold, which gave occaſion to the fable of the Golden Fleece and the Argonautic expedition, ſo much celebrated by the ancients.

Sir John Chardin tells us, that this country extends above 100 miles in length and 60 in breadth; being not near ſo extenſive as the ancient Colchis, which reached from the frontiers of Iberia or Georgia Proper, weſtward to the Palus Mæotis: that it is beautifully diverſified with hills, mountains, valleys, woods, and plains, but badly cultivated: that there are all the kinds of fruits which are found in England, growing wild, but taſteleſs and inſipid for want of culture: that, if the natives underſtood the art of making wines, thoſe of this country would be the fineſt in the world: that there are many rivers which have their ſource in Mount Caucaſus, particularly the Phaſis, now called the *Rione*: that the country abounds in beeves, hogs, wild boars, ſtags, and other veniſon; and in partridges, pheaſants, and quails: that falcons, eagles, pelicans, lions, leopards, tygers, wolves, and jackals, breed on Mount Caucaſus, and ſometimes greatly annoy the country: that the people are generally handſome, the men ſtrong and well made, and the women very beautiful; but both ſexes very vicious and debauched: that they marry their nieces, aunts, or other relations, indifferently; and take two or three wives

wives if they pleaſe, and as many concubines as they will: that they not only make a common practice of ſelling their children, but even murder them, or bury them alive, when they find it difficult to bring them up: that the common people uſe a ſort of paſte, made of a plant called *gom*, inſtead of bread; but that of the better ſort conſiſts of wheat, barley, or rice: that the gentry have an abſolute power over their vaſſals, which extends to life, liberty, and eſtate: that their arms are the bow and arrow, the lance, the ſabre or broadſword, and the buckler: that they are very naſty, and eat ſitting croſs-legged upon a carpet, like the Perſians; but the poorer ſort upon a mat or bench, in the ſame poſture: that the country is very thin of inhabitants, no leſs than 12,000 being ſuppoſed to be ſold yearly to the Turks and Perſians: that the principal commodities exported from it are, honey, wax, hides, caſtor, martens ſkins, flax ſeed, thread, ſilk, and linen cloth; but that there are no gold or ſilver mines now, and very little money: that the revenue of the prince or viceroy amounts to about 20,000 crowns per annum: that the inhabitants call themſelves *Chriſtians;* but that both they and their prieſts are altogether illiterate, and ignorant of the doctrines and precepts of Chriſtianity: that their biſhops are rich, have a great number of vaſſals, and are clothed in ſcarlet and velvet; and that their ſervice is according to the rites of the Greek church, with a mixture of Judaiſm and Paganiſm.

The cities of moſt note in this country in ancient times were Pityus; Dioſcurias, or Dioſcorias, which was ſo called from Caſtor and Pollux, two of the Argonauts, by whom it is ſuppoſed to have been founded, and who in Greek are ſtyled *Dioſcuroi*, at preſent known by the name of *Savatapoli;* Aea on the Phaſis, ſuppoſed to be the ſame as Hupolis; *Phaſis*, ſo called from the river on which it ſtood; Cyta, at the mouth of the river Cyaneus, the birth place of the famous Medea, called from thence, by the poets, *Cytæis;* Saracæ, Zadris, Surium, Madia, and Zoliſſa. As for modern cities, it does not appear that there are any here conſiderable enough to merit a deſcription; or, if there are, they ſeem to be little, if at all, known to Europeans.

MINHO, a great river in Spain, which taking its riſe in Galicia, divides that province from Portugal, and falls into the Atlantic at Caminha.

MINIATURE, in a general ſenſe, ſignifies repreſentation in a ſmall compaſs, or leſs than the reality.

MINIATURE PAINTING;

A DELICATE kind of painting, conſiſting of little points or dots; uſually done on vellum, ivory, or paper, with very thin, ſimple, water colours.—The word comes from the Latin *minium*, "red lead;" that being a colour much uſed in this kind of painting. The French frequently call it *mignature*, from *mignon*, "fine, pretty," on account of its ſmallneſs and delicacy: and it may be ultimately derived from μικρος, "ſmall."

Miniature is diſtinguiſhed from other kinds of painting by the ſmallneſs and delicacy of its figures and faintneſs of the colouring; on which account it requires to be viewed very near.

SECT. I. *Of Drawing and Deſigning.*

To ſucceed in this art, a man ſhould be perfectly ſkilled in the art of deſigning or drawing: but as moſt people who affect the one, know little or nothing of the other, and would have the pleaſure of painting without giving themſelves the trouble of learning to deſign (which is indeed an art that is not acquired without a great deal of time, and continual application), inventions have been found out to ſupply the place of it; by means of which a man deſigns or draws without knowing how to deſign.

The firſt is chalking: that is, if you have a mind to do a print or deſign in miniature, the backſide of it, on another paper, muſt be blackened with ſmall coal, and then rubbed very hard with the finger wrapped in a linen cloth: afterwards the cloth muſt be lightly drawn over the ſide ſo blackened that no black grains may remain upon it to ſoil the vellum you would paint upon; and the print or draught muſt be faſtened upon the vellum with four pins, to keep it from ſhifting. And if it be another paper that is blackened, it muſt be put between the vellum and the print, or draught, with the blackened ſide upon the vellum. Then, with a blunted pin or needle, you muſt paſs over the principal lines or ſtrokes of the print, or draught, the contours, the plaits of the drapery, and over every thing elſe that muſt be diſtinguiſhed; preſſing ſo hard, that the ſtrokes may be fairly marked upon the vellum underneath.

Copying by ſquares is another convenient method for ſuch as are but little ſkilled in the art of deſigning, and would copy pictures, or other things, that cannot be chalked. The method is this: The piece muſt be divided into many equal parts by little ſquares, marked out with charcoal, if the piece be clear and whitiſh, and the black can be fairly ſeen upon it; or with white chalk, if it be too brown and duſky. After which, as many ſquares of equal dimenſions muſt be made on white paper, upon which the piece muſt be deſigned; becauſe, if this be done immediately upon vellum, (as one is apt to miſcarry in the firſt attempt), the vellum may be ſoiled with falſe touches. But when it is neatly done upon paper, it muſt be chalked upon the vellum in the manner before deſcribed. When the original and the paper are thus ordered, obſerve what is in each ſquare of the piece to be deſigned; as a head, an arm, a hand, and ſo forth; and place it in the correſponding part of the paper. And thus finding where to place all the parts of the piece, you have nothing to do but to form them well, and to join them together. By this method you may reduce or enlarge a piece to what compaſs you pleaſe, making the ſquares of your paper greater or leſs than thoſe of the original; but they muſt always be of an equal number.

To copy a picture, or other thing, in the ſame ſize and

Drawing and Deſigning.

and proportion, another method is, to make uſe of varniſhed paper, or of the ſkin of a hog's bladder, very tranſparent, ſuch as is to be had at the gold-beaters. Talc or iſinglaſs will likewiſe do as well. Lay any one of thoſe things upon your piece; through it you will ſee all the ſtrokes and touches, which are to be drawn upon it with a crayon or pencil. Then take it off; and faſtening it under paper or vellum, ſet up both againſt the light in the manner of a window; and with a crayon, or a ſilver needle, mark out upon the paper or vellum you have put uppermoſt, all the lines and touches you ſhall ſee drawn upon the varniſhed paper, bladder, talc, or iſinglaſs, you have made uſe of, and which will plainly appear through this window.

After this manner, making uſe of the window, or of glaſs expoſed to the light, you may copy all ſorts of prints, deſigns, and other pieces on paper or vellum: laying and faſtening them under the paper or vellum upon which you would draw them. And it is a very good and a very eaſy contrivance for doing pieces of the ſame ſize and proportion.

If you have a mind to make pieces look another way, there is nothing to be done but to turn them; laying the printed or drawn ſide upon the glaſs, and faſtening the paper or vellum upon the back of it; remembering to let your lights fall on the left ſide.

A good method likewiſe to take a true copy of a picture in oil, is to give a touch of the pencil upon all the principal ſtrokes, with lake tempered with oil; and to clap upon the whole a paper of the ſame ſize: then paſſing the hand over it, the touches of the lake will ſtick and leave the deſign of your piece expreſſed upon the paper, which may be chalked like other things. But you muſt remember to take off with the crumb of bread what remains of the lake upon the picture before it be dry.

You muſt likewiſe make uſe of pounce, made of powdered charcoal put in a linen rag; with which the piece you would copy muſt be rubbed, after you have pricked all the principal ſtrokes or touches, and faſtened white paper or vellum underneath.

When the piece is marked out upon the vellum, you muſt paſs with a pencil of very clear carmine over all the traces, that they may not be effaced as you work: then clean your vellum with the crumb of bread, that no black may remain upon it.

The vellum muſt be paſted upon a plate of braſs or wood, of the ſize you would make your piece, to keep it firm and tight. But this paſting muſt be on the edges of your vellum only, and behind the plate, for which purpoſe your vellum muſt exceed your plate above an inch on every ſide; for the part you paint upon muſt never be paſted; becauſe it would not only give it an ill look, but you could not take it off if you would. Cut off the little ſhags and locks of the vellum; and wetting the fair ſide with a linen cloth dipped in water, clap the other upon the plate with a clean paper between them: ſo much as hangs over muſt be paſted upon the back of the plate, drawing it equally on all ſides, and hard enough to ſtretch it well.

SECT. II. *Of Materials.*

THE chief colours made uſe of for painting in miniature are,

Colours, &c.

Carmine.
Venice and Florence lake.
Roſe pink.
Vermilion.
Red lead.
Brown red.
Red orpiment.
Ultramarine.
Verditer.
Indigo.
Gall ſtone.
Yellow ochre.
Dutch pink.
Gamboge.
Naples yellow.
Pale maſticot.
Deep yellow maſticot.
Ivory black.
Lamp black.
True Indian ink.
Biſtre, or wood ſoot.
Raw umber.
Burnt umber.
Sap green.
Verdigris.
Flake white.
Crayons of all colours.
Gold and ſilver ſhells.
Leaf gold and leaf ſilver.

The ſeven tranſparent colours, which are uſed where writing is ſeen through the colour.

Liquid {
Lake.
Blue.
Yellow.
Graſs-green.
Dark-green.
Purple colour.
Brown.

Moſt of theſe colours neceſſary for miniature painting may eaſily be prepared by attending to the directions given under the article *COLOUR-Making*.

As colours taken from earth and other heavy matter are always too coarſe be they never ſo well ground, eſpecially for delicate work, becauſe of a certain ſand remaining in them; the fineſt parts may be drawn out by diluting them with the finger in a cup of water. When they are well ſteeped, let them ſettle a while: then pour out the cleareſt, which will be at top, into another veſſel. This will be the fineſt, and muſt be let dry; and when it is uſed, muſt be diluted with gum water.

If you mix a little of the gall of an ox, a carp, or an eel, particularly of the laſt, in green, black, gray, yellow, and brown, colours, it will not only take away their greaſy nature, but alſo give them a luſtre and brightneſs they have not of themſelves. The gall of eels muſt be taken out when they are ſkinned, and hung upon a nail to dry; and when you would uſe it, it muſt be diluted with brandy; add a little of it mixed with the colour you have diluted already. This likewiſe makes the colour ſtick better to the vellum, which it hardly does when it is greaſy: moreover, this gall hinders it from ſcaling.

olours, &c.

Some colours are made clearer by fire ; as yellow ochre, brown red, ultramarine, and umber : all others are darkened by it. But if you heat the ſaid colours with a ſharp fire, they change ; for the brown red becomes yellow ; yellow ochre becomes red ; umber reddens alſo. Ceruſs by fire takes the colour of citron, and is often called *maſticot*. Obſerve, that yellow ochre heated, becomes more tender than it was, and ſofter than brown red. Likewiſe brown red heated becomes ſofter than fine yellow ochre. Both are very proper. The fineſt and trueſt ultramarine, heated upon a red-hot iron, becomes more glittering ; but it waſtes, and is coarſer and harder to work with in miniature.

All theſe colours are diluted in little cups of ivory, made on purpoſe, or in ſea ſhells, with water in which gum arabic and ſugarcandy are put. For inſtance, in a glaſs of water put a piece of gum as big as a walnut, and half that quantity of ſugarcandy. This laſt hinders the colours from ſcaling when they are laid on, which they generally do when they want it, or the vellum is greaſy.

This gum water muſt be kept in a neat bottle corked ; and you never muſt take any out of it with a pencil that has colour upon it, but with a quill or ſome ſuch thing.

Some of this water is put in the ſhell with the colour you would temper, and diluted with the finger till it be very fine. If it be too hard, you muſt let it ſoften in the ſhell with the ſaid water before you dilute it. Afterwards let it dry ; and do thus with every colour, except lily-green, ſap-green, and gamboge, which muſt be tempered with fair water only. But ultramarine, lake, and biſtre, are to be more gummed than other colours.

If you make uſe of ſea ſhells, you muſt let them ſteep two or three days beforehand in water : then cleanſe them in boiling hot water, mixed with vinegar, in order to carry off a certain ſalt, which otherwiſe ſticks to them, and ſpoils the colours that are put to them.

To know whether colours are ſufficiently gummed, you have nothing to do but to give a ſtroke of the pencil upon your hand when they are diluted, which dries immediately : if they chap and ſcale, there is too much gum ; if they rub out by paſſing the finger over them, there is too little. It may be ſeen likewiſe when the colours are laid on the vellum, by paſſing the finger over them. If they ſtick to it like a powder, it is a ſign there is not gum enough, and more muſt be put to the water with which you temper them : but take care you do not put too much ; for that makes the colour extremely hard and dry. It may be known likewiſe by their glueineſs and brightneſs : ſo the more they are gummed, the darker they paint ; and when you have a mind to give a greater ſtrength to a colour than it has of itſelf, you have nothing to do but to give it a great deal of gum.

Provide yourſelf with an ivory pallet, very ſmooth, as big as your hand ; on one ſide of which the colours for the carnation, or naked parts of a picture, are to be ranged in the following manner. In the middle put a great deal of white, pretty largely ſpread ; becauſe it is the colour moſt made uſe of : and upon the edge, from the left to the right, place the following colours at a little diſtance from the white.

Colours, &c.

Maſticot.
Dutch pink.
Orpiment.
Yellow ochre.
Green ; compoſed of verditer, Dutch pink, and white, in equal quantities.
Blue ; made of ultramarine, indigo, and white, to a great degree of paleneſs.
Vermilion.
Carmine.
Biſtre, and
Black.

On the other ſide of the pallet, ſpread ſome white in the ſame manner as for the carnation. And when you have a mind to paint draperies, or other things, place near the white the colour you would make them of, in order to work, as ſhall be ſhown hereafter.

The uſe of good pencils is a great matter. In order to make a good choice, wet them a little ; and if the hairs keep cloſe together as you turn them upon the finger, and make but one point, they are good : but if they cloſe not together, but make ſeveral points, and ſome are longer than others, they are good for nothing. When they are too ſharp pointed, with only four or five hairs longer than the reſt, yet cloſing all together, they are, notwithſtanding, good ; but they muſt be blunted with a pair of ſciſſars, taking care at the ſame time you do not clip away too much. It is proper to have two or three ſorts of them ; the largeſt for laying the grounds and dead colouring, and the ſmalleſt for finiſhing.

To bring the hairs of your pencil to join cloſe together and make a good point, you muſt often put the pencil juſt between your lips when you are at work ; moiſtening and preſſing it cloſe with the tongue, even when there is colour upon it ; for if there be too much, ſome of it is taken off by this means, and enough left for giving fine and equal touches. You need not apprehend this will do you any harm. None of the colours for miniature, except orpiment, when they are prepared, have either ill taſte or ill quality. This expedient muſt eſpecially be uſed for dotting, and for finiſhing, particularly the naked parts of a picture, that the touches may be neat and fair, and not too much charged with colour. As for draperies and other things, as well in dead colouring as in finiſhing, it is ſufficient, in order to make the hairs of your pencil join well, and to unload it when it has too much colour, to draw it upon the edge of the ſhell, or upon the paper you muſt put upon your work to reſt your hand on, giving ſome ſtrokes upon it before you work upon your piece.

To work well in miniature, you muſt do it in a room that has but one window, and fix yourſelf very near it, with a table and deſk almoſt as high as the window ; placing yourſelf in ſuch a manner, that the light may always come in on the left ſide, and never forward or on the right.

When you would lay a colour on all parts equally ſtrong, as for a ground, you muſt make your mixtures in ſhells, and put in enough for the thing you deſign to paint ; for if there be not enough, it is a great chance but the colour you mix afterwards is too dark or too light.

Of Working.

Sect. III. *Of Working.*

After having ſpoke of vellum, pencils, and colours, let us now ſhow how they are to be employed. In the firſt place, then, when you would paint a piece, be it carnation, drapery, or any thing elſe, you muſt begin by dead-colouring; that is to ſay, by laying your colours on with liberal ſtrokes of the pencil, in the ſmootheſt manner you can, as the painters do in oil; not giving it all the force it is to have for a finiſhing; that is, make the lights a little brighter, and the ſhades leſs dark, than they ought to be; becauſe in dotting upon them, as you muſt do after dead-colouring, the colour is always fortified, and would at laſt be too dark.

There are ſeveral ways of dotting; and every painter has his own. Some make their dots perfectly round; others make them a little longiſh; others hatch by little ſtrokes that croſs each other every way, till the work appears as if it had been wrought with dots. This laſt method is the beſt, the boldeſt, and the ſooneſt done: wherefore ſuch as would paint in miniature ought to uſe it, and to inure themſelves from the firſt to dot in the plump and the ſoft way; that is to ſay, where the dots are loſt, in a manner, in the ground upon which you work, and only ſo much appears as is ſufficient to make the work ſeem dotted. The hard and the dry way is quite the reverſe, and always to be avoided. This is done by dotting with a colour much darker than your ground, and when the pencil is not moiſtened enough with the colour, which makes the work ſeem rough and uneven.

Study likewiſe carefully to loſe and drown your colours one in another, ſo that it may not appear where they disjoin; and to this end, ſoften or allay your touches with colours that partake of both, in ſuch ſort that it may not appear to be your touches which cut and disjoin them. By the word *cut*, we are to underſtand what manifeſtly ſeparates and divides, and does not run in and blend itſelf with the neighbouring colours; which is rarely practiſed but upon the borders of drapery.

When your pieces are finiſhed, to heighten them a little, give them a fine air; that is to ſay, give, upon the extremity of the lights, ſmall touches with a colour yet lighter, which muſt be loſt and drowned with the reſt.

When the colours are dry upon your pallet or in your ſhells, in order to uſe them, they muſt be diluted with water. And when you perceive they want gum, which is ſeen when they eaſily rub off the hand or the vellum if you give a touch with them upon either, they muſt be tempered with gum water inſtead of pure water, till they are in condition.

There are ſeveral ſorts of grounds for pictures and portraitures. Some are wholly dark, compoſed of biſtre, umbre, and Cologn earth, with a little black and white; others more yellow, in which is mixed a great deal of ochre; others grayer, which partake of indigo. In order to paint a ground, make a waſh of the colour or mixture you would have it, or according to that of the picture or portraiture you would copy; that is to ſay, a very light lay, in which there is hardly any thing but water, in order to ſoak the vellum. Then paſs another lay over that, ſomewhat thicker, and ſtrike it on very ſmoothly with large ſtrokes as quick as you can, not touching twice in the ſame place before it be dry; becauſe the ſecond ſtroke carries off what has been laid on at the firſt, eſpecially when you lean a little too light upon the pencil.

Of Working.

Other dark grounds are likewiſe made of a colour a little greeniſh; and thoſe are moſt in uſe, and the propereſt to lay under all ſorts of figures and portraitures; becauſe they make the carnation, or naked parts of a picture, appear very fine; are laid on very eaſily, and there is no occaſion to dot them, as one is often obliged to do the others, which are rarely made ſmooth and even at the firſt; whereas in theſe one ſeldom fails of ſucceſs at the firſt bout. To make them, you muſt mix black, Dutch pink, and white, all together: more or leſs of each colour, according as you would have them darker or lighter. You are to make one lay very light, and then a thicker, as of the firſt grounds. You may alſo make them of other colours, if you pleaſe; but theſe are the moſt common.

When you paint a holy perſon upon one of theſe grounds, and would paint a ſmall glory round the head of your figure, you muſt not lay the colour too thick in that part, or you may even lay none at all, eſpecially where this glory is to be very bright; but lay for the firſt time with white and a little ochre mixed together, of a ſufficient thickneſs; and in proportion as you go from the place of the head, put a little more ochre; and to make it loſe itſelf, and die away with the colour of the ground, hatch with a free ſtroke of the pencil, following the round of the glory ſometimes with the colour of which it is made, and ſometimes with that of the ground, mixing a little white or ochre with the laſt when it paints too dark to work with: and do this till one be inſenſibly loſt in another, and nothing can be ſeen to disjoin them.

To fill an entire ground with a glory, the brighteſt part is laid on with a little ochre and white, adding more of the firſt in proportion as you come nearer the edges of the picture: and when the ochre is not ſtrong enough (for you muſt always paint darker and darker), add gall ſtone, afterwards a little carmine, and laſtly biſtre. This firſt laying, or dead colouring, is to be made as ſoft as poſſible; that is to ſay, let theſe ſhadowings loſe themſelves in one another without gap or interſection. Then the way is to dot upon them with the ſame colours, in order to drown the whole together; which is pretty tedious, and a little difficult, eſpecially when there are clouds of glory on the ground. Their lights muſt be fortified in proportion as you remove from the figure, and finiſhed as the reſt, by dotting and rounding the clouds; the bright and obſcure parts of which muſt run inſenſibly into one another.

For a day ſky, take ultramarine and a good deal of white, and mix them together. With this make a lay, as ſmooth as you can, with a large pencil and liberal ſtrokes, as for grounds; applying it paler and paler as you deſcend towards the horizon; which muſt be done with vermilion or red lead, and with white of the ſame ſtrength with that where the ſky ends, or ſomething leſs; making this blue loſe itſelf in the red, which you bring down to the ſkirts of the earth, or tops of houſes; mixing towards the end gall ſtone and

Of orking

a good deal of white, in ſuch a manner that the mixture be ſtill paler than the former, without any viſible interſection or parting between all theſe colours of the ſky.

When there are clouds in the ſky, you may ſpare the places where they are to be; that is to ſay, you need not lay on any blue there, but form them, if they are reddiſh, with vermilion gall ſtone, and white, with a little indigo; and if they are more upon the black, put in a good deal of the laſt; painting the lights of one and the other with maſticot, vermilion, and white, more or leſs of any of theſe colours, according to the ſtrength you would give them, or according to that of the original you copy; rounding the whole as yot dot; for it is a difficult matter to lay them very ſmooth at the firſt painting: and if the ſky is not even enough, you muſt dot it alſo.

It is at your pleaſure to exempt the places of the clouds, for you may lay them upon the ground of the ſky; heightening the bright parts by putting a good deal of white, and fortifying the ſhadows by uſing leſs. This is the ſhorteſt way.

A night or ſtormy ſky, is done with indigo, black, and white, mixed together; which is laid as for a day ſky. To this mixture muſt be added ochre, vermilion, or brown red, for the clouds; the lights of which are to be of maſticot or red lead, and a little white, now redder, now yellower, at diſcretion. And when it is a tempeſtuous ſky, and lightning appears in ſome places, be it blue or red, it is to be done as in a day ſky, drowning and loſing the whole together at the firſt forming or dead colouring, and at the finiſhing.

SECT. IV. *Of Draperies.*

To paint a blue drapery, put ultramarine near the white upon your pallet; and mix a part of the one with the other, till it makes a fine pale, and has a body. With this mixture you muſt form the brighteſt parts; and then adding more ultramarine, form ſuch as are darker; and go on after this manner till you come to the deepeſt plaits and the thickeſt ſhades, where you muſt lay pure ultramarine: and all this muſt be done as for a firſt forming or dead colouring; that is to ſay, laying the colour on with free ſtrokes of the pencil, yet as ſmooth as you can; loſing the lights in the ſhadows with a colour neither ſo pale as the light nor ſo dark as the ſhades. Then dot with the ſame colour as in the firſt forming, but a ſmall matter deeper; that the dots may be fairly ſeen. All the parts muſt be drowned one in another, and the plaits appear without interſection. When the ultramarine is not dark enough to make the deeper ſhadows, how well ſoever it be gummed, mix a little indigo with it to finiſh them. And when the extremities of the lights are not bright enough, heighten them with white and a very little ultramarine.

A drapery of carmine is done in the ſame manner as the blue; except that in the darkeſt places there is to be a lay of pure vermilion, before you dead colour with carmine, which muſt be applied at top; and in the ſtrongeſt ſhades, it muſt be gummed very much. To deepen it the more, mix a little biſtre with it.

Of Draperies.

There is likewiſe made another red drapery, which is firſt drawn with vermilion, mixing white with it to dead colour the bright places, laying it pure and unmixed for thoſe that are darker, and adding carmine for the grand ſhades. It is finiſhed afterwards, like other draperies, with the ſame colours. And when the carmine with the vermilion do not darken enough, work with the firſt alone, but only in the deepeſt of the ſhades.

A drapery of lake is made in the ſame manner with that of carmine; mixing a good deal of white with it for the bright places, and very little for thoſe that are dark. It is finiſhed likewiſe with dotting; but you have nothing to do with vermilion in it.

Violet draperies are likwiſe done after this manner; after making a mixture of carmine and ultramarine, putting always white for the bright parts. If you would have your violet be columbine or dove colour, there muſt be more carmine than ultramarine: but if you would have it bluer and deeper, put more ultramarine than carmine.

A drapery is made of a fleſh colour, beginning with a lay made of white, vermilion, and very pale lake; and making the ſhades with the ſame colours, uſing leſs white in them. This drapery muſt be very pale and tender, becauſe the ſtuff of this colour is thin and light; and even the ſhades of it ought not to be deep.

To make a yellow drapery, put a lay of maſticot over all; then one of gamboge upon that, excepting the brighteſt places, where the maſticot muſt be left entire; the dead colour with ochre, mixed with a little gamboge and maſticot, putting more or leſs of the laſt according to the ſtrength of the ſhades. And when theſe colours do not darken enough, add gall ſtone. And gall ſtone pure and unmixed is uſed for the thickeſt ſhades; mixing a little biſtre with it, if there be occaſion to make them ſtill darker. You finiſh by dotting with the ſame colours you dead-coloured with, and loſing the lights and the ſhades in one another.

If you put Naples yellow, or Dutch pink, in lieu of maſticot and gamboge, you will make another ſort of yellow.

The green drapery is made by a general lay of verditer; with which, if you find it too blue, mix maſticot for the lights, and gamboge for the ſhades. Afterwards add to this mixture lily-green or ſap-green, to ſhadow with; and as the ſhades are thicker, put more of theſe laſt greens, and even work with them pure and unmixed where they are to be extremely dark. You finiſh with the ſame colours, a little darker.

By putting more yellow, or more blue, in theſe colours, you may make different ſorts of green as you pleaſe.

To make a black drapery, you dead colour with black and white, and finiſh with the ſame colour, putting more black as the ſhades are thicker; and for the darkeſt, mix indigo with it, eſpecially when you would have the drapery appear like velvet. You may always give ſome touches with a brighter colour, to heighten the lights of any drapery whatſoever.

A white woollen drapery is made by a lay of white, in which there muſt be a very ſmall matter of ochre, orpiment, or gall ſtone, that it may look a little yellowiſh, Of Draperies.

lowiſh. Then dead-colour, and finiſh the ſhades with blue, a little black, white, and biſtre; putting a great deal of the laſt in the darkeſt.

The light gray is begun with black and white, and finiſhed with the ſame colour deeper.

For a brown drapery, make a lay of biſtre, white, and a little brown red; and ſhadow with this mixture, made a little darker.

There are other draperies, called *variable*, becauſe the lights are of a different colour from the ſhades. Theſe are moſtly uſed for the veſtments of angels, for young and gay people, for ſcarfs and other airy attire, admitting of a great many folds, and flowing at the pleaſure of the wind. The moſt common are the violets: of which they make two ſorts; one, where the lights are blue; and the other, where they are yellow.

For the firſt, put a lay of ultramarine and very pale white upon the lights; and ſhadow with carmine, ultramarine, and white, as for a drapery wholly violet; ſo that only the grand lights appear blue. Yet they muſt be dotted with violet, in which there is a great deal of white, and loſt inſenſibly in the ſhades.

The other is done by putting upon the lights only, inſtead of blue, a lay of maſticot; working the reſt as in the drapery all violet, excepting that it muſt be dotted, and the light parts blended with the ſhadowy, that is, the yellow with the violet, with a little gamboge.

The carmine red is done like the laſt; that is, let the lights be done with maſticot, and the ſhades with carmine; and to loſe the one in the other, make uſe of gamboge.

The lake red is done like that of carmine.

The green is done as the lake: always mixing verditer with lily or ſap green, to make the ſhades; which are not very dark.

Several other ſorts of draperies may be made at diſcretion, always taking care to preſerve the union of the colours, not only in one ſort of cloth or ſo, but alſo in a group of ſeveral figures; avoiding, as much as the ſubject will allow, the putting of blue near the colour of fire, of green againſt black; and ſo of other colours which cut and disjoin, and whoſe union is not kind enough.

Several other draperies are made of foul colours, as brown red, biſtre, indigo, &c. and all in the ſame manner. Likewiſe of other colours, ſimple and compound; the agreement between which is always to be minded, that the mixture may produce nothing harſh and diſagreeable to the eye. No certain rule can be laid down for this. The force and effect of your colours are only to be known from uſe and experience, and you muſt work according to that knowledge.

Linen cloths are done thus: After drawing the plaits or folds, as is done in a drapery, put a lay of white over all; then dead colour, and finiſh the ſhades with a mixture of ultramarine, black, and white, uſing more or leſs of the laſt, according to their ſtrength or tenderneſs; and in the greateſt deepenings put biſtre, mixed with a little white; giving only ſome touches of this mixture, and even of pure biſtre, upon the extremities of the greateſt ſhadows, where the folds muſt be drawn, and loſt with the reſt.

Of Draperies.

They may be done in another manner, by making a general lay of this mixture of ultramarine, black, and very pale white; and dead colour (as has been ſaid before) with the ſame colour, but a little deeper. And when the ſhades are dotted and finiſhed, heighten the lights with pure white, and loſe them with the deepenings of the linen. But of whatever ſort you make them, when they are finiſhed, you muſt give a yellowiſh teint of orpiment and white to certain places; laying it lightly on, and as it were in water; ſo that what is underneath may, notwithſtanding, plainly appear, as well the ſhadows as the dotting.

Yellow linen cloth is done by putting a lay of white, mixed with a little ochre. Then form and finiſh the ſhades with biſtre, mixed with white and ochre; and in the thickeſt ſhades uſe pure biſtre; and before you finiſh, give ſome teints here and there of ochre and white, and others of white and ultramarine, as well upon the ſhades as the lights; but let them be very bright: and drown the whole together in dotting, and it will look finely. As you finiſh, heighten the extremities of the lights with maſticot and white. You may add to this ſort of linen, as well as to the white, certain bars from ſpace to ſpace, as in Turkey mantuas; that is, ſmall ſtripes blue and red with ultramarine and carmine; one of red between two of blue, very bright and clear upon the lights, and deeper upon the ſhades. Virgins are pretty often dreſſed with veils of this ſort (by Popiſh painters), and ſcarfs of this kind are put about necks that are bare; becauſe they become the teint mighty well.

If you would have both theſe ſorts of linen tranſparent, and the ſtuff or other thing that is beneath appear through them, make the firſt lay for them very light and clear, and mix in the colour to ſhadow with, a little of that which is underneath, eſpecially towards the end of the ſhades; and only do the extremities of the lights, for the yellow, with maſticot and white; and for the white, with pure white.

They may be done in another manner, eſpecially when you would have them altogether as clear as muſlin, lawn, or gauze. To this end form and finiſh what is to be beneath, as if nothing was to be put over it. Then mark out the light and clear folds with white or maſticot; and a ſhadowy with biſtre and white, or with black, blue, and white, according to the colour you would make them off; making the reſt ſomewhat fainter: yet this is not neceſſary but for the parts that are not to be ſo clear.

Crape is done the ſame way; excepting that the folds of the ſhades and the lights, and the borders too, are to be marked out with little filaments of black upon what is underneath; which is likewiſe to be finiſhed beforehand.

When you would make a ſtuff like a watered tabby, make the waves upon it with a colour a little lighter, or a little darker, in the lights and the ſhades.

There is a manner of touching draperies which diſtinguiſhes the ſilken from the woollen. The laſt are more terreſtrial and ſenſible; the others more light and fading. But it muſt be obſerved, that this is an effect which depends partly upon the ſtuff and partly upon the colour; and for the employing theſe in a manner ſuitable to the ſubjects and the deepenings of

painting,

painting, we ſhall here touch upon their different qualities.

We have no colour which partakes more of light, nor which comes nearer the air, than white; which ſhows it to be fickle and fleeting. It may, nevertheleſs, be held and brought to by ſome neighbouring colour, more heavy and ſenſible, or by mixing them together.

Blue is a moſt fleeting colour: and ſo we ſee, that the ſky and the remoteſt views of a picture are of this colour; but it will become lighter and fickler in proportion as it is mixed with white.

Pure black is the heavieſt and moſt terreſtrial of all colours; and the more of it you mix with others, the nearer you bring them to the eye.

Nevertheleſs, the different diſpoſitions of black and white make alſo their effects different: for white often makes black diſappear, and black brings white more into view; as in the reflection of globes, or other figures to be made round, where there are always parts that fly as it were from the eye, and deceive it by the craft of art: and under the white are here comprehended all the light colours; as under the black, all the heavy colours.

Ultramarine is then ſoft and light.

Ochre is not ſo much ſo.

Maſticot is very light; and ſo is verditer.

Vermilion and carmine come near this quality.

Orpiment and gamboge not ſo near.

Lake holds a certain mean, rather ſoft than rough.

Dutch pink is an indifferent colour, eaſily taking the quality of others. So it is made terreſtrial by mixing it with colours that are ſo; and, on the contrary, the moſt light and fleeting by joining it with white or blue.

Brown red, umber, dark greens, and biſtre, are the heavieſt and moſt terreſtrial, next to black.

Skilful painters, who underſtand perſpective, and the harmony of colours, always obſerve to place the dark and ſenſible colours on the fore parts of their pictures; and the moſt light and fleeting they uſe for the diſtances and remote views. And as for the union of colours, the different mixtures that may be made of them will learn you the friendſhip or antipathy they have to one another. And upon this you muſt take your meaſures for placing them with ſuch agreement as ſhall pleaſe the eye.

For the doing of lace, French points, or other things of that nature, put over all a lay of blue, black, and white, as for linen; then heighten the flowerwork with pure white: afterwards make the ſhades above with the firſt colour, and finiſh them with the ſame. When they are upon the carnation or naked parts of a picture, or upon any thing elſe that you would ſhow through another, finiſh what is beneath, as if nothing was to be put over it: and at top, make the points or lace with pure white, ſhadowing and finiſhing them with the other mixture.

If you would paint a fur, you muſt begin with a kind of drapery, done, if it be dark, with biſtre and white, making the ſhadowings of the ſame colour, with leſs white. If the fur be white, do it with blue, white, and a little biſtre. And when this beginning, or firſt forming, is done, inſtead of dotting, draw ſmall ſtrokes, turning, now in one manner, now in another, according to the courſe and flatting of the hair. Heighten the lights of dark furs with ochre and white, and of the other with white and a little blue.

For doing a building, if it be of ſtone, take indigo, biſtre, and white, with which make the beginning or firſt form of it: and for ſhadowing it, put leſs of this laſt; and more biſtre than indigo, according to the colour of the ſtone you would paint. To theſe you may likewiſe add a little ochre, both for the forming and the finiſhing. But to make it finer, you muſt give, here and there, eſpecially for old fabrics, blue and yellow teints, ſome with ochre, others with ultramarine, mixing always white with them, whether before the firſt forming, provided they appear through the draught, or whether upon it, loſing or drowning them with the reſt when you finiſh.

When the building is of wood, as there are many ſorts, it is done at diſcretion; but the moſt ordinary way is to begin or firſt form with ochre, biſtre, and white, and finiſh without white, or with very little; and if the ſhades are deep, with pure biſtre. In the other they add ſometimes vermilion, ſometimes green or black; in a word, juſt according to the colour they would give it; and they finiſh with dotting, as in draperies and every thing elſe.

SECT. V. *Of Carnations, or the naked parts of a Painting.*

THERE are in carnation ſo many different colourings, that it would be a difficult thing to give general rules upon ſo variable a ſubject. Nor are they minded, when one has got, by cuſtom and practice, ſome habit of working eaſily: and ſuch as are arrived to this degree, employ themſelves in copying their originals, or elſe they work upon their ideas, without knowing how: inſomuch, that the moſt ſkilful, who do it with leſs reflection and pains than others, would likewiſe be more put to it to give an account of their maxims and knowledge in the matter of painting, if they were to be aſked what colours they made uſe of for ſuch and ſuch a colouring, a teint here, and another there.

Nevertheleſs, as beginners want ſome inſtruction at the firſt, we will ſhow in general after what manner ſeveral carnations are to be done.

In the firſt place, After having drawn your figure with carmine, and ordered your piece, apply for women and children, and generally for all tender colourings, a lay of white, mixed with a very little of the blue made for faces, of which we have told the compoſition; but let it hardly be ſeen.

And for men, inſtead of blue, they put in this firſt lay a little vermilion; and when they are old, a little ochre is mixed with it.

Afterwards follow all the traces with vermilion, carmine, and white, mixed together; and begin all the ſhades with this mixture, adding white in proportion as they are weaker; and putting but little in the darkeſt, and none, in a manner, in certain places where ſtrong touches are to be given: for inſtance, in the corner of the eye; under the noſe; at the ears; under the chin; in the ſeparations of the fingers; in all joints; at the corners of the nails; and generally in every part where you would mark out ſeparations in ſhades that are obſcure. Neither need you fear to give to thoſe places all the force and ſtrength they ought to have as ſoon as you begin or firſt form them, becauſe in working at top with green, the red you have put there is always weakened.

After having begun, or firſt formed, or dead-coloured, with red, make blue teints with ultramarine and a great deal of white, upon the parts which fly from the eye; that is to ſay, upon the temples; under and in the corners of the eyes; on both ſides the mouth, above and below; a little upon the middle of the forehead; between the noſe and the eyes; on the ſide of the cheeks; on the neck and other places where the fleſh aſſumes a bluiſh caſt. Yellowiſh teints are likewiſe made with ochre or orpiment, and a little vermilion mixed with white, under the eyebrows, on the ſides of the noſe towards the bottom, a little underneath the cheeks, and upon the other parts which riſe and come nearer the eye. It is eſpecially from theſe teints that the natural complexion is to be obſerved, in order to catch it; for painting being an imitation of nature, the perfection of the art conſiſts in the juſtneſs and ſimplicity of the repreſentation, eſpecially in face painting.

When, therefore, you have done your firſt lay, your dead-colouring, and your teints, you muſt work upon the ſhades, dotting with green for the carnations or naked parts, mixing, according to the rule we have given for the teints, a little blue for the parts which fly from the eye; and, on the other hand, making it a little yellower for thoſe that are more ſenſible; that is to ſay, which riſe, and come nearer the eye: and at the end of the ſhades, on the ſide of the light, you muſt blend and loſe your colour inſenſibly in the ground of the carnation with blue, and then with red, according to the places where you paint. If this mixture of green does not work dark enough at firſt, paſs over the ſhades ſeveral times, now with red, and now with green; always dotting: and this do till they are as they ſhould be.

And if you cannot with theſe colours give the ſhades all the force they ought to have, finiſh, in the darkeſt, with biſtre mixed with orpiment, ochre, or vermilion, and ſometimes with pure biſtre, according to the colouring you would make, but lightly, laying on your colour very clear.

You muſt dot upon the clear and bright places with a little vermilion or carmine, mixed with much white, and a very ſmall matter of ochre, in order to loſe them with the ſhadowy, and to make the teints die away inſenſibly into one another; taking care, as you dot, or hatch, to make your ſtrokes follow the turnings and windings of the fleſhy parts. For though the rule be to croſs always, this dotting or hatching ought to appear a little more here, becauſe it rounds the parts. And as this mixture might make a colouring too red, if it was always to be uſed, they work likewiſe in every part, to blend the teints and the ſhades with blue and a little green, and much white, ſo mixed as to be very pale; excepting, nevertheleſs, that this colour muſt not be put upon the cheeks, nor upon the extremities of the clear parts, no more than the other mixture upon theſe laſt, which muſt be left with all their light; as certain places of the chin, of the noſe, and of the forehead, and upon the cheeks; which, and the cheeks, ought nevertheleſs to be redder than the reſt, as well as the feet, the hollows of the hands, and the fingers of both.

Obſerve, that theſe two laſt mixtures ought to be ſo pale, that the work ſhall hardly be viſible; for they ſerve only to ſoften it; to unite the teints with one another, and the ſhades with the lights, and to drown the traces. Care muſt likewiſe be taken that you work not too much with the red mixture upon the blue teints, nor with the blue upon the others; but change the colour from time to time, when you perceive it works too blue or too red, till the work be finiſhed.

The white of the eyes muſt be ſhadowed with this ſame blue, and a little fleſh colour; and the corners, on the ſide of the noſe, with vermilion and white; giving them a little touch of carmine. The whole is ſoftened with this mixture of vermilion, carmine, white, and a very ſmall matter of ochre.

The apples or balls of the eyes are done with the mixture of ultramarine and white; the laſt prevailing a little; adding a little biſtre, if they are yellowiſh; or a little black, if they are gray. Make the little black circle in the middle, called the *cryſtal of the eye*; and ſhadow the balls with indigo, biſtre, or black, according to the colour they are of; giving to each a ſmall touch of pure vermilion round the cryſtal; which muſt be loſt with the reſt at the finiſhing. This gives vivacity to the eye.

The round or circumference of the eye is done with biſtre and carmine; that is to ſay, the ſlits or partings, and the eyelids, when they are large and bold; eſpecially the upper ones; which muſt afterwards be ſoftened with the red or blue mixtures we have mentioned before, to the end they may be loſt in one another, and nothing ſeem interſected. When this is done, give a little touch of pure white upon the cryſtal, on the ſide of the lights. This makes the eye ſhine, and gives life to it.

The mouth is dead-coloured with vermilion, mixed with white; and finiſhed with carmine, which is ſoftened as the reſt. And when the carmine does not work dark enough, mix a little biſtre with it. This is to be underſtood of the corners in the ſeparation of the lips; and particularly, of certain mouths half open.

The hands, and all the other parts of carnation, are done in the ſame manner as the faces; obſerving, that the ends of the fingers be a little redder than the reſt. When your whole work is formed and dotted, mark the ſeparations of all the parts with little touches of carmine and orpiment mixed together, as well in the ſhadowy as the light places; but a little deeper and ſtronger in the firſt, and loſe them in the reſt of the carnation.

The eyebrows and the beard are dead-coloured, as are the ſhades of carnations; and finiſhed with biſtre, ochre, or black, according to the colour they are of, drawing them by little ſtrokes the way they ought to go; that is to ſay, give them all the nature of hair. The lights of them muſt be heightened with ochre and biſtre, a little vermilion, and much white.

For the hair of the head, make a lay of biſtre, ochre, and white, and a little vermilion. When it is very dark coloured, uſe black inſtead of ochre. Afterwards form the ſhadowy parts with the ſame colours, putting leſs

Of Carnations.

leſs white in them; and finiſh with pure biſtre, or mixed with ochre or black, by ſmall ſtrokes very fine, and cloſe to each other, waving and buckling them according to the curling of the hair. The light parts muſt alſo be heightened by little ſtrokes with ochre or orpiment, white, and a little vermilion. After which, loſe the lights and the ſhades in each other, by working ſometimes with a dark and ſometimes with a light colour.

And for the hair about the forehead, through which the ſkin is ſeen, it muſt be firſt formed with the colour thereof, and that of the carnation, working and ſhadowing with one and the other, as if you deſigned to paint none. Then form it, and finiſh with biſtre. The lights are to be heightened as the other. Gray hair is dead-coloured with white, black, and biſtre, and finiſhed with the ſame colour, but deeper; heightening the bright and clear parts of the hair, as well as thoſe of the eyebrows and the beard, with white and very pale blue, after having formed them as the others, with the colour of the fleſh or ſkin; and finiſh with biſtre.

But the moſt important thing is to ſoften one's work; to blend the teints in one another, as well as the beard and the hair about the forehead, with the other hair and the carnation; taking eſpecial care not to work rough and dry; and that the traces, turnings, and windings of the carnation or naked parts, be not interſected. You muſt likewiſe accuſtom yourſelf to put white in your colours only in proportion as you work lighter or darker; for the colour you uſe the ſecond time muſt be always a little ſtronger and deeper than the firſt, unleſs it be for ſoftening.

Different colourings are eaſily made, by putting more or leſs of red, or blue, or yellow, or biſtre, whether for the dead-colouring, or for the finiſhing.—That for women ought to be bluiſh; that for children a little red; and both freſh and florid. That for men ought to be yellower; eſpecially when they are old.

To make a colouring of death, there muſt be a firſt lay of white and orpiment, or a very pale ochre: dead-colour with vermilion, and lake, inſtead of carmine, and a good deal of white; and afterwards work over it with a green mixture, in which there is more blue than any other colour, to the end the fleſh may be livid and of a purple colour. The tints are done the ſame way as in another colouring; but there muſt be a great many more blue than yellow ones, eſpecially upon the parts which fly from the ſight, and about the eyes; and the laſt are only to be upon the parts which riſe and come nearer the eye. They are made to die away in one another, according to the ordinary manner; ſometimes with very pale blue, and ſometimes with ochre and white, and a little vermilion; ſoftening the whole together. The parts and contours muſt be rounded with the ſame colours. The mouth is to be, in a manner, of a quite violet. It is dead-coloured, however, with a little vermilion, ochre, and white; but finiſhed with lake and blue; and to give it the deep ſtrokes, they take biſtre and lake, with which they likewiſe do the ſame to the eyes, the noſe, and the ears. If it be a crucifix, or ſome martyr, upon whom blood is to be ſeen, after the finiſhing the carnation, form it with vermilion, and finiſh it with carmine, making in the drops of blood a little bright reflecting ſpark, to round them. For the crown of thorns, make a lay of ſea-green and maſticot; ſhadow it with biſtre and green; and heighten the clear and light parts with maſticot.

Iron is formed, or firſt laid, with indigo, a little black and white; and finiſhed with pure indigo, heightening it with white.

For painting fire and flames, the lights are done with maſticot and orpiment; and for the ſhades, they mix vermilion and carmine.

A ſmoke is done with black, indigo, and white, and ſometimes with biſtre; one may likewiſe add vermilion or ochre, according to the colour it is to be of.

Pearls are painted by putting a lay of white, and a little blue: they are ſhadowed and rounded with the ſame colour, deeper; a ſmall white dot is made almoſt in the middle on the ſide of the light; and on the other ſide, between the ſhadow and the edge of the pearl, they give a touch with maſticot, to make the reflection; and under the pearls is made a little ſhadow of the colour of the ground they are upon.

Diamonds are made with pure black; then they heighten them with little touches of white on the ſide of the light. It is the ſame thing for any other jewels you have a mind to paint: there is nothing to be done but to change the colour.

For making a figure of gold, put a lay of ſhell-gold, and ſhadow it with gallſtone. Silver is done the ſame way; excepting that it muſt be ſhadowed with indigo.

One great means of acquiring a perfection in the art, is to copy excellent originals. We enjoy with pleaſure and tranquillity the labour and pains of others. But a man muſt copy a great number before he is able to produce as fine effects; and it is better to be a good copier than a bad author.

Sect. VI. *Of Landſcapes.*

Of Landſcapes.

In the firſt place, After having ordered the economy of your landſcape as of your other pieces, you muſt form the neareſt grounds or lands, when they are to appear dark, with ſap or lily-green, biſtre, and a little verditer, to give a body to your colour; then dot with this mixture, but a little darker, adding ſometimes a little black to it.

For ſuch pieces of ground as the light falls upon, and which are therefore clear and bright, make a lay of ochre and white, then ſhadow and finiſh with biſtre. In ſome they mix a little green, particularly for ſhadowing and finiſhing.

There are ſometimes upon the fore part certain reddiſh lands; which are dead-coloured with brown-red, white, and a little green; and finiſhed with the ſame, putting a little more green in them.

For the making of graſs and leaves upon the foreground, you muſt, when that is finiſhed, form with ſea-green, or verditer, and a little white; and for thoſe that are yellowiſh, mix maſticot. Afterwards ſhadow them with lily-green, or biſtre and gallſtone, if you would have them appear withered.

The grounds or lands at a little diſtance are formed with

Of Landſcapes.

with verditer, and ſhadowed and finiſhed with ſap-green, adding biſtre for ſome of the touches here and there.

Such as are at a greater diſtance, are done with ſea-green and a little blue; and ſhadowed with verditer.

In a word, the farther they go, the more bluiſh they are to be made; and the fartheſt diſtance ought to be of ultramarine and white; mixing in ſome places ſmall touches of vermilion.

Water is painted with indigo and white, and ſhadowed with the ſame colour, but deeper; and to finiſh it, inſtead of dotting, they do nothing but make ſtrokes and traces without croſſing; giving them the ſame turn with the waves, when there are any. Sometimes a little green muſt be mixed in certain places, and the light and clear parts heightened with pure white, particularly where the water foams.

Rocks are dead-coloured like buildings of ſtone; excepting that a little green is mixed for forming and ſhadowing them. Blue and yellow teints are made upon them, and loſt with the reſt in finiſhing. And when there are ſmall branches, with leaves, moſs, or graſs, when all is finiſhed, they are to be raiſed at top with green and maſticot. They may be made yellow, green, and reddiſh, for appearing dry in the ſame manner as on the ground. Rocks are dotted as the reſt; and the farther they are off the more grayiſh they are made.

Caſtles, old houſes, and other buildings of ſtone and wood, are done in the manner above mentioned; ſpeaking of thoſe things, when they are upon the firſt lines. But when you would have them appear at a diſtance, you muſt mix brown-red and vermilion, with much white; and ſhadow very tenderly with this mixture; and the farther they are off, the weaker are the ſtrokes to be for the ſeparations. If they are covered with ſlate, it is to be made bluer than the reſt.

Trees are not done till the ſky be finiſhed; one may, nevertheleſs, ſpare the places of them when they contain a good number; and however it be, ſuch as come near the eye, are to be dead-coloured with verditer, mixing ſometimes ochre; and ſhadowed with the ſame colours, adding lily-green. Afterwards you muſt work leaves upon them by dotting without croſſing: for this muſt be done with ſmall longiſh dots, of a darker colour, and pretty full of it, which muſt be conducted on the ſide the branches go, by little tufts of a little darker colour. Then heighten the lights with verditer or ſea-green, and maſticot, making leaves in the ſame manner; and when there are dry branches or leaves, they are dead-coloured with brown-red or gallſtone, with white; and finiſhed with gallſtone, without white, or with biſtre.

The trunks of trees are to be dead-coloured with ochre, white, and a little green, for the light and clear parts; and for the dark, they mix black, adding biſtre and green for ſhadowing one and the other.—Blue and yellow tints are likewiſe made upon them and little touches given here and there with white and maſticot; ſuch as you ordinarily ſee upon the bark of trees.

The branches which appear among the leaves are done with ochre, verditer, and white; or with biſtre and white; according to the light they are placed in. They muſt be ſhadowed with biſtre and lily-green.

Trees, which are at a little diſtance, are dead-coloured with verditer and ſea-green; and are ſhadowed and finiſhed with the ſame colours, mixed with lily-green. When there are ſome which appear yellowiſh, lay with ochre and white, and finiſh with gallſtone.

For ſuch as are in the diſtances and remote views, you muſt dead-colour with ſea-green; with which, for finiſhing, you muſt mix ultramarine. Heighten the lights of one and the other with maſticot, by ſmall diſjoined leaves.

It is the moſt difficult part of landſcape, in manner of miniature, to leaf a tree well. To learn, and break one's hand to it a little, the way is to copy good ones; for the manner of touching them is ſingular, and cannot be acquired but by working upon trees themſelves; about which you muſt obſerve to make little boughs, which muſt be leafed, eſpecially ſuch as are below and toward the ſky.

And generally, let your landſcapes be coloured in a handſome manner, and full of nature and truth; for it is that which gives them all their beauty.

Of Flowers.

SECT. VII. *Of Flowers.*

IT is an agreeable thing to paint flowers, not only on account of the ſplendour of their different colours, but alſo by reaſon of the little time and pains that are beſtowed in trimming them. There is nothing but delight in it; and, in a manner, no application. You maim and bungle a face, if you make one eye higher than another; a ſmall noſe with a large mouth; and ſo of other parts. But the fears of theſe diſproportions conſtrain not the mind at all in flower painting; for unleſs they be very remarkable, they ſpoil nothing. For this reaſon, moſt perſons of quality, who divert themſelves with painting, keep to flowers. Nevertheleſs, you muſt apply yourſelf to copy juſtly; and for this part of miniature, as for the reſt, we refer you to nature, for ſhe is your beſt model. Work, then, after natural flowers; and look for the tints and different colours of them upon your pallet: a little uſe will make you find them eaſily; and to facilitate this to you at the firſt, we ſhall, in the continuance of our deſign, ſhow the manner of painting ſome; for natural flowers are not always to be had; and one is often obliged to work after prints, where nothing is ſeen but graving.

It is a general rule, that flowers are deſigned and laid like other figures; but the manner of forming and finiſhing them is different: for they are firſt formed only by large ſtrokes and traces, which you muſt turn at the firſt the way the ſmall ones are to go, with which you finiſh; this turning aiding much thereto. And for finiſhing them, inſtead of hatching or dotting, you draw ſmall ſtrokes very fine, and very cloſe to one another, without croſſing; repaſſing ſeveral times, till your dark and your clear parts have all the force you would give them.

Of Roses.—After making your firſt ſketch, draw with carmine the red roſe, and apply a very pale lay of carmine and white. Then form the ſhades with the ſame colour, putting leſs white in it: and laſtly, with pure

Of lowers.

Of Flowers.

pure carmine, but very bright and clear at the firſt; fortifying it more and more as you proceed in your work, and according to the darkneſs of the ſhades. This is done by large ſtrokes. Then finiſh; working upon it with the ſame colour by little ſtrokes, which you muſt make go the ſame way with thoſe of the graving, if it be a print you copy; or the way the leaves of the roſe turn, if you copy after a painting, or after nature; loſing the dark in the clear parts, and heightening the greateſt lights, and the brighteſt or moſt lightſome leaves, with white and a little carmine. You muſt always make the hearts of roſes, and the ſide of the ſhadow darker than the reſt; and mix a little indigo for ſhadowing the firſt leaves, particularly when the roſes are blown, to make them ſeem faded. The ſeed is dead-coloured with gamboge; with which a little ſap green is mixed for ſhadowing. Roſes ſtreaked with ſeveral colours, ought to be paler than others, that the mixture of colours may be better ſeen; which are done with carmine; a little darker in the ſhades, and very clear in the lights; always hatching by ſtrokes. For white roſes you muſt put a lay of white, and form and finiſh them as the red; but with black, white, and a little biſtre; and make the ſeed a little yellower. Yellow roſes are done by putting in every part a lay of maſticot, and ſhadowing them with gamboge, gallſtone, and biſtre; heightening the clear and light places with maſticot and white.

The ſtiles, the leaves, and the buds of all ſorts of roſes are formed with verditer, with which is mixed a little maſticot and gamboge; and for ſhadowing them, they add ſap green, putting leſs of the other colours when the ſhades are deep. The outſide of the leaves ought to be bluer than the inſide; wherefore it muſt be dead-coloured with ſea green, and ſap green mixed with that for ſhadowing, making the veins or fibres on this ſide clearer than the ground, and thoſe on the other ſide darker. The prickles which are upon the ſtiles and buds of roſes, are done with little touches of carmine, which are made to go every way; and for thoſe that are upon the ſtalks, they are formed with verditer and carmine, and ſhadowed with carmine and biſtre: making the bottom of the ſtalks more reddiſh than the top, i. e. you muſt mix with the green carmine and pure biſtre.

Of Tulips.—As there is an infinity of tulips, different from one another, one cannot pretend to mention the colours with which they are all done. We will only touch upon the handſomeſt, called *ſtreaked;* and theſe ſtreaks are dead-coloured with very clear carmine in ſome places, and with darker than others; finiſhing with the ſame colour by little ſtrokes, which muſt be carried the ſame way with the ſtreaks. And in others is put firſt a lay of vermilion. Then they form them by mixing carmine, and finiſh them with pure carmine. In ſome they put Florence lake over the vermilion inſtead of carmine. Some are done with lake and carmine mixed together, and with lake alone, or with white and lake for the firſt forming; whether it be roſepink or Florence lake. There are ſome of a purple colour, which are formed with ultramarine, carmine, or lake, ſometimes bluer and ſometimes redder. The manner of doing both one and the other is the ſame; there is no difference but in the colours. You muſt, in certain places, as between the ſtreaks of vermilion, carmine, or lake, ſometimes put blue made of ultramarine and white, and ſometimes a very bright purple, which is finiſhed by ſtrokes as the reſt, and loſt with the ſtreaks. There are ſome likewiſe that have ſallow tints, that are made with lake, biſtre, and ochre, according as they are: but this is only in fine and rare tulips, and not in the common ones. For ſhadowing the bottom of them, they ordinarily take indigo and white for ſuch whoſe ſtreaks are of carmine. For ſuch as are of lake, they take black and white; with which, in ſome, biſtre is mixed, and in others green. Some are likewiſe to be ſhadowed with gamboge and umber, and always by ſtrokes and traces, that turn as the leaves turn. Other tulips are likewiſe done, called *bordered;* that is to ſay, the tulip is not ſtreaked but on the edges of the leaves, where there is a border. It is white in the purple; red in the yellow; yellow in the red; and red in the white. The purple is laid with ultramarine, carmine, and white; ſhadowing and finiſhing it with this mixture. The border is ſpared; that is to ſay, let only a light lay of white be put there, and let it be ſhadowed with very bright indigo. The yellow is formed with gamboge, and ſhadowed with the ſame colour, mixing ochre and umber or biſtre with it. The border is laid with vermilion, and finiſhed with a very ſmall matter of carmine. The red is formed with vermilion, and finiſhed with the ſame colour, mixing carmine or lake with it. The bottom and the border are done with gamboge; and for finiſhing, they add gallſtone and umber, or biſtre. The white is ſhadowed with black, blue, and white. Indian ink is very proper for this. The ſhadowings of it are very tender. It produces alone the effect of blue and white, mixed with the other black. The border of this white tulip is done with carmine. In all theſe ſorts of tulips, they leave a nerve or ſinew in the middle of the leaves that are brighter than the reſt; and the borders are drowned at the bottom by ſmall traces, turning croſſwiſe; for they muſt not appear cut and ſeparated, as the ſtreaked or party-coloured. They make them likewiſe of ſeveral other colours. When they happen to be ſuch whoſe bottoms on the inſide are black, as it were, they form and finiſh them with indigo, as alſo the ſeed about the nozzle or ſtalk. And if the bottom is yellow, it is formed with gamboge, and finiſhed by adding umber or biſtre. The leaves and the ſtalks of tulips are ordinarily formed with ſea green, and ſhadowed and finiſhed with lily green, by large traces all along the leaves. Some may likewiſe be done with verditer, mixing maſticot with it, and ſhadowed with ſap green, that the green of the ſhades may be yellower.

The Anemony, or *Wind flower.*—There are ſeveral ſorts of them, as well double as ſingle. The laſt are ordinarily without ſtreaks. Some are made of a purple colour, with purple and white, ſhadowing them with the ſame colour; ſome redder, others bluer; ſometimes very pale, and ſometimes very dark. Others are formed with lake and white, and finiſhed with the ſame, putting leſs white; ſome without any white at all. Others are formed with vermilion, and ſhadowed with the ſame colour; adding carmine. We ſee likewiſe white ones, and ſome of a citron colour. The laſt are laid with maſticot; and one and the other ſhadowed and finiſhed ſometimes with vermilion, and ſometimes with very brown lake, eſpecially near the ſeed, at the bottom; which is often likewiſe of a blackiſh colour, that is done with indigo, or black and blue, mixing for ſome a little biſtre; and always working by very fine ſtrokes and traces, and loſing the lights in the ſhades. There are others that are brighter and clearer at the bottom than anywhere elſe; and ſometimes they are perfectly white there, though the reſt of the flower be dark. The ſeed of all theſe anemonies is done with indigo and black, with a very little white, and ſhadowed with indigo; and in ſome it is raiſed with maſticot. The double anemonies are of ſeveral colours. The handſomeſt have their large leaves ſtreaked. Some are done, that is, the ſtreaked or party coloured, with vermilion, to which carmine is added for the finiſhing; ſhadowing the reſt of the leaves with indigo; and for the ſmall leaves within, a lay is put of vermilion and white, and they are ſhadowed with vermilion mixed with carmine, mixing here and there ſome ſtronger touches, eſpecially in the heart of the flower, next the great leaves on the ſide of the ſhadow. They finiſh with carmine, by little ſtrokes and traces, turning the ſame way with the mixed or party colours, and the leaves. They form and finiſh the ſtreaks or party colours of ſome others, as well as the ſmall leaves, with pure carmine; leaving, nevertheleſs, in the middle of the laſt, a little circle, in which is laid dark purple, which is loſt with the reſt. And when all is finiſhed, they give ſome touches with this ſame colour round about the ſmall leaves, eſpecially on the ſide of the ſhadow, drowning them with the large ones, the remainder of which is ſhadowed either with indigo or black. In ſome, the ſmall leaves are done with lake or purple, though the party colours of the large ones be done with carmine. There are others, whoſe mixed colours are done with carmine, in the middle of moſt of the large leaves; putting in ſome places vermilion underneath, and loſing theſe colours with the ſhadows of the bottom; which are done with indigo and white. The ſmall leaves are laid with maſticot, and ſhadowed with very dark carmine on the ſide of the ſhade, and with very clear on the ſide of the light, leaving there in a manner pure maſticot, and giving only ſome little touches with orpiment and carmine, to ſeparate the leaves, which may be ſhadowed ſometimes with a very little pale green. There are double anemonies painted all red, and all purple. The firſt are formed with vermilion and carmine, in a manner without white, and ſhadowed with pure carmine, well gummed, that they may be very dark. Purple anemonies are laid with purple, and white, and finiſhed with white. In a word, there are double anemonies as there are ſingle ones, of all colours; and they are done in the ſame manner. The green of one and the other is verditer; with which maſticot is mixed for forming. It is ſhadowed and finiſhed with ſap green. The ſtiles of them are a little reddiſh; wherefore they are ſhadowed with carmine mixed with biſtre, and ſometimes with green, after having laid them with maſticot.

The Carnation and the Pink.—It is with pinks and carnations as with anemonies and tulips; that is, there are ſome mixt-coloured, and others of one ſingle colour. The firſt are ſtreaked and diverſified ſometimes with vermilion and carmine; ſometimes with pure lake, or with white; ſome ſtreaks very dark, and others very pale; ſometimes by little ſtreaks and diverſifications, and ſometimes by large ones. Their bottoms are ordinarily ſhadowed with indigo and white. There are pinks of a very pale fleſh colour, and ſtreaked and diverſified with another, a little deeper, made with vermilion and lake. Others, which are of lake and white, are ſhadowed and ſtreaked without white. Others all red, which are done with vermilion and carmine as dark as poſſible. Others all of lake. And, laſtly, there are others, wherein nature or fancy is the rule. The green of one and the other is ſea green, ſhadowed with lily green or ſap green.

The Red Lily.—It is laid with red lead, formed with vermilion, and in the deepeſt of the ſhades with carmine; and finiſhed with the ſame colour by ſtrokes and traces, turning as the leaves turn. The clear and light parts are heightened with red lead and white. The ſeed is done with vermilion and carmine. The green parts are done with verditer, ſhadowed with lily or ſap green.

The Day Lily.—There are three ſorts of them:

1. The gridelin, a little red;
2. The gridelin, very pale; and,
3. The white.

For the firſt they put a lay of lake and white, and ſhadow and finiſh with the ſame colour deeper; mixing a little black to deaden it, eſpecially in the darkeſt places.

The ſecond are laid with white, mixed with a very little lake and vermilion, in ſuch a manner that theſe two laſt colours are hardly ſeen. Afterwards they ſhadow with black and a little lake, working redder in the middle of the leaves, next the ſtalks; which ought to be, as alſo the ſeed, of the ſame colour, particularly towards the top; and at the bottom a little greener.

The ſtile of the ſeed is laid with maſticot, and ſhadowed with ſap green.

The other day lilies are done by putting a lay of pure white, and ſhadowing and finiſhing with black and white.

The ſtalks of theſe laſt, and the greens of them all, are done with ſea green, and ſhadowed with ſap green.

The Hyacinth, or *Purple-flower*.—There are four ſorts of them:

The blue, a little dark;
Others paler;
The gridelin;
And the white.

The firſt are laid with ultramarine and white; and ſhadowed and finiſhed with leſs white. Others are laid and ſhadowed with pale blue. The gridelines are formed with lake and white, and a very ſmall matter of ultramarine; and finiſhed with the ſame colour a little deeper. For the laſt they put a lay of white; then they ſhadow them with black, with a little white; and finiſh them all by ſtrokes and traces, following the turnings and windings of the leaves. The green and the ſtalks of ſuch as are blue, are done with ſea and lily green very dark: and in the ſtalks of the firſt may be mixed a little carmine, to make them reddiſh. The ſtalks of the two others, as alſo the green, are

Of Flowers.

are formed with verditer and maiſtcot, and ſhadowed with ſap green.

The Piony.—A lay of Venice lake and white muſt be put on all parts, pretty ſtrong: then ſhadow with leſs white, and with none at all in the darkeſt places: after which finiſh with the ſame colour by traces, turning them as for the roſe; gumming it very much in the deepeſt of the ſhades; and raiſing the lights and the edges of the moſt lightſome leaves with white and a little lake. Little veins are likewiſe made, which go like the ſtrokes in hatching, but are more viſible. The green of this flower is done with ſea green, and ſhadowed with ſap green.

Cowslips.—They are of four or five colours. There are ſome of a very pale purple.

The gridelin. The white and the yellow.

The purple is done with ultramarine, carmine, and white; putting leſs white for ſhadowing. The gridelin is laid with Venice lake, and a very ſmall matter of ultramarine, with much white; and ſhadowed with the ſame colour deeper. For the white a lay of white muſt be put; and they muſt be ſhadowed with black and white; and finiſhed, as the others, by traces or ſtrokes. The heart of theſe cowſlips is done with maſticot in the ſhape of a ſtar, which is ſhadowed with gamboge, making a little circle in the middle with ſap green. The yellow are laid with maſticot, and ſhadowed with gamboge and umber. The ſtiles, the leaves, and the buds, are formed with verditer, mixed with a little maſticot, and finiſhed with ſap green; making the fibres or veins, which appear upon the leaves, with this ſame colour; and heightening the lights of the largeſt with maſticot.

The Ranunculus, or *Crow-foot.*—There are ſeveral ſorts of them: the fineſt are the orange-coloured. For the firſt, they put a lay of vermilion, with a very ſmall matter of gamboge; and add carmine for ſhadowing; finiſhing it with this laſt colour, and a little gallſtone. In the others may be put Venice lake inſtead of carmine, eſpecially in the heart of the flower. The orange-coloured are laid with gamboge, and finiſhed with gallſtone, vermilion, and a little carmine; leaving ſome little yellow ſtreaks. The green of the ſtalks is done with verditer and very pale maſticot; mixing lily green to ſhadow them. That of the leaves is a little darker.

The Crocus.—Theſe are of two colours:

Yellow and purple. The yellow are formed with maſticot and gallſtone, and ſhadowed with gamboge and gallſtone: after which, upon each leaf, on the outſide, are made three ſtreaks, ſeparate from one another, with biſtre and pure lake; which are loſt, by little traces, in the bottom. The outſide of the leaves is left all yellow.—The purple is laid with carmine, mixed with a little ultramarine, and very pale white. They are formed and finiſhed with leſs white; making likewiſe, in ſome, purple ſtripes or ſtreaks, very dark, as in the yellow; and in others only ſmall veins. The ſeed of both is yellow, and is done with orpiment and gallſtone. For the ſtiles, they put a lay of white, and ſhadow with black, mixed with a little green. The green of this flower is formed with very pale verditer, and ſhadowed with ſap-green.

The Iris.—The Perſian iris is done by putting, for the inſide leaves, a lay of white, and ſhadowing them with indigo and green together, leaving a little white ſeparation in the middle of each leaf; and for thoſe on the outſide, they put in the ſame place a lay of maſticot, which is ſhadowed with gallſtone and orpiment; making little dark and longiſh dots over all the leaf, at a ſmall diſtance from one another. And at the end of each are made large ſtrains, with biſtre and lake in ſome, and in others with pure indigo, but very black. The reſt, and the outſide of the leaves, are ſhadowed with black. The green is formed with ſea green, and very pale maſticot, and ſhadowed with ſap green. The Suſian iris is laid with purple and white, putting a little more carmine than ultramarine; and for the ſhades, eſpecially in the middle leaves, they put leſs white; and, on the contrary, more ultramarine than carmine; making the veins of this very colour, and leaving in the middle of the inſide leaves a little yellow ſinew. There are others which have this very ſinew in the firſt leaves; the end of which only is bluer than the reſt. Others are ſhadowed and finiſhed with the ſame purple, redder: They have alſo the middle ſinew on the outſide leaves; but white and ſhadowed with indigo. There are likewiſe yellow ones; which are done by putting a lay of maſticot and orpiment; ſhadowing them with gallſtone, and making the veins upon the leaves with biſtre. The green of one and the other is done with ſea green, mixing a little maſticot for the ſtiles. They are ſhadowed with ſap green.

Of Flowers.

The Jasmine.—It is done with a lay of white, and ſhadowed with black and white; and for the outſide of the leaves, they mix a little biſtre; making the half of each, on this ſide, a little reddiſh with carmine.

The Tuberose.—For the doing of this, they make a lay of white, and ſhadow with black, with a little biſtre in ſome places; and for the outſide of the leaves they mix a little carmine, to give them a reddiſh teint, particularly upon the extremities. The ſeed is done with maſticot, and ſhadowed with ſap green. The green of it is laid with verditer, and ſhadowed with ſap green.

The Hellebore.—The flower of hellebore is done almoſt in the ſame manner; that is, let it be laid with white, and ſhadowed with black and biſtre, making the outſide of the leaves a little reddiſh here and there. The ſeed is laid with dark green, and raiſed with maſticot. The green of it is foul and ruſty, and is formed with verditer, maſticot, and biſtre; and finiſhed with ſap green and biſtre.

The White Lily.—It is laid with white, and ſhadowed with black and white. The ſeed is done with orpiment and gallſtone. And the green is done as in the tuberoſe.

The Snow-drop.—It is formed and finiſhed as the white lily. The ſeed is laid with maſticot, and ſhadowed with gallſtone. And the green is done with ſea and ſap green.

The Jonquil.—It is laid with maſticot and gallſtone, and finiſhed with gamboge and gallſtone. The green is formed with ſea green, and ſhadowed with ſap green.

The Daffodil.—All daffodils, the yellow, the double, and the ſingle, are done by putting a lay of maſticot: they are formed with gamboge, and finiſhed by adding umber and biſtre; excepting the bell in the middle, which is done with orpiment and gallſtone, bordered

bordered or edged with vermilion and carmine. The white are laid with white, and ſhadowed with black and white; excepting the cup or bell, which is done with maſticot and gamboge. The green is ſea green, ſhadowed with ſap green.

The MARIGOLD.—It is done by putting a lay of maſticot, and then one of gamboge; ſhadowing it with this very colour, after vermilion is mixed with it: and for finiſhing, they add gallſtone and a little carmine. The green is done with verditer, ſhadowed with ſap green.

The AUSTRIAN ROSE.—For making the Auſtrian roſe, they put a lay of maſticot, and another of gamboge. Then they form it, mixing gallſtone; and finiſh it with the laſt colour, adding biſtre and a very ſmall matter of carmine in the deepeſt ſhades.

The INDIAN PINK, or *French Marigold.*—It is done by putting a lay of gamboge; ſhadowing it with this colour, after you have mixed a good deal of carmine and gallſtone with it; and leaving about the leaves a little yellow border of gamboge, very clear in the lights, and darker in the ſhades. The ſeed is ſhadowed with biſtre. The green, as well of the roſe as the pink, is formed with verditer, and finiſhed with ſap-green.

The SUN-FLOWER.—It is formed with maſticot and gamboge, and finiſhed with gallſtone and biſtre. The green is laid with verditer and maſticot, and ſhadowed with ſap green.

The PASSION-FLOWER.—It is done as the roſe, and the green of the leaves likewiſe; but the veins are done with a darker green.

POETICAL PINKS and SWEET WILLIAM.—They are done by putting a lay of lake and white; ſhadowing them with pure lake, with a little carmine for the laſt; which are afterwards dotted on all parts with little round dots, ſeparate from one another; and the threads in the middle are raiſed with white. The green of them is ſea green, which is finiſhed with ſap green.

The SCABIOUS.—There are two ſorts of ſcabious, the red and the purple. The leaves of the firſt are laid with Florentine lake in which there is a little white; and ſhadowed without white; and for the middle, which is a great boſs or huſk in which the ſeed lies, it is formed and finiſhed with pure lake, with a little ultramarine or indigo to make it darker. Then they make little white longiſh dots over it, at a pretty diſtance from one another, clearer in the light than in the ſhade, making them go every way. The other is done by putting a lay of very pale purple, as well upon the leaves as the boſs in the middle; ſhadowing both with the ſame colour, a little deeper: and inſtead of little white touches for the ſeed, they make them purple; and about each grain they make out a little circle, and this over the whole boſs or huſk in the middle. The green is formed with verditer and maſticot, and ſhadowed with ſap green.

The SWORD or *Day Lily.*—It is laid with Florence lake and very pale white; formed and finiſhed with pure lake, very clear and bright in ſome places, and very dark in others; mixing even biſtre in the thickeſt of the ſhades. The green is verditer, ſhadowed with ſap green.

HEPATICA, or *Liverwort.*—There is red and blue. The laſt is done by putting on all parts a lay of ultramarine, white, and a little carmine or lake: ſhadowing the inſide of the leaves with the mixture, but deeper; excepting thoſe of the firſt rank; for which, and for the outſide of every one of them, they add indigo and white, that the colour may be paler, and not ſo fine. The red is laid with lake columbine and very pale white; and finiſhed with leſs white. The green is done with verditer, maſticot, and a little biſtre; and ſhadowed with ſap green, and a little biſtre, eſpecially on the outſide of the leaves.

The POMEGRANATE.—The flower of the pomegranate is laid with red lead; ſhadowed with vermilion and carmine; and finiſhed with this laſt colour. The green is laid with verditer and maſticot, and ſhadowed with ſap green.

The flower of the Indian BEAN.—It is done with a lay of Levant lake and white; ſhadowing the middle leaves with pure lake; and adding a little ultramarine for the others. The green is verditer, ſhadowed with ſap green.

The COLUMBINE.—There are columbines of ſeveral colours: the moſt common are the purple, the gridelin, and the red. For the purple, they lay with ultramarine, carmine, and white; and ſhadow with this mixture deeper. The gridelin are done the ſame way, putting a great deal leſs ultramarine than carmine. The red are done with lake and white, finiſhing with leſs white. There are ſome mixed flowers of this kind, of ſeveral colours; which muſt be formed and finiſhed as the others, but paler, making the mixtures of a little darker colour.

The LARK'S HEEL.—Theſe are of different colours, and of mixed colours: the moſt common are the purple, the gridelin, and the red; which are done as the columbines.

VIOLETS and PANSIES.—Violets and panſies are done the ſame way; excepting that in the laſt the two middle leaves are bluer than the others; that is, the borders or edges; for the inſide of them is yellow: and there little back veins are made, which take their beginning from the heart of the flower, and die away towards the middle.

The MUSCIPULA, or *Catch-fly.*—There are two ſorts of it, the white and the red; the laſt is laid with lake and white, with a little vermilion, and finiſhed with pure lake. As for the knot or nozzle of the leaves, it is formed with white and a very ſmall matter of vermilion, mixing biſtre or gallſtone to finiſh it. The leaves of the white are laid with white; adding biſtre and maſticot upon the knots which are ſhadowed with pure biſtre, and the leaves with black and white. The green of all theſe flowers is done with verditer and maſticot, and ſhadowed with ſap green.

The CROWN IMPERIAL,—which is of two colours, the yellow and the red. The firſt is done by putting a lay of orpiment, and ſhadowing it with gallſtone and orpiment with a little vermilion. The other is laid with orpiment and vermilion, and ſhadowed with gallſtone and vermilion; making the beginning of the leaves next the ſtile, with lake and biſtre, very dark; and veins with this mixture both in one and the other, all along the leaves. The green is done with verditer and maſticot, ſhadowed with ſap green and gamboge.

The CYCLAMEN, or *Sowbread.*—The red is laid with carmine, a little ultramarine, and much white; and finiſhed with the ſame colour, deeper; putting, in a manner, only carmine in the middle of the leaves, next the heart, and in the reſt add a little more ultramarine. The other is laid with white, and ſhadowed with black. The ſtalks of one and the other ought to be a little reddiſh; and the green, verditer and ſap green.

The GILLIFOWER.—There are ſeveral ſorts of gilliflowers; the white, the yellow, the purple, the red, and the mixed of various colours. The white are laid with white, and ſhadowed with black, and with a little indigo in the heart of the leaves. The yellow, with maſticot, gamboge, and gallſtone. The purple are formed with purple and white; and finiſhed with leſs white; making the colour brighter in the heart, and even a little yellowiſh. The red with lake and white; finiſhing them with white. The mixed coloured are laid with white, and the mixtures are ſometimes made with purple, in which there is much ultramarine; others again, in which there is more carmine. Sometimes they are of lake, and ſometimes of carmine. Some are done with white, and others without white; ſhadowing the reſt of the leaves with indigo. The ſeed of all is formed with verditer and maſticot, and finiſhed with ſap green. The leaves and ſtiles are laid with the ſame green, mixing ſap green to finiſh them.

FRUITS, fiſhes, ſerpents, and all ſorts of reptiles, are to be touched in the ſame manner as the figures of men are; that is, hatched or dotted.

Birds and all other animals are done like flowers, by ſtrokes or traces.

Never make uſe, for any of theſe things, of white lead. It is only proper in oil. It blackens like ink when only tempered with gum; eſpecially if you ſet your work in a moiſt place, or where perfumes are. Ceruſs of Venice is as fine, and of as pure a white. Be not ſparing in the uſe of this, eſpecially in forming or dead-colouring; and let it enter into all your mixtures, in order to give them a certain body, which will render your work gluiſh, and make it appear ſoft, plump, and ſtrong.

The taſte of painters is, nevertheleſs, different in this point. Some uſe a little of it, and others none at all. But the manner of the laſt is meagre and dry. Others uſe a great deal; and doubtleſs it is the beſt method, and moſt followed among ſkilful perſons; for beſides that it is ſpeedy, one may by the uſe of it copy all ſorts of pictures; which would be almoſt impoſſible otherwiſe; notwithſtanding the contrary opinion of ſome, who ſay, that in miniature we cannot give the force and all the different teints we ſee in pieces in oil. But this is not true, at leaſt of good painters; and effects prove it pretty plainly: for we ſee figures, landſcapes, pictures, and every thing elſe in miniature, touched in as grand, as true, and as noble a manner (though more tender and delicate), as they are in oil.

However, painting in oil has its advantages; were they only theſe, that it exhibits more work, and takes up leſs time. It is better defended likewiſe againſt the injuries of time; and the right of birth muſt be granted it, and the glory of antiquity.

But miniature likewiſe has its advantages; and without repeating ſuch as have been mentioned already, it is neater and more commodious. You may eaſily carry all your implements in your pockets, and work when and wherever you pleaſe, without ſuch a number of preparations. You may quit and reſume it when and as often as you will; which is not done in the other; in which one is rarely to work dry.

To conclude: In the art of painting, excellence does not depend upon the greatneſs of the ſubject, but upon the manner in which it is handled. Some catch the airs of a face well; others ſucceed better in landſcapes: ſome work in little, who cannot do it in large: ſome are ſkilled in colours, who know little of deſign: others, laſtly, have only a genius for flowers: and even the Baſſans got themſelves a fame for animals; which they touched in a very fine manner, and better than any thing elſe.

MINIM, in *Muſic*, a note equal to two crotchets, or half a ſemibreve. See MUSIC.

MINIMS, a religious order in the church of Rome, founded by St Francis de Paula, towards the end of the 15th century. Their habit is a coarſe black woollen ſtuff, with a woollen girdle, of the ſame colour, tied in five knots. They are not permitted to quit their habit and girdle night nor day. Formerly they went barefooted, but are now allowed the uſe of ſhoes.

MINIMUM, in the higher geometry, the leaſt quantity attainable in a given caſe.

MINISTER, a perſon who preaches, performs religious worſhip in public, adminiſters the ſacraments, &c.

MINISTER of State, a perſon to whom the prince intruſts the adminiſtration of government. See COUNCIL.

Foreign MINISTER, is a perſon ſent into a foreign country, to manage the affairs of his province or of the ſtate to which he belongs. Of theſe there are two kinds: thoſe of the firſt rank are ambaſſadors and envoys extraordinary, who repreſent the perſons of their ſovereigns; the miniſters of the ſecond rank are the ordinary reſidents.

MINIUM, or RED-LEAD. See CHEMISTRY *Index*.

MINNIN, a ſtringed inſtrument of muſic among the ancient Hebrews, having three or four chords to it, although there is reaſon to queſtion the antiquity of this inſtrument; both becauſe it requires a hair bow, which was a kind of plectrum not known to the ancients, and becauſe it ſo much reſembles the modern viol. Kircher took the figures of this, the machul, chinnor, and pſaltery, from an old book in the Vatican library.

MINOR, a Latin term, literally denoting *leſs*; uſed in oppoſition to *major*, greater.

MINOR, in *Law*, denotes a perſon under age; or who, by the laws of the country, is not yet arrived at the power of adminiſtering his own affairs, or the poſſeſſion of his eſtate. Among us, a perſon is a minor till the age of twenty-one, before which time his acts are invalid. See AGE, and INFANT.

It is a maxim in the common law, that in the king there is no minority, and therefore he hath no legal guardian; and his royal grants and aſſents to acts of parliament are good, though he has not in his natural capacity attained the legal age of twenty-one. It is alſo provided by the cuſtom and law of parliament, that no one ſhall ſit or vote in either houſe, unleſs he be twenty-one years of age. This is likewiſe expreſsly declared by ſtat 7. and 8 Will. III. cap. 25. with regard to the houſe of commons.

MINOR, in *Logic*, is the ſecond propoſition of a formal or regular ſyllogiſm, called alſo the *aſſumption*.

MINOR, in *Muſic*, is applied to certain concords, which differ from or are lower than others of the ſame denomination by a leſſer ſemitone or four commas.—Thus we ſay, a third minor, or leſſer third, or a ſixth major and minor. Concords that admit of major and minor, i. e. greater and leſs, are ſaid to be imperfect concords.

MINORCA, an iſland of the Mediterranean, ſituated between 39 and 40 degrees of north latitude, and near four degrees of eaſt longitude. It is about 33 miles in length from north-weſt to ſouth-eaſt, in breadth from eight to twelve, but in general about ten miles; ſo that in ſize it may nearly equal the county of Huntingdon or Bedfordſhire. The form is very irregular; and the coaſts are much indented by the ſea, which forms a great number of little creeks and inlets, ſome of which might be very advantageous.

This iſland is one of thoſe called by the ancient Romans *Baleares*, which aroſe from the dexterity of the inhabitants in uſing the ſling. It fell under the power of the Romans, afterwards of the northern barbarians, who deſtroyed that empire. From them it was taken by the Arabs; who were ſubdued by the king of Majorca, and he by the king of Spain. The Engliſh ſubdued it in 1708; it was afterwards retaken by the French in 1756, but reſtored to Britain by the treaty of Paris in 1763. The Spaniards took it in 1782; and in 1798, it again became ſubject to Great Britain.

The air of this iſland is much more clear and pure than in Britain; being ſeldom darkened with thick fogs; yet the low valleys are not free from miſts and unwholeſome vapours; and in windy weather the ſpray of the ſea is driven over the whole iſland. Hence it happens that utenſils of braſs or iron are extremely ſuſceptible of ruſt, in ſpite of all endeavours to preſerve them; and houſehold furniture becomes mouldy. The ſummers are dry, clear, calm, and exceſſively hot; the autumns moiſt, warm, and unequal; at one time perfectly ſerene, at another cloudy and tempeſtuous. During the winter there are ſometimes violent ſtorms, though neither frequent nor of long continuance; and whenever they ceaſe, the weather returns to its uſual ſerenity. The ſpring is always variable, but reſembles the winter more than the ſummer. The changes of heat and cold are neither ſo great nor ſo ſudden in this climate as in many others. In the compaſs of a year, the thermometer ſeldom riſes much above the 80th, or falls below the 48th degree. In ſummer there is ſcarcely ever a difference of four or five degrees between the heat of the air at noon and at night: and in winter the variation is ſtill leſs conſiderable. But this muſt be underſtood of a thermometer ſhaded from the influence of the ſolar beams: for if expoſed to them it will often riſe 12, 14, or 16 degrees higher than what we have mentioned; and in other ſeaſons the difference between the heat of the air in the ſun and the ſhade is much greater. Yet even in the dog-days, the heat of the atmoſphere, at leaſt in open places, ſeldom ſurpaſſes that of human blood. The winds are very boiſterous about the equinoxes, and ſometimes during the winter. At other times they are generally moderate, and, according to the obſervations of ſeamen, they rarely blow in the ſame direction near the iſlands adjacent to the gulf of Lyons as in the open ſea. During the ſummer there is commonly a perfect calm in the mornings and evenings; but the middle of the day is cooled by refreſhing breezes which come from the eaſt, and, following the courſe of the ſun, increaſe gradually till two or three in the afternoon, after which they inſenſibly die away as night approaches. This renders the heat of the ſun leſs dangerous and inconvenient; and if theſe breezes intermit for a day or two, the natives grow languid and inactive from the heat. The northerly winds in general are clear and healthy, diſpel the miſts, and make a clear blue ſky; whilſt thoſe which blow from the oppoſite quarter, render the air warm, moiſt, and unhealthy. The north wind is ſuperior in power to all the reſt; which appears from hence, that the tops of all the trees incline to the ſouth, and the branches on the north ſide are bare and blaſted. The next to it in force is the north-weſt. Both are frequent towards the cloſe of winter and in the ſpring; and, being dry and cold, they ſhrivel up the leaves of the vegetables, deſtroy their tender ſhoots, and are often exceſſively detrimental to the vineyards and riſing corn. The piercing blaſts at that ſeaſon from the north-eaſt, as they are more moiſt, and more frequently attended with rain, are leſs prejudicial. The ſouth and ſouth-eaſt winds are by much the moſt unhealthy. In whatever ſeaſons they blow, the air is foggy, and affects the breathing; but in the ſummer ſeaſon they are ſultry and ſuffocating. An exceſſive dejection of ſpirits is then a univerſal complaint; and on expoſing the thermometer to the rays of the ſun, the mercury has frequently riſen above the 100th degree. The weſt wind is uſually drier than the ſouth: the eaſt is cold and bluſtering in the ſpring, and ſultry in the ſummer.

The weather in Minorca is generally fair and dry; but when it rains, the ſhowers are heavy, though of ſhort continuance, and they fall moſt commonly in the night. The ſky in ſummer is clear, and of a beautiful azure, without clouds or rain; but moderate dews deſcend regularly after ſunſet. In autumn the weather becomes leſs ſerene; whirlwinds and thunder become frequent; and in the night time lightning, and thoſe meteors called *fallings ſtars*, are very common. Water ſpouts alſo are often ſeen at that ſeaſon, and frequently break upon the ſhore. A ſudden alteration in the weather takes place about the autumnal equinox; the ſkies are darkened with clouds, and the rains fall in ſuch quantities, that the torrents thereby occaſioned, pouring down from the hills, tear up trees by the root, carry away cattle, break down fences, and do conſiderable miſchief to the gardens and vineyards. But theſe anniverſary rains are much more violent than laſting; always falling in ſudden and heavy ſhowers, with intervals of fair weather. They are accompanied with thunder, lightning, and ſqualls of wind, moſt commonly from the north. Hail and ſnow are often intermixed with the rains which fall in winter and in ſpring; but the ſnow, for the moſt part, diſſolves immediately; and ice is here an uncommon appearance.

The whole coaſt of Minorca lies low; and there are only a few hills near the centre, of which the moſt conſiderable, named *Toro* by the inhabitants, may be ſeen at the diſtance of 12 or 14 leagues from the land. The ſurface of the iſland is rough and unequal; and in many places divided by long narrow vales of a conſiderable depth, called *barancoes* by the natives. They begin towards the middle of the iſland, and after ſeveral windings terminate at the ſea. The ſouth-weſt ſide is more plain and regular than towards the north-eaſt; where the hills are higher, with low marſhy valleys betwixt them, the ſoil leſs fruitful, and the whole tract unhealthy to man and beaſt. Near the towns and villages the fields are well cultivated, and encloſed with ſtone walls; but the reſt for the moſt part are rocky, or covered with woods and thickets. There are ſome pools of ſtanding water, but very few rivulets, which is the greateſt defect about the iſland, as the inhabitants have ſcarcely any wholeſome water excepting what is ſaved from the clouds.

The ſoil is light, thin, and very ſtony, with a good deal of ſea ſalt, and, in ſome places, of calcareous nitre intermixed. In moſt places there is ſo little earth, that the iſland appears to be but one large irregular rock, covered here and there with mould, and an infinite variety of ſtones. Notwithſtanding this, however, it is not only extremely proper for vineyards, but produces more wheat and barley than could at firſt ſight be imagined; and if the peaſants may be credited, it would always yield a quantity of corn and wine ſufficient for the natives, did not the violence of the winds, and the exceſſive drought of the weather, frequently ſpoil their crops. The fields commonly lie fallow for two years, and are ſown the third. About the latter end of winter, or the beginning of ſpring, they are firſt broke up: and next autumn, as ſoon as the rains fall, they are again ploughed and prepared for receiving the proper ſeeds. The tillage is very eaſily performed; for a plough ſo light as to be tranſported from place to place on the ploughman's ſhoulder, and to be drawn by a heifer, or an aſs ſometimes aſſiſted by an hog, is ſufficient for opening ſo thin a ſoil. The later the harveſt happens, the more plentiful it proves. The barley is uſually cut down about the 20th of May and the wheat is reaped in June, ſo that the whole harveſt is commonly got in by Midſummer day. The grain is not thraſhed with flails as in this country, but trodden out on a ſmooth piece of rock by oxen and aſſes, according to the cuſtom of the eaſtern nations.

The natives of Minorca are commonly lean, thin, and well-built, of a middle ſtature, and olive complexion; but their character is by no means agreeable. Such is the natural impetuoſity of their temper, that the ſlighteſt cauſe provokes them to anger, and they ſeem to be incapable of forgiving or forgetting an injury. Hence quarrels break out daily, even among neighbours and relations: and family diſputes are tranſmitted from father to ſon; and thus, though lawyers and pettifoggers are very numerous in this country, there are ſtill too few for the clients. Both ſexes are, by conſtitution, extremely amorous: they are often betrothed to each other while children, and marry at the age of 14. The women have eaſy labours, and commonly return in a few days to their uſual domeſtic buſineſs; but, leſt the family ſhould become too numerous for their income, it is a practice among the poorer ſort to keep their children at the breaſt for two or three years, that by this means the mothers may be hindered from breeding.

Bread of the fineſt wheat flour, well fermented and well baked, is more than half the diet of people of all ranks. Rice, pulſe, vermicelli, herbs and roots from the garden, ſummer fruits, pickled olives and pods of the Guinea pepper, make up almoſt all the other half, ſo that ſcarce a fifth of their whole food is furniſhed from the animal kingdom, and of this fiſh makes by much the moſt conſiderable portion. On Fridays, and other faſt days, they abſtain entirely from fleſh; and during Lent they live altogether on vegetables and fiſh, excepting Sundays, when they are permitted the uſe of eggs, cheeſe, and milk. Moſt of their diſhes are high-ſeaſoned with pepper, cloves, cinnamon, and other ſpices; and garlic, onions, or leeks, are almoſt conſtant ingredients. They eat a great deal of oil, and that none of the ſweeteſt or beſt flavoured; uſing it not only with ſalads, but alſo with boiled and fried fiſh, greens, pulſe, &c. inſtead of butter. A ſlice of bread ſoaked in boiled water, with a little oil and ſalt, is the common breakfaſt of the peaſants, well known by the name of *oleagua*. Their ordinary meals are very frugal, and conſiſt of very little variety; but on feſtivals and other ſolemn occaſions their entertainments are to the laſt degree profuſe and extravagant, inſomuch that the bill of fare of a country farmer's wedding dinner would ſcarce be credited.

With regard to other matters, the Minorquins are accuſed of prodigious indolence in the way of buſineſs, and neglect of the natural advantages they poſſeſs. In the bowels of the earth are iron, copper, and lead ores, of none of which any uſe hath been made except the laſt. A lead mine was worked to advantage ſome time ago, and the ore ſent into France and Spain for the uſe of the potteries in thoſe countries. The proprietor diſcontinued his work on ſome ſmall diſcouragement; and indeed it is ſaid, that theſe people are of all mankind the moſt eaſily put out of conceit with an undertaking that does not bring them in mountains of preſent gain, or that admits of the ſlighteſt probability of diſappointing their moſt ſanguine expectations: nor will their purſe admit of many diſappointments; and thus their poverty co-operating with their natural deſpondence and love of eaſe, is the principal cauſe of their backwardneſs to engage in projects, though ever ſo promiſing, for the improvement of their private fortune, and the advantage of the commerce of their

Minorca.

country. This lead ore went under the name of *vernis* among the natives, as it was wholly uſed by the potters in varniſhing and glazing their earthen veſſels.

There are few exports of any account, and they are obliged to their neighbours for near one-third of their corn, all their oil, and ſuch a variety of articles of leſs conſideration, that nothing could preſerve them from a total bankruptcy, but the Engliſh money circulated by the troops, which is exchanged for the daily ſupplies of proviſions, increaſed by the multiplication of vineyards, the breeding of poultry, and the production of vegetables, in a proportion of at leaſt five to one ſince the iſland has been in our poſſeſſion. It will not require many words to enumerate their exports: they make a ſort of cheeſe, little liked by the Engliſh, which ſells in Italy at a very great price; this, perhaps, to the amount of 800l. *per annum*.—The wool they ſend abroad may produce 900l. more.—Some wine is exported; and, if we add to its value that of the home conſumption, which has every merit of an export, being nine parts in ten taken off by the troops for ready money, it may well be eſtimated at 16,000l. a-year. In honey, wax, and ſalt, their yearly exports may be about 400l. and this comes pretty near the ſum of their exports, which we eſtimate together at 18,100l. ſterling *per annum*.

A vaſt balance lies againſt them, if we conſider the variety and importance of the articles they fetch from other countries, for which they muſt pay ready caſh. Here it may be neceſſary to withdraw ſome things from the heap, ſuch as their cattle, ſheep, and fowls, on which they get a profit; for the country does not produce them in a ſufficient abundance to ſupply them, eſpecially when we have a fleet of men of war ſtationed there.

Their imports are, corn, cattle, ſheep, fowls, tobacco, oil, rice, ſugar, ſpices, hardware, and tools of all kinds; gold and ſilver lace; chocolate, or cocoa to make it; tobacco, timber, plank, boards, millſtones, tobacco pipes, playing cards, turnery ware, ſeeds, ſoap, ſaddles; all manner of cabinetmakers work, iron ſpikes, nails, fine earthen ware, glaſs lamps, braſiery; paper, and other ſtationary wares; copperas, galls, dye ſtuffs, painters bruſhes and colours; muſical inſtruments, muſic, and ſtrings; watches, wine, fruit, all manner of fine and printed linens, muſlins, cambrics, and laces; bottles, corks, ſtarch, indigo, fans, trinkets, toys, ribbands, tape, needles, pins, ſilk, mohair, lanthorns, cordage, tar, pitch, roſin, drugs, gloves, fire-arms, gunpowder, ſhot, and lead; hats, caps, velvet, cotton ſtuffs, woollen cloths, ſtockings, capes, medals, veſtments, luſtres, pictures, images, agnus dei's, books, pardons, bulls, relicks, and indulgencies.

The iſland is divided into what they ſtyle *terminos*, of which there were anciently five, now reduced to four, and reſemble our counties. The termino of Ciudadella, at the north-weſtern extremity of the iſland, is ſo ſtyled from this place, which was once a city, and the capital of Minorca. It makes a venerable and majeſtic figure, even in its preſent ſtate of decay, having in it a large Gothic cathedral, ſome other churches and convents, the governor's palace, and an exchange, which is no contemptible pile.—There are in it 600 houſes, which before the ſeat of government and the courts of juſtice

Minorca.

were removed to Mahon, were fully inhabited; and there are ſtill more gentlemen's families here than in all the reſt of the iſland. It hath a port commodious enough for the veſſels employed in the trade of this country, which, though in the poſſeſſion of a maritime power, is leſs than it formerly was. It is ſtill, in the ſtyle of our officers, *the beſt quarters* (and there are none bad) in the country; and if there was a civil government, and the place made a free port, the beſt judges are of opinion it would very ſoon become a flouriſhing place again; and the fortifications, if it ſhould be found neceſſary, might then alſo be eaſily reſtored and improved.

The termino of Fererias is the next, a narrow ſlip reaching croſs from ſea to ſea, and the country little cultivated; it is therefore united to Mercandal. In this laſt termino ſtands Mont-toro in the very centre of the iſle, and the higheſt ground, ſome ſay the only mountain in it; on the ſummit of which there is a convent, where even in the hotteſt months the monks enjoy a cool air, and at all times a moſt delightful proſpect. About ſix miles north from Mont-toro ſtands the caſtle that covers Port Fornelles, which is a very ſpacious harbour on the eaſt ſide of the iſland. There are in it ſhoals and foul ground, which, to thoſe who are unacquainted with them, render it difficult and dangerous; yet the packets bound from Mahon to Marſeilles frequently take ſhelter therein; and while the Spaniards were in poſſeſſion of the iſle, large ſhips and men of war frequented it. At a ſmall diſtance from this lies another harbour called *Adia*, which runs far into the land; but being reputed unſafe, and being ſo near Fornelles, is at preſent uſeleſs. The country about it is, however, ſaid to be the pleaſanteſt and wholeſomeſt ſpot in the iſland, and almoſt the only one plentifully ſupplied with excellent ſpring water; ſo that the gardens are well laid out, and the richeſt and fineſt fruits grow here in the higheſt perfection. Alaior is the next termino, in which there is nothing remarkable but the capital of the ſame name, well ſituated on an eminence, in a pleaſant and tolerably cultivated country.

The termino of Mahon, at the ſouth-eaſt end of the iſland, is at preſent the moſt conſiderable of them all, containing about 60,000 Engliſh acres, and nearly one-half of the inhabitants in Minorca. The town of Mahon derives its name from the Carthaginian general Mago, who is univerſally allowed to be its founder.—It ſtands on an eminence on the weſt ſide of the harbour, the aſcent pretty ſteep. There are in it a large church, three convents, the governor's palace, and ſome other public edifices. It is large, but the ſtreets are winding, narrow and ill paved. The fortreſs of St Philip ſtands near the entrance of the harbour, which it covers, is very ſpacious, of great ſtrength, with ſubterranean works to protect the garriſon from bombs, large magazines, and whatever elſe is neceſſary to render it a complete fortification, and hath a numerous and well diſpoſed artillery. Port Mahon is allowed to be the fineſt harbour in the Mediterranean, about 90 fathoms wide at its entrance, but within very large and ſafe, ſtretching a league or more into the land. Beneath the town of Mahon there is a very fine quay, one end of which is reſerved for the ſhips of war, and furniſhed with all the accommodations neceſſary for careening and refitting them; the other ſerves for merchantmen.

On

On the other ſide of the harbour is Cape Mola, where it is generally agreed a fortreſs might be conſtructed which would be impregnable, as the caſtle of St Philip was eſteemed before we took it, and beſtowed ſo much money upon it, that, though ſome works were erected at Cape Mola, it was not judged proper to proceed in the fortifications there at a freſh expence; at leaſt this is the only reaſon that hath been aſſigned. Minorca was taken by the Spaniards during the American war, and is now in their poſſeſſion.

MINORS, or FRIERS MINOR, an appellation which the Franciſcans aſſume, out of ſhow of humility; calling themſelves *fratres minores*, i. e. leſſer brothers, and ſometimes *minorites*. There is alſo an order of regular minors at Naples, which was eſtabliſhed in the year 1588, and confirmed by Sixtus V.

MINOS, in *Fabulous Hiſtory*, a king of Crete, ſon of Jupiter and Europa. He flouriſhed about 1432 years before the Chriſtian era. He gave laws to his ſubjects, which ſtill remained in full force in the age of the philoſopher Plato, about 1000 years after the death of the legiſlator. His juſtice and moderation procured him the appellation of the favourite of the gods, the confidant of Jupiter, and the wiſe legiſlator, in every city of Greece; and, according to the poets, he was rewarded for his equity after death with the office of ſupreme and abſolute judge in the infernal regions. In this capacity he is repreſented ſitting in the middle of the ſhades, and holding a ſceptre in his hand. The dead plead their different cauſes before him; and the impartial judge ſhakes the fatal urn, which is filled with the deſtinies of mankind. He married Ithona, by whom he had Lycaſtes, who was the father of Minos II.

MINOS II. was a ſon of Lycaſtes, the ſon of Minos I. and king of Crete. He married Paſiphae, the daughter of Sol and Perſeis, and by her he had many children. He increaſed his paternal dominions by the conqueſt of the neighbouring iſlands; but ſhowed himſelf cruel in the war which he carried on againſt the Athenians, who had put to death his ſon Androgeus. He took Megara by the treachery of Scylla; and not ſatisfied with victory, he obliged the vanquiſhed to bring him yearly to Crete ſeven choſen boys and the ſame number of virgins to be devoured by the MINOTAUR. This bloody tribute was at laſt aboliſhed when THESEUS had deſtroyed the monſter. When DÆDALUS, whoſe induſtry and invention had fabricated the labyrinth, and whoſe imprudence in aſſiſting Paſiphae in the gratification of her unnatural deſires, had offended Minos, fled from the place of his confinement with wings, and arrived ſafe in Sicily; the incenſed monarch purſued the offender, reſolved to puniſh his infidelity. Cocalus, king of Sicily, who had hoſpitably received Dædalus, entertained his royal gueſt with diſſembled friendſhip; and, that he might not deliver to him a man whoſe ingenuity and abilities he ſo well knew, he put Minos to death. Minos died about 35 years before the Trojan war. He was father of Androgeus, Glaucus, and Deucalion; and two daughters, Phædra, and Ariadne. Many authors have confounded the two Minoſes, the grandfather and the grandſon; but Homer, Plutarch, and Diodorus, prove plainly that they were two different perſons.

MINOTAUR, in *Fabulous Hiſtory*, a celebrated monſter, half a man and half a bull, according to this verſe of Ovid,

Semibovemque virum, ſemivirumque bovem.

It was the fruit of Paſiphae's amour with a bull. Minos refuſed to ſacrifice a white bull to Neptune, an animal which he had received from the god for that purpoſe. This offended Neptune, and he made Paſiphae the wife of Minos enamoured of this fine bull, which had been refuſed to his altars. Dædalus proſtituted his talents in being ſubſervient to the queen's unnatural deſires; and by his means, Paſiphae's horrible paſſions were gratified, and the Minotaur came into the world. Minos confined in the labyrinth this monſter, which convinced the world of his wife's laſciviouſneſs, and reflected diſgrace upon his family. The Minotaur uſually devoured the choſen young men and maidens which the tyranny of Minos yearly exacted from the Athenians. Theſeus delivered his country from this tribute, when it had fallen to his lot to be ſacrificed to the voracity of the Minotaur; and by means of Ariadne, the king's daughter, he deſtroyed the monſter, and made his eſcape from the windings of the labyrinth.—The fabulous tradition of the Minotaur, and of the infamous commerce of Paſiphae with a favourite bull, has been often explained. Some ſuppoſe that Paſiphae was enamoured of one of her huſband's courtiers called *Taurus*; and that Dædalus favoured the paſſions of the queen, by ſuffering his houſe to become the retreat of the two lovers. Paſiphae ſome time after brought twins into the world, one of whom greatly reſembled Minos and the other Taurus; and in the natural reſemblance of their countenance with that of their ſuppoſed fathers, originated their name, and conſequently the fable of the Minotaur.

MINOW, a very ſmall ſpecies of cyprinus. See ICHTHYOLOGY *Index*.

MINSTER, (Saxon, *Mynſter* or *Mynſtre*), anciently ſignified the church of a monaſtery or convent.

MINSTREL, an ancient term for a ſinger and inſtrumental performer.

The word *minſtrel* is derived from the French *meneſtrier*, and was not in uſe here before the Norman conqueſt. It is remarkable, that our old monkiſh hiſtorians do not uſe the words *citharœdus*, *cantator*, or the like, to expreſs a *minſtrel* in Latin; but either *mimus*, *hiſtrio*, *joculator*, or ſome other word that implies *geſture*. Hence it ſhould ſeem that the minſtrels ſet off their ſinging by mimicry or action; or, according to Dr Brown's hypotheſis, united the powers of melody, poem, and dance.

The Saxons as well as the ancient Danes, had been accuſtomed to hold men of this profeſſion in the higheſt reverence. Their ſkill was conſidered as ſomething divine, their perſons were deemed ſacred, their attendance was ſolicited by kings, and they were everywhere loaded with honours and rewards. In ſhort, poets and their art were held among them in that rude admiration which is ever ſhown by an ignorant people to ſuch as excel them in intellectual accompliſhments. When the Saxons were converted to Chriſtianity, in proportion as letters prevailed among them this rude admiration began to abate, and poetry was no longer a peculiar profeſſion. The poet and the minſtrel became two perſons. Poetry was cultivated by men of letters indiſcriminately, and many of the moſt popular rhymes were compoſed amidſt the leiſure and retirement of monaſteries. But the minſtrels continued a diſtinct order of men, and got their livelihood by ſinging verſes to the harp at the houſes of the great. There they were ſtill hoſpitably and reſpectfully received, and retained many of the honours ſhown to their predeceſſors the Bards and Scalds. And indeed, though ſome of them only recited the compoſitions of others, many of them ſtill compoſed ſongs themſelves: and all of them could probably invent a few ſtanzas on occaſion. There is no doubt but moſt of the old heroic ballads were produced by this order of men. For although ſome of the larger metrical romances might come from the pen of the monks or others, yet the ſmaller narratives were probably compoſed by the minſtrels who ſung them. From the amazing variations which occur in different copies of theſe old pieces, it is evident they made no ſcruple to alter each other's productions, and the reciter added or omitted whole ſtanzas according to his own fancy or convenience.

In the early ages, as is hinted above, this profeſſion was held in great reverence among the Saxon tribes, as well as among their Daniſh brethren. This appears from two remarkable facts in hiſtory, which ſhow that the ſame arts of muſic and ſong were equally admired among both nations, and that the privileges and honours conferred upon the profeſſors of them were common to both; as it is well known their cuſtoms, manners, and even language, were not in thoſe times very diſſimilar.

When King Alfred the Great was deſirous to learn the true ſituation of the Daniſh army, which had invaded his realm, he aſſumed the dreſs and character of a minſtrel; and taking his harp, and only one attendant (for in the earlieſt times it was not unuſual for a minſtrel to have a ſervant to carry his harp), he went with the utmoſt ſecurity into the Daniſh camp. And though he could not but be known to be a Saxon, the character he had aſſumed procured him an hoſpitable reception; he was admitted to entertain the king at table, and ſtaid among them long enough to contrive that aſſault which afterwards deſtroyed them. This was in the year 878.

About 60 years after, a Daniſh king made uſe of the ſame diſguiſe to explore the camp of King Athelſtan. With his harp in his hand, and dreſſed like a minſtrel, Anlaff king of the Danes went among the Saxon tents, and taking his ſtand near the king's pavilion, began to play, and was immediately admitted. There he entertained Athelſtan and his lords with his ſinging and his muſic; and was at length diſmiſſed with an honourable reward, though his ſongs muſt have diſcovered him to have been a Dane. Athelſtan was ſaved from the conſequences of this ſtratagem by a ſoldier, who had obſerved Anlaff bury the money which had been given him, from ſome ſcruple of honour or motive of ſuperſtition. This occaſioned a diſcovery.

From the uniform procedure of both theſe kings, it is plain that the ſame mode of entertainment prevailed among both peoples, and that the minſtrel was a privileged character among both. Even as late as the reign of Edward II. the minſtrels were eaſily admitted into the royal preſence, as appears from a paſſage in Stow, which alſo ſhows the ſplendour of their appearance.

"In the year 1316, Edward II. did ſolemnize his feaſt of Pentecoſt at Weſtminſter, in the great hall; where ſitting royally at the table with his peers about him, there entered a woman adorned like a minſtrel, ſitting on a great horſe trapped, as minſtrels then uſed, who rode round about the tables, ſhowing paſtime; and at length came up to the king's table and laid before him a letter, and forthwith turning her horſe, ſaluted every one, and departed."—The ſubject of this letter was a remonſtrance to the king on the favours heaped by him on his minions, to the neglect of his knights and faithful ſervants.

The meſſenger was ſent in a minſtrel's habit, as what would gain an eaſy admiſſion; and was a woman concealed under that habit, probably to diſarm the king's reſentment; for we do not find that any of the real minſtrels were of the female ſex; and therefore conclude this was only an artful contrivance peculiar to that occaſion.

In the 4th year of Richard II. John of Gaunt erected at Tetbury in Staffordſhire a court of minſtrels, with a full power to receive ſuit and ſervice from the men of that profeſſion within five neighbouring counties, to enact laws, and determine their controverſies; and to apprehend and arreſt ſuch of them as ſhould refuſe to appear at the ſaid court, annually held on the 16th of Auguſt. For this they had a charter, by which they were empowered to appoint a king of the minſtrels with four officers to preſide over them. Theſe were every year elected with great ceremony; the whole form of which is deſcribed by Dr Plott; in whoſe time, however, they ſeem to have become mere muſicians.

Even ſo late as the reign of King Henry VIII. the reciters of verſes or moral ſpeeches learnt by heart, intruded without ceremony into all companies; not only in taverns, but in the houſes of the nobility themſelves. This we learn from Eraſmus, whoſe argument led him only to deſcribe a ſpecies of theſe men who did not ſing their compoſitions; but the others that did, enjoyed without doubt the ſame privileges.

We find that the minſtrels continued down to the reign of Elizabeth; in whoſe time they had loſt much of their dignity, and were ſinking into contempt and neglect. Yet ſtill they ſuſtained a character far ſuperior to any thing we can conceive at preſent of the ſingers of old ballads.

When Queen Elizabeth was entertained at Killingworth caſtle by the earl of Leiceſter in 1575, among the many devices and pageants which were exhibited for her entertainment, one of the perſonages introduced was that of an ancient minſtrel, whoſe appearance and dreſs are ſo minutely deſcribed by a writer there preſent, and gives us ſo diſtinct an idea of the character, that we ſhall quote the paſſage at large.

"A perſon very meet ſeemed he for the purpoſe, of a xlv. years old, apparelled partly as he would himſelf. His cap off: his head ſeemingly rounded tonſterwiſe: fair kembed, that, with a ſponge daintly dipt in a little capon's greaſe, was finely ſmoothed, to make it ſhine like a mallard's wing. His beard ſnugly ſhaven: and yet his ſhirt after the new trink, with ruffs fair ſtarched, ſlecked, and gliſtering like a pair of new ſhoes, marſhalled in good order with a ſetting ſtick, and ſtrut, ‘ that’ every ruff ſtood up like a wafer. A ſide [i. e. long] gown of Kendale green, after the freſhneſs of the year now, gathered at the neck with a narrow gorget, faſtened afore with a white claſp and a keeper cloſe up to the chin; but eaſily, for heat, to undo when he liſt. Seemingly begirt in a red caddis girdle: from that a pair of capped Sheffield knives hanging a’ two ſides. Out of his boſom drawn from a lappet of his napkin edged with a blue lace, and marked with a D for Damian; for he was but a bachelor yet.

“ His gown had ſide [i. e. long] ſleeves down to midleg, ſlit from the ſhoulder to the hand, and lined with white cotton. His doublet ſleeves of black worſted: upon them a pair of points of tawny chamlet laced along the wriſt with blue threaden pointes. A wealt towards the hands of fuſtian-a-napes. A pair of red neather ſtocks. A pair of pumps on his feet, with a croſs cut at his toes for corns; not new indeed, yet cleanly blackt with ſoot, and ſhining as a ſhoing horn.

“ About his neck a red ribband ſuitable to his girdle. His harp in good grace dependent before him. His wreſt tyed to a green lace and hanging by: under the gorget of his gown a fair flaggon chain (pewter for) ſilver, as a Squire Minſtrel of Middleſex, that travelled the country this ſummer ſeaſon, unto fair and worſhipful men’s houſes. From his chain hung a ſcutcheon, with metal and colour, reſplendent upon his breaſt, of the ancient arms of Iſlington.”

—This minſtrel is deſcribed as belonging to that village. We ſuppoſe ſuch as were retained by noble families wore their arms hanging down by a ſilver chain as a kind of badge. From the expreſſion of Squire Minſtrel above, we may conclude there were other inferior orders, as Yeomen Minſtrels or the like.

This minſtrel, the author tells us a little below, “ after three lowly courteſies, cleared his voice with a hem . . . and wiped his lips with the hollow of his hand for ’filing his napkin; tempered a ſtring or two with his wriſt; and, after a little warbling on his harp for a prelude, came forth with a ſolemn ſong, warranted for ſtory out of King Arthur’s acts, &c.”

Towards the end of the 16th century, this claſs of men had loſt all credit, and were ſunk ſo low in the public opinion, that in the 39th year of Elizabeth a ſtatute was paſſed by which “ minſtrels,” wandering abroad, were included among “ rogues, vagabonds, and ſturdy beggars,” and were adjudged to be puniſhed as ſuch. This act ſeems to have put an end to the profeſſion, for after this time they are no longer mentioned.

MINT, the place in which the king’s money is coined. See Coinage.

There were anciently mints in almoſt every county in England; but the only mint at preſent in the Britiſh dominions is that in the Tower of London. The officers of the mint are, 1. The warden of the mint, who is the chief; he overſees the other officers, and receives the bullion. 2. The maſter worker, who receives bullion from the wardens, cauſes it to be melted, delivers it to the moneyers, and, when it is coined, receives it again. 3. The comptroller, who is the overſeer of all the inferior officers, and ſees that all the money is made to the juſt aſſize. 4. The aſſay maſter, who weighs the gold and ſilver, and ſees that it is according to the ſtandard. 5. The two auditors who take the accounts. 6. The ſurveyor of the melting; who, after the aſſay maſter has made trial of the bullion, ſees that it is caſt out, and not altered after it is delivered to the melter. 7. The engraver; who engraves the ſtamps and dies for the coinage of the money. 8. The clerk of the irons; who ſees that the irons are clean and fit to work with. 9. The melter, who melts the bullion before it be coined. 10. The provoſt of the mint; who provides for and overſees all the moneyers. 11. The blanchers, who anneal and cleanſe the money. 12. The moneyers; ſome of whom forge the money, ſome ſhare it, ſome round and mill it, and ſome ſtamp and coin it. 13. The porters who keep the gate of the mint.

Mint was alſo a pretended place of privilege, in Southwark, near the King’s Bench, put down by ſtatute. If any perſons, within the limits of the mint, ſhall obſtruct any officer in the ſerving of any writ or proceſs, &c. or aſſault any perſon therein, ſo as he receive any bodily hurt, the offender ſhall be guilty of felony, and be tranſported to the plantations, &c. Stat. 9. Geo. I.

MINT Marks. It hath been uſual, from old time, to oblige the maſters and workers of the mint, in the indentures made with them, “ to make a privy mark in all the money that they made, as well of gold as of ſilver, ſo that another time they might know, if need were, and witte which moneys of gold and ſilver among other of the ſame moneys, were of their own making, and which not.” And whereas, after every trial of the pix at Weſtminſter, the maſters and workers of the mint, having there proved their moneys to be lawful and good, were immediately entitled to receive their *quietus* under the great ſeal, and to be diſcharged from all ſuits or actions concerning thoſe moneys, it was then uſual for the ſaid maſters and workers to change the privy mark before uſed for another, that ſo the moneys from which they were not yet diſcharged might be diſtinguiſhed from thoſe for which they had already received their *quietus*: which new mark they then continued to ſtamp upon all their moneys, until another trial of the pix gave them alſo their *quietus* concerning thoſe.

The pix is a ſtrong box with three locks, whoſe keys are reſpectively kept by the warden, maſter, and comptroller of the mint; and in which are depoſited, ſealed up in ſeveral parcels, certain pieces taken at random out of every *journey* as it is called; that is, out of every 15 pounds weight of gold, or 60 pounds weight of ſilver, before the ſame is delivered to the proprietors. And this pix is, from time to time, by the king’s command, opened at Weſtminſter, in the preſence of the lord-chancellor, the lords of the council, the lords-commiſſioners of the treaſury, the juſtices of the ſeveral benches, and the barons of the exchequer; before whom a trial is made, by a jury of goldſmiths impannelled and ſworn for that purpoſe, of the collective weights of certain parcels of the ſeveral pieces of gold and ſilver taken at random from thoſe contained in the pix; after which thoſe parcels being ſeverally melted, aſſays are then made of the bullion

bullion of gold and ſilver ſo produced, by the melting certain ſmall quantities of the ſame againſt equal weights taken from the reſpective trial pieces of gold and ſilver that are depoſited and kept in the exchequer for that uſe. This is called the *trial of the pix;* the report made by the jury upon that trial is called the *verdict of the pix* for that time; and the indented trial pieces juſt above mentioned, are certain plates of ſtandard gold and ſtandard ſilver, made with the greateſt care, and delivered in upon oath, from time to time as there is occaſion, by a jury of the moſt able and experienced goldſmiths, ſummoned by virtue of a warrant from the lords of the treaſury to the wardens of the myſtery of goldſmiths of the city of London for that purpoſe; and which plates being ſo delivered in, are divided each, at this time, into ſeven parts by indentures, one of which parts is kept in his majeſty's court of exchequer at Weſtminſter, another by the ſaid company of goldſmiths, and two more by the officers of his majeſty's mint in the Tower; the remaining three being for the uſe of the mint, &c. in Scotland. The pix has ſometimes been tried every year, or even oftener, but ſometimes not more than once in ſeveral years: and from hence is underſtood how it comes to paſs, that, among the pieces that are dated as well as marked, three or more different dates are ſometimes found upon pieces impreſſed with the ſame mark: and again, that different marks are found upon pieces bearing the ſame date. Theſe marks are firſt obſervable upon the coins of King Edward III.; the words above quoted concerning thoſe marks are from the indentures made with the lord Haſtings, maſter and worker to King Edward IV.; and the marks themſelves continued to be ſtamped very conſpicuouſly upon the moneys, till the coinage by the mill and ſcrew was introduced and ſettled after the Reſtoration, in the year 1662; ſince which time, the moneys being made with far greater regularity and exactneſs than before, theſe marks have either been totally laid aſide, or ſuch only have been uſed as are of a more ſecret nature, and only known to the officers and engravers concerned in the coinage: and indeed the conſtant practice that has ever ſince prevailed, of dating all the ſeveral pieces, has rendered all ſuch marks of much leſs conſequence than before.

MINT. See MENTHA, BOTANY and MATERIA MEDICA *Index*.

MINTURNÆ, a town of Campania, between Sinueſſa and Formiæ. It was in the marſhes in this neighbourhood that Marius concealed himſelf in the mud to avoid the partizans of Sylla. The people condemned him to death; but when his voice alone had terrified the executioner, they ſhowed themſelves compaſſionate and favoured his eſcape.

MINUET, a very graceful kind of dance, conſiſting of a coupee, a high ſtep, and a balance: it begins with a beat, and its motion is triple.

The invention of the minuet ſeems generally to be aſcribed to the French, and particularly to the inhabitants of the province of Poictou. The word is ſaid by Menage and Furetiere to be derived from the French *menue* or *menu*, "ſmall or little;" and in ſtrictneſs ſignifies a ſmall ſpace. The melody of this dance conſiſts of two ſtrains, which, as being repeated, are called *repriſes*, each having eight or more bars, but never an odd number. The meaſure is three crotchets in a bar, and is thus marked $\frac{3}{4}$, though it is commonly performed in the time $\frac{3}{8}$. Walther ſpeaks of a minuet in Lully's opera of *Roland*, each ſtrain of which contains ten bars, the ſectional number being 5; which renders it very difficult to dance.

MINUTE, in *Geometry*, the 60th part of a degree of a circle.

MINUTE of Time, the 60th part of an hour.

MINUTE, in *Architecture*, uſually denotes the 60th, ſometimes the 30th, part of a module. See ARCHITECTURE.

MINUTE is alſo uſed for a ſhort memoir, or ſketch of a thing taken in writing.

MINUTIUS FELIX. See FELIX.

MINYÆ, a name given to the inhabitants of Orchomenos in Bœotia, from Minyas king of the country. Orchomenos the ſon of Minyas gave his name to the capital of the country; and the inhabitants ſtill retained their original appellation, in contradiſtinction to the Orchomenians of Arcadia. A colony of Orchomenians paſſed into Theſſaly and ſettled in Iolchos; from which circumſtance the people of the place, and particularly the Argonauts, were called *Minyæ*. This name they received, according to the opinion of ſome, not becauſe a number of Orchomenians had ſettled among them, but becauſe the chief and nobleſt of them were deſcended from the daughters of Minyas. Part of the Orchomenians accompanied the ſons of Codrus when they migrated to Ionia. The deſcendants of the Argonauts, as well as the Argonauts themſelves, received the name of *Minyæ*. They firſt inhabited Lemnos, where they had been born from the Lemnian women who had murdered their huſbands. They were driven from Lemnos by the Pelaſgi, about 1160 before the Chriſtian era, and came to ſettle in Laconia, from whence they paſſed into Calliſte with a colony of Lacedæmonians.

MIQUELETS, a name given to the Spaniards who inhabit the Pyrenean mountains on the frontiers of Arragon and Catalonia, and live by robbing.

MIQUELON, a ſmall deſert iſland to the ſouthweſt of Cape May in Newfoundland, ceded to the French by the peace of 1763, for drying and curing their fiſh. W. Long. 54. 30. N. Lat. 47. 22.

MIRABILIS, MARVEL OF PERU; a genus of plants belonging to the pentandria claſs; and in the natural method ranking with thoſe of which the order is doubtful. See BOTANY *Index*.

MIRACLE, in its original ſenſe, is a word of the ſame import with *wonder;* but in its uſual and more appropriate ſignification, it denotes "an effect contrary to the eſtabliſhed conſtitution and courſe of things, or a ſenſible deviation from the known laws of nature."

That the viſible world is governed by ſtated general rules, or that there is an order of cauſes and effects eſtabliſhed in every part of the ſyſtem of nature which falls under our obſervation, is a fact which cannot be controverted. If the Supreme Being, as ſome have ſuppoſed, be the only real agent in the univerſe, we have the evidence of experience, that, in the particular ſyſtem to which we belong, he acts by ſtated rules. If he employs inferior agents to conduct the various motions from which the phenomena reſult, we have the ſame evidence that he has ſubjected

Miracle.

ed thoſe agents to certain fixed laws, commonly called the *laws of nature*. On either hypotheſis, effects which are produced by the regular operation of theſe laws, or which are conformable to the eſtabliſhed courſe of events, are properly called *natural;* and every contradiction to this conſtitution of the natural ſyſtem, and the correſpondent courſe of events in it, is called a *miracle*.

If this definition of a miracle be juſt, no event can be deemed miraculous merely becauſe it is ſtrange, or even to us unaccountable; ſince it may be nothing more than a regular effect of ſome unknown law of nature. In this country earthquakes are rare; and for monſtrous births perhaps no *particular* and ſatisfactory account can be given: yet an earthquake is as regular an effect of the eſtabliſhed laws of nature as any of thoſe with which we are moſt intimately acquainted; and under circumſtances in which there would always be the ſame kind of production, the monſter is nature's genuine iſſue. It is therefore neceſſary, before we can pronounce any effect to be a true miracle, that the circumſtances under which it is produced be known, and that the common courſe of nature be in ſome degree underſtood; for in all thoſe caſes in which we are totally ignorant of nature, it is impoſſible to determine what is, or what is not, a deviation from its courſe. Miracles, therefore, are not, as ſome have repreſented them, appeals to our ignorance. They ſuppoſe ſome antecedent knowledge of the courſe of nature, without which no proper judgement can be formed concerning them; though with it their reality may be ſo apparent as to prevent all poſſibility of a diſpute.

Thus, were a phyſician to cure a blind man of a cataract, by anointing his eyes with a chemical preparation which we had never before ſeen, and to the nature and effects of which we are abſolute ſtrangers, the cure would undoubtedly be *wonderful;* but we could not pronounce it *miraculous*, becauſe, for any thing known to us, it might be the natural effect of the operation of the unguent on the eye. But were he to recover his patient merely by commanding him to ſee, or by anointing his eyes with ſpittle, we ſhould with the utmoſt confidence pronounce the cure to be a miracle; becauſe we know perfectly that neither the human voice nor human ſpittle have, by the eſtabliſhed conſtitution of things, any ſuch power over the diſeaſes of the eye. No one is now ignorant, that perſons apparently dead are often reſtored to their families and friends, by being treated in the manner recommended by the Humane Society. To the vulgar, and ſometimes even to men of ſcience, theſe effects appear very wonderful; but as they are known to be produced by phyſical agency, they can never be conſidered as miraculous deviations from the laws of nature. On the other hand, no one could doubt of his having witneſſed a real miracle who had ſeen a perſon that had been four days dead come alive out of his grave at the *call* of another, or who had even beheld a perſon exhibiting all the *ſymptoms* of death inſtantly reſuſcitated merely by being *deſired* to live.

Thus eaſy is it, in all caſes in which the courſe of nature is underſtood, to determine whether any particular event be really a miracle; whilſt in circumſtances where we know nothing of nature and its courſe, even a true miracle, were it performed, could not be admitted as ſuch, or carry any conviction to the mind of a philoſopher.

Miracle.

If miracles be effects contrary to the eſtabliſhed conſtitution of things, we are certain that they will never be performed on trivial occaſions. The conſtitution of things was eſtabliſhed by the Creator and Governor of the univerſe, and is undoubtedly the offspring of infinite wiſdom purſuing a plan for the beſt of purpoſes. From this plan no deviation can be made but by God himſelf, or by ſome powerful being acting with his permiſſion. The plans deviſed by wiſdom are ſteady in proportion to their perfection, and the plans of infinite wiſdom muſt be abſolutely perfect. From this conſideration, ſome men have ventured to conclude, that no miracle was ever wrought, or can rationally be expected; but maturer reflection muſt ſoon ſatiſfy us that all ſuch concluſions are haſty.

Man is unqueſtionably the principal creature in this world, and apparently the only one in it who is capable of being made acquainted with the relation in which he ſtands to his Creator. We cannot, therefore, doubt, but that ſuch of the laws of nature as extend not their operation beyond the limits of this earth were eſtabliſhed chiefly, if not ſolely, for the good of mankind; and if, in any particular circumſtances, that good can be more effectually promoted by an occaſional deviation from thoſe laws, ſuch a deviation may be reaſonably expected. Were man, in the exerciſe of his mental and corporeal powers, ſubjected to the laws of phyſical neceſſity, the circumſtances ſuppoſed would indeed never occur, and of courſe no miracle could be admitted. But ſuch is not the nature of man.

Without repeating what has been ſaid elſewhere (See METAPHYSICS, Part III. Chap. V.) of neceſſity and liberty, we ſhall here take it for granted, that the relation between motives and actions is different from that between cauſe and effect in phyſics; and that, mankind have ſuch command over themſelves, as that by their voluntary conduct, they can make themſelves in a great degree either happy or miſerable. We know likewiſe from hiſtory, that, by ſome means or other, almoſt all mankind were once ſunk into the groſſeſt ignorance of the moſt important truths; that they knew not the Being by whom they were created and ſupported; that they paid divine adoration to ſtocks, ſtones, and the vileſt reptiles; and that they were ſlaves to the moſt impious, cruel, and degrading ſuperſtitions.

From this depraved ſtate it was ſurely not unworthy of the common “Father of all” to reſcue his helpleſs creature, to enlighten their underſtandings that they might perceive what is right, and to preſent to them motives of ſufficient force to engage them in the practice of it. But the underſtandings of ignorant barbarians cannot be enlightened by arguments; becauſe of the force of ſuch arguments as regard moral ſcience they are not qualified to judge. The philoſophers of Athens and Rome inculcated, indeed, many excellent moral precepts, and they ſometimes ventured to expoſe the abſurdities of the reigning ſuperſtition: but their lectures had no influence upon the multitude; and they had themſelves imbibed ſuch erroneous notions reſpecting the attributes of the Supreme Being, and the nature of the human ſoul, and converted thoſe notions into firſt principles, of which they would not

permit

permit an examination, that even among them a thorough reformation was not to be expected from the powers of reaſoning. It is likewiſe to be obſerved, that there are many truths of the utmoſt importance to mankind, which unaſſiſted reaſon could never have diſcovered. Amongſt theſe we may confidently reckon the immortality of the ſoul, the terms upon which God will be reconciled to ſinners, and the manner in which that all-perfect Being may be acceptably worſhipped; about all of which philoſophers were in ſuch uncertainty, that, according to Plato, "Whatever is ſet right, and as it ſhould be, in the preſent evil ſtate of the world, can be ſo only by the particular interpoſition of God (A).

An immediate revelation from Heaven, therefore, was the only method by which infinite wiſdom and perfect goodneſs could reform a bewildered and vicious race. But this revelation, at whatever time we ſuppoſe it given, muſt have been made directly either to ſome choſen individuals commiſſioned to inſtruct others, or to every man and woman for whoſe benefit it was ultimately intended. Were every perſon inſtructed in the knowledge of his duty by immediate inſpiration, and were the motives to practiſe it brought home to his mind by God himſelf, human nature would be wholly changed: men would not be maſters of their own actions; they would not be moral agents, nor by conſequence be capable either of reward or of puniſhment. It remains, therefore, that if God has been graciouſly pleaſed to enlighten and reform mankind, without deſtroying that moral nature which is eſſential to virtue, he can have done it only by revealing his truth to certain choſen inſtruments, who were the immediate inſtructors of their contemporaries, and through them have been the inſtructors of ſucceeding ages.

Let us ſuppoſe this to have been actually the caſe, and conſider how thoſe inſpired teachers could communicate to others every truth which had been revealed to themſelves. They might eaſily, if it was part of their duty, deliver a ſublime ſyſtem of natural and moral ſcience, and eſtabliſh it upon the common baſis of experiment and demonſtration; but what foundation could they lay for thoſe truths which unaſſiſted reaſon cannot diſcover, and which, when they are revealed, appear to have no neceſſary relation to any thing previouſly known? To a bare affirmation that they had been immediately received from God, no rational being could be expected to aſſent. The teachers might be men of known veracity, whoſe ſimple aſſertion would be admitted as ſufficient evidence for any fact in conformity with the laws of nature; but as every man has the evidence of his own conſciouſneſs and experience that revelations from heaven are deviations from theſe laws, an aſſertion ſo apparently extravagant would be rejected as falſe, unleſs ſupported by ſome better proof than the mere affirmation of the teacher. In this ſtate of things, we can conceive no evidence ſufficient to make ſuch doctrines be received as the truths of God, but the power of working miracles committed to him who taught them. This would, indeed, be fully adequate to the purpoſe. For if there were nothing in the doctrines themſelves impious, immoral, or contrary to truths already known, the only thing which could render the teacher's aſſertion incredible, would be its implying ſuch an intimate communion with God as is contrary to the eſtabliſhed courſe of things, by which men are left to acquire all their knowledge by the exerciſe of their own faculties.— Let us now ſuppoſe one of thoſe inſpired teachers to tell his countrymen, that he did not deſire them, on his *ipſe dixit*, to believe that he had any preternatural communion with the Deity, but that for the truth of his aſſertion he would give them the evidence of their own ſenſes; and after this declaration let us ſuppoſe him immediately to raiſe a perſon from the dead in their preſence, merely by calling upon him to come out of his grave. Would not the only poſſible objection to the man's veracity be removed by this miracle? and his aſſertions that he had received ſuch and ſuch doctrines from God be as fully credited, as if it related to the moſt common occurrence? Undoubtedly it would; for when ſo much preternatural *power* was viſibly communicated to this perſon, no one could have reaſon to queſtion his having received an equal portion of preternatural *knowledge*. A palpable deviation from the known laws of nature, in one inſtance, is a ſenſible proof that ſuch a deviation is poſſible in another; and in ſuch a caſe as this, it is the witneſs of God to the truth of a man.

Miracles, then, under which we include prophecy, are the only direct evidence which can be given of divine inſpiration. When a religion, or any religious truth, is to be revealed from heaven, they appear to be abſolutely neceſſary to enforce its reception among men; and this is the only caſe in which we can ſuppoſe them neceſſary, or believe for a moment that they ever have been or will be performed.

The hiſtory of almoſt every religion abounds with relations of prodigies and wonders, and of the intercourſe of men with the gods; but we know of no religious ſyſtem, thoſe of the Jews and Chriſtians excepted, which appealed to miracles as the ſole evidence of its truth and divinity. The pretended miracles mentioned by Pagan hiſtorians and poets are not ſaid to have been publicly wrought to enforce the truth of a new religion contrary to the reigning idolatry. Many of them may be clearly ſhown to have been mere natural events; (ſee MAGIC). Others of them are repreſented as having been performed in ſecret on the moſt trivial occaſions, and in obſcure and fabulous ages long prior to the era of the writers by whom they are recorded. And ſuch of them as at firſt view appear to be beſt atteſted, are evidently tricks contrived for intereſted purpoſes; to flatter power, or to promote the prevailing ſuperſtitions. For theſe reaſons, as well as on account of the immoral character of the divinities by whom they are ſaid to have been wrought, they are altogether unworthy of examination, and carry in the very nature of them the completeſt proofs of falſehood and impoſture.

But

(A) Ευ γαρ χρη ειδεναι, ὁ τι περ αν σωθη τε και γενηται οιον δει, εν τοιαυτη καταστασει πολιτειων. Θεου μοιραν αυτο σωσαι. De Repub. lib. vi.

But the miracles recorded of Moſes and of Chriſt bear a very different character. None of them is repreſented as wrought on trivial occaſions. The writers who mention them were eye witneſſes of the facts; which they affirm to have been performed publicly, in atteſtation of the truth of their reſpective ſyſtems. They are indeed ſo incorporated with theſe ſyſtems, that the miracles cannot be ſeparated from the doctrines; and if the miracles were not really performed, the doctrines cannot poſſibly be true. Beſides all this, they were wrought in ſupport of revelations which oppoſed all the religious ſyſtems, ſuperſtitions, and prejudices, of the age in which they were given: a circumſtance which of itſelf ſets them, in point of authority, infinitely above the Pagan prodigies, as well as the lying wonders of the Romiſh church.

It is indeed, we believe, univerſally admitted, that the miracles mentioned in the book of Exodus and in the four Goſpels, might, to thoſe who ſaw them performed, be ſufficient evidence of the divine inſpiration of Moſes and of Chriſt; but to us it may be thought that they are no evidence whatever, as we muſt believe in the miracles themſelves, if we believe in them at all, upon the bare authority of human teſtimony. Why, it has been ſometimes aſked, are not miracles wrought in all ages and countries? If the religion of Chriſt was to be of perpetual duration, every generation of men ought to have complete evidence of its truth and divinity.

To the performance of miracles in every age and in every country, perhaps the ſame objections lie as to the immediate inſpiration of every individual. Were thoſe miracles univerſally received as ſuch, men would be ſo overwhelmed with the *number* rather than with the *force* of their authority, as hardly to remain maſters of their own conduct; and in that caſe the very end of all miracles would be defeated by their frequency. The truth, however, ſeems to be, that miracles ſo frequently repeated would not be received as ſuch, and of courſe would have *no* authority; becauſe it would be difficult, and in many caſes impoſſible, to diſtinguiſh them from natural events. If they recurred regularly at certain intervals, we could not prove them to be deviations from the known laws of nature, becauſe we ſhould have the ſame experience for the one ſeries of events as for the other; for the regular ſucceſſion of preternatural effects, as for the eſtabliſhed conſtitution and courſe of things.

Be this, however, as it may, we ſhall take the liberty to affirm, that for the reality of the Goſpel miracles we have evidence as convincing to the reflecting mind, though not ſo ſtriking to vulgar apprehenſion, as thoſe had who were contemporary with Chriſt and his apoſtles, and actually ſaw the mighty works which he performed. To the admirers of Mr Hume's philoſophy this aſſertion will appear an extravagant paradox; but we hope to demonſtrate its truth from principles which, conſiſtently with himſelf, that author could not have denied. He has indeed endeavoured to prove *, that "no teſtimony is ſufficient to eſtabliſh a miracle;" and the reaſoning employed for this purpoſe is, that "a miracle being a violation of the laws of nature which a firm and unalterable experience has eſtabliſhed, the proof againſt a miracle, from the very nature of the fact, is as entire as any argument from experience can be; whereas our experience of human veracity, which (according to him) is the ſole foundation of the evidence of teſtimony, is far from being uniform, and can therefore never preponderate againſt that experience which admits of no exception." This boaſted and plauſible argument has with equal candour and acuteneſs been examined by Dr Campbell *, who juſtly obſerves, that ſo far is experience from being the ſole foundation of the evidence of teſtimony, that, on the contrary, teſtimony is the ſole foundation of by far the greater part of what Mr Hume calls firm and unalterable experience; and that if in certain circumſtances we did not give an implicit faith to teſtimony, our knowledge of events would be confined to thoſe which had fallen under the immediate obſervation of our own ſenſes. For a ſhort view of this celebrated controverſy in which the Chriſtian ſo completely vanquiſhes the philoſopher, ſee the word ABRIDGMENT.

But though Dr Campbell has expoſed the ſophiſtry of his opponent's reaſoning, and overturned the *principles* from which he reaſons, we are perſuaded that he might ſafely have joined iſſue with him upon thoſe very principles. To us, at leaſt, it appears that the teſtimony upon which we receive the Goſpel miracles is preciſely of that kind which Mr Hume has acknowledged ſufficient to eſtabliſh even a miracle. "No teſtimony (ſays he) is ſufficient to eſtabliſh a miracle, unleſs the teſtimony be of ſuch a kind that its falſehood would be more miraculous than the fact which it endeavours to eſtabliſh. When one tells me that he ſaw a dead man reſtored to life, I immediately conſider with myſelf whether it be more probable that this perſon ſhould either deceive or be deceived, or that the fact which he relates ſhould really have happened. I weigh the one miracle againſt the other; and according to the ſuperiority which I diſcover, I pronounce my deciſion, and always reject the greater miracle." In this paſſage every reader may remark what did not eſcape the perſpicacious eye of Dr Campbell, a ſtrange confuſion of terms; but as all miracles are equally eaſy to the Almighty; and as Mr Hume has elſewhere obſerved, that "the raiſing of a feather, when the wind wants ever ſo little of a force requiſite for that purpoſe, is as real a miracle as the raiſing of a houſe or a ſhip into the air;" candour obliges us to ſuppoſe, that by talking of greater and leſs miracles and of always rejecting the *greater*, he meant nothing more, but that of two deviations from the known laws of nature he always rejects that which in itſelf is leaſt probable.

If, then, we can ſhow that the teſtimony given by the apoſtles and other firſt preachers of Chriſtianity to the miracles of their Maſter would, upon their ſuppoſition that thoſe miracles were not really performed, have been as great a deviation from the known laws of nature as the miracles themſelves, the balance muſt be conſidered as evenly poiſed by oppoſite miracles; and whilſt it continues ſo, the judgment muſt remain in a ſtate of ſuſpenſe. But if it ſhall appear, that in this caſe the falſe teſtimony would have been a deviation from the laws of nature leſs probable in itſelf than the miracles recorded in the Goſpels, the balance will be inſtantly deſtroyed; and by Mr Hume's maxim we ſhall be obliged to reject the ſuppoſition of falſehood in the teſtimony

---

Eſſay on iracles.

* *Diſſertation on Miracles.*

of the apoſtles, and admit the miracles of Chriſt to have been really performed.

In this argument we need not waſte time in proving that thoſe miracles, as they are repreſented in the writings of the New Teſtament, were of ſuch a nature, and performed before ſo many witneſſes, that no impoſition could poſſibly be practiſed on the ſenſes of thoſe who affirm that they were preſent. From every page of the Goſpels this is ſo evident, that the philoſphical adverſaries of the Chriſtian faith never ſuppoſe the apoſtles to have been themſelves deceived, but boldly accuſe them of bearing falſe witneſs. But if this accuſation be well founded, their teſtimony itſelf is as great a miracle as any which they record of themſelves or of their Maſter.

It has been ſhown elſewhere (ſee METAPHYSICS, N° 138.), that by the law of aſſociation, which is one of the laws of nature, mankind, in the very proceſs of learning to ſpeak, neceſſarily learn to ſpeak the truth; that ideas and relations are in the mind of every man ſo cloſely aſſociated with the words by which they are expreſſed in his native tongue, and in every other language of which he is maſter, that the one cannot be entirely ſeparated from the other; that therefore no man can on any occaſion ſpeak falſehood without ſome *effort;* that by no effort can a man give conſiſtency to an unpremeditated detail of falſehood, if it be of any length, and include a number of particulars; and that it is ſtill leſs poſſible for ſeveral men to agree in ſuch a detail, when at a diſtance from each other, and croſs queſtioned by their enemies.

This being the caſe, it follows, if the teſtimony of the apoſtles to their own and their Maſter's miracles be falſe, either that they muſt have concerted a conſiſtent ſcheme of falſehood, and agreed to publiſh it at every hazard; or that God, or ſome powerful agent appointed by him, muſt have diſſolved all the aſſociations formed in their minds between ideas of ſenſe and the words of language, and arbitrarily formed new aſſociations, all in exact conformity to each other, but all in direct contradiction to truth. One or other of theſe events muſt have taken place; becauſe, upon the ſuppoſition of falſehood, there is no other alternative. But ſuch a diſſolution and formation of aſſociations as the latter implies, muſt, to every man who ſhall attentively conſider it, appear to be as real a miracle, and to require as great an exertion of power, as the reſurrection of the dead. Nor is the ſuppoſed voluntary agreement of the apoſtles in a ſcheme of falſehood an event leſs miraculous. When they ſat down to fabricate their pretended revelation, and to contrive a ſeries of miracles to which they were unanimouſly to appeal for its truth, it is plain, ſince they proved ſucceſsful in their daring enterpriſe, that they muſt have clearly foreſeen every poſſible circumſtance in which they could be placed, and have prepared conſiſtent anſwers to every queſtion that could be put to them by their moſt inveterate and moſt enlightened enemies; by the ſtateſman, the lawyer, the philoſopher, and the prieſt. That ſuch foreknowledge as this would have been miraculous, will not ſurely be denied; ſince it forms the very attribute which we find it moſt difficult to allow even to God himſelf. It is not, however, the *only* miracle which this ſuppoſition would compel us to ſwallow. The very *reſolution* of the apoſtles to propagate the belief of falſe miracles in ſupport of ſuch a religion as that which is taught in the New Teſtament, is as great a miracle as human imagination can eaſily conceive.

When they formed this deſign, either they muſt have hoped to ſucceed, or they muſt have foreſeen that they ſhould fail in their undertaking; and in either caſe, they *choſe evil for its own ſake.* They could not, if they foreſaw that they ſhould fail, look for any thing but that contempt, diſgrace, and perſecution, which were then the inevitable conſequences of an unſucceſsful endeavour to overthrow the eſtabliſhed religion. Nor could their proſpects be brighter upon the ſuppoſition of their ſucceſs. As they knew themſelves to be falſe witneſſes and impious deceivers, they could have no hopes beyond the grave; and by determining to oppoſe all the religious ſyſtems, ſuperſtitions, and prejudices of the age in which they lived, they wilfully expoſed themſelves to inevitable miſery in the preſent life, to inſult, and impriſonment, to ſtripes and death. Nor can it be ſaid that they might look forward to power and affluence when they ſhould, through ſufferings, have converted their countrymen; for ſo deſirous were they of obtaining nothing but *miſery*, as the end of their miſſion, that they made their own perſecution a teſt of the truth of their doctrines. They introduced the Maſter from whom they pretended to have received theſe doctrines as telling them, that "they were ſent forth as ſheep in the midſt of wolves; that they ſhould be delivered up to councils, and ſcourged in ſynagogues; that they ſhould be hated of all men for his name's ſake; that the brother ſhould deliver up the brother to death, and the father the child; and that he who took not up his croſs and followed after him was not worthy of him." The very ſyſtem of religion, therefore, which they invented and reſolved to impoſe upon mankind, was ſo contrived, that the worldly proſperity of its firſt preachers, and even their exemption from perſecution, was incompatible with its ſucceſs. Had theſe clear predictions of the Author of that religion, under whom the apoſtles acted only as miniſters, not been verified, all mankind muſt have inſtantly perceived that their pretence to inſpiration was falſe, and that Chriſtianity was a ſcandalous and imprudent impoſture. All this the apoſtles could not but foreſee when they formed their plan for deluding the world. Whence it follows, that when they reſolved to ſupport their pretended revelation by an appeal to forged miracles, they wilfully, and with their eyes open, expoſed themſelves to inevitable miſery, whether they ſhould ſucceed or fail in their enterpriſe; and that they concerted their meaſures ſo as not to admit of a poſſibility of recompenſe to themſelves, either in this life or in that which is to come. But if there be a law of nature, for the reality of which we have better evidence than we have for others, it is, that "no man can chooſe miſery for its *own ſake*," or make the acquiſition of it the ultimate end of his purſuit. The exiſtence of other laws of nature we know by teſtimony and our own obſervation of the regularity of their effects. The exiſtence of this law is made known to us not only by theſe means, but alſo by the ſtill clearer and more concluſive evidence of our own conſciouſneſs.

Thus, then, do miracles force themſelves upon our aſſent in every poſſible view which we can take of this intereſting ſubject. If the teſtimony of the firſt preachers

preachers of Chriſtianity was true, the miracles recorded in the Goſpel were certainly performed, and the doctrines of our religion are derived from heaven. On the other hand, if that teſtimony was falſe, either God muſt have miraculouſly effaced from the minds of thoſe by whom it was given all the aſſociations formed between their ſenſible ideas and the words of language, or he muſt have endowed thoſe men with the gift of preſcience, and have impelled them to fabricate a pretended revelation for the purpoſe of deceiving the world, and involving themſelves in certain and foreſeen deſtruction.

The power neceſſary to perform the one ſeries of theſe miracles may, for any thing known to us, be as great as that which would be requiſite for the performance of the other; and, conſidered merely as exertions of preternatural power, they may ſeem to balance each other, and to hold the mind in a ſtate of ſuſpenſe. But when we take into conſideration the different purpoſes for which theſe oppoſite and contending miracles were wrought, the balance is inſtantly deſtroyed. The miracles recorded in the Goſpels, if real, were wrought in ſupport of a revelation which, in the opinion of all by whom it is received, has brought to light many important truths which could not otherwiſe have been made known to men; and which, by the confeſſion of its adverſaries, contains the pureſt moral precepts by which the conduct of mankind was ever directed. The oppoſite ſeries of miracles, if real, was performed to enable, and even to compel, a company of Jews, of the loweſt rank and of the narroweſt education, to fabricate, with the view of inevitable deſtruction to themſelves, a conſiſtent ſcheme of falſehood, and by an appeal to forged miracles to impoſe it upon the world as a revelation from heaven. The object of the former miracles is worthy of a God of infinite wiſdom, goodneſs, and power. The object of the latter is abſolutely inconſiſtent with wiſdom and goodneſs, which are demonſtrably attributes of that Being by whom alone miracles can be performed. Whence it follows, that the ſuppoſition of the apoſtles bearing *falſe* teſtimony to the miracles of their Maſter, implies a ſeries of deviations from the laws of nature, infinitely leſs probable in themſelves than thoſe miracles: and therefore by Mr Hume's maxim, we muſt neceſſarily reject the ſuppoſition of falſehood in the teſtimony, and admit the reality of the miracles. So true it is, that for the reality of the Goſpel miracles we have evidence as convincing to the reflecting mind, as thoſe had who were contemporary with Chriſt and his apoſtles, and were actual witneſſes to their mighty works.

MIRANDA-DE-EBRO, a town of Spain, in Old Caſtile, with a ſtrong caſtle; ſeated in a country that produces excellent wine. W. Long. 3. 10. N. Lat. 42. 52.

MIRANDO-DE-DOURO, or *Duero*, a ſtrong town of Portugal, and capital of the province of Tra-los-Montes, with a biſhop's ſee. It is well fortified, and ſeated on a rock near the confluence of the rivers Douro and Freſna. W. Long. 5. 40. N. Lat. 41. 30.

MIRANDOLA, a town of Italy, and capital of a duchy of the ſame name, ſituated between the duchies of Mantua and Modena; is well fortified, and has alſo a ſtrong citadel and fort. It has been ſeveral times taken and retaken. E. Long. 11. 5. N. Lat. 44. 52.

MIRIAM, ſiſter of Aaron and Moſes, makes two or three remarkable appearances in Scripture. It was owing to her that her mother was employed by Pharaoh's daughter as nurſe to Moſes. She put herſelf at the head of the women of Iſrael after their paſſage through the Red ſea, in order to ſing the ſong which the men had ſung before. She joined with her brother Aaron in murmuring againſt Moſes, and was ſeverely chaſtiſed for that action; for ſhe became leprous, and continued ſeparate from the reſt without the camp for ſeven days. She died before her brothers, though in the ſame year with them, and was buried at the public expence.

MIRROR, a name for a looking glaſs, or any poliſhed body, whoſe uſe is to form the images of diſtant objects, by reflection of the rays of light. See REFLECTION.

Mirrors are either plane, convex, or concave. The firſt reflect the rays of light in a direction exactly ſimilar to that in which they fall upon them, and therefore repreſent bodies of their natural magnitude. The convex ones make the rays diverge much more than before reflection, and therefore greatly diminiſh the images of thoſe objects which they ſhow: while the concave ones, by collecting the rays into a focus, not only magnify the objects they ſhow, but will burn very fiercely when expoſed to the rays of the ſun; and hence they are commonly known by the name of *burning mirrors*. See *BURNING Mirrors*.

In ancient times the mirrors were made of ſome kind of metal; and from a paſſage of the Moſaic writings we learn that the mirrors uſed by the Jewiſh women were made of braſs. The Jews certainly had been taught to uſe that kind of mirrors by the Egyptians; from whence it is probable that brazen mirrors were the firſt kind uſed in the world. Any kind of metal, indeed, when well poliſhed, will reflect very powerfully; but of all others ſilver reflects the moſt, though it has been in all countries too expenſive a material for common uſe. Gold alſo is very powerful; and metals, or even wood, gilded and poliſhed, will act very powerfully as burning mirrors. Even poliſhed ivory, or ſtraw nicely plaited together, will form mirrors capable of burning, if on a large ſcale.

Since the invention of glaſs, and the application of quickſilver to it, became generally known, it hath been univerſally employed for thoſe plane mirrors uſed as ornaments to houſes; but in making reflecting teleſcopes, they have been found much inferior to metallic ones. It doth not appear that the ſame ſuperiority belongs to the metalline burning mirrors, conſidered merely as burning glaſſes; ſince the mirror with which M. Macquer melted platina, though only 22 inches diameter, and which was made of quickſilvered glaſs, produced much greater effects than M. Vilette's metalline ſpeculum, which conſiderably exceeded it in ſize. It is very probable, however, that this mirror of M. Vilette's was by no means ſo well poliſhed as it ought to have been; as the art of preparing the metal for taking the fineſt poliſh has but lately been diſcovered and publiſhed in the Philoſophical Tranſactions by Mr Mudge. See *GLASS-Grinding*.

MIRE-CROW, SEA-CROW, or *Pewit*. See LARUS, ORNITHOLOGY *Index*.

MISADVENTURE, in common language, ſignifies ſies any unlucky accident which takes place without being foreſeen.

Misadventure, in *Law*, has an eſpecial ſignification for the killing a man partly by negligence, and partly by chance. See Homicide.

MISANTHROPY (from *μισος*, *hatred*, and *ανθρωπος*, a *man*); a general diſlike or averſion to man, and mankind. In which ſenſe it ſtands oppoſed to *philanthropy*, or the love of mankind.

MISCARRIAGE. See Abortion and Midwifery.

MISCHNA, or Misna, (from שנה, *iteravit*), a part of the Jewiſh Talmud.

The Miſchna contains the text; and the Gemara, which is the ſecond part of the Talmud, contains the commentaries: ſo that the Gemara is, as it were, a gloſſary on the Miſchna.

The Miſchna conſiſts of various traditions of the Jews, and of explanations of ſeveral paſſages of Scripture: theſe traditions ſerving as an explication of the written law, and ſupplement to it, are ſaid to have been delivered to Moſes during the time of his abode on the Mount; which he afterwards communicated to Aaron, Eleazar, and his ſervant Joſhua. By theſe they were tranſmitted to the 70 elders, by them to the prophets, who communicated them to the men of the great ſanhedrim, from whom the wiſe men of Jeſuralem and Babylon received them. According to Prideaux's account, they paſſed from Jeremiah to Baruch, from him to Ezra, and from Ezra to the men of the great ſynagogue, the laſt of whom was Simon the Juſt; who delivered them to Antigonus of Socho; and from him they came down in regular ſucceſſion to Simeon, who took our Saviour in his arms; to Gamaliel, at whoſe feet Paul was educated; and laſt of all to Rabbi Judah the Holy, who committed them to writing in the Miſchna. But Dr Prideaux, rejecting this Jewiſh fiction, obſerves, that after the death of Simon the Juſt, about 299 years before Chriſt, the Miſchnical doctors aroſe, who, by their comments and concluſions, added to the number of thoſe traditions which had been received and allowed by Ezra and the men of the great ſynagogue; ſo that towards the middle of the ſecond century after Chriſt under the empire of Antoninus Pius, it was found neceſſary to commit theſe traditions to writing; more eſpecially, as their country had conſiderably ſuffered under Adrian, and many of their ſchools had been diſſolved, and their learned men cut off; and therefore the uſual method of preſerving their traditions had failed. Rabbi Judah on this occaſion being rector of the ſchool at Tiberias, and preſident of the ſanhedrim in that place, undertook the work, and compiled it in ſix books, each conſiſting of ſeveral tracts, which altogether make up the number of 63. *Prid. Connex.* vol. ii. p. 468, &c. edit. 9. This learned author computes, that the Miſchna was compoſed about the 150th year of our Lord; but Dr Lightfoot ſays, that Rabbi Judah compiled the Miſchna about the year of Chriſt 190, in the latter end of the reign of Commodus; or, as ſome compute, in the year of Chriſt 220. Dr Lardner is of opinion, that this work could not have been finiſhed before the year 190, or later. Collect. of Jewiſh and Heathen Teſtimonies, &c. vol. i. p. 178. Thus the book called the *Miſchna* was formed; a book which the Jews have generally received with the greateſt veneration. The original has been publiſhed with a Latin tranſlation by Surenhuſius, with notes of his own, and others from the learned Maimonides, &c. in 6 vol. fol. Amſterd. A. D. 1698—1703. (See Talmud). It is written in a much purer ſtyle, and is not near ſo full of dreams and viſions as the Gemara.

MISDEMEANOUR, in *Law*, ſignifies a crime. Every crime is a miſdemeanour; yet the law has made a diſtinction between crimes of a higher and a lower nature; the latter being denominated *miſdemeanours*, the former *felonies*, &c. For the underſtanding of which diſtinction, we ſhall give the following definition from Blackſtone's Commentaries, vol. iv. 5.

"A crime, or miſdemeanour, is an act *committed* or *omitted*, in violation of a public law, either forbidding or commanding it. This general definition comprehends both *crimes* and *miſdemeanours*; which, properly ſpeaking, are mere ſynonymous terms; though, in common uſage, the word *crime* is made to denote ſuch offences as are of a deeper and more atrocious dye; while ſmaller faults, and omiſſions of leſs conſequence, are compriſed under the gentler name of *miſdemeanours* only."

MISE, in law books, is uſed in various ſenſes: thus it ſometimes ſignifies coſts or expences; in which ſenſe it is commonly uſed in entering of judgments in actions perſonal. It is alſo uſed for the iſſue to be tried on the grand aſſize; in which caſe, joining of the miſe upon the mere right, is putting in iſſue between the tenant and demandant, Who has the beſt or cleareſt right.

Mise, alſo ſignifies a tax or tallage, &c. An honorary gift, or cuſtomary preſent from the people of Wales to every new king or prince of Wales, anciently given in cattle, wine, and corn, but now in money, being 5000l. or more, is denominated a *miſe*: ſo was the uſual tribute or fine of 3000 merks paid by the inhabitants of the county palatine of Cheſter at the change of every owner of the ſaid earldom, for enjoying their liberties. And at Cheſter they have a miſe-book, wherein every town and village in the county is rated what to pay towards the miſe. The 27 Hen. VIII. c. 26. ordains that lords ſhall have all ſuch miſes and profits of their lands as they had in times paſt, &c.

Mise, is ſometimes alſo corruptly uſed for *meaſe*, in law French *mees*, "a meſſuage;" as a *miſe place*, in ſome manors, is ſuch a meſſuage or tenement as anſwers the lord a heriot at the death of its owner.—2. *Inſt.* 528.

MISENUM, or Misenus, in *Ancient Geography*; a promontory, port, and town in Campania, ſituated to the ſouth-weſt of Baiæ, in the Sinus Puteolanus, on the north ſide. Here Auguſtus had a fleet, called *Claſſis Miſenenſis*, for guarding the Mare Inferum; as he had another at Ravenna for the Superum.

On this peninſula a villa was built by Caius Marius, with a degree of elegance that gave great offence to the moſt auſtere among the Romans, who thought it ill ſuited to the character of ſo rough a ſoldier. Upon the ſame foundation Lucullus the plunderer of the eaſtern world, erected an edifice, in compariſon of which the former houſe was a cottage; but even his magnificence wes eclipſed by the ſplendour of the palace which the emperors raiſed upon the ſame ſpot. To theſe proud abodes

abodes of heroes and monarchs, which have long been levelled to the ground, a few fiſhing huts, as Mr Swinburne informs us, and a lonely public houſe, have ſucceeded: hither boatmen reſort to tipple perhaps on the identical ſite where the voluptuous maſters of the world quaffed Chian and Falernian wines.

MISER, a parſimonious perſon who is at the ſame time rich; or a wretch covetous to extremity, whom avarice has diveſted of all the charities of human nature, and made even an enemy to himſelf.

Of this moſt unaccountable of all characters, many inſtances occur; ſome of them ſo extraordinary as almoſt to ſurpaſs belief. The following are here ſelected, as being of recent date, perfectly authentic, and the laſt of them in particular exhibiting an aſſemblage of qualities the moſt ſingular perhaps that ever exiſted in the ſame perſon. Too little dignified to merit a place in regular biography, yet too curious a variety of human character to paſs unnoticed in this work, the preſent ſeemed the only title under which it could with propriety be introduced.

1. In December 1790, died at Paris, literally of want, Mr Oſtervald, a well known banker. This man, originally of Neufchatel, felt the violence of the diſeaſe of avarice (for ſurely it is rather a diſeaſe than a paſſion of the mind) ſo ſtrongly, that within a few days of his death, no importunities could induce him to buy a few pounds of meat for the purpoſe of making a little ſoup for him. "'Tis true (ſaid he), I ſhould not diſlike the ſoup, but I have no appetite for the meat; what then is to become of that?" At the time that he refuſed this nouriſhment, for fear of being obliged to give away two or three pounds of meat, there was tied round his neck a ſilken bag, which contained 800 aſſignats of 1000 livres each. At his outſet in life, he drank a pint of beer which ſerved him for ſupper, every night at a houſe much frequented, from which he carried home all the bottle corks he could come at. Of theſe, in the courſe of eight years, he had collected as many as ſold for 12 louis d'or, a ſum that had laid the foundation of his future fortune, the ſuperſtructure of which was rapidly raiſed by his uncommon ſucceſs in ſtock jobbing. He died poſſeſſed of three millions of livres (125,000l. ſterling).

2. The late John Elwes, Eſq. was member for Berkſhire in three ſucceſſive parliaments. His family name was *Meggot*; and his father was a brewer of great eminence, and diſtinguiſhed by no peculiarity of character: but his mother, though ſhe was left nearly 100,000l. by her huſband, ſtarved herſelf to death! At an early period of life he was ſent to Weſtminſter ſchool, where he remained for 10 or 12 years. During that time he certainly had not miſapplied his talents; for he was a good claſſical ſcholar to the laſt: and it is a circumſtance not a little remarkable, though well authenticated, that he never read afterwards, nor had he ever any knowledge in accounts; to which may in ſome meaſure be attributed the total ignorance he was always in as to his affairs. From Weſtminſter ſchool Mr Meggot removed to Geneva, where he ſoon entered upon purſuits more agreeable to him than ſtudy. The riding maſter of the academy there had then to boaſt perhaps of three of the beſt riders in Europe, Mr Worſley, Mr Elwes, and Sir Sidney Meadows. Of the three, Elwes was reckoned the moſt deſperate; the young horſes were always put into his hands, and he was the rough rider to the other two.

On his return to England, after an abſence of two or three years, he was to be introduced to his uncle the late Sir Harvey Elwes, who was then living at Stoke in Suffolk, perhaps the moſt perfect picture of human penury that ever exiſted. The attempts at ſaving money were in him ſo extraordinary, that Mr Elwes perhaps never quite reached them, even at the laſt period of his life.—Of what temperance can do, Sir Harvey was an inſtance. At an early period of life he was given over for a conſumption, and he lived till betwixt 80 and 90 years of age. On his death, his fortune, which was at leaſt 250,000l. fell to his nephew Mr Meggot, who by will was ordered to aſſume the name and arms of Elwes. To this uncle, and this property, Mr Elwes ſucceeded when he had advanced beyond the 40th year of his age. For 15 years previous to this period, he was well known in the more faſhionable circles of London. He had always a turn for play; and it was only late in life, and from paying always and not always being paid, that he conceived diſguſt at it. The theory which he profeſſed, "that it was impoſſible to aſk a gentleman for money," he perfectly confirmed by the practice; and he never violated this feeling to the lateſt hour of his life.

The manners of Mr Elwes were ſuch—ſo gentle, ſo attentive, ſo gentlemanly, and ſo engaging—that rudeneſs could not ruffle them, or ſtrong ingratitude break their obſervance. He retained this peculiar feature of the old court to the laſt; but he had a praiſe beyond this: He had the moſt gallant diſregard of his own perſon, and all care about himſelf that can be imagined. The inſtances in younger life, in the moſt imminent perſonal hazard, are innumerable; but when age had deſpoiled him of his activity, and might have rendered care and attention about himſelf natural, he knew not what they were: He wiſhed no one to aſſiſt him: "He was as young as ever; he could walk; he could ride, and he could dance; and he hoped he ſhould not give trouble even when he was old:" He was at that time 75.

It is curious to remark how he contrived to mingle ſmall attempts at ſaving with objects of the moſt unbounded diſſipation. After ſitting up a whole night at play for thouſands with the moſt faſhionable and profligate men of the time, amidſt ſplendid rooms, gilt ſofas, wax lights, and waiters attendant on his call, he would walk out about four in the morning, not towards home, but into Smithfield, to meet his own cattle, which were coming to market from Thaydonhall, a farm of his in Eſſex! There would this ſame man, forgetful of the ſcenes he had juſt left, ſtand in the cold or rain, bartering with a carcaſs butcher for a ſhilling! Sometimes when the cattle did not arrive at the hour he expected, he would walk on in the mire to meet them; and more than once has gone on foot the whole way to his farm without ſtopping, which was 17 miles from London, after ſitting up the whole night. Had every man been of the mind of Mr Elwes, the race of innkeepers muſt have periſhed, and poſt-chaiſes have been returned back to thoſe who made them; for it was the buſineſs of his life to avoid both. He always travelled on horſeback. To ſee him ſetting out on a journey, was a matter truly curious; his firſt care was to put two or three eggs, boiled hard, into his great coat pocket, or any ſcraps of bread which he found; baggage he never took; then mounting one of his hunters, his next attention was to get out of London into that road where turnpikes were the feweſt: then, ſtopping under any hedge where graſs preſented itſelf for his horſe, and a little water for himſelf, he would ſit down and refreſh himſelf and his horſe together.

The chief reſidence of Mr Elwes at this period of his life was in Berkſhire, at his own ſeat at Marcham. Here it was he had two natural ſons born, who inherit the greateſt part of his property by a will made about the year 1785. The keeping of fox hounds was the only inſtance in the whole life of Mr Elwes of his ever ſacrificing money to pleaſure; and may be ſelected as the only period when he forgot the cares, the perplexities, and the regret, which his wealth occaſioned. But even here every thing was done in the moſt frugal manner. Scrub, in the Beaux Stratagem, when compared with Mr Elwes's huntſman, had an idle life of it. This famous huntſman might have fixed an epoch in the hiſtory of ſervants: for in a morning, getting up at four o'clock, he milked the cows; he then prepared breakfaſt for Mr Elwes or any friends he might have with him: then ſlipping on a green coat, he hurried into the ſtable, ſaddled the horſes, got the hounds out of the kennel, and away they went into the field. After the fatigues of hunting, he refreſhed himſelf by rubbing down two or three horſes as quickly as he could; then running into the houſe to lay the cloth, and wait at dinner; then hurrying again into the ſtable to feed the horſes—diverſified with an interlude of the cows again to milk, the dogs to feed, and eight hunters to litter down for the night.

In the penury of Mr Elwes there was ſomething that ſeemed like a judgment from heaven. All earthly comforts he voluntarily denied himſelf: he would walk home in the rain in London rather than pay a ſhilling for a coach; he would ſit in wet clothes ſooner than have a fire to dry them; he would eat his proviſions in the laſt ſtage of putrefaction ſooner than have a freſh joint from the butchers; and he wore a wig for above a fortnight, which his biographer* ſaw him pick up out of a rut in a lane where they were riding. This was the laſt extremity of laudable economy; for to all appearance it was the caſt-off wig of ſome beggar!

Mr Elwes had now reſided about 13 years in Suffolk, when the conteſt for Berkſhire preſented itſelf on the diſſolution of the parliament; and when, to preſerve the peace of that county, he was nominated by Lord Craven. Mr Elwes, though he had retired from public buſineſs for ſome years, had ſtill left about him ſome of the ſeeds of more active life, and he agreed to the propoſal. It came farther enhanced to him, by the agreement, that he was to be brought in by the freeholders for nothing. All he did on the occaſion was dining at the ordinary at Reading; and he got into parliament for 18 pence!

Though a new man, Mr Elwes could not be called a young member; for he was at this time nearly 60 years old when he thus entered on public life. But he was in poſſeſſion of all his activity; and, preparatory to his appearance on the boards of St Stephen's Chapel, he uſed to attend conſtantly during the races and other public meetings all the great towns where his voters reſided. At the different aſſemblies he would dance among the youngeſt to the laſt, after riding over on horſeback, and frequently in the rain, to the place of meeting. A gentleman who was one night ſtanding by, obſerved on the extraordinary agility of ſo old a man.—"O! that is nothing (replied another); for Mr Elwes, to do this, rode 20 miles in the rain, with his ſhoes ſtuck into his boots and his bag-wig in his pocket."

The honour of parliament made no alteration in the dreſs of Mr Elwes: on the contrary, it ſeemed at this time to have attained additional meanneſs; and nearly to have reached that happy climax of poverty, which has more than once drawn on him the compaſſion of thoſe who paſſed by him in the ſtreet. For the ſpeaker's dinners, however, he had one ſuit, with which the ſpeaker in the courſe of the ſeſſions became very familiar. The miniſter likewiſe was well acquainted with it; and at any dinner of oppoſition ſtill was his apparel the ſame. The wits of the minority uſed to ſay, "that they had full as much reaſon as the miniſter to be ſatisfied with Mr Elwes, as he had the ſame habit with every body." At this period of his life Mr Elwes wore a wig. Much about the time when his parliamentary life ceaſed, that wig was worn out; ſo then, being older and wiſer as to expence, he wore his own hair, which like his expences was very ſmall.

All this time the income of Mr Elwes was increaſing hourly, and his preſent expenditure was next to nothing; for the little pleaſures he had once engaged in he had now given up. He kept no houſe, and only one old ſervant and a couple of horſes: he reſided with his nephew: his two ſons he had ſtationed in Suffolk and Berkſhire, to look after his reſpective eſtates: and his dreſs certainly was no expence to him; for had not other people been more careful than himſelf, he would not have had it even mended.

When he left London, he went on horſeback to his country ſeats with his couple of hard eggs, and without once ſtopping upon the road at any houſe. He always took the moſt unfrequented road, and uſed every ſhift to avoid turnpikes. Marcham was the ſeat he now chiefly viſited; which had ſome reaſon to be flattered with the preference, as his journey into Suffolk coſt him only twopence-halfpenny, while that into Berkſhire amounted to fourpence!

As Mr Elwes came into parliament without expence, he performed his duty as a member would have done in the pure days of our conſtitution. What he had not bought he never attempted to ſell; and he went forward in that ſtraight and direct path, which can alone ſatisfy a reflecting mind. Amongſt the ſmaller memorials of the parliamentary life of Mr Elwes may be noted, that he did not follow the cuſtom of members in general by ſitting on any particular ſide of the houſe, but ſat as occaſion preſented itſelf on either indiſcriminately; and he voted much in the ſame manner, but never roſe to ſpeak. In his attendance at the houſe, he was always early and late; and he never left it for dinner, as he had accuſtomed himſelf to faſting, ſometimes for 24 hours in continuance.

When he quitted parliament, he was, in the common phraſe, "a fiſh out of water!" The ſtyle of Mr Elwes's

---

* Mr Topham; from whoſe *Life of John Elwes, Eſq.* the particulars of this article are extracted.

Elwes's life had left him no domeſtic ſcenes to which he could retire—his home was dreary and poor—his rooms received no cheerfulneſs from fire; and while the outſide had all the appearance of a "Houſe to be Let," the inſide was a deſert; but he had his penury alone to thank for this, and for the want of all the little conſolations which ſhould attend old age, and ſmooth the paſſage of declining life. At the cloſe of the ſpring of 1785, he wiſhed again to viſit, which he had not done for ſome years, his ſeat at Stoke. But then the journey was a moſt ſerious object to him. The famous old ſervant was dead; all the horſes that remained with him were a couple of worn-out brood mares; and he himſelf was not in that vigour of body in which he could ride 60 or 70 miles on the ſuſtenance of *two boiled eggs*. The mention of a poſt chaiſe would have been a crime—"He afford a poſt chaiſe, indeed! where was he to get the money?" would have been his exclamation. At length he was carried into the country as he was carried into parliament, free of expence, by a gentleman who was certainly not quite ſo rich as Mr Elwes. When he reached Stoke—the ſeat of more active ſcenes, of ſomewhat reſembling hoſpitality, and where his fox hounds had ſpread ſomewhat like vivacity around—he remarked, "he had expended a great deal of money once very fooliſhly; but that a man grew wiſer by time."

The rooms at this ſeat, which were now much out of repair, and would have all fallen in but for his ſon John Elwes, Eſq. who had reſided there, he thought too expenſively furniſhed, as worſe things might have ſerved. If a window was broken, there was to be no repair but that of a little brown paper, or that of piecing in a bit of broken glaſs; which had at length been done ſo frequently, and in ſo many ſhapes, that it would have puzzled a mathematician to ſay "what figure they deſcribed." To ſave fire, he would walk about the remains of an old greenhouſe, or ſit with a ſervant in the kitchen. During the harveſt he would amuſe himſelf with going into the fields to glean the corn on the grounds of his own tenants; and they uſed to leave a little more than common to pleaſe the old gentleman, who was as eager after it as any pauper in the pariſh. In the advance of the ſeaſon, his morning employment was to pick up any ſtray chips, bones, or other things, to carry to the fire, in his pocket—and he was one day ſurpriſed by a neighbouring gentleman in the act of pulling down, with ſome difficulty, a crow's neſt for this purpoſe. On the gentleman wondering why he gave himſelf this trouble—"Oh, Sir, (replied old Elwes), it is really a ſhame that theſe creatures ſhould do ſo. Do but ſee what waſte they make! They don't care how extravagant they are!"

As no gleam of favourite paſſion, or any ray of amuſement, broke through this gloom of penury, his inſatiable deſire of ſaving was now become uniform and ſyſtematic. He uſed ſtill to ride about the country on one of theſe mares—but then he rode her very economically, on the ſoft turf, adjoining the road, without putting himſelf to the expence of ſhoes, as he obſerved, "The turf was ſo pleaſant to a horſe's foot!" And when any gentleman called to pay him a viſit, and the boy who attended in the ſtables, was profuſe enough to put a little hay before his horſe, old Elwes would ſlily ſteal back into the ſtable, and take the hay very carefully away. That very ſtrong appetite which Mr Elwes had in ſome meaſure reſtrained during the long ſitting of parliament, he now indulged moſt voraciouſly, and on every thing he could find. To ſave, as he thought, the expence of going to a butcher, he would have a whole ſheep killed, and ſo eat mutton to the—*end of the chapter*. When he occaſionally had his river drawn, though ſometimes horſe loads of ſmall fiſh were taken, not one would he ſuffer to be thrown in again; for he obſerved, "He ſhould never ſee them again!" Game in the laſt ſtate of putrefaction, and meat that *walked about his plate*, would he continue to eat, rather than have new things killed before the old proviſion was finiſhed. With this diet—the *charnel houſe of ſuſtenance*—his dreſs kept pace—equally in the laſt ſtage of *abſolute diſſolution*. Sometimes he would walk about in a tattered brown-coloured hat, and ſometimes in a red and white woollen cap, like a priſoner confined for debt. His ſhoes he never would ſuffer to be cleaned, leſt they ſhould be worn out the ſooner. But ſtill, with all this *ſelf-denial*—that penury of life to which the inhabitant of an *alms houſe* is not doomed—ſtill did he think he was profuſe, and frequently ſay, "He muſt be a little more careful of his property." His diſquietude on the ſubject of money was now continual. When he went to bed, he would put five or ten guineas into a bureau; and then, full of his money, after he had retired to reſt, and ſometimes in the middle of the night, he would come down to ſee if it was there.

The ſcene of mortification at which Mr Elwes was now arrived was all but a denial of the common neceſſaries of life: and indeed it might have admitted a doubt, whether or not, if his manors, his fiſh ponds, and ſome grounds in his own hands, had not furniſhed a ſubſiſtence, where he had not any thing *actually to buy*, he would not, rather than have *bought any thing*, have ſtarved. Strange as this may appear, it is not exaggerated.—He one day, during this period, dined upon the remaining part of a moor hen, which had been brought out of the river by a *rat!* and at another ate an undigeſted part of a pike which a larger one had ſwallowed, but had not finiſhed, and which were taken in this ſtate in a net. At the time this laſt circumſtance happened, he diſcovered a ſtrange kind of ſatisfaction; for he ſaid to a friend, "Aye! this was killing two birds with one ſtone!" In the room of all comment—of all moral—let it be remarked, that at this time Mr Elwes was perhaps worth nearly *eight hundred thouſand pounds!* and, at this period, he had not made his will, of courſe was not ſaving from any ſentiment of affection for any perſon.

The ſummer of 1788 Mr Elwes paſſed at his houſe in Welbeck ſtreet, London; and he paſſed that ſummer without any other ſociety than that of two maid ſervants; for he had now given up the expence of keeping any male domeſtic. His chief employment uſed to be that of getting up early in a morning to viſit ſome of his houſes in Mary-le-bone, which during the ſummer were repairing. As he was there generally at four o'clock in a morning, he was of courſe on the ſpot before the workmen; and he uſed contentedly to ſit down on the ſteps before the door, to ſcold them when they did come. The neighbours who uſed to ſee him appear thus regularly every morning, and who concluded, from his apparel, that he was one of the workmen, obſerved, "there never was ſo punctual a man as the old carpenter." During the whole morning he would continue to run up and down ſtairs to ſee the men were not idle for an inſtant, with the ſame anxiety as if his whole happineſs in life had been centered in the finiſhing of this houſe, regardleſs of the greater property he had at a ſtake in various places, and for ever employed in the *minutiæ* only of affairs. Indeed ſuch was his anxiety about this houſe, the rent of which was not above 50l. a-year, that it brought on a fever which nearly coſt him his life: but the fate which dragged him on thus ſtrangely to bury him under the load of his own wealth, ſeemed as reſiſtleſs as it was unaccountable.

In the muſcular and unencumbered frame of Mr Elwes there was every thing that promiſed extreme length of life; and he lived to above 70 years of age without any natural diſorder attacking him: but, as Lord Bacon has well obſerved, "the minds of ſome men are a lamp that is continually burning;" and ſuch was the mind of Mr Elwes. Removed from thoſe occaſional public avocations which had once engaged his attention, money was now his only thought. He roſe upon money—upon money he lay down to reſt; and as his capacity ſunk away from him by degrees, he dwindled from the real cares of his property into the puerile concealment of a few guineas. This little ſtore he would carefully wrap up in various papers, and depoſiting them in different corners, would amuſe himſelf with running from one to the other, to ſee whether they were all ſafe. Then forgetting, perhaps, where he had concealed ſome of them, he would become as ſeriouſly afflicted as a man might be who had loſt all his property. Nor was the day alone thus ſpent—he would frequently riſe in the middle of the night, and be heard walking about different parts of the houſe, looking after what he had thus hidden and forgotten.

During the winter of 1789, the laſt winter Mr Elwes was fated to ſee, his memory viſibly weakened every day; and from the unceaſing wiſh to ſave money, he now began to fear he ſhould die in want of it. Mr Gibſon had been appointed his builder in the room of Mr Adams; and one day, when this gentleman waited upon him, he ſaid with apparent concern, "Sir, pray conſider in what a wretched ſtate I am: you ſee in what a good houſe I am living; and here are five guineas, which is all I have at preſent; and how I ſhall go on with ſuch a ſum of money puzzles me to death. I dare ſay you thought I was rich; now you ſee how it is!"

Mr George Elwes having now ſettled at his ſeat at Marcham in Berkſhire, he was naturally deſirous that, in the aſſiduities of his wife, his father might at length find a comfortable home. In London he was certainly moſt uncomfortable: but ſtill, with theſe temptations before and behind him, a journey with any expence annexed to it was inſurmountable. This, however, was luckily obviated by an offer from Mr Partis, a gentleman of the law, to take him to his ancient ſeat in Berkſhire with his purſe perfectly whole. But there was one circumſtance ſtill very diſtreſſing—the old gentleman had now nearly worn out his laſt coat, and he would not buy a new one; his ſon, therefore, with a pious fraud, contrived to get Mr Partis to buy him a coat and make him a preſent of it. Thus formerly having had a good coat, then a bad one, and at laſt no coat at all, he was kind enough to accept one from a neighbour.

Mr Elwes carried with him into Berkſhire five guineas and a half, and half a crown. Leſt the mention of this ſum may appear ſingular, it ſhould be ſaid, that previous to his journey he had carefully wrapped it up in various folds of paper, that no part of it might be loſt. On the arrival of the old gentleman, Mr George Elwes and his wife did every thing they could to make the country a ſcene of quiet to him. But "he had that within" which baffled every effort of this kind. Of his heart it might be ſaid, "there was no peace in Iſrael." His mind, caſt away upon the vaſt and troubled ocean of his property, extending beyond the bounds of his calculation, returned to amuſe itſelf with fetching and carrying about a few guineas, which in that ocean was indeed a drop. But nature had now carried on life nearly as far as ſhe was able, and the ſand was almoſt run out. The firſt ſymptom of more immediate decay was his inability to enjoy his reſt at night. Frequently would he be heard at midnight as if ſtruggling with ſome one in his chamber, and crying out, "I will keep my money, I will; nobody ſhall rob me of my property." On any one of the family going into his room, he would ſtart from this fever of anxiety, and, as if waking from a troubled dream, again hurry into bed, and ſeem unconſcious of what had happened. At length, on the 26th November 1789, expired this miſerably rich man, whoſe property, nearly reaching to a million, extended itſelf almoſt through every county in England.

MISERICORDIA, in *Law*, is an arbitrary fine impoſed on any perſon for an offence: this is called *miſericordia*, becauſe the amercement ought to be but ſmall, and leſs than that required by magna charta. If a perſon be outrageouſly amerced in a court that is not of record, the writ called *moderata miſericordia* lies for moderating the amercement according to the nature of the fault.

MISFORTUNE. An unlucky accident.

MISFORTUNE, or chance, in *Law*, a deficiency of the will; or committing of an unlawful act by misfortune or chance, and not by deſign. In ſuch caſe, the will obſerves a total neutrality, and does not co-operate with the deed; which therefore wants one main ingredient of a crime. See CRIME.

Of this, when it affects the life of another, we have ſpoken under the article HOMICIDE; and in this place have only occaſion to obſerve, that if any accidental miſchief happens to follow from the performance of a lawful act, the party ſtands excuſed from all guilt: but if a man be doing any thing unlawful, and a conſequence enſues which he did not foreſee or intend, as the death of a man or the like, his want of foreſight ſhall be no excuſe; for, being guilty of one offence, in doing antecedently what is in itſelf unlawful, he is criminally guilty of whatever conſequence may follow the firſt miſbehaviour.

MISFEASANCE, in law books, ſignifies a treſpaſs.

MISLETOE. See Viscum, Botany *Index*.

MISNOMER, in *Law*, a miſnaming or miſtaking a perſon's name. The Chriſtian name of a perſon ſhould always be perfect; but the law is not ſo ſtrict in regard to ſurnames, a ſmall miſtake in which will be diſpenſed with to make good a contract, and ſupport the act of the party. See Plea *to Indictment*.

MISPRISIONS, (a term derived from the old French, *meſpris*, a neglect or contempt), are, in the acceptation of our law, generally underſtood to be all ſuch high offences as are under the degree of capital, but nearly bordering thereon: and it is ſaid, that a miſpriſion is contained in every treaſon and felony whatſoever; and that, if the king ſo pleaſe, the offender may be proceeded againſt for the miſpriſion only. And upon the ſame principle, while the juriſdiction of the ſtar-chamber ſubſiſted, it was held that the king might remit a proſecution for treaſon, and cauſe the delinquent to be cenſured in that court, merely for a high miſdemeanor: as happened in the caſe of Roger earl of Rutland, in 43 Eliz. who was concerned in the earl of Eſſex's rebellion. Miſpriſions are generally divided into two ſorts; negative, which conſiſt in the concealment of ſomething which ought to be revealed; and poſitive, which conſiſt in the commiſſion of ſomething which ought not to be done.

1. Of the firſt, or negative kind, is what is called *miſpriſion of treaſon*; conſiſting in the bare knowledge and concealment of treaſon, without any degree of aſſent thereto; for any aſſent makes the party a principal traitor; as indeed the concealment, which was conſtrued aiding and abetting, did at the common law; in like manner as the knowledge of a plot againſt the ſtate, and not revealing it, was a capital crime at Florence, and other ſtates of Italy. But it is now enacted by the ſtatute 1 & 2 Ph. & Mar. c. 10. that a bare concealment of treaſon ſhall be only held a miſpriſion. This concealment becomes criminal, if the party appriſed of the treaſon does not, as ſoon as conveniently may be, reveal it to ſome judge of aſſize or juſtice of the peace. But if there be any probable circumſtances of aſſent, as if one goes to a treaſonable meeting, knowing beforehand that a conſpiracy is intended againſt the king; or, being in ſuch company once by accident, and having heard ſuch treaſonable conſpiracy, meets the ſame company again, and hears more of it, but conceals it; this is an implied aſſent in law, and makes the concealer guilty of actual high treaſon.

Miſpriſion of felony is alſo the concealment of a felony which a man knows, but never aſſented to; for, if he aſſented, this makes him either principal or acceſſory. And the puniſhment of this, in a public officer, by the ſtatute Weſtm. 1. 3 Edw. I. c. 9. is impriſonment for a year and a day; in a common perſon, impriſonment for a leſs diſcretionary time; and, in both, fine and ranſom at the king's pleaſure: which pleaſure of the king muſt be obſerved, once for all, not to ſignify any extrajudicial will of the ſovereign, but ſuch as is declared by his repreſentatives, the judges in his courts of juſtice; *voluntas regis in curia, non in camera*.

2. Miſpriſions, which are merely poſitive, are generally denominated *contempt* or *high miſdemeanours*; of which the principal is the *mal-adminiſtration* of ſuch high officers as are in public truſt and employment. This is uſually puniſhed by the method of parliamentary impeachment; wherein ſuch penalties, ſhort of death, are inflicted, as to the wiſdom of the houſe of peers ſhall ſeem proper; conſiſting uſually of baniſhment, impriſonment, fines, or perpetual diſability. Hither alſo may be referred the offence of *embezzling the public money*, called among the Romans *peculatus*; which the Julian law puniſhed with death in a magiſtrate, and with deportation, or baniſhment, in a private perſon. With us it is not a capital crime, but ſubjects the committer of it to a diſcretionary fine and impriſonment.—Other miſpriſions are, in general, ſuch contempts of the executive magiſtrate as demonſtrate themſelves by ſome arrogant and undutiful behaviour towards the king and government: for a detail of which, *vide* Blackſtone's Comment. iv. 22.

MISSAL, the Romiſh maſs-book, containing the ſeveral maſſes to be ſaid on particular days. It is derived from the Latin word *miſſa*, which, in the ancient Chriſtian church, ſignified every part of divine ſervice.

MISSEL-bird, a ſpecies of Turdus. See Turdus, Ornithology *Index*.

MISSIO, among the Romans, was a full diſcharge given to a ſoldier after 20 years ſervice, and differed from the *exauctoratio*, which was a diſcharge from duty after 17 years ſervice. Every ſoldier had a right to claim his *miſſio* at the end of 20 years.

MISSION, in *Theology*, denotes a power or commiſſion to preach the goſpel. Jeſus Chriſt gave his diſciples their miſſion in theſe words, *Go and teach all nations*, &c.

The Romaniſts reproach the Proteſtants, that their miniſters have no miſſion, as not being authorized in the exerciſe of their miniſtry, either by an uninterrupted ſucceſſion from the apoſtles, or by miracles, or by any extraordinary proof of a vocation.

Many among us deny any other miſſion neceſſary for the miniſtry than the talents neceſſary to diſcharge it.

Mission is alſo uſed for an eſtabliſhment of people zealous for the glory of God and the ſalvation of ſouls; who go and preach the goſpel in remote countries and among infidels.

There are miſſions in the Eaſt as well as in the Weſt Indies. Among the Romaniſts, the religious orders of St Dominic, St Francis, St Auguſtine, and the Jeſuits, have miſſions in the Levant, America, &c. The Jeſuits have alſo miſſions in China, and all other parts of the globe where they have been able to penetrate. There have been alſo ſeveral Proteſtant miſſions for diffuſing the light of Chriſtianity through the benighted regions of Aſia and America. Of this kind has been the Daniſh miſſion planned by Frederic IV. in 1706. And the liberality of private benefactors in our own country has been alſo extended to the ſupport of miſſionaries among the Indians in America, &c.

MISSIONARY, an eccleſiaſtic who devotes himſelf and his labours to ſome miſſion, either for the inſtruction of the orthodox, the conviction of heretics, or the converſion of infidels. See Jesuits.

MISSISSIPPI, a noble river in America, which waters about five-eighths of the United States, forming their weſtern boundary, and ſeparating them from the province of Louiſiana and the Indian country. Its length has not been accurately aſcertained, but it is conjectured to be upwards of 3000 miles. There are numerous tributary ſtreams which fall into it from the W. and E.; and the country on both ſides of the river, is ſaid to be equal in goodneſs and fertility to any in North America. It is navigable as far as to what are denominated the *falls of St Anthony*, and ſome ſay farther. There are ſalt ſprings on each ſide of this river, which produce ſalt of an excellent quality, and large quantities of coal are found on its upper branches. Its mouths alſo form an iſland of conſiderable extent. Theſe are ſituated between 29° and 30° N. Lat. and between 89° and 90° W. Long.

MISSOURI, a river in Louiſiana, which falls into the Miſſiſſippi from the weſt, 195 miles above the mouth of the Ohio, and about 1160 miles from the Balize in the gulf of Mexico. The extent of its navigation is not ſufficiently known; but by the map of Captain Hutchins it appears to be navigable 1300 miles. The progreſs of ſettlement by the Spaniards on the ſouth and weſt, and by the Engliſh on the north and eaſt, is reported by late travellers to be aſtoniſhing; and according to the map of Mr M'Kenzie, it appears that there is a communication by water, attended with little difficulty, from the upper lakes to Nootka ſound, or its vicinity.

In a voyage of diſcovery undertaken by Captains Lewis and Clarke in 1805, under the auſpices of the American government, it appears that the Miſſouri at the diſtance of 3848 miles by the courſe of the river from its junction with the Miſſiſſippi, divides into three branches, to which they gave the names of Jefferſon's, Madiſon's, and Gallatin's rivers; and the firſt of theſe, Jefferſon's river, and the only one explored, is navigable for 248 miles. Phil. Mag. xxvii. 13.

MISSUS, in the Circenſian games, were the matches in horſe or chariot races. The uſual number of *miſſus* or matches in one day was 24; though the emperor Domitian preſented the people with 100. The laſt match was generally made at the expence of the people, who made a collection for the purpoſe; hence it was called *miſſus ærarius*, a ſubſcription plate.

MIST, or FOG. See FOG.

MISTAKE, any wrong action committed, not through an evil deſign, but through an error of judgment.

MISTAKE, in *Law*. See IGNORANCE.

MISUSER, in *Law*, is an abuſe of any liberty or benefit; as "He ſhall make fine for his MISUSER." Oid. Nat. Br. 149. By miſuſer a charter of a corporation may be forfeited; ſo alſo an office, &c.

MITCHELSTOWN, a poſt town of Ireland, in the county of Cork and province of Munſter in Ireland, where there is a college founded by the earl of Kingſton for the ſupport of 12 decayed gentlemen and 12 decayed gentlewomen, who have 40l. yearly, and handſome apartments.

MITE, a ſmall piece of money mentioned Luke xii. 59. and xxi. 2. In the Greek it is χοδραντης, i. e. *quadrans*, or a quarter of the Roman *denarius*; ſo that the mite was worth about ſeven farthings, or twopence of our money.

MITE. See ACARUS, ENTOMOLOGY *Index*.

MITELLA, BASTARD AMERICAN SANICLE; a genus of plants belonging to the decandria claſs, and in the natural method ranking under the 13th order, *Succulentæ*. See BOTANY *Index*.

MITHRA, feaſts of, in antiquity, were feaſts celebrated among the Romans in honour of Mithras or the ſun. The moſt ancient inſtance of this Mithras among the Romans occurs in an inſcription dated in the third conſulate of Trajan, or about the year of Chriſt 101. This is the dedication of an altar to the ſun under the above name thus inſcribed, *Deo Soli Mithræ*. But the worſhip of Mithras was not known in Egypt and Syria in the time of Origen, who died about the year of Chriſt 263; though it was common at Rome for more than a century before this time. The worſhip of Mithras was proſcribed at Rome in the year 378, by order of Gracchus, prefect of the prætorium. According to M. Freret, the feaſts of Mithras were derived from Chaldea, where they had been inſtituted for celebrating the entrance of the ſun into the ſign Taurus.

MITHRAS, or MITHRA, a god of Perſia and Chaldea, ſuppoſed to be the ſun. His worſhip was introduced at Rome. He is generally repreſented as a young man, whoſe head is covered with a turban after the manner of the Perſians. He ſupports his knee upon a bull that lies on the ground, and one of whoſe horns he holds in one hand, while with the other he plunges a dagger in his neck.

MITHRIDATE, an old term, in *Pharmacy*; an antidote, or compoſition, in form of an electuary, ſuppoſed to ſerve either as a remedy or a preſervative againſt poiſons. It takes its name from the inventor, Mithridates king of Pontus, who is ſaid to have ſo fortified his body againſt poiſons with antidotes and preſervatives, that when he had a mind to diſpatch himſelf, he could not find any poiſon that would take effect.

MITHRIDATES, the name of ſeveral kings of Pontus. See PONTUS.

MITHRIDATES VII. ſurnamed *Eupator* and *the Great*, ſucceeded to the throne at the age of 11 years, about 123 years before the Chriſtian era. The beginning of his reign was marked by ambition, cruelty, and artifice. He murdered his own mother, who had been left by his father co-heireſs of the kingdom; and he fortified his conſtitution by drinking antidotes againſt the poiſon with which his enemies at court attempted to deſtroy him. He early inured his body to hardſhip, and employed himſelf in the moſt manly exerciſes, often remaining whole months in the country, and making frozen ſnow and the earth the place of his repoſe. Naturally ambitious and cruel, he ſpared no pains to acquire himſelf power and dominion. He murdered the two ſons whom his ſiſter Laodice had had by Ariarathes king of Cappadocia, and placed one of his own children, only eight years old, on the vacant throne. Theſe violent proceedings alarmed Nicodemes king of Bithynia, who had married Laodice the widow of Ariarathes. He ſuborned a youth to be king of Cappadocia, as the third ſon of Ariarathes; and Laodice was ſent to Rome to impoſe upon the ſenate, and aſſure them that her third ſon was now alive, and that his pretenſions to the kingdom of Cappadocia were juſt and well grounded. Mithridates, on his part, ſent to Rome Gordius the governor of his ſon; who ſolemnly declared before the Roman people, that the youth who ſat on on the throne of Cappadocia was the third ſon and lawful heir of Ariarathes, and that he was ſupported as ſuch by Mithridates. This intricate affair diſpleaſed the Roman ſenate; and finally to ſettle the diſpute they took away the kingdom of Cappadocia from Mithridates, and Paphlagonia from Nicomedes. Theſe two kingdoms being thus ſeparated from their original poſſeſſors, were preſented with their freedom and independence; but the Cappadocians refuſed it, and received Ariobarzanes for king. Such were the firſt ſeeds of enmity between Rome and the king of Pontus. Mithridates never loſt an opportunity by which he might leſſen the influence of his adverſaries; and the more effectually to deſtroy their power in Aſia, he ordered all the Romans that were in his dominions to be maſſacred. This was done in one night, and no leſs than 150,000, according to Plutarch, or 80,000 Romans, as Appian mentions, were made the victims of his cruelty. This called aloud for vengeance. Aquilius, and ſoon after Sylla, marched againſt Mithridates with a large army. The former was made priſoner; but Sylla obtained a victory over the king's generals; and another deciſive engagement rendered him maſter of all Greece, Macedonia, Ionia, and Aſia Minor. This ill fortune was aggravated by the loſs of about 200,000 men, who were killed in the ſeveral engagements that had been fought; and Mithridates, weakened by repeated ill ſucceſs by ſea and land, ſued for peace from the conqueror, which he obtained on condition of defraying the expences which the Romans had incurred by the war, and of remaining ſatisfied with the poſſeſſions which he had received from his anceſtors. While theſe negotiations of peace were carried on, Mithridates was not unmindful of his real intereſt. His poverty, and not his inclinations, obliged him to wiſh for peace. He immediately took the field with an army of 140,000 infantry, and 16,000 horſe, which conſiſted of his own forces and thoſe of his ſon-in-law Tigranes king of Armenia. With ſuch a numerous army he ſoon made himſelf maſter of the Roman provinces in Aſia; none dared to oppoſe his conqueſts; and the Romans, relying on his fidelity, had withdrawn the greateſt part of their armies from the country. The news of his warlike preparations were no ſooner heard, than Lucullus the conſul marched into Aſia; and without delay he blocked up the camp of Mithridates who was then beſieging Cyzicus. The Aſiatic monarch eſcaped from him, and fled into the heart of his kingdom. Lucullus purſued him with the utmoſt celerity; and would have taken him priſoner after a battle, had not the avidity of his ſoldiers preferred the plundering of a mule loaded with gold to the taking of a monarch who had exerciſed ſuch cruelties againſt their countrymen, and ſhown himſelf ſo faithleſs to the moſt ſolemn engagements. After this eſcape Mithridates was more careful about the ſafety of his perſon; and he even ordered his wives and ſiſters to deſtroy themſelves, fearful of their falling into the enemy's hands. The appointment of Glabrio to the command of the Roman forces, inſtead of Lucullus, was favourable to Mithridates, who recovered the greateſt part of his dominions. The ſudden arrival of Pompey, however, ſoon put an end to his victories. A battle in the night was fought near the Euphrates, in which the troops of Pontus laboured under every diſadvantage. The engagement was by moon-light, and as the moon then ſhone in the face of the enemy, the lengthened ſhadows of the arms of the Romans having induced Mithridates to believe that the two armies were cloſe together, the arrows of his ſoldiers were darted from a great diſtance, and their efforts rendered ineffectual. An univerſal overthrow enſued, and Mithridates, bold in his misfortunes, ruſhed through the thick ranks of the enemy at the head of 800 horſemen, 500 of whom periſhed in the attempt to follow him. He fled to Tigranes; but that monarch refuſed an aſylum to his father-in-law, whom he had before ſupported with all the collected forces of his kingdom. Mithridates found a ſafe retreat among the Scythians; and though deſtitute of power, friends, and reſources, yet he meditated the overthrow of the Roman empire, by penetrating into the heart of Italy by land. Theſe wild projects were rejected by his followers, and he ſued for peace. It was denied to his ambaſſadors; and the victorious Pompey declared, that, to obtain it, Mithridates muſt aſk it in perſon. He ſcorned to truſt himſelf in the hands of his enemy, and reſolved to conquer or to die. His ſubjects refuſed to follow him any longer; and revolting from him, made his ſon Pharnaces king. The ſon ſhowed himſelf ungrateful to his father; and even, according to ſome writers, he ordered him to be put to death. This unnatural treatment broke the heart of Mithridates; he obliged his wife to poiſon herſelf, and attempted to do the ſame himſelf. It was in vain: the frequent antidotes he had taken in the early part of his life, ſtrengthened his conſtitution againſt the poiſon; and when this was unavailing, he attempted to ſtab himſelf. The blow was not mortal; and a Gaul who was then preſent, at his own requeſt, gave him the fatal ſtroke, about 64 years before the Chriſtian era. Such were the misfortunes, abilities, and miſerable end, of a man, who ſupported himſelf ſo long againſt the power of Rome, and who, according to the declarations of the Roman authors, proved a more powerful and indefatigable adverſary to the capital of Italy than the great Hannibal, Pyrrhus, Perſeus, or Antiochus. Mithridates has been commended for his eminent virtues, and cenſured for his vices. As a commander he deſerves the moſt unbounded applauſe; and it may create admiration to ſee him waging war with ſuch ſucceſs, during ſo many years, againſt the moſt powerful people on earth, led to the field by a Sylla, a Lucullus, and a Pompey. He was the greateſt monarch that ever ſat on a throne, according to the opinion of Cicero; and indeed no greater proof of his military character can be brought, than the mention of the great rejoicings which happened in the Roman armies and in the capital at the news of his death. No leſs than 12 weeks were appointed for public thankſgivings to the immortal gods; and Pompey, who had ſent the firſt intelligence of his death to Rome, and who had partly haſtened his fall, was rewarded with the moſt uncommon honours. It is ſaid that Mithridates conquered 24 nations, whoſe different languages he knew and ſpoke with the ſame eaſe and fluency as his own. As a man of letters he alſo deſerves attention. He was acquainted with the Greek language, and even wrote in that dialect a treatiſe on botany. His ſkill in phyſic is well known; and even now there is a celebrated antitode which bears his name, and is called *mithridate*. Superſtition as well as nature had united to render him great; and, if we rely upon the authority of Juſtin, his birth was accompanied by the appearance of two large comets, which were ſeen for 70 days ſucceſſively, and whoſe ſplendour eclipſed the mid-day ſun, and covered the fourth part of the heavens.

MITHRIDATICUM BELLUM, the *Mithridatic War*, one of the longeſt and moſt celebrated wars ever carried on by the Romans againſt a foreign power. See PONTUS.

MITRA, was a cap or covering for the head, worn by the Roman ladies, and ſometimes by the men; but it was looked upon as a mark of effeminacy in the laſt, eſpecially when it was tied upon their heads.

MITRE, a ſacerdotal ornament worn on the head, by biſhops and certain abbots on ſolemn occaſions; being a ſort of cap, pointed and cleft at top. The high prieſt among the Jews wore a mitre or bonnet on his head. The inferior prieſts of the ſame nation had likewiſe their mitres; but in what reſpect they differed from that of the high prieſt, is uncertain. Some contend that the ancient biſhops wore mitres; but this is by no means certain.

MITRE, in *Architecture*, is the workmen's term for an angle that is juſt 45 degrees, or half a right one. If the angle be a quarter of a right angle, they call it a *half mitre*.

To deſcribe ſuch angles, they have an inſtrument called the *mitre ſquare;* with this they ſtrike mitre lines on their quarters or battens; and for deſpatch, they have a *mitre box*, as they call it, which is made of two pieces of wood, each about an inch thick, one nailed upright on the edge of the other; the upper piece hath the mitre lines ſtruck upon it on both ſides, and a kerf to direct the ſaw in cutting the mitre joints readily, by only applying the piece into this box.

MITRE is uſed by the writers of the Iriſh hiſtory for a ſort of baſe money, which was very common there about the year 1270, and for 30 years before and as many after.

There were beſides the mitre ſeveral other pieces, called, according to the figures impreſſed upon them, roſaries, lionades, eagles, and by the like names. They were imported from France and other countries, and were ſo much below the proper currency of the kingdom, that they were not worth ſo much as a halfpenny each. They were at length decryed in the year 1300, and good coins ſtruck in their place. Theſe were the firſt Iriſh coins in which the ſceptre was left out. They were ſtruck in the reign of Edward, the ſon of our Henry III. and are ſtill found among the other antiquities of that country. They have the king's head in a triangle full faced. The penny, when well preſerved, weighs 22 grains; the halfpenny 10¼ grains.

MITTAU, the capital of the duchy of Courland. It is ſtrongly fortified; but was taken by the Swedes in 1701, and by the Muſcovites in 1706. E. Long. 23. 51. N. Lat. 56. 44.

MITTIMUS, as generally uſed, hath two ſignifications. 1. It ſignifies a writ for removing or transferring of records from one court to another. 2. It ſignifies a precept, or command in writing, under the hand and ſeal of a juſtice of the peace, directed to the gaoler or keeper of ſome priſon, for the receiving and ſafe keeping of an offender charged with any crime, until he be delivered by due courſe of law.

MITYLENE, or MYTELENE, in *Ancient Geography*, a celebrated, powerful, and affluent city, capital of the iſland of Leſbos. It received its name from *Mitylene*, the daughter of Macareus, a king of the country. It is greatly commended by the ancients for the ſtatelineſs of its buildings and the fruitfulneſs of its ſoil, but more particularly for the great men it produced: Pittacus, Alcæus, Sappho, Terpander, Theophanes, Hellanicus, &c. were all natives of Mitylene. It was long a ſeat of learning; and, with Rhodes and Athens, it had the honour of having educated many of the great men of Rome and Greece. In the Peloponneſian war, the Mitylenians ſuffered greatly for their revolt from the power of Athens; and in the Mithridatic wars, they had the boldneſs to reſiſt the Romans, and diſdain the treaties which had been made between Mithridates and Sylla. See METELIN.

MIXT, or MIXT BODY, in *Chemiſtry*, that which is compounded of different elements or principles.

MIXTURE, a compound or aſſemblage of ſeveral different bodies in the ſame maſs. Chemical mixture is attended with many phenomena which are never obſerved in ſimple mixtures; ſuch as heat, efferveſcence, &c. To chemical mixture belong the union of acids and alkalies, the amalgamation of metals, ſolution of gums, &c. and upon it depend many of the principal operations of CHEMISTRY. See that article, *paſſim*.

MIXTURE, in *Pharmacy*, a medicine which differs from a julep in this reſpect, that it receives into its compoſition not only ſalts, extracts, and other ſubſtances diſſoluble in water; but alſo earths, powders, and ſuch ſubſtances as cannot be diſſolved.

MIZEN, in the ſea language, is a particular maſt or ſail. The mizen maſt ſtands in the ſternmoſt part of the ſhip. In ſome great ſhips there are two of theſe; when that next the main-maſt is called the *main-mizen*, and that next the poop the *bonaventure mizen*.

MIZRAIM, or MISRAIM, the dual name of Egypt, uſed in Scripture to denote the Higher and Lower Egypt, which ſee. It ſometimes occurs ſingular, *Mazor:* 2 Kings xix. Iſaiah xix. Micah vii.

MNEMOSYNE, in fabulous hiſtory, a daughter of Cœlus and Terra. She married Jupiter, by whom ſhe had the nine Muſes. The word *mnemoſyne* ſignifies "memory;" and therefore the poets have rightly called Memory the mother of the Muſes, becauſe it is to that mental endowment that mankind are indebted for their progreſs in ſcience.

MNIUM, MARSHMOSS; a genus of the natural order of muſci, belonging to the cryptogamia claſs of plants. See BOTANY *Index*.

MOAB, in *Ancient Geography*, a country of Arabia Petræa; ſo called from Moab the ſon of Lot, to whoſe poſterity this country was allotted by divine appointment, Deut. xi. 9. It was originally occupied by the Emim, a race of giants extirpated by the Moabites, *ibid.* Moab anciently lay to the ſouth of Ammon, before Sihon the Amorite ſtripped both nations of a part of their territory, afterwards occupied by the Iſraelites, Numb. xxi.; and then Moab was bounded by the river Arnon to the north, the Lacus Aſphaltites to the weſt, the brook Zared to the ſouth, and the mountains Abarim to the eaſt.

MOAT, or DITCH, in *Fortification*, a deep trench dug round the rampart of a fortified place, to prevent ſurpriſes.

The brink of the moat, next the rampart, is called the *ſcarpe*; and the oppoſite one, the *counterſcarpe*.

A dry moat round a large place, with a ſtrong garriſon, is preferable to one full of water; becauſe the paſſage may be diſputed inch by inch, and the beſiegers, when lodged in it, are continually expoſed to the bombs, grenades, and other fire works, which are thrown inceſſantly from the rampart into their works. In the middle of dry moats, there is ſometimes another ſmall one, called *cunette*; which is generally dug ſo deep till they find water to fill it.

The deepeſt and broadeſt moats are accounted the beſt; but a deep one is preferable to a broad one: the ordinary breadth is about 20 fathoms, and the depth about 16.

To drain a moat that is full of water, they dig a trench deeper than the level of the water, to let it run off; and then throw hurdles upon the mud and ſlime, covering them with earth or bundles of ruſhes, to make a ſure and firm paſſage.

MOATAZALITES, or SEPARATISTS, a religious ſect among the Turks, who deny all forms and qualities in the Divine Being; or who diveſt God of his attributes.

There are two opinions among the Turkiſh divines concerning God. The firſt admits metaphyſical forms or attributes; as, that God has wiſdom, by which he is wiſe; power, by which he is powerful; eternity, by which he is eternal, &c. The ſecond allows God to be wiſe, powerful, eternal; but will not allow any form or quality in God, for fear of admitting a multiplicity. Thoſe who follow this latter opinion are called *Moatazalites*; they who follow the former, *Sephalites*.

The Moatazalites alſo believed that the word of God was created *in ſubjecto*, as the ſchoolmen term it, and to conſiſt of letters and ſound; copies thereof being written in books to expreſs or imitate the original: they denied abſolute predeſtination, and affirmed that man is a free agent. This ſect is ſaid to have firſt invented the ſcholaſtic divinity, and is ſubdivided into no leſs than 20 inferior ſects, which mutually brand one another with infidelity.

MOBILE, MOVEABLE, any thing ſuſceptible of motion, or that is diſpoſed to be moved either by itſelf or by ſome other prior *mobile* or mover.

Primum MOBILE, in the ancient aſtronomy, was a ninth heaven or ſphere, imagined above thoſe of the planets and fixed ſtars. This was ſuppoſed to be the firſt mover, and to carry all the lower ſpheres round along with it; by its rapidity communicating to them a motion whereby they revolved in 24 hours. But the diurnal revolution of the planets is now accounted for without the aſſiſtance of any ſuch *primum mobile*.

Perpetuum MOBILE. See *Perpetual* MOTION.

MOCHO, MOCO, or *Mokha*; by ſome ſuppoſed to be the Muſa or Muza of Ptolemy, is a port and town on the Red ſea, of conſiderable trade; contains about 10,000 inhabitants, Jews, Armenians, and Mohammedans; and it gives name to a kingdom extending along the moſt ſouthern coaſt of Arabia; of which that part which lies next the ſea is a dry barren deſert, in ſome places 10 or 12 leagues over; but bounded by mountains, which being well watered, enjoy an almoſt perpetual ſpring; and beſides coffee, the peculiar produce of this country, yields corn, grapes, myrrh, frankincenſe, caſſia, balm, gums of ſeveral ſorts, mangos, dates, pomegranates, &c. The weather here is ſo hot and ſultry in ſummer, eſpecially when the ſouth wind blows, that it would be inſupportable, if it was not mitigated by the cool breezes that generally blow from the mountains on the north, or the Red and Arabic ſeas on the weſt and eaſt. The heat in winter is equal to that of our warmeſt ſummers; and it is very ſeldom that either clouds or rain are ſeen. The city of Mocho is now the emporium for the trade of all India to the Red ſea. The trade was removed hither from Aden, in conſequence of the prophecy of a ſheik, much revered by the people, who foretold that it would ſoon become a place of extenſive commerce notwithſtanding its diſadvantageous ſituation. The buildings here are lofty, and tolerably regular, having a pleaſant aſpect from Mecca. The ſteeples of ſeveral moſques are very high, preſenting themſelves to view at a great diſtance. Their markets are well ſtored with beef, mutton, lamb, kid, camels, and antelopes fleſh, common fowls, Guinea hens, partridges, and pigeons. The ſea affords plenty of fiſh, but not ſavoury; which ſome think proceeds from the extreme ſaltneſs of the water and the nature of their aliment. The markets are alſo ſtocked with fruit, ſuch as grapes, peaches, apricots, quinces, and nectarines; although neither ſhrub nor tree is to be ſeen near the town, except a few date trees. Frequently no rain falls here in two or three years, and ſeldom more than a ſhower or two in a year; but in the mountains, at the diſtance of about 20 miles from Mocha, the earth is watered with a gentle ſhower every morning, which makes the valleys fertile in corn and the fruits natural to the climate. The Arab inhabitants, though remarkably grave and ſuperſtitions, are ſaid to be extremely covetous and hypocritical; robbing, thieving, and committing piracy, without the leaſt ſcruple or remorſe. The Engliſh and Dutch companies have handſome houſes here, and carry on a great trade in coffee, olibanum, myrrh, aloes, liquid ſtorax, white and yellow arſenic, gum arabic, mummy, balm of Gilead, and other drugs. One inconvenience, however, they ſuſtain from the violence and exactions of the Arabian princes; but the king's cuſtoms are eaſy, being fixed at three per cent. to Europeans. Of the coins at Mocha, the moſt current is the camaſſie, which riſes and falls in value at the banker's diſcretion: they are from 50 to 80 for a current dollar, which is but an imaginary ſpecies, being always reckoned one and a half per cent. lower than Spaniſh dollars.

MOCKING BIRD. See TURDUS, ORNITHOLOGY *Index*.

MOCOCO. See LEMUR, MAMMALIA *Index*.

MODE, which is a word of the ſame general import with MANNER, is uſed as a technical term in grammar, metaphyſics, and muſic. For its import in GRAMMAR, ſee that article, N° 80.

MODE, in *Metaphyſics*, ſeems properly to denote the manner of a thing's exiſtence: but Locke, whoſe language

language in that ſcience is generally adopted, uſes the word in a ſenſe ſomewhat different from its ordinary and proper ſignification. "Such complex ideas, which, however compounded, contain not in them the ſuppoſition of ſubſiſting by themſelves, but are conſidered as dependencies on, or affections of, ſubſtances," he calls *modes*. Of theſe *modes*, there are, according to him, two ſorts, which deſerve diſtinct conſideration. Firſt, There are ſome "which are only variations, or different combinations of the ſame ſimple idea, without the mixture of any other, as *a dozen* or *a ſcore;* which are nothing but the ideas of ſo many diſtinct units added together:" and theſe he calls *ſimple modes*. Secondly, "There are others compounded of ſimple ideas of ſeveral kinds put together to make one complex one; v. g. *beauty*, conſiſting of a certain compoſition of colour and figure, cauſing delight in the beholder; *theft*, which being the concealed change of the poſſeſſion of any thing without the conſent of the proprietor, contains, as is viſible, a combination of ſeveral ideas of ſeveral kinds;" and theſe he calls *mixed modes*. For the juſt diſtinction between *ideas* and *notions*, as well as between *ideas* and the *qualities* of external objects, which in this account of modes are all confounded together, ſee METAPHYSICS.

MODE, in *Muſic*, a regular diſpoſition of the air and accompaniments, relative to certain principal ſounds upon which a piece of muſic is formed, and which are called the *eſſential ſounds of the mode*.

Our *modes* are not, like thoſe of the ancients, characterized by any ſentiment which they tend to excite, but reſult from our ſyſtem of harmony alone. The ſounds eſſential to the mode are in number three, and form together one perfect chord. 1. The tonic or key, which is the fundamental note both of the tone and of the mode. 2. The dominant, which is a fifth from the tonic. 3. The mediant, which properly conſtitutes the *mode*, and which is a third from the ſame tonic. As this third may be of two kinds, there are of conſequence two different modes. When the mediant forms a greater third with the tonic, the mode is major; when the third is leſſer, it is minor. See MUSIC.

MODEL, in a general ſenſe, an original pattern, propoſed for any one to copy or imitate.

1
Different kinds of models.

This word is particularly uſed, in building, for an artificial pattern made in wood, ſtone, plaſter, or other matter, with all its parts and proportions, in order for the better conducting and executing ſome great work, and to give an idea of the effect it will have in large. In all great buildings, it is much the ſureſt way to make a model in relievo, and not to truſt to a bare deſign or draught. There are alſo models for the building of ſhips, &c. and for extraordinary ſtaircaſes, &c.

They alſo uſe models in painting and ſculpture; whence, in the academies, they give the term *model* to a naked man or women, diſpoſed in ſeveral poſtures, to afford an opportunity to the ſcholars to deſign them in various views and attitudes.

2
General method of making models.

Models in imitation of any natural or artificial ſubſtance, are moſt uſually made by means of moulds compoſed of plaſter of Paris. For the purpoſe of making theſe moulds, this kind of plaſter is much more fit than any other ſubſtance, on account of the power it has of abſorbing water, and ſoon condenſing into a hard ſubſtance, even after it has been rendered ſo thin as to be of the conſiſtence of cream. This happens in a ſhorter or longer time as the plaſter is of a better or worſe quality; and its good or bad properties depend very much upon its age, to which, therefore, particular regard ought to be had. It is ſold in the ſhops at very different prices; the fineſt being made uſe of for caſts, and the middling ſort for moulds. It may be very eaſily coloured by means of almoſt any kind of powder excepting what contains an alkaline ſalt; for this would chemically decompoſe the ſubſtance of it, and render it unfit for uſe. A very conſiderable quantity of chalk would alſo render it ſoft and uſeleſs, but lime hardens it to a great degree. The addition of common ſize will likewiſe render it much harder than if mere water is made uſe of. In making either moulds or models, however, we muſt be careful not to make the mixture too thick at firſt; for if this is done, and more water added to thin it, the compoſition muſt always prove brittle and of a bad quality.

The particular manner of making models (or *caſts*, as they are alſo called) depends on the form of the ſubject to be taken. The proceſs is eaſy, where the parts are elevated only in a ſlight degree, or where they form only a right or obtuſe angle with the principal ſurface from which they project; but where the parts project in ſmaller angles, or form curves inclined towards the principal ſurface, the work is more difficult. This obſervation, however, holds good only with regard to hard and inflexible bodies; for ſuch as are ſoft may often be freed from the mould, even though they have the ſhape laſt mentioned. But though this be the caſe with the ſoft original ſubſtance, it is not ſo with the inflexible model when once it is caſt.

The moulds are to be made of various degrees of thickneſs, according to the ſize of the model to be caſt; and may be from half an inch to an inch, or, if very large, an inch and a half. Where a number of models are to be taken from one mould, it will likewiſe be neceſſary to have it of a ſtronger contexture than where only a few are required, for very obvious reaſons.

3
Anatomical models.

It is much more eaſy to make a mould for any ſoft ſubſtance than a rigid one, as in any of the viſcera of the animal body; for the fluidity of the mixture makes it eaſily accommodate itſelf to the projecting parts of the ſubſtance; and as it is neceſſary to inflate theſe ſubſtances, they may be very readily extracted again by letting out the air which diſtended them.

When a model is to be taken, the ſurface of the original is firſt to be greaſed, in order to prevent the plaſter from ſticking to it; but if the ſubſtance itſelf is ſlippery, as is the caſe with the internal parts of the human body, this need not be done: when neceſſary, it may be laid over with linſeed oil by means of a painter's bruſh. The original is then to be laid on a ſmooth table, previouſly greaſed or covered with a cloth, to prevent the plaſter ſticking to it; then ſurround the original with a frame or ridge of glaziers putty, at ſuch a diſtance from it as will admit the plaſter to reſt upon the table on all ſides of the ſubject for about an inch, or as much as is ſufficient to give the proper degree of ſtrength to the mould. A ſufficient

Pole's Anatomical Inſtructor.

cient quantity of plaſter is then to be poured as uniformly as poſſible over the whole ſubſtance, until it be everywhere covered to ſuch a thickneſs as to give a proper ſubſtance to the mould, which may vary in proportion to the ſize. The whole muſt then be ſuffered to remain in this condition till the plaſter has attained its hardneſs; when the frame is taken away, the mould may be inverted, and the ſubject removed from it: and when the plaſter is thoroughly dry let it be well ſeaſoned.

Having formed and ſeaſoned the moulds, they muſt next be prepared for the caſts by greaſing the inſide of them with a mixture of olive oil and lard in equal parts, and then filled with fine fluid plaſter, and the plane of the mould formed by its reſting on the ſurface of the table covered to a ſufficient thickneſs with coarſe plaſter, to form a ſtrong baſis or ſupport for the caſt where this ſupport is requiſite, as is particularly the caſe where the thin and membranous parts of the body are to be repreſented. After the plaſter is poured into the mould, it muſt be ſuffered to ſtand until it has acquired the greateſt degree of hardneſs it will receive; after which the mould muſt be removed: but this will be attended with ſome difficulty when the ſhape of the ſubject is unfavourable; and in ſome caſes the mould muſt be ſeparated by means of a ſmall mallet and chiſſel. If by theſe inſtruments any parts of the model ſhould be broken off, they may be cemented by making the two ſurfaces to be applied to each other quite wet; then interpoſing betwixt them a little liquid plaſter; and laſtly, the joint ſmoothed after being thoroughly dry. Any ſmall holes that may be made in the mould can be filled up with liquid plaſter, after the ſides of them have been thoroughly wetted, and ſmoothed over with the edge of a knife.

In many caſes it is altogether impracticable to prepare a mould of one piece for a whole ſubject; and therefore it muſt be conſidered how this can be done in ſuch a manner as to divide the mould into the feweſt pieces. This may be effected by making every piece cover as much of the pattern as poſſible, without ſurrounding ſuch projecting parts, or running into ſuch hollows as would not admit a ſeparation of the mould. It is impoſſible, however, to give any particular directions in this matter which can hold good in every inſtance, the number of pieces of which the mould is to conſiſt being always determined from the ſhape of the pattern. Thus the mould of the human calculus will require no more than three pieces, but that of an *os femoris* could ſcarce have fewer than ten or twelve.—Where any internal pieces are required, they are firſt to be made, and then the outer pieces after the former have become hard.

To make a mould upon a hard and dry ſubſtance, we muſt, in the firſt place, rub the ſurface of it ſmoothly over with the mixture of oil and lard above mentioned. Such hollows as require internal pieces are then to be filled up with fluid plaſter; and while it continues in this ſtate, a wire loop muſt be introduced into it, by which, when hardened, it can be pulled off. The plaſter ſhould be ſomewhat raiſed in a pyramidal form around this wire, and afterwards cut ſmooth with a knife while yet in its ſoft ſtate; preſerving two or three angular ridges from the loop to the outer edge, that it may fix the more ſteadily in the outer piece of the mould to be afterwards made upon it. Let the outer piece then be well greaſed, to prevent the ſecond piece from adhering; the loop being encloſed with ſome glaziers putty, both to prevent the ſecond piece from adhering and to preſerve a hollow place for the cord.

To form the ſecond or outſide piece, mix a quantity of plaſter proportioned to the extent of ſurface it is to cover and the intended thickneſs of the mould: when it is juſt beginning to thicken, or aſſumes ſuch a conſiſtence as not to run off very eaſily, ſpread it over the internal piece or pieces as well as the pattern, taking care at the ſame time not to go too far leſt it ſhould not deliver ſafely; and as the plaſter becomes more tenacious, add more upon the pattern until it has become ſufficiently thick, keeping the edges ſquare and ſmooth like the edge of a board. The plaſter ſhould be ſpread equally upon all parts, which is beſt done by a painter's pallet knife or apothecary's bolus knife: but for this the inſtrument ſhould be ſomewhat leſs pliable than it is commonly made.

When the outſide piece is hardened, the edges are to be pared ſmooth, and nearly made ſquare with a ſmall pointed knife. Little holes of a conical ſhape are to be made with the point of a knife about an inch diſtant from one another, according to the ſize of the piece. Theſe are deſigned to receive the fluid plaſter in forming the adjacent parts of the mould, and occaſion points correſponding to the hollows; and are intended to preſerve the edges of the different pieces ſteadily in their proper relative ſituations. The third piece is then to be formed in a manner ſimilar to the ſecond; greaſing the edges of the former plentifully with hog's lard and oil, to prevent the pieces from adhering to each other. Thus the pattern is to be wholly encloſed, only leaving a proper orifice for pouring in the plaſter to form the model; ſmall holes being alſo bored in the mould oppoſite to the wire-loops fixed in the inſide pieces, through which a cord is to be conveyed from the loop to confine ſuch pieces during the time of caſting. In ſome caſes, however, it is not neceſſary that the mould ſhould totally encloſe the pattern; for inſtance, where a model is to be made of a pedeſtal, or a buſt of any part of the human body. The bottom of ſuch moulds being left open, there is accordingly ample room for pouring in the plaſter.

After the mould is completely formed, it is next to be dried either naturally or by a gentle artificial heat, and then ſeaſoned in the following manner:—Having been made thoroughly dry, which, if the mould is large, will require two or three weeks, it is to be bruſhed over plentifully with linſeed oil boiled with ſugar of lead, finely levigated litharge, or oil of vitriol. The inſide and joints of the mould ſhould be particularly well ſupplied with it. If the mould be large, it is needleſs to attend to the outſide; but when the moulds are ſmall, it will not be improper to boil them in the oil; by which means their pores are more exactly filled than could otherwiſe be done. After the moulds have undergone this operation, they are again ſet by to dry, when, being greaſed with olive oil and hog's lard, they are fit for uſe. If linſeed oil be uſed for greaſing the moulds, it will in a ſhort time impart a diſagreeable yellow colour to the caſts.

The mould being properly prepared and ſeaſoned, nothing more is requiſite to form the model than to pour the fineſt liquid plaſter of Paris into it. After a layer of this, about half an inch in thickneſs, has been formed all round the mould, we may uſe the coarſer kind to fill it up entirely, or to give to the model what thickneſs we pleaſe.

4 Models from living ſubjects.

Beſides the models which are taken from inanimate bodies, it has been frequently attempted to take the exact reſemblance of people while living, by uſing their face as the original of a model, from whence to take a mould; and the operation, however diſagreeable, has been ſubmitted to by perſons of the higheſt ranks in life. A conſiderable difficulty occurs in this, however, by reaſon of the perſon's being apt to ſhrink and diſtort his features when the liquid is poured upon him; neither is he altogether without danger of ſuffocation, unleſs the operator well underſtands his buſineſs.

To avoid the former inconvenience, it will be proper to mix the plaſter with warm inſtead of cold water, by which means the perſon will be under no temptation to ſhrink; and to prevent any danger of a fatal accident, the following method is to be practiſed: Having laid the perſon horizontally on his back, the head muſt firſt be raiſed by means of a pillow to the exact poſition in which it is naturally carried when the body is erect; then the parts to be repreſented muſt be very thinly covered over with fine oil of almonds by means of a painter's bruſh; the face is then to be firſt covered with fine fluid plaſter, beginning at the upper part of the forehead, and ſpreading it over the eyes, which are to be kept cloſe, that the plaſter may not come in contact with the globe; yet not cloſed ſo ſtrongly as to cauſe any unnatural wrinkles. Cover then the noſe and ears, plugging firſt up the *meatus auditorii*, with cotton, and the noſtrils with a ſmall quantity of tow rolled up, of a proper ſize, to exclude the plaſter. During the time that the noſe is thus ſtopped, the perſon is to breathe through the mouth: in this ſtate the fluid plaſter is to be brought down low enough to cover the upper lip, obſerving to leave the rolls of tow projecting out of the plaſter. When the operation is thus far carried on, the plaſter muſt be ſuffered to harden; after which the tow may be withdrawn, and the noſtrils left free and open for breathing. The mouth is then to be cloſed in its natural poſition, and the plaſter brought down to the extremity of the chin. Begin then to cover that part of the breaſt which is to be repreſented, and ſpread the plaſter to the outſides of the arms and upwards, in ſuch a manner as to meet and join that which is previouſly laid on the face: when the whole of the maſs has acquired its due hardneſs, it is to be cautiouſly lifted, without breaking, or giving pain to the perſon. After the mould is conſtructed, it muſt be ſeaſoned in the manner already directed; and when the mould is caſt, it is to be ſeparated from the mould by means of a ſmall mallet and chiſſel. The eyes, which are neceſſarily ſhown cloſed, are to be carved, ſo that the eyelids may be repreſented in an elevated poſture; the noſtrils hollowed out, and the back part of the head, from which, on account of the hair, no mould can be taken, muſt be finiſhed according to the ſkill of the artiſt. The edges of the model are then to be neatly ſmoothed off, and the buſt fixed on its pedeſtal.

5 Topographical models, &c.

The method of making models in the plaſter of Paris is undoubtedly the moſt eaſy way of obtaining them. When models, however, are made of ſuch large objects that the model itſelf muſt be of conſiderable ſize, it is vain to attempt making it in the way above deſcribed. Such models muſt be conſtructed by the hand with ſome ſoft ſubſtance, as wax, clay, putty, &c. and it being neceſſary to keep all the proportions with mathematical exactneſs, the conſtruction of a ſingle model of this kind muſt be a work of great labour and expence as well as of time. Of all thoſe which have been undertaken by human induſtry, however, perhaps the moſt remarkable is that conſtructed by General Pfiffer, to repreſent the mountainous parts of Switzerland. It is compoſed of 142 compartments, of different ſizes and forms, reſpectively numbered, and ſo artfully put together, that they can be ſeparated and replaced with the greateſt eaſe. The model itſelf is 20½ feet long and 12 broad, and formed on a ſcale which repreſents two Engliſh miles and a quarter by an Engliſh foot: comprehending part of the cantons of Zug, Zurich, Schweitz, Underwalden, Lucerne, Berne, and a ſmall part of the mountains of Glarus; in all, an extent of country of 18¼ leagues in length and 12 in breadth. The higheſt point of the model, from the level of the centre (which is the lake of Lucerne), is about ten inches; and as the moſt elevated mountain repreſented therein riſes 1475 toiſes or 9440 feet above the lake of Lucerne, at a groſs calculation, the height of an inch in the model is about 900 feet. The whole is painted of different colours, in ſuch a manner as to repreſent objects as they exiſt in nature; and ſo exactly is this done, that not only the woods of oak, beech, pine, and other trees, are diſtinguiſhed, but even the ſtrata of the ſeveral rocks are marked, each being ſhaped upon the ſpot, and formed of granite, gravel, or ſuch other ſubſtances as compoſe the natural mountain. So minute alſo is the accuracy of the plan, that it compriſes not only all the mountains, lakes, rivers, towns, villages, and foreſts, but every cottage, bridge, torrent, road, and even every path is diſtinctly marked.

The principal material employed in the conſtruction of this extraordinary model, is a mixture of charcoal, lime, clay, a little pitch, with a thin coat of wax; and is ſo hard that it may be trod upon without any damage. It was begun in the year 1766, at which time the general was about 50 years of age, and it employed him till the month of Auguſt 1785; during all which long ſpace of time he was employed in the moſt laborious and even dangerous taſks.—He raiſed the plans with his own hands on the ſpot, took the elevation of mountains, and laid them down in their ſeveral proportions. In the proſecution of this laborious employment, he was twice arreſted for a ſpy; and in the popular cantons was frequently forced to work by moon light, in order to avoid the jealouſy of the peaſants, who imagined that their liberty would be endangered ſhould a plan of their country be taken with ſuch minute exactneſs. Being obliged frequently to remain on the tops of ſome of the Alps, where no proviſions could be procured, he he took along with him a few milk goats, who ſupplied him with nouriſhment. When any part was finiſhed, he ſent for the people reſiding near the ſpot, and deſired them to examine each mountain with accuracy, whether it correſponded, as far as the ſmallneſs of the ſcale would admit, with its natural appearance; and then, by frequently retouching, corrected the deficiencies. Even after the model was finiſhed, he continued his Alpine expeditions with the ſame ardour as ever, and with a degree of vigour that would fatigue a much younger perſon. All his elevations were taken from the level of the lake Lucerne; which, according to M. Sauſſure, is 1408 feet above the level of the Mediterranean.

MODENA, a duchy of Italy, bounded on the ſouth by Tuſcany and the republic of Lucca, on the north by the duchy of Mantua, on the eaſt by the Bologneſe and the territories of the Church, and on the weſt by the duchy of Parma; extending in length from ſouth to north about 56 Engliſh miles, and in breadth between 24 and 36, and yielding plenty of corn, wine, and fruits, with mineral waters. In ſome places alſo petroleum is ſkimmed off the ſurface of the water of deep wells made on purpoſe; and in others is found a kind of earth or tophus, which, when pulverized, is ſaid to be an excellent remedy againſt poiſon, fevers, dyſenteries, and hypochondriac diſorders. The country of La Salſa affords ſeveral kinds of petrifactions. The principal rivers are the Croſtolo, Secchia, and Panaro. The family of Eſté, dukes of Modena, is very ancient. They had their name from Eſté, a ſmall city in the diſtrict of Padua. In 1753, the duke was appointed imperial vicar general, field marſhal, and governor of the Milaneſe, during the minority of the archduke Peter Leopold, who was declared governor general of the Auſtrian Lombardy. The duke, though a vaſſal of the empire, hath an unlimited power within his own dominions.

MODENA, an ancient city, in Latin *Mutina*, which gives name to a duchy of Italy, and is its capital. It ſtands 28 miles eaſt of Parma, 44 almoſt ſouth of Mantua, and 20 weſt of Bologna; and is a pretty large and populous, but not a handſome city. The population is ſaid to amount to about 40,000. It is much celebrated by Roman authors for its grandeur and opulence; but was a great ſufferer by the ſiege it underwent during the troubles of the triumvirate. It hath long been the uſual reſidence of the dukes; and is alſo the ſee of a biſhop, who is ſuffragan to the archbiſhop of Bologna. Mr Keyſler ſays, that when Decius Brutus was beſieged here by Mark Antony, Hirtius the conſul made uſe of carrier pigeons; and that, even at this day, pigeons are trained up at Modena to carry letters and bring back anſwers. This city hath given birth to ſeveral celebrated perſons, particularly Taſſo the poet, Corregio the great painter, Sigonius the civilian and hiſtorian, Da Vignola the architect, and Montecuculi the imperial general. The tutelary ſaint of it is named *Geminianus*. The ducal palace is a very noble edifice, in which, among the other fine pictures, the birth of Chriſt by Corregio, called *la Notte Felice*, is much celebrated. The only manufacture for which this city is noted, is that of maſks, of which great numbers are exported. The churches of the Jeſuits, of the Theatines, and of St Dominic, are well worth viewing. In the college of St Carlo Boromeo between 70 and 80 young noblemen are continually maintained, and inſtructed both in the ſciences and genteel exerciſes. St Beatrix, who was of the family of Eſté, is ſaid to knock always at the gate of the palace three days before any of the family dies. Before moſt of the houſes are covered walks or porticoes, as at Bologna. The city is fortified, and on its ſouth ſide ſtands the citadel. E. Long. 11. 0. N. Lat. 44. 34.

MODERATION, in *Ethics*, is a virtue conſiſting in the proper government of our appetites, paſſions, and purſuits, with reſpect to honours, riches, and pleaſures; and in this ſenſe it is ſynonymous with *temperance*: it is alſo often uſed to denote *candour*.

MODERATOR, in the ſchools, the perſon who preſides at a diſpute, or in a public aſſembly: thus the preſident of the annual aſſembly of the church of Scotland is ſtyled *moderator*.

MODERN, ſomething new, or of our time; in oppoſition to what is antique or *ancient*.

Modern Authors, according to Naude, are all thoſe who have wrote ſince Boethius. The modern philoſophy commences with Galileo; the modern aſtronomy with Copernicus.

MODESTY, in *Ethics*, is ſometimes uſed to denote humility; and ſometimes to expreſs chaſtity, or purity of ſentiments and manners.—Modeſty, in this laſt ſenſe, and as particularly applied to women, is defined by the authors of the *Encyclopédie Methodique*, as a natural, chary, and honeſt ſhame; a ſecret fear; a feeling on account of what may be accompanied with diſgrace. Women who poſſeſs only the remains of a ſuſpicious modeſty, make but feeble efforts to reſiſt: thoſe who have obliterated every trace of modeſty from their countenance, ſoon extinguiſh it completely in their ſoul, and throw aſide for ever the veil of decency. She, on the contrary, who truly poſſeſſes modeſty, paſſes over in ſilence attempts againſt her honour, and forbears ſpeaking of thoſe from whom ſhe has received an outrage, when in doing ſo ſhe muſt reveal actions and expreſſions that might give alarm to virtue.

The idea of modeſty is not a chimera, a popular prejudice, or an illuſion ariſing from laws and education. Nature, which ſpeaks the ſame language to all men, has, with the unanimous conſent of nations, annexed contempt to female incontinence. To reſiſt and to attack are laws of her appointment: and while ſhe beſtows deſires on both parties, they are in the one accompanied with boldneſs, in the other with ſhame. To individuals ſhe has allotted long ſpaces of time for the purpoſes of ſelf-preſervation, and but moments for the propagation of their ſpecies. What arms more gentle than *Modeſty* could ſhe have put into the hands of that ſex which ſhe deſigned to make reſiſtance.

If it were the cuſtom for both ſexes to make and receive advances indiſcriminately, vain importunity would not be prevented: the fire of paſſion would never be ſtirred up, but languiſh in tedious liberty; the moſt amiable of all feelings would ſcarcely warm the human breaſt; its object would with difficulty be attained. That obſtacle which ſeems to remove this object to a diſtance, in fact brings it nearer. The veil of ſhame only makes the deſires more attractive. Modeſty kindles that flame which it endeavours to ſuppreſs: its fears, its evaſions, its caution, its timid avowals, its pleaſing and affecting fineſſes, ſpeak more plainly what it wiſhes to conceal, than paſſion can do without it: it is MODESTY, in ſhort, which enhances the value of a favour, and mitigates the pain of a refuſal.

Since modeſty is the ſecret fear of ignominy; and ſince all nations, ancient or modern, have confeſſed the obligation of its laws; it muſt be abſurd to violate them in the puniſhment of crimes, which ſhould always have for its object the re-eſtabliſhment of order. Was it the intention of thoſe oriental nations, who expoſed women to elephants, trained for an abominable ſpecies of puniſhment, to violate one law by the obſervance of another? By an ancient practice among the Romans a girl could not be put to death before ſhe was marriageable. Tiberius found means to evade this law, by ordering them to be violated by the executioner previous to the infliction of puniſhment; the refinement of a cruel tyrant, who ſacrificed the morals to the cuſtoms of his people! When the legiſlature of Japan cauſed women to be expoſed naked in the market places, and obliged them to walk on all fours like brutes, modeſty was ſhocked: but when it wanted to force a mother—when it wanted to compel a ſon—nature received an outrage.

Such is the influence of climate in other countries, that the phyſical part of love poſſeſſes an almoſt irreſiſtible force. The reſiſtance is feeble; the attack is accompanied with a certainty of ſucceſs. This is the caſe at Patana, at Bantam, and in the ſmall kingdoms on the coaſt of Guinea. When the women in theſe countries (ſays Mr Smith) meet with a man, they lay hold of him and threaten to inform their huſbands if he deſpiſes their favours. But here the ſexes ſeem to have aboliſhed the laws peculiar to each. It is fortunate to live in a temperate climate like ours, where that ſex which poſſeſſes the moſt powerful charms exerts them to embelliſh ſociety; and where modeſt women, while they reſerve themſelves for the pleaſures of one, contribute to the amuſement of all.

MODIFICATION, in *Philoſophy*, that which modifies a thing, or gives it this or that manner of being. Quantity and quality are accidents which modify all bodies.

Decree of MODIFICATION, in *Scots Law*, a decree aſcertaining the extent of a miniſter's ſtipend, without proportioning it among the perſons liable in payment.

MODILLIONS, in *Architecture*, ornaments in the corniche of the Ionic, Corinthian, and Compoſite columns.

MODIUS, a Roman dry meaſure for all ſorts of grain, containing 32 heminæ, or 16 ſextarii, or one-third of the amphora; amounting to an Engliſh peck. See MEASURE.

MODULATION, the art of forming any thing to certain proportion.

MODULATION, in reading or ſpeaking. See READING.

MODULATION, in *Muſic*, derived from the Latin *modulari*. This word, in our language, is ſuſceptible of ſeveral different ſignifications. It frequently means no more than an air, or a number of muſical ſounds properly connected and arranged. Thus it anſwers to what Mr Malcolm underſtands by the word *tune*, when he does not expreſsly treat concerning the tuning of inſtruments. Thus likewiſe it expreſſes the French word *chant;* for which reaſon, in the article MUSIC, we have frequently expreſſed the one word by the other. But the preciſe and technical acceptation to which it ought to be confined, is the art of compoſing melody or harmony agreeably to the laws preſcribed by any particular key, that of changing the key, or of regularly and legitimately paſſing from one key to another. See MUSIC.

MODULE, in *Architecture*, a certain meaſure, or bigneſs, taken at pleaſure, for regulating the proportions of columns, and the ſymmetry or diſpoſition of the whole building. Architects generally chooſe the ſemidiameter of the bottom of the column for their module, and this they ſubdivide into parts or minutes.

MOEONIA, or MÆONIA. See MÆONIA and LYDIA.

MOESIA, or MYSIA, in *Ancient Geography*, a country of Europe, extending from the confluence of the Savus and the Danube to the ſhores of the Euxine. It was divided into Upper and Lower Mœſia. Lower Mœſia was on the borders of the Euxine, and comprehended that tract of country which received the name of *Pontus* from its vicinity to the ſea. Upper Mœſia lay beyond the other in the inland country.

MOFFAT, a village of Scotland, in Annandale, in the county of Dumfries, 50 miles ſouth-weſt of Edinburgh; famous for its ſulphureous well, which has been in juſt eſtimation for near 150 years as a remedy in all cutaneous and ſcrofulous complaints; and for its chalybeate ſpring, called Hartfell ſpaw, which was diſcovered above 50 years ago, and is of a very bracing quality.—The place is chiefly ſupported by the company who reſort thither for the benefit of its waters and air; but it has alſo a manufacture of coarſe woollen ſtuffs. It is a well-built clean village; and contains many good and even elegant lodgings, a tolerable aſſembly room, a bowling green and walks, and a good inn. The population in 1801 amounted to 1619.

MOFFETTA. See AMPSANCTI.

MOGODORE, or MAGADORE, a large, uniform, and well built town in the kingdom of Morocco, ſituated about 350 miles from Tangier on the Atlantic ocean, and ſurrounded on the land ſide by deep and heavy ſands. The European factory here conſiſts of about a dozen mercantile houſes of different nations, whoſe owners, from the protection granted them by the emperor, live in full ſecurity from the Moors, whom indeed they keep at a rigid diſtance. They export, to America, mules; to Europe, Morocco leather, hides, gum arabic, gum ſandaric, oſtrich feathers, copper, wax, wool, elephants teeth, fine mats, beautiful carpeting, dates, figs, raiſins, olives, almonds, oil, &c. In return, they import timber, artillery of all kinds, gunpowder, woollen cloths, linens, lead, iron in bars, all kinds of hardware and trinkets, ſuch as looking glaſſes, ſnuff boxes, watches, ſmall knives, &c. tea, ſugar, ſpices, and moſt of the uſeful articles which are not otherwiſe to be procured in this empire. The town is regularly fortified on the ſea

ſea ſide; and on the land, batteries are ſo placed as to prevent any incurſion from the ſouthern Arabs, who are of a turbulent diſpoſition, and who, from the great wealth which is known to be always in Mogodore, would gladly avail themſelves of any opportunity that offered to pillage the town. The entrance, both by ſea and land, conſiſts of elegant ſtone arch-ways, with double gates. The market place is handſomely built, with piazzas of the ſame materials; and at the water port there is a cuſtomhouſe and powder magazine, both of which are neat ſtone buildings. Beſides theſe public edifices, the emperor has a ſmall but handſome palace for his occaſional reſidence. The ſtreets of the town, though very narrow, are all in ſtraight lines; and the houſes, contrary to what we meet with in the other towns of the empire, are lofty and regular. The bay, which is little better than a road, and is very much expoſed when the wind is at north-weſt, is formed by a curve in the land, and a ſmall iſland about a quarter of a mile from the ſhore. —Its entrance is defended by a fort well furniſhed with guns.

1 Moguls deſcended from Japhet.

MOGULS, a celebrated nation of Aſia, whoſe conqueſts formerly were the moſt rapid and extenſive of any people recorded in hiſtory. They themſelves deduce their origin from Japhet, or, as they call him, *Japhis*, the ſon of Noah. His ſon Turk, they ſay, was the firſt king, or khan, of thoſe nations who are now known by the ſeparate names of *Turks*, *Tartars*, and *Moguls;* and the Tartars eſpecially aſſert, that their proper deſignation is *Turks*. To this prince is attributed many of thoſe inventions which barbarous nations commonly aſcribe to their firſt ſovereigns. He was ſucceeded by Taunak; in whoſe reign the whole poſterity of Turk were divided into four large tribes, denominated the *orda's* of Erlat, Gialair, Kaugin, Berlas or Perlas; of which laſt came the famous Timur Beg, or Tamerlane.—From this time to that of Alanza Khan, we meet with nothing remarkable. In his reign the Turks being immerſed in all kinds of luxury, univerſally apoſtatized into idolatry. Having two ſons, Tartar and Mogul, he divided his dominions among them, and thus gave riſe to the two empires of the Tartars and Moguls.

2 Almoſt exterminated.

The two nations had not long exiſted before they began to make war upon each other; and after long contention, the event at laſt was, that Il Khan, emperor of the Moguls, was totally overthrown by Siuntz Khan, emperor of the Tartars; and ſo great was the defeat, that the Mogul nation ſeems to have been almoſt exterminated. Only two of Il Khan's family ſurvived this diſaſter. Theſe were Kajan his youngeſt ſon, and Nagos his nephew, who were both of an age, and had both been married the ſame year. Theſe two princes, with their wives, had been taken priſoners by Siuntz Khan, but found means to make their eſcape to their own country. Here they ſeized upon all the cattle which had not been carried off by the Tartars; which was eaſily done, as having none to diſpute the property with them; then ſtripping ſome of the ſlain, they took their clothes, and retired into the mountains. They paſſed ſeveral mountains without much difficulty; but at laſt advanced to the foot of one exceedingly high, which had no way over it but a very ſmall path made by certain animals, called in the Tartar language *archara*. This path they found themſelves obliged to make uſe of, though it was ſo ſtrait, that only one could paſs at a time, and he was in the moſt imminent danger of breaking his neck at the leaſt falſe ſtep. Having aſcended the mountain on one ſide by this path, they deſcended by the ſame on the other ſide; and were agreeably ſurpriſed to find themſelves in a moſt delightful tract, interſperſed with rivulets and charming meadows, abounding with a vaſt variety of delicious fruits, and encloſed on all ſides by inacceſſible mountains, in ſuch a manner as to ſhelter them from all future purſuits of the Tartars. Here they lived ſome time, and gave this beautiful country the name of *Irgana-kon*, in alluſion to its ſituation; *Irgana* ſignifying, in the old language of the Moguls, a "valley," and *Kon* a "ſteep height."

3 They arrive in a delightful valley.

In proceſs of time theſe two families very much increaſed. Kajan, whoſe poſterity was the moſt numerous, called his deſcendants *Kajath;* but the people ſpringing from Nagos were divided into two tribes; one of which received the appellation of *Nagoſter*, and the other that of *Durlagan*.

Theſe two Mogul princes and their deſcendants lived in this place for more than 400 years; but the latter then finding it too narrow for them, meditated a return to the country from which their forefathers had been driven. For ſome time, however, they found this impracticable, as the path that conducted their anceſtors had been long ſince deſtroyed. At laſt they diſcovered, that one part of the high mountain above mentioned was not very thick in a certain place; and alſo, that it conſiſted entirely of iron ore. To this, having before ſet fire to a layer of wood, and another of charcoal, laid along the foot of the mountain, they applied 70 large bellows, and at laſt melted the mountain in ſuch a manner, that an opening was made large enough for a loaded camel to paſs; and through this paſſage they all marched out with great joy.

4 From whence they at laſt iſſue and defeat the Tartars.

The Moguls having thus iſſued as it were from a new world, overthrew the Tartars in their turn; and continued to be a very conſiderable nation till the time of their great hero Temujin, afterwards called *Jenghiz Khan*, whom they extol in the moſt extravagant manner. It is difficult, however, to ſay, at the time Temujin made his appearance, how far the dominions of the Moguls extended, or in what eſtimation they were held by their neighbours. It ſeems to be pretty certain that great part of the vaſt region, now known by the name of *Tartary*, was then in a ſtate of conſiderable civilization, and likewiſe extremely populous, as we find mention made of many cities which the Moguls deſtroyed; and the incredible multitudes whom they ſlaughtered, abundantly ſhow the populouſneſs of the country. On the eaſt, the country of the Moguls and Tartars had the great deſert which divides Tartary from China; on the weſt, it had the empire of Karazm, founded by Mahmud Gazni; and on the ſouth were the countries now known by the name of *Indoſtan*, *Siam*, *Pegu*, *Tonquin*, and *Cochin China*. Thus it comprehended the eaſtern part of modern Tartary, and all Siberia. This whole region was divided among a great number of *Aymacks*, or *tribes;* who had each one or more khans, according as it was more or leſs numerous, or divided into branches. Among theſe that of the *Kara-its* was the moſt powerful: their

5 State of Aſia at the time of Jenghiz Khan.

prince aſſumed the title of *Grand Khan*, and among the reſt the Moguls were tributary to him; but, according to the Chineſe hiſtorians, both the one and the other were tributary to the emperor of Kitay or Katay. China was divided into two parts: the nine ſouthern provinces were in the hands of the Chineſe emperors of the Song dynaſty, who kept their court at Hang-chew, the capital of the province of Chekyang; the five northern provinces, excepting part of Shenſi, were poſſeſſed by the Kin, a people of Eaſtern Tartary, from whom are deſcended the Manchew Tartars, at preſent maſters of China. This vaſt dominion was named *Kitay* or *Katay*, and was divided into two parts: that which belonged to China, was properly called *Kitay;* and the part which belonged to Tartary was called *Karakitay*, in which ſome even include the territories of the Moguls, Karaits, and other tribes which are the ſubject of the preſent hiſtory. The weſtern part of the empire of Kitay was poſſeſſed by a Turkiſh prince, who had lately founded a new kingdom there called *Hya;* whoſe capital city was Hyachew, now Ninghya in Shenſi, from whence the kingdom took its name. To the weſt of Hya lay Tangut; a country of great extent, and formerly very powerful; but at that time reduced to a low ſtate, and divided among many princes; ſome of whom were ſubject to the emperor of Hya, and others to the emperor of China. All Tartary to the weſtward as far as the Caſpian ſea, with the greater part of Little Buckharia, which then paſſed under the general name of *Turkeſtan*, was ſubject to Ghurkhan, Khurkhan, or Kaver Khan; to whom even the Gazni monarchs are ſaid to have been tributary. This Ghurkhan had been prince of the Weſtern Kitan or Lyau; who, driven out of Kitay by the king, ſettled in Little Buckharia, and the country to the north, where they founded a powerful ſtate about the year 1124.

6
Deſcent and birth of Temujin.

Thus the Moguls, properly ſo called, had but a very ſmall extent of empire which could be called their own, if indeed they had any, when Temujin made his appearance. This hero is ſaid by the Tartars to have been of divine origin, ſince his family could be traced no farther back than ten generations, the mother of whom was got with child by a ſpirit. The names and tranſactions of his predeceſſors are equally uncertain and unimportant: he himſelf, however, was born in the year 1163, and is ſaid to have come into the world with congealed blood in his hands; from whence it was prognoſticated that he would be a great warrior, and obtain the victory over all his enemies.

7
Subdues his revolted ſubjects by means of Vang Khan.

This prediction, if any ſuch there was, Temujin moſt literally fulfilled. At the time of his father's deceaſe, his ſubjects amounted to between 30,000 and 40,000 families; but of theſe two-thirds quickly deſerted, and Temujin was left almoſt without ſubjects. When only 13 years of age, he fought a bloody battle againſt theſe revolters; but either was defeated, or gained an indeciſive victory; ſo that he remained in obſcurity for 27 years longer. His good fortune at laſt he owed to the friendſhip of Vang Khan, who ruled over a great number of Tartar tribes to the north of Kitay, and has been heard of under the name of *Preſter John* among the Europeans. This prince took Temujin under his protection; and a rebellion being afterwards raiſed againſt himſelf, Temujin was made his general, and the khan was kept in poſſeſſion of his throne: ſoon after which Temujin ſubdued the tribes which had revolted from himſelf, treating them at the ſame time with the utmoſt barbarity.

8
Who becomes jealous, and contrives his deſtruction.

This happened in the year 1201; but Vang Khan, inſtead of continuing the friend of Temujin, now became jealous, and reſolved to deſtroy him by treachery. With this view he propoſed a marriage between Temujin's ſon Juji and his own daughter, and another between Temujin's daughter and his own ſon. Temujin was invited to the camp of Vang Khan, in order to celebrate this double marriage; but receiving intelligence of ſome evil intention againſt him, he excuſed himſelf to Vang Khan's meſſengers, and deſired that the ceremony might be put off to ſome other time.

A few days after the departure of theſe meſſengers, Badu and Kiſhlik, two brothers, who kept the horſes of one of Vang Khan's chief domeſtics, came and informed Temujin, that the grand Khan finding he had miſſed his aim, was reſolved to ſet out inſtantly, and ſurpriſe him next morning, before he could ſuſpect any danger. Temujin, alarmed at this intelligence, quitted his camp, in the night time, and retired with all his people to ſome diſtance. He was ſcarce gone when Vang Khan's troops arrived, and diſcharged an incredible number of arrows among the empty tents; but finding nobody there, they purſued Temujin in ſuch haſte that they fell into great diſorder. In this condition they were ſuddenly attacked and routed by Temujin; after which an open war with Vang Khan took place.

9
Temujin overcomes all his enemies.

By this quarrel almoſt all the princes of Tartary were put in motion, ſome ſiding with Temujin, and others with Vang Khan. But at laſt fortune declared in favour of the former: Vang Khan was overthrown in a battle, where he loſt 40,000 men, and obliged to fly for refuge to a prince named *Tayyan Khan*, who was Temujin's father-in-law, and his own enemy, and by whom he was ungenerouſly put to death. Temujin immediately began to ſeize on his dominions, great part of which voluntarily ſubmitted: but a confederacy was formed againſt him by a number of Vang Khan's tributaries, at the head of whom was Jamuka, a prince who had already diſtinguiſhed himſelf by his enmity to Temujin; and even Tayyan Khan himſelf was drawn into the plot, through jealouſy of his ſon-in-law's good fortune. But Temujin was well prepared; and in the year 1204 attacked Tayyan Khan, entirely routed his army, killed himſelf, and took Jemuka priſoner, whoſe head he cauſed inſtantly to be ſtruck off; after which he marched againſt the other tribes who had conſpired againſt him. Them he quickly reduced; took a city called *Kaſhin*, where he put all to the ſword who had borne arms againſt him; and reduced all the Mogul tribes in 1205.

Temujin now, having none to oppoſe him, called a general diet, which he appointed to be held on the firſt day of the ſpring 1206; that is, on the day in which the ſun entered Aries. To this diet were ſummoned all the great lords both Moguls and Tartars; and in the mean time, to eſtabliſh good order in the army, he divided his ſoldiers into bodies of 10,000, 1000, 100, and 10 men, with their reſpective officers, all ſubordinate to the generals, or thoſe who commanded the bodies of 10,000; and theſe were to act under his own

10 Aſſumes the title of Jenghiz Khan.

own ſons. On the day of holding the diet, the princes of the blood and great lords appeared dreſſed in white. Temujin dreſſed in the ſame manner, with his crown on his head, ſat down on his throne, and was complimented by the whole aſſembly, who wiſhed him the continuance of his health and proſperity. After this they confirmed the Mogul empire to him and his ſucceſſors, adding all thoſe kingdoms which he had ſubdued, the deſcendants of whoſe vanquiſhed khans were deprived of all right or title to them; and after this he was proclaimed emperor with much ceremony. During this inauguration, a pretended prophet declared that he came from God to tell the aſſembly, that from thenceforth Temujin ſhould aſſume the name of *Jenghiz Khan*, or *the moſt Great Khan of khans;* prophecying alſo, that all his poſterity ſhould be khans from generation to generation. This prophecy, which was no doubt owing to Temujin himſelf, had a ſurpriſing effect on his ſubjects, who from that time concluded that all the world belonged of right to them, and even thought it a crime againſt heaven for any body to pretend to reſiſt them.

11 Invades Hya, China, &c.

Jenghiz Khan having now reduced under his ſubjection all the wandering tribes of Moguls and Tartars, began to think of reducing thoſe countries to the ſouth and ſouth-weſt of his own, where the inhabitants were much more civilized than his own ſubjects: and the countries being full of fortified cities, he muſt of courſe expect to meet with more reſiſtance. He began with the emperor of Hya, whoſe dominions he invaded in 1209, who at laſt ſubmitted to become his tributary. But in the mean time Jenghiz Khan himſelf was ſuppoſed to be tributary to the emperor of Kitay: who, in 1210, ſent him an officer, demanding the cuſtomary tribute. This was refuſed with the utmoſt indignation, and a war commenced, which ended not but with the diſſolution of the empire of Kitay, as mentioned under the article CHINA.

In the year 1216, Jenghiz Khan reſolved to carry his arms weſtward, and therefore left his general Muchuli to purſue his conqueſts in Kitay. In his journey weſtward he overthrew an army of 300,000 Tartars who had revolted againſt him; and, in 1218, ſent ambaſſadors deſiring an alliance with Mohammed Karazm Shah, emperor of Gazna. His ambaſſador was haughtily treated: however, the alliance was concluded; but ſoon after broken, through the treachery, as it is ſaid, of the Karazmian monarch's ſubjects. This brought on a war attended with the moſt dreadful devaſtations, and which ended with the entire deſtruction of the empire of Karazm or Gazna, as related under the the article GAZNA.

After the reduction of Karazm, part of the Moguls broke into Iran or Perſia, where alſo they made large conqueſts, while others of their armies invaded Georgia and the countries to the weſt; all this time committing ſuch enormities, that the Chineſe hiſtorians ſay both men and ſpirits burſt with indignation. In 1225, Jenghiz Khan returned to Hya, where he made war on the emperor for having ſheltered ſome of his enemies. The event was, that the emperor was ſlain, and his kingdom conquered, or rather deſtroyed; which, however, was the laſt exploit of this moſt cruel conqueror, who died in 1227, as he marched to complete the deſtruction of the Chineſe.

12 Vaſt extent of his empire.

13 Bagdad reduced.

The Mogul empire, at the death of Jenghiz Khan, extended over a prodigious tract of country; being more than 1800 leagues in length from eaſt to weſt, and upwards of 1000 in breadth from north to ſouth. Its princes, however, were ſtill inſatiable, and puſhed on their conqueſts on all ſides. Oktay was acknowledged emperor after Jenghiz Khan; and had under his immediate government Moguleſtan (the country of the Moguls properly ſo called), Kitay, and the countries eaſtward to the Tartarian ſea. Jagaty his brother governed under him a great part of the weſtern conqueſts. The country of the Kipjacks, and others to the eaſt, and north-eaſt, north, and north-weſt, were governed by Batu or Patu the ſon of Juji, who had been killed in the wars; while Tuli or Toley, another ſon of Jenghiz Khan, had Khoraſſan, Perſia, and what part of India was conquered. On the eaſt ſide the Mogul arms were ſtill attended with ſucceſs; not only the empire of Kitay, but the ſouthern part of CHINA, was conquered, as already related under that article, N° 24—42. On the weſt ſide matters continued much in the ſame way till the year 1254, when Magu, or Menkho, the fourth khan of the Moguls, (the ſame who was afterwards killed at the ſiege in China*), raiſed a great army, which he gave to his brother Hulaku or Hulagu, to extend his dominions weſtward. In 1255, he entered Iran, where he ſuppreſſed the Iſmaelians or Aſſaſſins, of whom an account is given under the article ASSASSINS, and two years afterwards he advanced to Bagdad, which he took, and cruelly put the caliph to death, treating the city with no more lenity than the Moguls uſually treated thoſe which fell into their hands. Every thing was put to fire and ſword; and in the city and its neighbourhood the number of ſlain, it is ſaid, amounted to 1,600,000. The next year he invaded Syria; the city of Damaſcus was delivered up, and, as it made no reſiſtance, the inhabitants were ſpared; but Aleppo being taken by ſtorm, a greater ſlaughter enſued there than had taken place at Bagdad, not even the children in their cradles being ſpared. Some cities of this country revolted the next year, or the year after; but falling again into the hands of the Moguls, they were plundered, and the inhabitants butchered without mercy, or carried into ſlavery.

14 It begins to decline.

Hulaku died in 1264, and at his death we may fix the greateſt extent of the Mogul empire. It now comprehended the whole of the continent of Aſia, excepting part of Indoſtan, Siam, Pegu, Cochin China, and a few of the countries of Leſſer Aſia, which had not been attacked by them; and during all theſe vaſt conqueſts no Mogul army had ever been conquered, except one by Jaloloddin, as mentioned under the article GAZNA.—From this period, however, the empire began to decline. The ambition of the khans having prompted them to invade the kingdoms of Japan and Cochin China, they were miſerably diſappointed in their attempts, and loſt a great number of men. The ſame bad ſucceſs attended them in Indoſtan; and in a ſhort time this mighty empire broke into ſeveral ſmaller ones. The governors of Perſia being of the family of Jenghiz Khan, owned no allegiance to any ſuperior; thoſe of Tartary did the ſame. The Chineſe threw off the yoke; and thus the continent of Aſia wore much the ſame face that it had done before Jenghiz Khan began his conqueſts.

---

* See *China*, N° 55.

The ſucceſſors of Hulaku reigned in Perſia till the year 1335; but that year Abuſaid Khan, the eighth from Hulaku, dying, the affairs of that country fell into confuſion for want of a prince of the race of Jenghiz Khan to ſucceed to the throne. The empire, therefore, was divided among a great number of petty princes who fought againſt each other almoſt without intermiſſion, till in the year 1369 Timur Bek, or Tamerlane, one of theſe princes, having conquered a number of others, was crowned at Balkh, with the pompous title of *Saheb Karan;* that is, "the emperor of the age, and the conqueror of the world." As he had juſt before taken that city, and deſtroyed one of his moſt formidable rivals who had ſhut himſelf up in it, the new emperor began his reign with beheading ſome of the inhabitants, impriſoning others, burning their houſes, and ſelling the women and children for ſlaves.

15
Tamerlane crowned emperor of Balkh.

16
Becomes a great conqueror.

In 1370 he croſſed the Sihun, made war on the Getes, and attacked Karazm. Next year he granted a peace to his enemies; but two years after, he again invaded the country of the Getes, and by the year 1379 had fully conquered that country as well as Korazan; and from that time he continued to extend his conqueſts in much the ſame manner as Jenghiz Khan had done, though with leſs cruelty.—In 1387 he had reduced Armenia, Georgia, and all Perſia; the conqueſt of which laſt was completed by the reduction of Iſpahan, 70,000 of the inhabitants of which were ſlaughtered on account of a ſedition raiſed by ſome raſh or evil diſpoſed perſons.

After the reduction of Perſia, Timur turned his arms northward and weſtward, ſubduing all the countries to the Euphrates. He took the city of Bagdad; ſubdued Syria; and having ravaged great part of Ruſſia, returned to Perſia in 1396, where he ſplendidly feaſted his whole army.

17
Invades and conquers Indoſtan.

In 1398 he invaded Indoſtan, croſſed the Indus on the 17th of September, reduced ſeveral fortreſſes, and made a vaſt number of captives. However, as he was afraid that, in caſe of any emergency, theſe priſoners might take part with the enemy, he gave orders to his ſoldiers to put all their Indian ſlaves to death; and in conſequence of this inhuman order, more than 100,000 of theſe poor wretches were ſlaughtered in leſs than an hour.

In the beginning of the year 1399 Timur was met by the Indian army; whom, after a deſperate battle, he defeated with great ſlaughter, and ſoon after took the city of Delhi the capital of the country. Here he ſeated himſelf on the throne of the Indian emperors, and here the ſharifs, kadis, the principal inhabitants of the city, came to make their ſubmiſſion, and begged for mercy. The tame elephants and rhinoceroſes likewiſe were brought to kneel before him as they had been accuſtomed to do to the Indian emperors, and made a great cry as if they implored his clemency. Theſe war elephants, 120 in number, were, at his return, ſent to Samarcand, and to the province where his ſons reſided. After this, at the requeſt of the lords of the court, Timur made a great feaſt; at which he diſtributed preſents to the princes and principal officers.

18
The city of Delhi deſtroyed, and the inhabitants ſlaughtered.

Delhi at this time conſiſted of three cities, called *Seyri, Old Delhi,* and *Jehan Penah.* Seyri was ſurrounded with a wall in form of a circle. Old Delhi was the ſame, but much larger, lying ſouth-weſt of the other. Theſe two parts were joined on each ſide by a wall; and the third, lying between them, was called *Jehan Penah,* which was larger than Old Delhi. Penah had ten gates; Seyri had ſeven, three of which looked towards Jehan Penah; this laſt had 13 gates, ſix to the north-weſt, and ſeven to the ſouth-eaſt. Every thing ſeemed to be in a quiet poſture; when, on the 12th of January 1399, the ſoldiers of Timur being aſſembled at one of the gates of Delhi, inſulted the inhabitants of the ſuburbs. The great emirs were ordered to put a ſtop to theſe diſorders; but their endeavours were not effectual. The ſultanas having a curioſity to ſee the rarities of Delhi, and particularly a famous palace adorned with 1000 pillars, built by an ancient king of India, went in with all the court; and the gate being on that occaſion left open for every body, above 15,000 ſoldiers got in unperceived. But there was a far greater number of troops in a large place between Delhi, Seyri, and Jehan Penah, who committed great diſorders in the two laſt cities. This made the inhabitants in deſpair fall on them; and many, ſetting fire to their houſes, burnt their wives and children. The ſoldiers ſeeing this confuſion, did nothing but pillage the houſes; while the diſorder was increaſed by the admiſſion of more troops, who ſeized the inhabitants of the neighbouring places who had fled thither for ſhelter. The emirs, to put a ſtop to this miſchief, cauſed the gates to be ſhut: but they were quickly opened by the ſoldiers within, who roſe in arms againſt their officers; ſo that by the morning of the 13th the whole army was entered, and this great city was totally deſtroyed. Some ſoldiers carried out 150 ſlaves, men, women, and children; nay, ſome of their boys had 20 ſlaves a piece to their ſhare. The other ſpoils, in jewels, plate, and manufactures, were immenſe; for the Indian women and girls were adorned with precious ſtones, and had bracelets and rings on their hands, feet, and even toes, ſo that the ſoldiers were loaded with them. On the 15th, in Old Delhi, the Indians retired into the great moſque to defend themſelves; but being attacked by the Tartars, they were all ſlaughtered, and towers erected with their heads. A dreadful carnage now enſued throughout the whole city, and ſeveral days were employed before the inhabitants could be made to quit it entirely; and as they went, the emirs took a number of them for their ſervice. The artiſans were alſo diſtributed among the princes and commanders; all but the maſons, who were reſerved for the emperor, in order to build him a ſpacious ſtone moſque at Samarcand.

After this terrible devaſtation, Timur marched into the different provinces of Indoſtan, every where defeating the Indians who oppoſed him, and ſlaughtering the Ghebrs or worſhippers of fire. On the 25th of March he ſet out on his return, and on the 9th of May arrived at Samarcand. In a few months after his arrival, he was obliged to undertake an expedition into Perſia, where affairs were in the utmoſt diſorder on account of the miſconduct of his ſon, whom he had appointed ſovereign of that empire. Here Timur ſoon ſettled matters; after which he again ſet out on an expedition weſtward, reduced many places in Georgia which had not ſubmitted before, and invaded and conquered Syria.

19
Timur quarrels with Bajazet the Turkiſh ſultan.

At the ſame time he quarrelled with Bajazet the Turkiſh ſultan, then buſied in an enterpriſe againſt Conſtantinople, in which he would probably have ſucceeded had not Timur interpoſed. The cauſe of this quarrel at firſt was, that Bajazet had demanded tribute from a prince who was under Timur's protection, and is ſaid to have returned an inſulting anſwer to the Tartar ambaſſadors who were ſent to him on that account. Timur, however, who was an enthuſiaſt in the cauſe of Mahometaniſm, and conſidered Bajazet as engaged in the cauſe of heaven when beſieging a Chriſtian city, was very unwilling to diſturb him in ſo pious a work; and therefore undertook ſeveral expeditions againſt the princes of Syria and Georgia, in order to give the Turkiſh monarch time to cool and return to reaſon. Among other places, he again inveſted the city of Bagdad, which had caſt off its allegiance to him; and having taken it by ſtorm, made ſuch a dreadful maſſacre of the inhabitants, that 120 towers were erected with the heads of the ſlain. In the mean time Bajazet continued to give freſh provocation, by protecting one Kara Yuſef a robber, who had even inſulted the caravan of Mecca; ſo that Timur at length reſolved to make war upon him. The ſultan, however, foreſeeing the danger of bringing ſuch a formidable enemy againſt himſelf, thought proper to aſk pardon, by a letter, for what was paſt, and promiſe obedience to Timur's will for the future. This embaſſy was graciouſly received; and Timur returned for anſwer, that he would forbear hoſtilities, provided Bajazet would either put Kara Yuſef to death, ſend him to the Tartar camp, or expel him out of his dominions. Along with the Turkiſh ambaſſadors he ſent one of his own; telling Bajazet that he would march into the confines of Anatolia, and there wait his final anſwer.

20
Bajazet defeated and taken priſoner.

Though Bajazet had ſeemed at firſt willing to come to an agreement with Timur, and to dread his ſuperior power; yet he now behaved in ſuch an unſatisfactory manner, that the Tartar monarch deſired him to prepare for war; upon which he raiſed the ſiege of Conſtantinople, and having met Timur with an army greatly inferior to the Tartars, was utterly defeated and taken priſoner. According to ſome accounts, he was treated with great humanity and honour; while others inform us, that he was ſhut up in an iron cage, againſt which he daſhed out his brains the following year. At any rate, it is certain that he was not reſtored to liberty, but died in confinement.

21
Death of Tamerlane, and diſſolution of his empire.

This victory was followed by the ſubmiſſion of many places of the Leſſer Aſia to Timur; the Greek emperor owned himſelf his tributary, as did alſo the ſultan of Egypt. After this Timur once more returned to Georgia, which he cruelly ravaged; after which he marched to Samarcand, where he arrived in the year 1405. Here, being now an old man, this mighty conqueror began to look forward to that ſtate which at one time or other is the dread of all living creatures; and Timur, in order to quiet the remorſes of his own conſcience, came to the following curious reſolution, which he communicated to his intimate friends; namely, that "as the vaſt conqueſts he had made were not obtained without *ſome violence*, which had occaſioned the deſtruction of a great number of God's creatures, he was reſolved, by way of atonement for his paſt crimes, to perform ſome good action; namely, to make war on the infidels, and exterminate the idolaters of China." This atonement, however, he did not live to accompliſh; for he died the ſame year of a burning fever, in the 71ſt year of his age and 36th of his reign.

On the death of Timur, his empire fell immediately into great diſorder, and the civil wars continued for five or ſix years; but at laſt peace was reſtored, by the ſettlement of Shah Rukh, Timur's ſon, on the throne. He did not, however, enjoy the empire in its full extent, or indeed much above one half of it; having only Karazm, Khoraſſan, Kandahar, Perſia, and part of Hindoſtan. Neither was he able, though a brave and warlike prince, to extend his dominions, though he tranſmitted them to his ſon Ulug Beg. He proved a wiſe and learned monarch; and is famous for the aſtronomical tables which he cauſed to be compoſed, and which are well known at this day. He was killed in 1448 by his ſon Abdollatif, who ſix months after was put to death by his own ſoldiers. After the death of Abdollatif, Abdollah, a grandſon of Shah Rukh, ſeized the throne; but, after reigning one year, was expelled by Abuſaid Mirza, the grandſon of Miran Shah the ſon of Timur. His reign was one continued ſcene of wars and tumults; till at laſt he was defeated and taken priſoner by one Haſſan Beg, who put him to death in 1468. From this time we may look upon the empire of Timur as entirely diſſolved, though his deſcendants ſtill reigned in Perſia and Indoſtan, the latter of which is ſtill known by the name of the *Mogul's empire.*

22
Hiſtory of Hindoſtan.

On the death of the above-mentioned monarch, his ſon Babr or Babor ſucceeded him, but was ſoon driven out by the Uſbeck Tartars; after which he reſided ſome time in Gazna, whence he made incurſions into Hindoſtan, and at length became maſter of the whole empire, excepting the kingdoms of Dekan, Guzerat, and Bengal.—For the tranſactions ſubſequent to this period, ſee HINDOSTAN and INDIA.

MOHAIR, in commerce, the hair of a kind of goat frequent about Angora in Turkey; the inhabitants of which city are all employed in the manufacture of camblets made of this hair.

Some give the name *mohair* to the camblets or ſtuffs made of this hair; of theſe there are two kinds; the one ſmooth and plain, the other watered like tabbies: the difference between the two only conſiſts in this, that the latter is callendered, the other not. There are alſo mohairs both plain and watered, whoſe woof is of wool, cotton, or thread.

MOHAIR Shell, in *Conchology*, a name given to a ſpecies of voluta, which ſeems of a cloſely and finely reticulated texture, and reſembles on the ſurface a piece of mohair or a very cloſe ſilkworm's web.

MOHAWKS. See MUCK.

MOHAWK Country, a part of North America, inhabited by one of the five nations of the Iroquois, ſituated between the province of New York, and the lake Ontario or Frontignac.

MOHILA, or MOELIA, one of the Comora iſlands in the Indian ſea, between the north end of Madagaſcar and the continent of Africa. The inland parts are mountainous and woody; but the lands adjoining to the ſea are watered by ſeveral fine ſtreams. The iſland abounds with proviſions of all kinds; and the Eaſt India ſhips of different nations ſometimes touch here for refreſhment.

MOHILOF, a large and ſtrong city of Poland, in the province of Lithuania, and palatinate of Mſciſlau. It is well built, populous, and has a conſiderable trade.

Near this place the Swedes obtained a great victory over the Ruſſians in 1707.

MOIDORE, a Portugueſe gold coin, value 1l. 7s. ſterling.

MOIETY (*Medietas*), the half of any thing.

MOIRA, a town of Ireland, in the county of Down and province of Ulſter, 69 miles from Dublin; noted for its linen manufacture. It gives title of earl to the family of Rawdon.

MOISTURE. See HUMIDITY.

The moiſture of the air has conſiderable effects on the human body. For the quantity and quality of the food, and the proportion of the meat to the drink, being given, the weight of a human body is leſs, and conſequently its diſcharges greater in dry weather than in wet weather; which may be thus accounted for: the moiſture of the air moiſtens the fibres of the ſkin and leſſens perſpiration by leſſening their vibratory motion. When perſpiration is thus leſſened by the moiſture of the air, urine indeed is by degrees increaſed, but not equally. Hence, according to Dr Bryan Robinſon, we learn, that to keep a body of the ſame weight in wet weather as in dry, either the quantity of food muſt be leſſened, or the proportion of the meat to the drink increaſed: and both theſe may be done by leſſening the drink without making any change in the meat.

The inſtrument uſed for determining the degree of moiſture in the air, is called an *hygrometer*. See HYGROMETER.

MOIVRE, ABRAHAM, a learned mathematician, was born at Vitri in Champagne, in France, 1667, where his father was a ſurgeon. At the revocation of the edict of Nantes, he came to England. Before he left France, he had begun the ſtudy of mathematics; and having perfected himſelf in that ſcience in London, he was obliged, by neceſſity, to teach it. Newton's *Principia*, which accidentally fell into his hands, ſhowed him how little progreſs he had made in a ſcience of which he thought himſelf maſter. From this work he acquired a knowledge of the geometry of infinites with as great facility as he had learned the elementary geometry; and in a ſhort time he was fit to be ranked with the moſt celebrated mathematicians. His ſucceſs in theſe ſtudies procured him a ſeat in the Royal Society of London and in the Academy of Sciences at Paris. His merit was ſo well underſtood in the former, that he was thought capable of deciding in the famous diſpute between Leibnitz and Newton concerning the differential calculus.—He publiſhed a Treatiſe on Chances in 1738, and another on Annuities in 1752; both extremely accurate. The Philoſophical Tranſactions contain many intereſting memoirs of his compoſition.—Some of them treat of the method of fluxions; others are on the lunula of Hippocrates; others on phyſical aſtronomy, in which he reſolved many important problems; and others, in ſhort, on the analyſis of the games of chance, in which he followed a different courſe from that of Montmort. Towards the cloſe of his life he loſt his ſight and hearing; and the demand for ſleep became ſo great that he required 20 hours of it in a day. He died at London, 1754, aged 87. His knowledge was not confined to mathematics; but he retained to the laſt a taſte for polite literature. He was intimately acquainted with the beſt authors of antiquity; and he was frequently conſulted about difficult paſſages in their works. Rabelais and Moliere were his favourite French authors: he had them by heart; and he one day obſerved to one of his acquaintance, "that he would rather have been Moliere than Newton." He recited whole ſcenes of the *Miſanthrope*, with that delicacy and force with which he remembered to have heard them recited at Paris 70 years before, by Moliere's own company. The character indeed was ſomewhat ſimilar to his own. He judged ſeverely of mankind; and could never conceal his diſguſt at the converſation of a fool, or his averſion to cunning and diſſimulation. He was free from the affectation of ſcience, and no one could know him to be a mathematician but from the accuracy of his thoughts. His converſation was general and inſtructive. Whatever he ſaid was well digeſted and clearly expreſſed. His ſtyle poſſeſſed more ſtrength and ſolidity than ornament and animation; but he was always correct, and he beſtowed as much pains on his ſentences as on his calculations. He could never endure any bold aſſertions or indecent witticiſms againſt religion.

MOLA, an ancient town of Italy, in the kingdom of Naples, and in the Terra di Lavoro, where they pretend to ſhow the ruins of Cicero's houſe. It is ſeated on the gulf of Venice, in E. Long. 17. 50. N. Lat. 41. 5.

MOLA Salſa (Salt Cake), in antiquity, was barley parched, and afterwards ground to meal or flour, then mixed with ſalt and frankincenſe, with the addition of a little water. Thus prepared, it was ſprinkled between the horns of the victim before it was killed in ſacrifice. This act was called *immolatio*, and was common to the Greeks as well as Romans; with this difference, that the *mola* of the Romans was of wheat. The Greeks called it ȣλη or ȣλοχυτη.

MOLARES, or DENTES MOLARES, in *Anatomy*, the large teeth, called in Engliſh the *grinders*. See ANATOMY *Index*.

MOLASSES, or MOLOSSES. See MOLOSSES.

MOLDAVIA, a province of Turkey in Europe, bounded on the north-eaſt by the river Nieſter, which divides it from Poland; on the eaſt, by Beſſarabia; on the ſouth by the Danube, which parts it from Bulgaria; and on the weſt, by Walachia and Tranſylvania. It is 240 miles in length and 150 in breadth. It lies in a good air and fruitful ſoil, producing corn, wine, rich paſtures, a good breed of horſes, oxen, ſheep, plenty of game, fiſh, fowl, honey, wax, and all European fruits. Its principal rivers are the Danube, Nieſter, Pruth, Bardalach, and Ceret. The inhabitants are Chriſtians of the Greek church, and Jaſſy is the principal town. It has been tributary to the Turks ſince the year 1574; who appoint a prince who is a native of the country, but have no regard to his being of the principal families. The province pays a large yearly tribute to the Turkiſh government; beſides raiſing a great body of horſe at its own expence.

MOLE, a river in Surry, which has taken its name from running under ground. It firſt diſappears at Boxhill, near Darking, in the county of Surry, and emerges again near Leatherhead.

MOLE. See TALPA, MAMMALIA *Index*; and for methods of deſtroying, ſee VERMIN, *Deſtruction of*.

MOLE, in *Midwifery*, a maſs of fleſhy matter, of a ſpherical

ſpherical figure, generated in the uterus, and ſometimes miſtaken for a child. See MIDWIFERY.

MOLE, or *Mark*. See NÆVUS.

MOLE, in *Architecture*, a maſſive work formed of large ſtones laid in the ſea by means of coffer dams, extended either in a right line or an arch of a circle, before a port, which it ſerves to cloſe; to defend the veſſels in it from the impetuoſity of the waves, and to prevent the paſſage of ſhips without leave. Thus we ſay the mole of the harbour of Meſſina, &c.

MOLE is ſometimes alſo uſed to ſignify the harbour itſelf.

MOLE, (*moles*), among the Romans, was alſo uſed for a kind of mauſoleum, built in manner of a round tower on a ſquare baſe, inſulate, encompaſſed with columns, and covered with a dome.—The mole of the emperor Adrian, now the caſtle of St Angelo, was the greateſt and moſt ſtately of all the moles. It was crowned with a brazen pine apple, wherein was a golden urn containing the aſhes of the emperor.

MOLE Cricket. See GRYLLOTALPA, ENTOMOLOGY *Index*.

MOLE Hills. Theſe little hillocks of earth are a very great prejudice to the paſture lands, not only in waſting ſo much of the land as they cover, but in obſtructing the ſcythe in mowing. In the weſt of England they uſe a peculiar inſtrument for the breaking up of theſe; it is a flat board, very thick, and of about eight inches in diameter, into which there is faſtened a perpendicular handle of three or four feet long. It has four broad and ſharp iron teeth at the front, which readily cut through the hill, and ſpread the earth it conſiſts of; and behind there is a large knob proper for breaking the clods with, if there are any. Some uſe a ſpade, or other common inſtrument, in the place of this, but not ſo well. There is, however, a much better inſtrument even than this, for deſtroying theſe hills, where they are in very great numbers. This is a kind of horſe machine; it has a ſharp iron about three feet over, and with a ſtrong back.—It is about four or five inches broad, and has two long handles for a horſe to be harneſſed to, and a croſs bar of iron to ſtrengthen it at the bottom of the handles, reaching from the one handle to the other. The middle of this croſs bar is furniſhed with one, two, or more ſharp pieces of iron like ſmall ploughſhares, to cut the mole hills into two, three, or more parts. The iron behind is of a ſemicircular figure. A ſingle horſe is harneſſed to this machine, and a boy muſt be employed to drive it, and a man to hold and guide it; the ſharp irons or ſhares are the firſt things that meet the hill, they run through it, break its texture, and cut it into ſeveral parts; and the circular iron following immediately behind them, cuts up the whole by the roots, and leaves the land level. This inſtrument will deſtroy as many mole hills in one day as a common labourer can do in eight, and would be of very great advantage to the kingdom if brought into general uſe.

MOLIERE, JOHN BAPTIST, a celebrated French comedian and dramatic writer, whoſe true name was *Pocquelin*, which for ſome reaſon he changed to that of Moliere. He was the ſon of a valet de chambre, and was born at Paris about the year 1620. He went through the ſtudy of the claſſics under the Jeſuits in the college of Clermont, and was deſigned for the bar; but at his quitting the law ſchools, he made choice of the actor's profeſſion. From a ſtrong attachment to the drama, his whole ſtudy and application were directed to the ſtage, and he continued till his death to exhibit plays, which were greatly applauded. It is ſaid the firſt motive of his going upon the ſtage was to enjoy the company of an actreſs for whom he had contracted a violent fondneſs. His comedies are highly eſteemed. And it is no wonder he ſo juſtly repreſented domeſtic feuds, and the torments of jealous huſbands, or of thoſe who have reaſon to be ſo; for it is aſſerted that no man ever experienced this more than Moliere. His laſt comedy was *Le Malade Imaginaire*, which was brought on the ſtage in 1673; and Moliere died on the fourth night of its repreſentation; ſome ſay in acting the very part of the pretended dead man, which gave ſome exerciſe for the wits of the time; but according to others he died in his bed that night, from the burſting of a vein in his lungs by coughing. The king, as a laſt mark of his favour, prevailed with the archbiſhop of Paris to ſuffer him to be buried in conſecrated ground; though he had irritated the clergy by his *Tartuff*. The moſt eſteemed editions of his works are that of Amſterdam, 5 vols. 12mo, 1699; and that of Paris, 6 vols. 4to, 1734.

MOLINISTS, in eccleſiaſtical hiſtory, a ſect in the Romiſh church, who follow the doctrine and ſentiments of the Jeſuit Molina, relating to ſufficient and efficacious grace. He taught that the operations of divine grace were entirely conſiſtent with the freedom of human will; and he introduced a new kind of hypotheſis to remove the difficulties attending the doctrines of predeſtination and liberty, and to reconcile the jarring opinions of Auguſtines, Thomiſts, Semi-Pelagians, and other contentious divines. He affirmed, that the decree of predeſtination to eternal glory was founded upon a previous knowledge and conſideration of the merits of the elect; that the grace, from whoſe operation theſe merits are derived, is not efficacious by its own intrinſic power only, but alſo by the conſent of our own will, and becauſe it is adminiſtered in thoſe circumſtances, in which the Deity, by that branch of his knowledge which is called *ſcientia media*, foreſees that it will be efficacious. The kind of preſcience, denominated in the ſchools *ſcientia media*, is that foreknowledge of future contingents that ariſes from an acquaintance with the nature and faculties of rational beings, of the circumſtances in which they ſhall be placed, of the objects that ſhall be preſented to them, and of the influence which their circumſtances and objects muſt have on their actions.

MOLINOSISTS, a ſect among the Romaniſts, who adhere to the doctrine of Molinos. Theſe are the ſame with what are otherwiſe called *Quietiſts*, whoſe chief principle was, that men ought to annihilate themſelves in order to be united to God, and afterwards remain in quietneſs of mind, without being troubled for what ſhall happen to the body. Molinos, the author of thoſe opinions, was a Spaniſh prieſt, and was born in 1627. His 68 propoſitions were examined in 1687 by the pope and inquiſitors, who decreed that his doctrine was falſe and pernicious, and that his books ſhould be burned. He was forced to recant his errors publicly in the Dominican church, and was condemned to perpetual impriſonment. He was then 60 years old, and had been ſpreading his doctrine 22 years before. He died in priſon in 1692.

MOLLUGO, AFRICAN CHICKWEED; a genus of

plants belonging to the triandria claſs, and in the natural method ranking under the 22d order, *Caryophyllei.* See BOTANY *Index*.

MOLLUSCA, in the Linnæan ſyſtem, one of the orders of vermes or worms. Theſe are ſimple naked animals, not included in a ſhell, but furniſhed with limbs. See HELMINTHOLOGY *Index*.

MOLOCH, a falſe god of the Ammonites, who dedicated their children to him, by making them "paſs through the fire," as the Scriptures expreſs it. There are various opinions concerning this method of conſecration. Some think, the children leaped over a fire ſacred to Moloch; others, that they paſſed between two fires; and others, that they were really burnt in the fire, by way of ſacrifice to this god. There is foundation for each of theſe opinions. For, firſt, it was uſual among the pagans to luſtrate or purify with fire; and, in the next place, it is expreſsly ſaid, that the inhabitants of Sepharvaim burnt their children in the fire to Anamelech and Adramelech; much ſuch deities as Moloch of the Ammonites.

Moſes, in ſeveral places, forbids the Iſraelites to dedicate their children to this god as the Ammonites did, and threatens death and utter extirpation to ſuch perſons as were guilty of this abominable idolatry. And there is great probability that the Hebrews were much addicted to the worſhip of this deity: ſince Amos, and after him St Stephen, reproaches them with having carried along with them into the wilderneſs the tabernacle of their god Moloch.

Solomon built a temple to Moloch upon the mount of Olives; and Manaſſeh, a long time after, imitated his impiety, by making his ſon paſs through the fire in honour of Moloch. It was chiefly in the valley of Tophet and Hinnom, to the eaſt of Jeruſalem, that the Iſraelites paid their idolatrous worſhip to this falſe god of the Ammonites.

There are various ſentiments concerning the relation which Moloch had to the other pagan divinities. Some believe he was the ſame with Saturn, to whom it is well known that human ſacrifices were offered. Others ſuppoſe him to be Mercury; others, Mars; others, Mithras; and others, Venus. Laſtly, Others take Moloch to be the ſun, or the king of heaven. Moloch was likewiſe called *Milcom;* as appears from what is ſaid of Solomon, that he went after Aſhtaroth the abomination of the Zidonians, and Milcom the abomination of the Ammonites.

MOLOSSES, MOLASSES, or *Melaſſes*, that groſs fluid matter remaining of ſugar after refining, and which no boiling will bring to a conſiſtence more ſolid than that of ſyrup; hence alſo called *ſyrup of ſugar*.

Properly, moloſſes are only the ſediment of one kind of ſugar called *chypre*, or brown ſugar, which is the refuſe of other ſugars not to be whitened or reduced into loaves.

Moloſſes are much uſed in Holland for the preparation of tobacco, and alſo among poor people inſtead of ſugar. There is a kind of brandy or ſpirit made of moloſſes; but by ſome held exceedingly unwholeſome. See below.

Artificial MOLOSSES. There has been found a method of making moloſſes from apples without the addition of ſugar. The apple that ſucceeds beſt in this operation is a ſummer ſweeting of a middle ſize, pleaſant to the taſte, and ſo full of juice that ſeven buſhels will yield a barrel of cyder.

The manner of making it is this: the apples are to be ground and preſſed, then the juice is to be boiled in a large copper, till three quarters of it be evaporated: this will be done with a moderate fire in about ſix hours, with the quantity of juice above mentioned; by this time it will be of the conſiſtence and taſte as well as of the colour of moloſſes.

This new moloſſes ſerves all the purpoſes of the common kind, and is of great uſe in preſerving cyder. Two quarts of it put into a barrel of racked cyder, will preſerve it, and give it an agreeable colour.

The invention of this kind of moloſſes was owing to Mr Chandler of Woodſtock in New England, who living at a diſtance from the ſea, and where the common moloſſes was very dear and ſcarce, provided this for the ſupply of his own family, and introduced the practice among people of the neighbourhood. It is to be obſerved, that this ſort of apple, the ſweeting, is of great uſe in making cyder; one of the very beſt kinds we know being made of it. The people in New England alſo feed their hogs with the fallings of their orchards of theſe apples; and the conſequence of this is, that their pork is the fineſt in the world.

MOLOSSES Spirit; a very clean and pure ſpirit, much uſed in England, and made from moloſſes or common treacle diſſolved in water, and fermented in the ſame manner as malt or the common malt ſpirit. See DISTILLATION.

MOLOSSI, a people of Epirus, who inhabited that part of the country which was called *Moloſſia*, or *Moloſſus*, from King Moloſſus, a ſon of Pyrrhus and Andromache. This country had the bay of Ambracia on the ſouth, and the country of the Perrhæbeans on the eaſt. The dogs of the place were famous, and received the name of *Moloſſi* among the Romans. Dodona was the capital of the country, according to ſome writers. Others, however, reckon it as the chief city of Theſprotia.

MOLOSSUS, in the Greek and Latin poetry, a foot conſiſting of three long ſyllables. As *audiri*, *cantabant*, *virtutem*.

It takes its name either from a dance in uſe among the people called *Moloſſi* or *Epirotæ;* or from the temple of Jupiter Moloſſus, where odes were ſung, in which this foot had a great ſhare; or elſe becauſe the march of the Moloſſi, when they went to the combat, was compoſed of theſe feet, or had the cadence thereof. The ſame foot was alſo called among the ancients, *Vertumnus*, *extenſipes*, *hippius*, *et cannius*.

MOLUCILLA, a genus of plants belonging to the didynamia claſs, and in the natural method ranking under the 42d order, *Verticillatæ*. See BOTANY *Index*.

MOLTEN-GREASE. See FARRIERY, Nº 499.

MOLUCCA ISLANDS, lie in the Eaſt Indian ſea under the line; of which there are five principal, namely, Ternate, Tydor, Machian, Motyr, and Bachian. The largeſt of them is hardly 30 miles in circumference. They produce neither corn, rice, nor cattle, except goats: but they have oranges, lemons, and other fruits; and are moſt remarkable for ſpices, eſpecially cloves. They have large ſnakes, which are not venomous, and very dangerous land crocodiles. At preſent they have three kings; and the Dutch, who are

are very ſtrong here, keep out all other European nations, being jealous of their ſpice trade. The religion is idolatry; but there are many Mahometans. They were diſcovered by the Portugueſe in 1511, who ſettled upon the coaſt; but the Dutch drove them away, and are now the maſters of all theſe iſlands.

MOLWITZ, a town of Sileſia, in the province of Grotſka, remarkable for a battle gained by the Pruſſians over the Auſtrians in 1741. E. Long. 16. 45. N. Lat. 50. 26.

MOLY. The name of this plant is rendered famous by Homer: and hence has been much inquired into, as to its true ſenſe, by the botaniſts of almoſt all times. The old interpreters of Homer explain this word by the "wild rue;" and the only reaſon for this is, that at ſome time, probably long after the days of Homer, the people of Cappadocia called the wild rue *moly*. But this plant is wholly different from the moly of Homer, which Theophraſtus affirms grew in his time in Arcadia in great plenty, and had a round bulbous root like an onion, and long and graſſy leaves like the ſquill. On the whole, the moly of Homer ſeems to have been a ſpecies of allium or garlic.

MOLYBDENA, a metal. See CHEMISTRY and MINERALOGY *Index*.

MOMBAZA, or MONBAZA, a town of Africa, in an iſland of the ſame name, with a caſtle and a fort; ſeated on the eaſtern coaſt, oppoſite to the country of Mombaza in Zanguebar, 75 miles ſouth of Melinda, and ſubject to Portugal. E. Long. 39. 30. S. Lat. 3. 15.

MOMBAZA, a country of Africa in Zanguebar, ſubject to the Portugueſe, from whence they export ſlaves, gold, ivory, rice, fleſh, and other proviſions, with which they ſupply the ſettlements in Braſil. The king of this country being a Chriſtian, had a quarrel with the Portugueſe governor, took the caſtle by aſſault in 1631, turned Mahometan, and murdered all the Chriſtians; but in 1729 they became maſters of the territory again.

MOMENT, in the doctrine of time, an inſtant, or the moſt minute and indiviſible part of duration.

MOMENTUM, in *Mechanics*, ſignifies the ſame with impetus, or the quantity of motion in a moving body; which is always equal to the quantity of matter multiplied into the velocity; or, which is the ſame thing, it may be conſidered as a rectangle under the quantity of matter and velocity. See MECHANICS.

MOMORDICA, MALE BALSAM APPLE; a genus of plants belonging to the monœcia claſs; and in the natural method ranking under the 34th order, *Cucurbitaceæ*. See BOTANY *Index*.

MOMUS, in fabulous hiſtory, the god of raillery, or the jeſter of the celeſtial aſſembly, and who ridiculed both gods and men. Being choſen by Vulcan, Neptune, and Minerva, to give his judgment concerning their works, he blamed them all: Neptune for not making his bull with horns before his eyes, in order that he might give a ſurer blow; Minerva for building a houſe that could not be removed in caſe of bad neighbours; and Vulcan, for making a man without a window in his breaſt, that his treacheries might be ſeen. For his free reflections upon the gods, Momus was driven from heaven. He is generally repreſented raiſing a maſk from his face, and holding a ſmall figure in his hand.

MONA, in *Ancient Geography*, two iſlands of this name in the ſea lying between Britain and Ireland. The one deſcribed by Cæſar, as ſituated in the middle paſſage between both iſlands, and ſtretching out in length from ſouth to north. Called *Monaœda* (Ptolemy); *Monapia*, or *Monabia* (Pliny). Suppoſed to be the iſle of Man.—Another Mona (Tacitus); an iſland more to the ſouth, and of greater breadth; ſituated on the coaſt of the Ordovices, from which it is ſeparated by a narrow ſtrait. The ancient ſeat of the Druids. Now called *Angleſey*, the iſland of the Angles or Engliſh.

MONA, an iſland of the Baltic ſea, ſouth-weſt of the iſland of Zealand, ſubject to Denmark. E. Long. 12. 30. N. Lat. 55. 20.

MONA. See INCHCOLM.

MONACO, a ſmall but handſome and ſtrong town of Italy, in the territory of Genoa, with a caſtle, citadel, and a good harbour. It is ſeated on a craggy rock, and has its own prince, under the protection of France. E. Long. 7. 33. N. Lat. 43. 48.

MONAD. See *LEIBNITZIAN Philoſophy*.

MONADELPHIA, (from *μονος*, *alone*, and *αδελφια*, a *brotherhood*;) a "ſingle brotherhood:" The name of the 16th claſs in Linnæus's ſexual ſyſtem, conſiſting of plants with hermaphrodite flowers; in which all the ſtamina are united below into one body or cylinder, through which paſſes the piſtillum. See BOTANY *Index*.

MONAGHAN, a county of Ireland, ſituated in the province of Ulſter, is bounded by Tyrone on the north, Armagh on the eaſt, Cavan and Louth on the ſouth, and Fermanagh on the weſt. It is a mountainous tract, but in ſome places is well improved. It contains 170,090 Iriſh plantation acres, and is about 30 miles long and 22 broad. The linen trade of this county is averaged at 104,000l. yearly.

MONAGHAN, the capital town of the county of that name, is diſtant 62 miles from Dublin, and gives title of baron to the family of Blayney. It was anciently called *Muinechan*. An abbey was founded here in a very early age, of which Moelodius the ſon of Aodh was abbot. In 1462, a monaſtery for conventual Franciſcans was erected on the ſite of this abbey, which was granted on the general ſuppreſſion of monaſteries to Edward Withe, and a caſtle has been ſince erected on the ſite by Edward Lord Blayney.

MONANDRIA, (from *μονος*, *alone*, and *ανηρ*, a *man* or *huſband*), the name of the firſt claſs in Linnæus's ſexual ſyſtem; conſiſting of plants with hermaphrodite flowers, which have only one ſtamen.

MONARCHY, a large ſtate governed by one; or a ſtate where the ſupreme power is lodged in the hands of a ſingle perſon. The word comes from the Greek *μοναρχης*, "one who governs alone;" formed of *μονος*, *ſolus*, and *αρχη*, *imperium*, "government." Of the three forms of government, viz. democracy, ariſtocracy, and monarchy, the laſt is the moſt powerful, all the ſinews of government being knit together, and united in the hand of the prince; but then there is imminent danger of his employing that ſtrength to improvident or oppreſſive purpoſes. As a democracy is the beſt calculated to direct the end of a law, and an ariſtocracy to invent the means by which that end ſhall be obtained, a monarchy is moſt fit for carrying thoſe means into execution.

The moſt ancient monarchy was that of the Aſſyrians, which was founded ſoon after the deluge. We uſually reckon four grand or univerſal monarchies; the Aſſyrian, Perſian, Grecian, and Roman; though St Auguſtine makes them but two; viz. thoſe of Babylon and Rome. Belus is placed at the head of the ſeries of Aſſyrian kings who reigned at Babylon, and is by profane authors eſteemed the founder of it, and by ſome the ſame whom the Scriptures call Nimrod. The principal Aſſyrian kings after Belus were Ninus, who built Nineveh, and removed the ſeat of empire to it; Semiramis, who, diſguiſing her ſex, took poſſeſſion of the kingdom inſtead of her ſon, and was killed and ſucceeded by her ſon Ninyas; and Sardanapalus, the laſt of the Aſſyrian monarchs, and more effeminate than a woman. After his death the Aſſyrian empire was ſplit into three ſeparate kingdoms, viz. the Median, Aſſyrian, and Babylonian. The firſt king of the Median kingdom was Arbaces; and this kingdom laſted till the time of Aſtyages, who was ſubdued and diveſted of his kingdom by Cyrus.

In the time of Cyrus there aroſe a new and ſecond monarchy called the Perſian, which ſtood upwards of 200 years from Cyrus, whoſe reign began A. M. 3468, to Darius Codomannus, who was conquered by Alexander, and the empire tranſlated to the Greeks A. M. 3674.—The firſt monarch was Cyrus, founder of the empire. 2. Cambyſes, the ſon of Cyrus. 3. Smerdis. 4. Darius, the ſon of Hyſtaſpis, who reigned 521 years before Chriſt. 5. Xerxes, who reigned 485 years before Chriſt. 6. Artaxerxes Longimanus, who reigned 464 years before Chriſt. 7. Xerxes the ſecond. 8. Ochus, or Darius, called Nothus, 424 years before Chriſt. 9. Artaxerxes Mnemon, 405 years before Chriſt. 10. Artaxerxes Ochus, 359 years before Chriſt. 11. Arſes, 338 years before Chriſt. 12. Darius Codomannus, 336 years before Chriſt, who was defeated by Alexander the Great, and deprived of his kingdom and life about 331 years before Chriſt: the dominion of Perſia after his death was tranſlated to the Greeks.

The third monarchy was the Grecian. As Alexander, when he died, did not declare who ſhould ſucceed him, there ſtarted up as many kings as there were commanders. At firſt they governed the provinces that were divided among them under the title of viceroys; but when the family of Alexander the Great was extinct, they took upon them the name of kings. Hence, in proceſs of time, the whole empire of Alexander produced four diſtinct kingdoms, viz. 1. The Macedonian; the kings of which, after Alexander, were Antipater, Caſſander, Demetrius Poliorcetes, Seleucus Nicanor, Meleager, Antigonus Doſon, Philip, and Perſeus, under whom the Macedonian kingdom was reduced to the form of a Roman province. 2. The Aſiatic kingdom, which upon the death of Alexander fell to Antigonus, comprehending that country now called Natolia, together with ſome other regions beyond Mount Taurus. From this kingdom proceeded two leſſer ones, viz. that of Pergamus, whoſe laſt king, Attalus, appointed the Roman people to be his heir; and Pontus, reduced by the Romans into the form of a province, when they had ſubdued the laſt king, Mithridates. 3. The Syrian, of whoſe twenty-two kings the moſt celebrated were, Seleucus Nicanor, founder of the kingdom; Antiochus Deus; Antiochus the Great; Antiochus Epiphanes; and Tigranes, who was conquered by the Romans under Pompey, and Syria reduced into the form of a Roman province. 4. The Egyptian, which was formed by the Greeks in Egypt, and flouriſhed near 240 years under 12 kings, the principal of whom were, Ptolemy Lagus, its founder; Ptolemy Philadelphus, founder of the Alexandrian library; and Queen Cleopatra, who was overcome by Auguſtus, in conſequence of which Egypt was added to the dominion of the Romans.

The fourth monarchy was the Roman, which laſted 244 years, from the building of the city until the time when the royal power was abrogated. The kings of Rome were Romulus, its founder; Numa Pompilius; Tullus Hoſtilius; Ancus Martius; Tarquinius Priſcus; Servius Tullius; and Tarquin the Proud, who was baniſhed, and with whom terminated the regal power.

There ſeems in reality no neceſſity to make the Medes, Perſians, and Greeks, ſucceed to the whole power of the Aſſyrians, to multiply the number of the monarchies. It was the ſame empire ſtill; and the ſeveral changes that happened in it did not conſtitue different monarchies. Thus the Roman empire was ſucceſſively governed by princes of different nations, yet without any new monarchy being formed thereby. Rome, therefore, may be ſaid to have immediately ſucceeded Babylon in the empire of the world. See EMPIRE.

Of monarchies ſome are abſolute and deſpotic, where the will of the monarch is uncontroulable; others are limited, where the prince's authority is reſtrained by laws, and part of the ſupreme power lodged in other hands, as in Britain. See GOVERNMENT.

Some monarchies again are hereditary, where the ſucceſſion devolves immediately from father to ſon; and others are elective, where, on the death of the monarch, his ſucceſſor is appointed by election, as in Poland.

Fifth-MONARCHY Men, in the eccleſiaſtical hiſtory of England, were a ſet of wrong-headed and turbulent enthuſiaſts who aroſe in the time of Cromwell, and who expected Chriſt's ſudden appearance upon earth to eſtabliſh a new kingdom; and, acting in conſequence of this illuſion, aimed at the ſubverſion of all human government.

MONARDA, INDIAN HOREHOUND, a genus of plants belonging to the diandria claſs; and in the natural method ranking under the 42d order, *Verticillatæ*. See BOTANY *Index*.

MONASTEREVAN, a poſt town of Ireland, in the county of Kildare and province of Leinſter, 36 miles from Dublin, ſo called from a magnificent abbey which was founded here, in which St Evan in the beginning of the 7th century placed a number of monks from South Munſter, and which had the privilege of being a ſanctuary. The conſecrated bell, which belonged to this ſaint, was on ſolemn trials ſworn upon by the whole tribe of the Eoganachts, and was always committed to the care of the Mac Evans, hereditary chief juſtices of Munſter; the abbot of this houſe ſat as a baron in parliament.—At the general ſuppreſſion of monaſteries, this abbey was granted to Lord Audley, who aſſigned it to Viſcount Ely. It afterwards came into the family of Moor, earls of Drogheda, and has been beautifully repaired by the preſent Lord Drogheda, ſtill wearing the venerable appearance of an abbey. There is a nurſery at Monaſterevan for the charter ſchools of the province of Leinſter; and the grand canal has been carried up to this town from Dublin, ſince which it has been much improved and enlarged with ſeveral new buildings.

MONASTERY, a convent or houſe built for the reception of religious; whether it be abbey, priory, nunnery, or the like.

Monastery is only properly applied to the houſes of monks, mendicant friars, and nuns. The reſt are more properly called *religious houſes*. For the origin of monaſteries, ſee Monastic and Monk.

The houſes belonging to the ſeveral religious orders which obtained in England and Wales were, cathedrals, colleges, abbeys, priories, preceptories, commandries, hoſpitals, friaries, hermitages, chantries, and free chapels. Theſe were under the direction and management of various officers. The diſſolution of houſes of this kind began ſo early as the 1312, when the Templars were ſuppreſſed; and in 1323 their lands, churches, advowſons, and liberties, here in England, were given by 17 Ed. II. ſt. 3. to the prior and brethren of the hoſpital of St John at Jeruſalem. In the years 1390, 1437, 1441, 1459, 1497, 1505, 1508, and 1515, ſeveral other houſes were diſſolved, and their revenues ſettled on different colleges in Oxford and Cambridge. Soon after the laſt period, Cardinal Wolſey, by licenſe of the king and pope, obtained a diſſolution of above 30 religious houſes for the founding and endowing his colleges at Oxford and Ipſwich. About the ſame time a bull was granted by the ſame pope to Cardinal Wolſey to ſuppreſs monaſteries, where there were not above ſix monks, to the value of 8000 ducats a-year, for endowing Windſor and King's College in Cambridge; and two other bulls were granted to Cardinals Wolſey and Campeius, where there were leſs than twelve monks, and to annex them to the greater monaſteries; and another bull to the ſame cardinals to inquire about abbeys to be ſuppreſſed in order to be made cathedrals. Although nothing appears to have been done in conſequence of theſe bulls, the motive which induced Wolſey and many others to ſuppreſs theſe houſes was the deſire of promoting learning; and Archbiſhop Cranmer engaged in it with a view of carrying on the Reformation. There were other cauſes that concurred to bring on their ruin: many of the religious were looſe and vicious; the monks were generally thought to be in their hearts attached to the pope's ſupremacy; their revenues were not employed according to the intent of the donors; many cheats in images, feigned miracles, and counterfeit relicks, had been diſcovered, which brought the monks into diſgrace; the Obſervant friars had oppoſed the king's divorce from Queen Catharine; and theſe circumſtances operated, in concurrence with the king's want of a ſupply and the people's deſire to ſave their money, to forward a motion in parliament; that in order to ſupport the king's ſtate and ſupply his wants, all the religious houſes might be conferred upon the crown which were not able to ſpend above 200l. a-year; and an act was paſſed for that purpoſe 27 Hen. VIII. c. 28. By this act about 380 houſes were diſſolved, and a revenue of 30,000l. or 32,000l. a-year came to the crown; beſides about 100,000l. in plate and jewels. The ſuppreſſion of theſe houſes occaſioned diſcontent, and at length an open rebellion: when this was appeaſed, the king reſolved to ſuppreſs the reſt of the monaſteries, and appointed a new viſitation: which cauſed the greater abbeys to be ſurrendered apace; and it was enacted by 31 Henry VIII. c. 13. that all monaſteries, &c. which have been ſurrendered ſince the 4th of February, in the 27th year of his majeſty's reign, and which hereafter ſhall be ſurrendered, ſhall be veſted in the king. The knights of St John of Jeruſalem were alſo ſuppreſſed by the 32 Henry VIII. c. 24. The ſuppreſſion of theſe greater houſes by theſe two acts produced a revenue to the king of above 100,000l. a-year, beſides a large ſum in plate and jewels. The laſt act of diſſolution in this king's reign was the act of 37 Henry VIII. c. 4. for diſſolving colleges, free chapels, chantries, &c. which act was farther enforced by 1 Edw. VI. c. 14. By this act were ſuppreſſed 90 colleges, 110 hoſpitals, and 2374 chantries and free chapels. The number of houſes and places ſuppreſſed from firſt to laſt, ſo far as any calculations appear to have been made, ſeems to be as follow:

Of leſſer monaſteries, of which we have the valuation, - - -	374
Of greater monaſteries, - -	186
Belonging to the hoſpitallers, -	48
Colleges, - - -	90
Hoſpitals, - - -	110
Chantries and free chapels, - -	2374
Total	3182

Beſides the friars houſes and thoſe ſuppreſſed by Wolſey, and many ſmall houſes of which we have no particular account.

The ſum total of the clear yearly revenue of the ſeveral houſes at the time of their diſſolution, of which we have any account, ſeems to be as follow:

Of the greater monaſteries,	L.104,919	13	3½
Of all thoſe of the leſſer monaſteries of which we have the valuation,	29,702	1	10½
Knights hoſpitallers head houſe in London,	2385	12	8
We have the valuation of only 28 of their houſes in the country,	3026	9	5
Friars houſes of which we have the valuation,	751	2	0¾
Total	L.140,784	19	3¾

If proper allowances are made for the leſſer monaſteries and houſes not included in this eſtimate, and for the plate, &c. which came into the hands of the king by the diſſolution, and for the value of money at that time, which was at leaſt ſix times as much as at preſent, and alſo conſider that the eſtimate of the lands was generally ſuppoſed to be much under the real worth, we muſt conclude their whole revenues to have been immenſe.

It does not appear that any computation hath been made of the number of perſons contained in the religious houſes.

Thoſe of the leſſer monaſteries diſſolved by 27 Hen. VIII. were reckoned at about	10,000
If we ſuppoſe the colleges and hoſpitals to have contained a proportionable number, theſe will make about - - -	5347
If we reckon the number in the greater monaſteries, according to the proportion of their revenues, they will be about 35,000; but as probably they had larger allowances in proportion to their number than thoſe of the leſſer monaſteries, if we abate upon that account 5000, they will then be -	30,000
One for each chantry and free chapel,	2374
Total	47,721

But as there were probably more than one perſon to officiate in ſeveral of the free chapels, and there were other houſes which are not included within this calculation, perhaps they may be computed in one general eſtimate at about 50,000. As there were penſions paid to almoſt all thoſe of the greater monaſteries, the king did not immediately come into the full enjoyment of their whole revenues: however, by means of what he did receive, he founded ſix new biſhoprics, viz. thoſe of Weſtminſter (which was changed by Queen Elizabeth into a deanery, with twelve prebends and a ſchool), Peterborough, Cheſter, Glouceſter, Briſtol, and Oxford. And in eight other ſees he founded deaneries and chapters, by converting the priors and monks into deans and prebendaries, viz. Canterbury, Wincheſter, Durham, Worceſter, Rocheſter, Norwich, Ely, and Carliſle. He founded alſo the colleges of Chriſt-church in Oxford and Trinity in Cambridge, and finiſhed King's college there. He likewiſe founded profeſſorſhips of divinity, law, phyſic, and of the Hebrew and Greek tongues, in both the ſaid univerſities. He gave the houſe of Greyfriars and St Bartholomew's hoſpital to the city of London, and a perpetual penſion to the poor knights of Windſor, and laid out great ſums in building and fortifying many ports in the channel. It is obſervable, upon the whole, that the diſſolution of theſe houſes was an act, not of the church, but of the ſtate; in the period preceding the Reformation, by a king and parliament of the Roman catholic communion in all points except the king's ſupremacy; to which the pope himſelf, by his bulls and licenſes, had led the way.

MONASTIC, ſomething belonging to monks, or the monkiſh life. The monaſtic profeſſion is a kind of civil death, which in all worldly matters has the ſame effect with the natural death. The council of Trent, &c. fix ſixteen years for the age at which a perſon may be admitted into the monaſtical ſtate.

St Anthony is the perſon who, in the fourth century, firſt inſtituted the monaſtic life; as St Pachomius, in the ſame century, is ſaid to have firſt ſet on foot the cœnobitic life, *i. e.* regular communities of religious. In a ſhort time the deſerts of Egypt became inhabited with a ſet of ſolitaries, who took upon them the monaſtic profeſſion. St Baſil carried the monkiſh humour into the eaſt, where he compoſed a rule which afterwards obtained through a great part of the weſt.

In the 11th century the monaſtic diſcipline was grown very remiſs. St Odo firſt began to retrieve it in the monaſtery of Cluny; that monaſtery, by the conditions of its erection, was put under the immediate protection of the holy ſee; with a prohibition to all powers, both ſecular and eccleſiaſtical, to diſturb the monks in the poſſeſſion of their effects or the election of their abbot. In virtue hereof they pleaded an exemption from the juriſdiction of the biſhop, and extended this privilege to all the houſes dependent on Cluny. This made the firſt congregation of ſeveral houſes, under one chief immediately ſubject to the pope, ſo as to conſtitute one body, or, as they now call it, one *religious order*. Till then, each monaſtery was independent and ſubject to the biſhop. See MONK.

MONDA, or MUNDA, in *Ancient Geography*, a river of Luſitania, running mid-way from eaſt to weſt into the Atlantic, between the Durius and Tagus, and waſhing Conimbrica. Now the *Mondego*, a river of Portugal, which running by Coimbra, falls into the Atlantic, 30 miles below it.

MONDAY, the ſecond day of the week, ſo called as being anciently ſacred to the moon; *q. d.* moon-day.

MONDOVI, a conſiderable town of Italy, in Piedmont; with a citadel, univerſity, and biſhop's ſee. It is the largeſt and moſt populous town of Piedmont, and is ſeated in E. Long. 8. 6. N. Lat. 44. 33.

MONEMUGI, an empire in the ſouth of Africa, has Zanguebar on the eaſt, Monomotapa on the ſouth, Motamba and Makoko on the weſt, and Abyſſinia on the north and partly to the eaſt, though its boundaries that way cannot be aſcertained. It is divided into the kingdoms of Mujaco, Makoko or Anſiko, Gingiro, Cambate, Alaba, and Monemugi Proper. This laſt lies in the middle of the torrid zone, and about the equinoctial line, ſouth of Makoko, weſt of Zanguebar, north of Monomotapa, and eaſt of Congo and of the northern parts of Monomotapa. To aſcertain its extent, is too difficult a taſk, being a country ſo little frequented. The country known, abounds with gold, ſilver, copper mines, and elephants. The natives clothe themſelves in ſilks and cottons, which they buy of ſtrangers, and wear collars of tranſparent amber beads, brought them from Cambaya: which beads ſerve alſo inſtead of money; gold and ſilver being too common, and of little value among them.

Their monarch always endeavours to be at peace with the princes round about him, and to keep an open trade with Quitoa, Melinda, and Mombaza, on the eaſt, and with Congo on the weſt; from all which places the black merchants reſort thither for gold. The Portugueſe merchants report, that on the eaſt ſide of Monemugi there is a great lake full of ſmall iſlands, abounding with all ſorts of fowl and cattle, and inhabited by negroes. They relate alſo, that on the main land eaſtward they heard ſometimes the ringing of bells, and that one could obſerve buildings very much like churches; and that from theſe parts came men of a brown and tawney complexion, who traded with thoſe iſlanders, and with the people of Monemugi. This country abounds in palm wine, oil, and honey.

MONETARIUS, or MONEYER, a name which antiquaries and medalliſts give to thoſe who ſtruck the ancient coins or monies.

Many of the old Roman, &c. coins have the name of of the *monetarius*, either written at length, or at leaſt the initial letters of it. See MEDAL.

MONEY, a piece of matter, commonly metal, to which public authority has affixed a certain value and weight to ſerve as a medium in commerce. See COIN, COMMERCE, and MEDALS; alſo the article BANK.

Money is uſually divided into *real* or *effective*, and *imaginary* or *money of account*,

I. *REAL Money.*

1. *Hiſtory of real money.* Real money includes all coins, or ſpecies of gold, ſilver, copper, and the like; which have courſe in common, and do really exiſt. Such are guineas, piſtoles, pieces of eight, ducats, &c.

Real money, civilians obſerve, has three eſſential qualities, viz. matter, form, and weight or value.

For the matter, copper is that thought to have been firſt coined; afterwards ſilver; and laſtly gold, as being the moſt beautiful, ſcarce, cleanly, diviſible, and pure of all metals.

The degrees of goodneſs are expreſſed in gold by carats; and in ſilver by pennyweights, &c. For there are ſeveral reaſons for not coining them pure and without alloy, viz the great loſs and expence in refining them, the neceſſity of hardening them to make them more durable, and the ſcarcity of gold and ſilver in moſt countries. See ALLOY.

Among the ancient Britons, iron rings, or, as ſome ſay, iron plates, were uſed for money; among the Lacedæmonians, iron bars quenched with vinegar, that they might not ſerve for any other uſe. Seneca obſerves, that there was anciently ſtamped money of leather, *corium forma publica impreſſum.* And the ſame thing was put in practice by Frederic II. at the ſiege of Milan; to ſay nothing of an old tradition among ourſelves, that in the confuſed times of the barons wars the like was done in England: but the Hollanders, we know, coined great quantities of paſteboard in the year 1574.

As to the form of money, it has been more various than the matter. Under this are comprehended the weight, figure, impreſſion, and value.

For the impreſſion, the Jews, though they deteſted images, yet ſtamped on the one ſide of their ſhekel the golden pot which held the manna, and on the other Aaron's rod. The Dardans ſtamped two cocks fighting. The Athenians ſtamped their coins with an owl, or an ox; whence the proverb on bribed lawyers, *Bos in lingua.* They of Ægina, with a tortoiſe; whence, that other ſaying. *Virtutem et ſapientiam vincunt teſtudines.* Among the Romans, the monetarii ſometimes impreſſed the images of men that had been eminent in their families on the coins: but no living man's head was ever ſtamped on a Roman coin till after the fall of the commonwealth. From that time they bore the emperor's head on one ſide. From this time the practice of ſtamping the prince's image on coins has obtained among all civilized nations; the Turks and other Mahometans alone excepted, who, in deteſtation of images, inſcribe only the prince's name, with the year of the tranſmigration of their prophet.

As to the figure, it is either round, as in Britain; multangular or irregular, as in Spain; ſquare, as in ſome parts of the Indies; or nearly globular, as in moſt of the reſt.

After the arrival of the Romans in this iſland, the Britons imitated them, coining both gold and ſilver with the images of their kings ſtamped on them. When the Romans had ſubdued the kings of the Britons, they alſo ſuppreſſed their coins, and brought in their own; which were current here from the time of Claudius to that of Valentinian the Younger, about the ſpace of 500 years.

Mr Camden obſerves, that the moſt ancient Engliſh coin he had known was that of Ethelbert king of Kent, the firſt Chriſtian king in the iſland; in whoſe time all money accounts begin to paſs by the names of *pounds*, *ſhillings*, *pence*, and *mancuſes*. Pence ſeems borrowed from the Latin *pecunia*, or rather from *pendo*, on account of its juſt weight, which was about threepence of our money. Theſe were coarſely ſtamped with the king's image on the one ſide, and either the mint-maſter's, or the city's where it was coined, on the other. Five of theſe pence made their ſchilling, probably ſo called from *ſcilingus*, which the Romans uſed for the fourth part of an ounce. Forty of theſe ſchillings made their pound; and 400 of theſe pounds were a legacy, or portion for a king's daughter, as appears by the laſt will of King Alfred. By theſe names they tranſlated all ſums of money in their Old Engliſh teſtament; talents by *pundes;* Judas's thirty pieces of ſilver by *thirtig ſcillinga;* tribute money, by *penninng;* the mite by *feorthling*.

But it muſt be obſerved, they had no other real money, but pence only; the reſt being imaginary moneys, i. e. names of numbers or weights. Thirty of theſe pence made a mancus, which ſome take to be the ſame with a mark: manca, as appears by an old MS. was *quinta pars unciæ.* Theſe mancas or mancuſes were reckoned both in gold and ſilver. For in the year 680 we read that Ina king of the Weſt Saxons obliged the Kentiſhmen to buy their peace at the price of 30,000 mancas of gold. In the notes on King Canute's laws, we find this diſtinction, that *mancuſa* was as much as a mark of ſilver, and *manca*, a ſquare piece of gold, valued at 30 pence.

The Danes introduced a way of reckoning money by ores, *per oras*, mentioned in Domeſday book; but whether they were a ſeveral coin, or a certain ſum, does not plainly appear. This, however, may be gathered from the Abbey book of Burton, that 20 ores were equivalent to two marks. They had alſo a gold coin called *byzantine*, or *bezant*, as being coined at Conſtantinople, then called *Byzantium.* The value of which coin is not only now loſt, but was ſo entirely forgot even in the time of King Edward III. that whereas the biſhop of Norwich was fined a byzantine of gold to be paid the abbot of St Edmund's Bury for infringing his liberties (as it had been enacted by parliament in the time of the Conqueror), no man then living could tell how much it was; ſo it was referred to the king to rate how much he ſhould pay.. Which is the more unaccountable, becauſe but 100 years before, 200,000 bezants were exacted by the ſoldan for the ranſom of St Louis of France: which were then valued at 100,000 livres.

Though the coining of money be a ſpecial prerogative of the king, yet the ancient Saxon princes communicated it to their ſubjects; inſomuch that in every good town there was at leaſt one mint; but at London

don eight; at Canterbury four for the king, two for the archbiſhop, one for the abbot at Wincheſter, ſix at Rocheſter, at Haſtings two, &c.

The Norman kings continued the ſame cuſtom of coining only pence, with the prince's image on one ſide, and on the other the name of the city where it was coined, with a croſs ſo deeply impreſſed, that it might be eaſily parted and broke into two halves, which, ſo broken, they called *halfpence;* or into four parts, which they called *fourthings* or *farthings*.

In the time of King Richard I. money coined in the eaſt parts of Germany came in ſpecial requeſt in England on account of its purity, and was called *eaſterling money*, as all the inhabitants of thoſe parts were called *Eaſterlings*. And ſhortly after, ſome of thoſe people ſkilled in coining were ſent for hither, to bring the coin to perfection; which ſince has been called *ſterling* for *Eaſterling*. See STERLING.

King Edward I. who firſt adjuſted the meaſure of an ell by the length of his arm, herein imitating Charles the Great, was the firſt alſo who eſtabliſhed a certain ſtandard for the coin, which is expreſſed to this effect by Greg. Rockley, mayor of London, and mint-maſter.—"A pound of money containeth twelve ounces: in a pound there ought to be eleven ounces, two eaſterlings, and one farthing; the reſt alloy. The ſaid pound ought to weigh twenty ſhillings and three pence in account and weight. The ounce ought to weigh twenty pence, and a penny twenty-four grains and a half. Note, That eleven ounces two pence ſterling ought to be of pure ſilver, called *leaf ſilver;* and the minter muſt add of other weight ſeventeen pence halfpenny farthing, if the ſilver be ſo pure."

About the year 1320, the ſtates of Europe firſt began to coin gold; and among the reſt, our King Edward III. The firſt pieces he coined were called *florences*, as being coined by Florentines: afterwards he coined nobles; then roſe-nobles, current at 6s. 8d. half nobles called *half pennies*, at 3s. 4d. of gold; and quarters at 20d. called *farthings of gold*. The ſucceeding kings coined roſe-nobles, and double roſe-nobles, great ſovereigns, and half Henry nobles, angels, and ſhillings.

King James I. coined units, double crowns, Britain crowns: then crowns, half-crowns, &c.

2. *Comparative value of Money and Commodities at different periods*. The Engliſh money, though the ſame names do by no means correſpond with the ſame quantity of precious metal as formerly, has not changed ſo much as the money of moſt other countries. From the time of William the Conqueror, the proportion between the pound, the ſhilling, and the penny, ſeems to have been uniformly the ſame as at preſent.

Edward III. as already mentioned, was the firſt of our kings that coined any gold; and no copper was coined by authority before James I. Theſe pieces were not called farthings, but *farthing tokens*, and all people were at liberty to take or refuſe them. Before the time of Edward III. gold was exchanged, like any other commodity, by its weight; and before the time of James I. copper was ſtamped by any one perſon who choſe to do it.

In the year 712 and 727, a ewe and lamb were rated at 1s. Saxon money till a fortnight after Eaſter. Between the years 900 and 1000, two hydes of land, each containing about 120 acres, were ſold for 100 ſhillings. In 1000, by King Ethelred's laws, a horſe was rated at 30s. a mare or a colt of a year old, at 20s. a mule or young aſs, at 12s. an ox at 30s. a cow at 24s. a ſwine at 8d. a ſheep at 1s. In 1043, a quarter of wheat was ſold for 60d. Hence it is computed, that in the Saxon times there was ten times leſs money, in proportion to commodities, than at preſent. Their nominal ſpecie, therefore, being about three times higher than ours, the price of every thing, according to our preſent language, muſt be reckoned thirty times cheaper than it is now.

In the reign of William the Conqueror, commodities were ten times cheaper than they are at preſent; from which we cannot help forming a very high idea of the wealth and power of that king: for his revenue was 400,000l. per annum, every pound being equal to that weight of ſilver, conſequently the whole may be eſtimated at 1,200,000l. of the preſent computation; a ſum which, conſidering the different value of money between that period and the preſent, was equivalent to 12,000,000l. of modern eſtimation.

The moſt neceſſary commodities do not ſeem to have advanced their price from William the Conqueror to Richard I.

The price of corn in the reign of Henry III. was near half the mean price in our times. Biſhop Fleetwood has ſhown, that in the year 1240, which was in this reign, 4l. 13s. 9d. was worth about 50l. of our preſent money. About the latter end of this reign, Robert de Hay, rector of Souldern, agreed to receive 100s. to purchaſe to himſelf and ſucceſſor the annual rents of 5s. in full compenſation of an acre of corn.

Butchers meat, in the time of the great ſcarcity in the reign of Edward II. was, by a parliamentary ordinance, ſold three times cheaper than our mean price at preſent; poultry ſomewhat lower, becauſe being now conſidered as a delicacy, it has riſen beyond its proportion. The mean price of corn at this period was half the preſent value, and the mean price of cattle one-eighth.

In the next reign, which was that of Edward III. the moſt neceſſary commodities were in general about three or four times cheaper than they are at preſent.

In theſe times, knights, who ſerved on horſeback in the army, had 2s. a-day, and a foot archer 6d. which laſt would now be equal to a crown a-day. This pay has continued nearly the ſame nominally (only that in the time of the commonwealth the pay of the horſe was advanced to 2s. 6d. and that of the foot 1s. though it was reduced again at the Reſtoration), but ſoldiers were proportionably of a better rank formerly.

In the time of Henry VI. corn was about half its preſent value, other commodities much cheaper. Biſhop Fleetwood has determined, from a moſt accurate conſideration of every circumſtance, that 3l. in this reign was equivalent to 28l. or 30l. now.

In the time of Henry VII. many commodities were three times as cheap here, and in all Europe, as they are at preſent, there having been a great increaſe of gold and ſilver in Europe ſince his time occaſioned by the diſcovery of America.

The commodities whoſe price has riſen the moſt ſince before the time of Henry VII. are butchers meat, fowls,

fowls, and fiſh, eſpecially the latter. And the reaſon why corn was always much dearer in proportion to other eatables, according to their prices at preſent, is, that in early times agriculture was little underſtood. It required more labour and expence, and was more precarious than it is at preſent. Indeed, notwithſtanding the high price of corn in the times we are ſpeaking of, the raiſing of it ſo little anſwered the expence, that agriculture was almoſt univerſally quitted for grazing; which was more profitable, notwithſtanding the low price of butchers meat. So that there was conſtant occaſion for ſtatutes to reſtrain grazing, and to promote agriculture; and no effectual remedy was found till the bounty upon the exportation of corn; ſince which above ten times more corn has been raiſed in this country than before.

The price of corn in the time of James I. and conſequently that of other neceſſaries of life, was not lower, but rather higher, than at preſent: wool is not two-thirds of the value it was then; the finer manufactures having ſunk in price by the progreſs of art and induſtry, notwithſtanding the increaſe of money. Butchers meat was higher than at preſent. Prince Henry made an allowance of near 4d. per pound for all the beef and mutton uſed in his family. This may be true with reſpect to London; but the price of butchers meat in the country, which does not even now much exceed this price at a medium, has certainly greatly increaſed of late years, and particularly in the northern counties.

The prices of commodities are higher in England than in France; beſides that the poor people of France live upon much leſs than the poor in England, and their armies are maintained at leſs expence. It is computed by Mr Hume, that a Britiſh army of 20,000 men is maintained at near as great an expence as 60,000 in France, and that the Engliſh fleet, in the war of 1741, required as much money to ſupport it as all the Roman legions in the time of the emperors. However, all that we can conclude from this is, that money is much more plentiful in Europe at preſent than it was in the Roman empire.

In the 13th century, the common intereſt which the Jews had for their money, Voltaire ſays, was 20 per cent. But with regard to this, we muſt conſider the great contempt that nation was always held in, the large contributions they were frequently obliged to pay, the riſk they ran of never receiving the principal, the frequent confiſcations of all their effects, and the violent perſecutions to which they were expoſed; in which circumſtances it was impoſſible for them to lend money at all, unleſs for moſt extravagant intereſt, and much diſproportioned to its real value. Before the diſcovery of America, and the plantation of our colonies, the intereſt of money was generally 12 per cent. all over Europe; and it has been growing gradually leſs ſince that time, till it is now generally about four or five.

When ſums of money are ſaid to be raiſed by a whole people, in order to form a juſt eſtimate of it, we muſt take into conſideration not only the quantity of the precious metal according to the ſtandard of the coin, and the proportion of the quantity of coin to the commodities, but alſo the number and riches of the people who raiſe it; for populous and rich countries will much more eaſily raiſe any certain ſum of money than one that is thinly inhabited, and chiefly by poor people. This circumſtance greatly adds to our ſurpriſe at the vaſt ſums of money raiſed by William the Conqueror, who had a revenue nearly in value equal to 12,000,000l. of our money (allowance being made for the ſtandard of coin and the proportion it bore to the commodities), from a country not near ſo populous or rich as England is at preſent. Indeed, the accounts hiſtorians give us of the revenues of this prince, and the treaſure he left behind him, are barely credible.

II. *IMAGINARY Money*, or *Money of Account*, is that which has never exiſted, or at leaſt which does not exiſt in real ſpecie, but is a denomination invented or retained to facilitate the ſtating of accounts, by keeping them ſtill on a fixed footing, not to be changed, like current coins, which the authority of the ſovereign raiſes or lowers according to the exigencies of the ſtate. Of which kind are pounds, livres, marks, maravedies, &c. See the annexed Table, where the fictitious money is diſtinguiſhed by a dagger (†).

Moneys of Account among the Ancients.—1. The Grecians reckoned their ſums of money by *drachma*, *minæ*, and *talenta*. The drachma was equal to $7\frac{3}{4}$d. ſterling; 100 drachmæ made the mina, equal to 3l. 4s. 7d. ſterling; 60 minæ made the talent, equal to 193l. 15s. ſterling; hence 100 talents amounted to 19,375l. ſterling. The mina and talentum, indeed, were different in different provinces: their proportions in Attic drachms are as follow: The Syrian mina contained 25 Attic drachms; the Ptolemaic $33\frac{1}{3}$; the Antiochic and Eubœan 100; the Babylonic 116; the greater Attic and Tyrian $133\frac{1}{3}$; the Æginean and Rhodian $166\frac{2}{3}$. The Syrian talent contained 15 Attic minæ; the Ptolemaic 20; the Antiochic 60; the Eubœan 60; the Babylonic 70; the greater Attic and Tyrian 80; the Æginean and Rhodian 100.

2. Roman moneys of account were the *ſeſtertius* and *ſeſtertium*. The ſeſtertius was equal to 1d. $3\frac{3}{4}$q. ſterling. One thouſand of theſe made the ſeſtertium, equal to 8l. 1s. 5d. 2q. ſterling. One thouſand of theſe ſeſtertia made the decies ſeſtertium (the adverb *centies* being always underſtood) equal to 8072l. 18s. 4d. ſterling. The decies ſeſtertium they alſo called *decies centena millia nummum*. Centies ſeſtertium, or centies HS, were equal to 80,729l. 3s. 4d. Millies HS to 807,291l. 13s. 4d. Millies centies HS to 888,020l. 16s. 8d.

THEORY OF MONEY.

1. *Of Artificial or Material Money.*

I. As far back as our accounts of the tranſactions of mankind reach, we find they had adopted the precious metals, that is, ſilver and gold, as the common meaſure of value, and as the adequate equivalent for every thing alienable.

The metals are admirably adapted for this purpoſe: they are perfectly homogeneous: when pure, their maſſes, or bulks, are exactly in proportion to their weights; no phyſical difference can be found between two pounds of gold, or ſilver, let them be the production of the mines of Europe, Aſia, Africa, or America: they are perfectly malleable, fuſible, and ſuffer the moſt exact diviſion which human art is capable to give them: they are capable of being mixed with one another, as well as with metals of a baſer, that is, of a leſs homogeneous nature, ſuch as copper: by this mixture they ſpread themſelves uniformly through the whole maſs of the compoſed lump, ſo that every atom of it becomes proportionally poſſeſſed of a ſhare of this noble mixture; by which means the ſubdiviſion of the precious metals is rendered very extenſive.

Their phyſical qualities are invariable: they loſe nothing by keeping; they are ſolid and durable; and though their parts are ſeparated by friction, like every other thing, yet ſtill they are of the number of thoſe which ſuffer leaſt by it.

If money, therefore, can be made of any thing, that is, if the proportional value of things vendible can be meaſured by any thing material, it may be meaſured by the metals.

II. The two metals being pitched upon as the moſt proper ſubſtances for realizing the ideal ſcale of money, thoſe who undertake the operation of adjuſting a ſtandard, muſt conſtantly keep in their eye the nature and qualities of a ſcale, as well as the principles upon which it is formed.

The unit of the ſcale muſt conſtantly be the ſame, although realized in the metals, or the whole operation fails in the moſt eſſential part. This realizing the unit is like adjuſting a pair of compaſſes to a geometrical ſcale, where the ſmalleſt deviation from the exact opening once given muſt occaſion an incorrect meaſure. The metals, therefore, are to money what a pair of compaſſes is to a geometrical ſcale.

This operation of adjuſting the metals to the money of account implies an exact and determinate proportion of both metals to the money unit, realized in all the ſpecies and denominations of coin, adjuſted to that ſtandard.

The ſmalleſt particle of either metal added to, or taken away from, any coins, which repreſent certain determinate parts of the ſcale, overturns the whole ſyſtem of material money. And if, notwithſtanding ſuch variation, theſe coins continue to bear the ſame denominations as before, this will as effectually deſtroy their uſefulneſs in meaſuring the value of things, as it would overturn the uſefulneſs of a pair of compaſſes, to ſuffer the opening to vary, after it is adjuſted to the ſcale repreſenting feet, toiſes, miles, or leagues, by which the diſtances upon the plan are to be meaſured.

III. Debaſing the ſtandard is a good term, becauſe it conveys a clear and diſtinct idea. It is diminiſhing the weight of the pure metal contained in that denomination by which a nation reckons, and which we have called the *money unit.* Raiſing the ſtandard requires no farther definition, being the direct contrary.

IV. Altering the ſtandard (that is, raiſing or debaſing the value of the money unit) is like altering the national meaſures or weights. This is beſt diſcovered by comparing the thing altered with things of the ſame nature which have ſuffered no alteration. Thus, if the foot of meaſure was altered at once over all England, by adding to it, or taking from it, any proportional part of its ſtandard length, the alteration would be beſt diſcovered by comparing the new foot with that of Paris, or of any other country, which had ſuffered no alteration. Juſt ſo, if the pound ſterling, which is the Engliſh unit, ſhall be found anyhow changed, and if the variation it has met with be difficult to aſcertain becauſe of a complication of circumſtances, the beſt way to diſcover it, will be to compare the former and the preſent value of it with the money of other nations which has ſuffered no variation. This the courſe of exchange will perform with the greateſt exactneſs.

V. Artiſts pretend, that the precious metals, when abſolutely pure from any mixture, are not of ſufficient hardneſs to conſtitute a ſolid and laſting coin. They are found alſo in the mines mixed with other metals of a baſer nature; and the bringing them to a ſtate of perfect purity occaſions an unneceſſary expence. To avoid, therefore, the inconvenience of employing them in all their purity, people have adopted the expedient of mixing them with a determinate proportion of other metals, which hurts neither their fuſibility, malleability, beauty, nor luſtre. This metal is called *alloy:* and, being conſidered only as a ſupport to the principal metal, is accounted of no value in itſelf. So that eleven ounces of gold, when mixed with one ounce of ſilver, acquires by that addition no augmentation of value whatever.

This being the caſe, we ſhall, as much as poſſible, overlook the exiſtence of alloy, in ſpeaking of money, in order to render language leſs ſubject to ambiguity.

2. *Incapacities of the Metals to perform the Office of an invariable Meaſure of Value.*

I. Were there but one ſpecies of ſuch a ſubſtance as we have repreſented gold and ſilver to be; were there but one metal poſſeſſing the qualities of purity, diviſibility, and durability; the inconveniences in the uſe of it for money would be fewer by far than they are found to be as matters ſtand.

Such a metal might then, by an unlimited diviſion into parts exactly equal, be made to ſerve as a tolerably ſteady and univerſal meaſure. But the rivalſhip between the metals, and the perfect equality which is found between all their phyſical qualities, ſo far as regards purity and diviſibility, render them ſo equally well adapted to ſerve as the common meaſure of value, that they are univerſally admitted to paſs current as money.

What is the conſequence of this? that the one meaſures the value of the other, as well as that of every other thing. Now the moment any meaſure begins to be meaſured by another, whoſe proportion to it is not phyſically, perpetually, and invariably the ſame, all the uſefulneſs of ſuch a meaſure is loſt. An example will make this plain.

A foot of meaſure is a determinate length. An Engliſh foot may be compared with the Paris foot, or with that of the Rhine; that is to ſay, it may be meaſured by them: and the proportion between their lengths may be expreſſed in numbers, which proportion will be the ſame perpetually. The meaſuring the one by the other will occaſion no uncertainty; and we may ſpeak of length by Paris feet, and be be perfectly well underſtood by others who are uſed to meaſure by the Engliſh foot, or by the foot of the Rhine.

But ſuppoſe that a youth of 12 years old takes it into his head to meaſure from time to time, as he advances in age, by the length of his own foot, and that he divides this growing foot into inches and decimals: what can be learned from his account of meaſures? As he increaſes in years, his foot, inches, and ſubdiviſions, will be gradually lengthening; and were every man to follow his example, and meaſure by his own foot, then the foot of a meaſure now eſtabliſhed would totally ceaſe to be of any utility.

This is juſt the caſe with the two metals. There is no determinate invariable proportion between their value; and the conſequence of this is, that when they are both taken for meaſuring the value of other things, the things to be meaſured, like lengths to be meaſured by the young man's foot, without changing their relative proportion between themſelves, change, however, with reſpect to the denominations of both their meaſures. An example will make this plain.

Let us ſuppoſe an ox to be worth 3000 pounds weight of wheat, and the one and the other to be worth an ounce of gold, and an ounce of gold to be worth exactly 15 ounces of ſilver: if the caſe ſhould happen, that the proportional value between gold and ſilver ſhould come to be as 14 is to 1, would not the ox, and conſequently the wheat, be eſtimated at leſs in ſilver, and more in gold, than formerly? Farther, Would it be in the power of any ſtate to prevent this variation in the meaſure of the value of oxen and wheat, without putting into the unit of their money leſs ſilver and more gold than formerly?

If therefore any particular ſtate ſhould fix the ſtandard of the unit of their money to one ſpecies of the metals, while in fact both the one and the other are actually employed in meaſuring value; does not ſuch a ſtate reſemble the young man who meaſures all by his growing foot? For if ſilver, for example, be retained as the ſtandard, while it is gaining upon gold one-fifteenth additional value; and if gold continue all the while to determine the value of things as well as ſilver; it is plain, that, to all intents and purpoſes, this ſilver meaſure is lengthening daily like the young man's foot, ſince the ſame weight of it muſt become every day equivalent to more and more of the ſame commodity; notwithſtanding that we ſuppoſe the ſame proportion to ſubſiſt, without the leaſt variation, between that commodity and every other ſpecies of things alienable.

Buying and ſelling are purely conventional, and no man is obliged to give his merchandiſe at what may be ſuppoſed to be the proportion of its worth. The uſe, therefore, of an univerſal meaſure, is to mark, not only the relative value of the things to which it is applied as a meaſure, but to diſcover in an inſtant the proportion between the value of thoſe, and of every other commodity valued by a determinate meaſure in all the countries of the world.

Were pounds ſterling, livres, florins, piaſtres, &c. which are all money of account, invariable in their values, what a facility would it produce in all converſions! what an aſſiſtance to trade! But as they are all limited or fixed to coins, and conſequently vary from time to time, this example ſhows the utility of the invariable meaſure which we have deſcribed.

There is another circumſtance which incapacitates the metals from performing the office of money; the ſubſtance of which the coin is made, is a commodity which riſes and ſinks in its value with reſpect to other commodities, according to the wants, competition, and caprices of mankind. The advantage, therefore, found in putting an intrinſic value into that ſubſtance which performs the function of money of account, is compenſated by the inſtability of that intrinſic value; and the advantage obtained by the ſtability of paper, or ſymbolical money, is compenſated by the defect it commonly has of not being at all times ſuſceptible of realization into ſolid property or intrinſic value.

In order, therefore, to render material money more perfect, this quality of metal, that is, of a commodity, ſhould be taken from it; and in order to render paper money more perfect, it ought to be made to circulate upon metallic or land ſecurity.

II. There are ſeveral ſmaller inconveniences accompanying the uſe of the metals, which we ſhall here ſhortly enumerate.

1*mo*, No money made of gold or ſilver can circulate long, without loſing its weight, although it all along preſerves the ſame denomination. This repreſents the contracting a pair of compaſſes which had been rightly adjuſted to the ſcale.

2*do*, Another inconvenience proceeds from the fabrication of money. Suppoſing the faith of princes who coin money to be inviolable, and the probity as well as capacity of thoſe to whom they commit the inſpection of the buſineſs of the metals to be ſufficient, it is hardly poſſible for workmen to render every piece exactly of a proper weight, or to preſerve the due proportion between pieces of different denominations, that is to ſay, to make every ten ſixpences exactly of the ſame weight with every crown piece and every five ſhillings ſtruck in a coinage. In proportion to ſuch inaccuracies, the parts of the ſcale become unequal.

3*tio*, Another inconvenience, and far from being inconſiderable, flows from the expence requiſite for the coining of money. This expence adds to its value as a manufacture, without adding any thing to its weight.

4*to*, The laſt inconvenience is, that by fixing the money of account entirely to the coin, without having any independent common meaſure, (to mark and controul theſe deviations from mathematical exactneſs, which are either inſeparable from the metals themſelves, or from the fabrication of them), the whole meaſure of value, and all the relative intereſts of debtors and creditors, become at the diſpoſal not only of workmen in the mint, of Jews who deal in money, of clippers and waſhers in coin; but they are alſo entirely at the mercy of princes who have the right of coinage, and who have frequently alſo the right of raiſing or debaſing the ſtandard of the coin, according as they find it moſt for their preſent and temporary intereſt.

3. *Methods which may be propoſed for leſſening the ſeveral Inconveniences to which Material Money is liable.*

The inconveniences from the variation in the relative value

value of the metals to one another, may in ſome meaſure be obviated by the following expedients.

1*mo*, By conſidering one only as the ſtandard, and leaving the other to ſeek its own value like any other commodity.

2*do*, By conſidering one only as the ſtandard, and fixing the value of the other from time to time by authority, according as the market price of the metals ſhall vary.

3*tio*, By fixing the ſtandard of the unit according to the mean proportion of the metals, attaching it to neither; regulating the coin accordingly; and upon every conſiderable variation in the proportion between them, either to make a new coinage, or to raiſe the denomination of one of the ſpecies, and lower it in the other, in order to preſerve the unit exactly in the mean proportion between the gold and ſilver.

4*to*, To have two units and two ſtandards, one of gold and one of ſilver, and to allow every body to ſtipulate in either.

5*to*, Or laſt of all, To oblige all debtors to pay one half in gold, and one half in the ſilver ſtandard.

4. *Variations to which the Value of the Money unit is expoſed from every Diſorder in the Coin.*

Let us ſuppoſe, at preſent, the only diſorder to conſiſt in a want of the due proportion between the gold and ſilver in the coin.

This proportion can only be eſtabliſhed by the market price of the metals; becauſe an augmentation and riſe in the demand for gold or ſilver has the effect of augmenting the value of the metal demanded. Let us ſuppoſe, that to-day one pound of gold may buy fifteen pounds of ſilver: If to-morrow there be a high demand for ſilver, a competition among merchants to have ſilver for gold will enſue: they will contend who ſhall get the ſilver at the rate of 15 pounds for one of gold: this will raiſe the price of it; and in proportion to their views of profit, ſome will accept of leſs than the 15 pounds. This is plainly a riſe in the ſilver, more properly than a fall in the gold; becauſe it is the competition for the ſilver which has occaſioned the variation in the former proportion between the metals.

Let us now ſuppoſe, that a ſtate, having with great exactneſs examined the proportion of the metals in the market, and having determined the preciſe quantity of each for realizing or repreſenting the money unit, ſhall execute a moſt exact coinage of gold and ſilver coin. As long as that proportion continues unvaried in the market, no inconvenience can reſult from that quarter in making uſe of metals for money of account.

But let us ſuppoſe the proportion to change; that the ſilver, for example, ſhall riſe in its value with regard to gold: will it not follow, from that moment, that the unit realized in the ſilver, will become of more value than the unit realized in the gold coin?

But as the law has ordered them to paſs as equivalents for one another, and as debtors have always the option of paying in what legal coin they think fit, will they not all chooſe to pay in gold; and will not then the ſilver coin be melted down or exported, in order to be ſold as bullion, above the value it bears when it circulates in coin? Will not this paying in gold alſo really diminiſh the value of the money unit, ſince upon this variation every thing muſt ſell for more gold than before, as we have already obſerved.

Conſequently, merchandiſes, which have not varied in their relative value to any other thing but to gold and ſilver, muſt be meaſured by the mean proportion of the metals: and the application of any other meaſure to them is altering the ſtandard. If they are meaſured by the gold, the ſtandard is debaſed; if by ſilver, it is raiſed.

If, to prevent the inconvenience of melting down the ſilver, the ſtate ſhall give up affixing the value of their unit to both ſpecies at once, and ſhall fix it to one, leaving the other to ſeek its price as any other commodity; in that caſe, no doubt, the melting down of the coin will be prevented; but will this ever reſtore the value of the money unit to its former ſtandard? Would it, for example, in the foregoing ſuppoſition, raiſe the debaſed value of the money unit in the gold coin, if that ſpecies were declared to be the ſtandard? It would, indeed, render ſilver coin purely a merchandiſe, and, by allowing it to ſeek its value, would certainly prevent it from being melted down as before; becauſe the pieces would riſe conventionally in their denomination; or an *agio*, as it is called, would be taken in payments made in ſilver; but the gold would not, on that account, riſe in its value, or begin to purchaſe any more merchandiſe than before. Were therefore the ſtandard fixed to the gold, would not this be an arbitrary and a violent revolution in the value of the money unit, and a debaſement of the ſtandard?

If, on the other hand, the ſtate ſhould fix the ſtandard to the ſilver, which we ſuppoſe to have riſen in its value, would that ever ſink the advanced value which the ſilver coin had gained above the worth of the former ſtandard unit? and would not this be a violent and an arbitrary revolution in the value of the money unit, and a raiſing of the ſtandard?

The only expedient, therefore, is, in ſuch a caſe, to fix the numerary unit to neither of the metals, but to contrive a way to make it fluctuate in a mean proportion between them; which is in effect the introduction of a pure ideal money of account.

The regulation of fixing the unit by the mean proportion, ought to take place at the inſtant the ſtandard unit is fixed with exactneſs both to the gold and ſilver. If it be introduced long after the market proportion between the metals has deviated from the proportion eſtabliſhed in the coin; and if the new regulation is made to have a retroſpect, with regard to the acquitting of permanent contracts entered into while the value of the money unit had attached itſelf to the loweſt currency in conſequence of the principle above laid down; then the reſtoring the money unit to that ſtandard where it ought to have remained (to wit, to the mean proportion) is an injury to all debtors, who have contracted ſince the time that the proportion of the metals began to vary.

This is clear from the former reaſoning. The moment the market price of the metals differs from that in the coin, every one who has payments to make, pays in that ſpecies which is the higheſt rated in the coin; conſequently, he who lends, lends in that ſpecies. If after the contract, therefore, the unit is carried

ried up to the mean proportion, this muſt be a loſs to him who had borrowed.

From this we may perceive, why there is leſs inconvenience from the varying of the proportion of the metals, where the ſtandard is fixed to one of them, than when it is fixed to both. In the firſt caſe, it is at leaſt uncertain whether the ſtandard or the merchandiſe ſpecies is to riſe; conſequently, it is uncertain whether the debtors or the creditors are to gain by a variation. If the ſtandard ſpecies ſhould riſe, the creditors will gain; if the merchandiſe ſpecies riſes, the debtors will gain; but when the unit is attached to both ſpecies, then the creditors never can gain, let the metals vary as they will; if ſilver riſes, then debtors will pay in gold; if gold riſes, the debtors will pay in ſilver. But whether the unit be attached to one or to both ſpecies, the infallible conſequence of a variation is, that one half of the difference is either gained or loſt by debtors and creditors. The invariable unit is conſtantly the mean proportional between the two meaſures.

5. *How the Variations of the intrinſic value of the Unit of Money muſt affect all the domeſtic Intereſts of a Nation.*

If the changing the content of the buſhel by which grain is meaſured, would affect the intereſt of thoſe who are obliged to pay, or who are entitled to receive, a certain number of buſhels of grain for the rent of lands; in the ſame manner muſt every variation in the value of the unit of account affect all perſons who, in permanent contracts, are obliged to make payments, or who are obliged to receive ſums of money ſtipulated in multiples or in fractions of that money unit.

Every variation, therefore, upon the intrinſic value of the money unit, has the effect of benefiting the claſs of creditors at the expence of debtors, or *vice verſa*.

This conſequence is deduced from an obvious principle. Money is more or leſs valuable in proportion as it can purchaſe more or leſs of every kind of merchandiſe. Now, without entering anew into the cauſes of the riſe and fall of prices, it is agreed upon all hands, that whether an augmentation of the general maſs of money in circulation has the effect of raiſing prices in general or not, any augmentation of the quantity of the metals appointed to be put into the money unit, muſt at leaſt affect the value of that money unit, and make it purchaſe more of any commodity than before: that is to ſay, 113 grains of fine gold, the preſent weight of a pound ſterling in gold, can buy 113 pounds of flour; were the pound ſterling raiſed to 114 grains of the ſame metal, it would buy 114 pounds of flour; conſequently, were the pound ſterling augmented by one grain of gold, every miller who paid a rent of ten pounds a-year, would be obliged to ſell 1140 pounds of his flour, in order to procure ten pounds to pay his rent, in place of 1130 pounds of flour, which he ſold formerly to procure the ſame ſum; conſequently, by this innovation, the miller muſt loſe yearly ten pounds of flour, which his maſter conſequently muſt gain. From this example, it is plain, that every augmentation of metals put into the pound ſterling, either of ſilver or gold, muſt imply an advantage to the whole claſs of creditors who are paid in pounds ſterling, and conſequently muſt be a proportional loſs to all debtors who muſt pay by the ſame denomination.

6. *Of the Diſorder in the Britiſh Coin, ſo far as it occaſions the melting down or the exporting of the Specie.*

The defects in the Britiſh coin are three.

1mo, The proportion between the gold and ſilver in it is found to be as 1 to $15\frac{2}{10}$, whereas the market price may be ſuppoſed to be nearly as 1 to $14\frac{1}{2}$.

2do, Great part of the current money is worn and light.

3tio, From the ſecond defect proceeds the third, to wit, that there are ſeveral currencies in circulation which paſs for the ſame value, without being of the ſame weight.

4to, From all theſe defects reſults the laſt and greateſt inconvenience, to wit, that ſome innovation muſt be made, in order to ſet matters on a right footing.

The Engliſh, beſides the unit of their money which they call the pound ſterling, have alſo the unit of their weight for weighing the precious metals.

This is called the *pound troy*, and conſiſts of 12 ounces, every ounce of 20 pennyweights, and every pennyweight of 24 grains. The pound troy, therefore, conſiſts of 240 pennyweights and 5760 grains.

The fineneſs of the ſilver is reckoned by the number of ounces and pennyweights of the pure metal in the pound troy of the compoſed maſs; or, in other words, the pound troy, which contains 5760 grains of ſtandard ſilver, contains 5328 grains of fine ſilver, and 432 grains of copper, called *alloy*.

Thus ſtandard ſilver is 11 ounces 2 pennyweights of fine ſilver in the pound troy to 18 pennyweights copper, or 111 parts fine ſilver to nine parts alloy.

Standard gold is 11 ounces fine to 1 ounce ſilver or copper employed for alloy, which together make the pound troy; conſequently, the pound troy of ſtandard gold contains 5280 grains fine, and 480 grains alloy, which alloy is reckoned of no value.

This pound of ſtandard ſilver is ordered, by ſtatute of the 43d of Elizabeth, to be coined into 62 ſhillings, 20 of which make the pound ſterling; conſequently, the 20 ſhillings contain 1718.7 grains of fine ſilver, and 1858.06 ſtandard ſilver.

The pound troy of ſtandard gold, $\frac{11}{12}$ fine, is ordered, by an act of King Charles II. to be cut into $44\frac{1}{2}$ guineas: that is to ſay, every guinea contains 129.43 grains of ſtandard gold, and 118.644 of fine gold; and the pound ſterling, which is $\frac{20}{21}$ of the guinea, contains 112.994, which we may ſtate at 113 grains of fine gold.

The coinage in England is entirely defrayed at the expence of the ſtate. The mint price for the metals is the very ſame with the price of the coin. Whoever carries to the mint an ounce of ſtandard ſilver, receives for it in ſilver coin 5s. 2d. or 62d.: whoever carries an ounce of ſtandard gold receives in gold coin 3l. 17s. $10\frac{1}{2}$d. the one and the other making exactly an ounce of the ſame fineneſs with the bullion. Coin, therefore, can-

have

have no value in the market above bullion; conſequently, no loſs can be incurred by thoſe who melt it down.

When the guinea was firſt ſtruck, the government (not inclining to fix the pound ſterling to the gold coin of the nation) fixed the guinea at 20 ſhillings, (which was then below its proportion to the ſilver), leaving it to ſeek its own price above that value, according to the courſe of the market.

By this regulation no harm was done to the Engliſh ſilver ſtandard; becauſe the guinea, or 118.644 grains fine gold, being worth more, at that time, than 20 ſhillings, or 1718.7 grains fine ſilver, no debtor would pay with gold at its ſtandard value; and whatever it was received for above that price was purely conventional.

Accordingly guineas ſought their own price until the year 1728, that they were fixed a-new, not below their value as at firſt, but at what was then reckoned their exact value, according to the proportion of the metals, viz. at 21 ſhillings; and at this they were ordered to paſs current in all payments.

This operation had the effect of making the gold a ſtandard as well as the ſilver. Debtors then paid indifferently in gold as well as in ſilver, becauſe both were ſuppoſed to be of the ſame intrinſic as well as current value; in which caſe no inconvenience could follow upon this regulation. But in time ſilver came to be more demanded; the making of plate began to prevail more than formerly, and the exportation of ſilver to the Eaſt Indies increaſing yearly, made the demand for it greater, or perhaps brought its quantity to be proportionally leſs than before. This changed the proportion of the metals; and by ſlow degrees they have come from that of 1 to 15.2 (the proportion they were ſuppoſed to have when the guineas were fixed and made a lawful money at 21 ſhillings) to that of 14.5, the preſent *ſuppoſed* proportion.

The conſequence of this has been, that the ſame guinea which was worth 1804.6 grains fine ſilver, at the time it was fixed at 21s. is now worth no more than 1719.9 grains of fine ſilver according to the proportion of 14½ to 1.

Conſequently debtors, who have always the option of the legal ſpecies in paying their debts, will pay pounds ſterling no more in ſilver but in gold; and as the gold pounds they pay in are not intrinſically worth the ſilver pounds they paid in formerly according to the ſtatute of Elizabeth, it follows that the pound ſterling in ſilver is really no more the ſtandard, ſince nobody will pay at that rate, and ſince nobody can be compelled to do it.

Beſides this want of proportion between the metals, the ſilver coined before the reign of George I. is now become light by circulation; and the guineas coined by all the princes ſince Charles II. paſs by tale, though many of them are conſiderably diminiſhed in their weight.

Let us now examine what profit the want of proportion and the want of weight in the coin can afford to the money-jobbers in melting it down or exporting it.

Did every body conſider coin only as the meaſure for reckoning value, without attending to its value as a metal, the deviations of gold and ſilver coin from perfect exactneſs, either as to proportion or weight, would occaſion little inconvenience.

Great numbers, indeed, in every modern ſociety, conſider coin in no other light than that of money of account; and have great difficulty to comprehend what difference any one can find between a light ſhilling and a heavy one, or what inconvenience there can poſſibly reſult from a guinea's being ſome grains of fine gold too light to be worth 21 ſhillings ſtandard weight. And did every one think in the ſame way, there would be no occaſion for coin of the precious metals at all; leather, copper, iron, or paper, would keep the reckoning as well as gold and ſilver.

But although there be many who look no farther than at the ſtamp on the coin, there are others whoſe ſole buſineſs it is to examine its intrinſic worth as a commodity, and to profit of every irregularity in the weight and proportion of metals.

By the very inſtitution of coinage, it is implied, that every piece of the ſame metal, and ſame denomination with regard to the money-unit, ſhall paſs current for the ſame value.

It is, therefore, the employment of money-jobbers, to examine, with a ſcrupulous exactneſs, the preciſe weight of every piece of coin which comes into their hands.

The firſt object of their attention is, the price of the metals in the market: a jobber finds, at preſent, that with 14.5 pounds of fine ſilver bullion, he can buy one pound of fine gold bullion.

He therefore buys up with gold coin all the new ſilver as faſt as it is coined, of which he can get at the rate of 15.2 pounds for one in gold; theſe 15.2 pounds ſilver coin he melts down into bullion, and converts that back into gold bullion, giving at the rate of only 14.5 pounds for one.

By this operation he remains with the value of $\frac{7}{10}$ of one pound weight of ſilver bullion clear profit upon the 15½ pounds he bought; which $\frac{7}{10}$ is really loſt by the man who inadvertently coined ſilver at the mint, and gave it to the money-jobber for his gold. Thus the ſtate loſes the expence of the coinage, and the public the convenience of change for their guineas.

But here it may be aſked, Why ſhould the money-jobber melt down the ſilver coin? can he not buy gold with it as well without melting it down? He cannot; becauſe when it is in coin he cannot avail himſelf of its being new and weighty. Coin goes by tale, not by weight; therefore, were he to come to market with his new ſilver coin, gold bullion being ſold at the mint price, we ſhall ſuppoſe, viz. at 3l. 17s. 10½d. ſterling money per ounce, he would be obliged to pay the price of what he bought with heavy money, which he can equally do with light.

He therefore melts down the new ſilver coin, and ſells it for bullion, at ſo many pence an ounce; the price of which bullion is, in the Engliſh market, always above the price of ſilver at the mint, for the reaſons now to be given.

When you ſell ſtandard ſilver bullion at the mint, you are to be paid in weighty money; that is, you receive for your bullion the very ſame weight in ſtandard coin; the coinage coſts nothing: but when you ſell bullion in the market, you are paid in worn-out ſilver, in gold, in bank notes, in ſhort, in every ſpecies of lawful current money. Now all theſe payments have ſome defect: the ſilver you are paid with is worn and light; the gold you are paid with is overrated, and perhaps alſo light; and the bank notes muſt have the ſame value with the ſpecie with which the bank pays them; that is, with light ſilver or overrated gold.

It is for theſe reaſons, that ſilver bullion, which is bought by the mint at 5s. 2d. per ounce of heavy ſilver money, may be bought at market at 65 pence the ounce in light ſilver, overrated gold, or bank notes, which is the ſame thing.

Further, We have ſeen how the impoſition of coinage has the effect of raiſing coin above the value of bullion, by adding a value to it which it had not as a metal.

Juſt ſo, when the unit is once affixed to certain determined quantities of both metals, if one of the metals ſhould afterwards riſe in value in the market, the coin made of that metal muſt loſe a part of its value as coin, although it retains it as a metal. Conſequently, as in the firſt caſe it acquired an additional value by being coined, it muſt now acquire an additional value by being melted down. From this we may conclude that when the ſtandard is affixed to both the metals in the coin, and when the proportion of that value is not made to follow the price of the market, that ſpecies which riſes in the market is melted down, and the bullion is ſold for a price as much exceeding the mint price as the metal has riſen in its value.

If, therefore, in England, the price of ſilver bullion is found to be at 65 pence the ounce, while at the mint it is rated at 62; this proves that ſilver has riſen $\frac{3}{65}$ above the proportion obſerved in the coin, and that all coin of ſtandard weight may conſequently be melted down with a profit of $\frac{3}{65}$. But as there are ſeveral other circumſtances to be attended to which regulate and influence the price of bullion, we ſhall here paſs them in review, the better to diſcover the nature of this diſorder in the Engliſh coin, and the advantages which money-jobbers may draw from it.

The price of bullion, like that of every other merchandiſe, is regulated by the value of the money it is paid with.

If bullion, therefore, ſells in England for 65 pence an ounce paid in ſilver coin, it muſt ſell for 65 ſhillings the pound troy; that is to ſay, the ſhillings it is commonly paid with do not exceed the weight of $\frac{1}{65}$ of a pound troy; for if the 65 ſhillings with which the pound of bullion is paid weigh more than a pound troy, it will be a ſhorter and better way for him who wants bullion to melt down the ſhillings and make uſe of the metal, than to go to market with them in order to get leſs.

We may, therefore, be very certain, that no man will buy ſilver bullion at 65 pence an ounce, with any ſhilling which weighs above $\frac{1}{65}$ of a pound troy.

We have gone upon the ſuppoſition that the ordinary price of bullion in the Engliſh market is 65 pence per ounce. This has been done upon the authority of ſome late writers on this ſubject: it is now proper to point out the cauſes which may make it deviate from that value.

I. It may, and certainly will vary, in the price, according as the currency is better or worſe. When the expence of a war, or a wrong balance of trade, have carried off a great many heavy guineas, it is natural that bullion ſhould riſe; becauſe then it will be paid for more commonly in light gold and ſilver; that is to ſay, with pounds ſterling, below the value of 113 grains fine gold, the worth of the pound ſterling in new guineas.

II. This wrong balance of trade, or a demand for bullion abroad, becoming very great, may occaſion a ſcarcity of the metals in the market, as well as a ſcarcity of the coin; conſequently, an advanced price muſt be given for it in proportion to the greatneſs and height of the demand. In this caſe, both the ſpecie and the bullion muſt be bought with paper. But the riſe in the price of bullion proceeds from the demand for the metals and the competition between merchants to procure them, and not becauſe the paper given as the price is at all of inferior value to the ſpecie. The leaſt diſcredit of this kind would not tend to diminiſh the value of the paper; it would annihilate it at once. Therefore, ſince the metals muſt be had, and that the paper cannot ſupply the want of them when they are to be exported, the price riſes in proportion to the difficulties in finding metals elſewhere than in the Engliſh market.

III. A ſudden call for bullion, for the making of plate. A goldſmith can well afford to give 67 pence for an ounce of ſilver, that is to ſay, he can afford to give one pound of gold for 14 pounds of ſilver, and perhaps for leſs, notwithſtanding that what he gives be more than the ordinary proportion between the metals, becauſe he indemnifies himſelf amply by the price of his workmanſhip; juſt as a tavern keeper will pay any price for a fine fiſh, becauſe, like the goldſmith, he buys for other people.

IV. The mint price has as great an effect in bringing down the price of bullion, as exchange has in raiſing it. In countries where the metals in the coin are juſtly proportioned, where all the currencies are of legal weight, and where coinage is impoſed, the operations of trade make the price of bullion conſtantly to fluctuate between the value of the coin and the mint price of the metals.

Now let us ſuppoſe that the current price of ſilver bullion in the market is 65 pence the ounce, paid in lawful money, no matter of what weight or of what metal. Upon this the money-jobber falls to work. All ſhillings which are above $\frac{1}{65}$ of a pound troy, he throws into his melting pot, and ſells them as bullion for 65d. per ounce; all thoſe which are below that weight he carries to market, and buys bullion with them at 65d. per ounce.

What is the conſequence of this?

That thoſe who ſell the bullion, finding the ſhillings which the money-jobber pays with perhaps not above $\frac{1}{66}$ of a pound troy, they on their ſide raiſe the price of the bullion to 66d. the ounce.

This makes new work for the money-jobber; for he muſt always gain. He now weighs all ſhillings as they come to hand; and as formerly he threw into his melting pot thoſe only which were worth more than $\frac{1}{65}$ of a pound troy, he now throws in all that are in value

lue above $\frac{1}{66}$. He then ſells the melted ſhillings at 66d. the ounce, and buys bullion with the light ones at the ſame price.

This is the conſequence of ever permitting any ſpecies of coin to paſs by the authority of the ſtamp, without controlling it at the ſame time by the weight: and this is the manner in which money-jobbers gain by the currency of light money.

It is no argument againſt this expoſition of the matter to ſay, that ſilver bullion is ſeldom bought with ſilver coin; becauſe the pence in new guineas are worth no more than the pence of ſhillings of 65 in the pound troy: that is to ſay, that 240 pence contained in $\frac{20}{21}$ of a new guinea, and 240 pence contained in 28 ſhillings of 65 to the pound troy, differ no more in the intrinſic value than 0.83 of a grain of fine ſilver upon the whole, which is a mere trifle.

Whenever, therefore, ſhillings come below the weight of $\frac{1}{65}$ of a pound troy, then there is an advantage in changing them for new guineas; and when that is the caſe, the new guineas will be melted down, and profit will be found in ſelling them for bullion, upon the principles we have juſt been explaining.

We have already given a ſpecimen of the domeſtic operations of the money-jobbers; but theſe are not the moſt prejudicial to national concerns. The jobbers may be ſuppoſed to be Engliſhmen; and in that caſe the profit they make remains at home: but whenever there is a call for bullion to pay the balance of trade, it is evident that this will be paid in ſilver coin; never in gold, if heavy ſilver can be got; and this again carries away the ſilver coin, and renders it at home ſo rare, that great inconveniences are found for want of the leſſer denominations of it. The loſs, however, here is confined to an inconvenience; becauſe the balance of trade being a debt which muſt be paid, we do not conſider the exportation of the ſilver for that purpoſe as any conſequence of the diſorder of the coin. But beſides this exportation which is neceſſary, there are others which are arbitrary, and which are made only with a view to profit of the wrong proportion.

When the money-jobbers find difficulty in carrying on the traffic we have deſcribed, in the Engliſh market, becauſe of the competition among themſelves, they carry the ſilver coin of the country, and ſell it abroad for gold, upon the ſame principles that the Eaſt India Company ſend ſilver to China in order to purchaſe gold.

It may be demanded, What hurt this trade can do to Britain, ſince thoſe who export ſilver bring back the ſame value in gold? Were this trade carried on by natives, there would be no loſs; becauſe they would bring home gold for the whole intrinſic value of the ſilver. But if we ſuppoſe foreigners ſending over gold to be coined at the Engliſh mint, and changing the gold into Engliſh ſilver coin, and then carrying off this coin, it is plain that they muſt gain the difference, as well as the money-jobbers. But it may be anſwered, That having given gold for ſilver at the rate of the mint, they have given value for what they have received. Very right; but ſo did Sir Hans Sloane, when he paid five guineas for an overgrown toad: he got value for his money; but it was value only to himſelf. Juſt ſo, whenever the Engliſh government ſhall be obliged to reſtore the proportion of the metals (as they muſt do), this operation will annihilate that imaginary value which they have hitherto ſet upon gold; which imagination is the only thing which renders the exchange of their ſilver againſt the foreign gold equal.

But it is farther objected, that foreigners cannot carry off the heavy ſilver; becauſe there is none to carry off. Very true; but then they have carried off a great quantity already: or if the Engliſh Jews have been too ſharp to allow ſuch a profit to fall to ſtrangers, (which may or may not have been the caſe), then this diſorder is an effectual ſtop to any more coinage of ſilver for circulation.

7. *Of the Diſorder in the Britiſh Coin, ſo far as it affects the Value of the Pound Sterling Currency.*

From what has been ſaid, it is evident, that there muſt be found in England two legal pounds ſterling, of different values; the one worth 113 grains of fine gold, the other worth 1718.7 grains of fine ſilver. We call them different: becauſe theſe two portions of the precious metals are of different values all over Europe.

But beſides theſe two different pounds ſterling, which the change in the proportion of the metals has created, the other defects of the circulating coin produce ſimilar effects. The guineas coined by all the princes ſince King Charles II. have been of the ſame ſtandard weight and fineneſs, $44\frac{1}{2}$ in a pound troy of ſtandard gold $\frac{11}{12}$ fine: theſe have been conſtantly wearing ever ſince they have been coined; and in proportion to their wearing they are of leſs value.

If, therefore, the new guineas are below the value of a pound ſterling in ſilver, ſtandard weight, the old muſt be of leſs value ſtill. Here then is another currency, that is, another pound ſterling; or indeed, more properly ſpeaking, there are as many different pounds ſterling as there are guineas of different weights. This is not all; the money-jobbers having carried off all the weighty ſilver, that which is worn with uſe, and reduced even below the ſtandard of gold, forms one currency more, and totally deſtroys all determinate proportion between the money unit and the currencies which are ſuppoſed to repreſent it.

It may be aſked, how, at this rate, any ſilver has remained in England? It is anſwered, that the few weighty ſhillings which ſtill remain in circulation, have marvellouſly eſcaped the hands of the money-jobbers: and as to the reſt, the rubbing and wearing of theſe pieces has done what the ſtate might have done; that is to ſay, it has reduced them to their due proportion with the lighteſt gold.

The diſorder, therefore, of the Engliſh coin has rendered the ſtandard of a pound ſterling quite uncertain. To ſay that it is 1718.7 grains of fine ſilver, is quite ideal. Who are paid in ſuch pounds? To ſay that it is 113 grains of pure gold, may alſo not be true; becauſe there are many currencies worſe than the new guineas.

What then is the conſequence of all this diſorder? What effect has it upon the current value of a pound ſterling? And which way can the value of that be determined?

The operations of trade bring value to an equation, notwithſtanding the greateſt irregularities poſſible; and ſo value over all the world by the means of foreign exchange. This is a kind of ideal ſcale for meaſuring the Britiſh coin, although it has not all the properties of that deſcribed above.

Exchange conſiders the pound ſterling as a value determined according to the combination of the values of all the different currencies, in proportion as payments are made in the one or the other; and as debtors generally take care to pay in the worſt ſpecies they can, it conſequently follows, that the value of the pound ſterling ſhould fall to that of the loweſt currency.

Were there a ſufficient quantity of worn gold and ſilver to acquit all bills of exchange, the pound ſterling would come down to the value of them; but if the new gold be alſo neceſſary for that purpoſe, the value of it muſt be proportionably greater.

All theſe combinations are liquidated and compenſated with one another, by the operations of trade and exchange; and the pound ſterling, which is ſo different in itſelf, becomes thereby, in the eyes of commerce, a determinate unit; ſubject, however, to variations, from which it never can be exempted.

Exchange, therefore, is one of the beſt meaſures for valuing a pound ſterling, preſent currency. Here occurs a queſtion:

Does the great quantity of paper money in England tend to diminiſh the value of the pound ſterling?

We anſwer in the negative. Paper money is juſt as good as gold or ſilver money, and no better. The variation of the ſtandard, as we have already ſaid, muſt influence the intereſts of debtors and creditors proportionally everywhere. From this it follows, that all augmentation of the value of the money unit in the ſpecie muſt hurt the debtors in the paper money; and all diminutions, on the other hand, muſt hurt the creditors in the paper money as well as everywhere elſe. The payments, therefore, made in paper money, never can contribute to the regulation of the ſtandard of the pound ſterling; it is the ſpecie received in liquidation of that paper money which alone can contribute to mark the value of the Britiſh unit; becauſe it is affixed to nothing elſe.

From this we may draw a principle, "That in countries where the money unit is entirely affixed to the coin, the actual value of it is not according to the legal ſtandard of that coin, but according to the mean proportion of the actual worth of thoſe currencies in which debts are paid.

From this we ſee the reaſon why the exchange between England and all other trading towns in Europe has long appeared ſo unfavourable. People calculate the real par, upon the ſuppoſition that a pound ſterling is worth 1718.7 grains troy of fine ſilver, when in fact the currency is not perhaps worth 1638, the value of a new guinea in ſilver, at the market proportion of 1 to 14.5; that is to ſay, the currency is but 95.3 per cent. of the ſilver ſtandard of the 43d of Elizabeth. No wonder then if the exchange be thought unfavourable.

From the principle we have juſt laid down, we may gather a confirmation of what we advanced concerning the cauſe of the advanced price of bullion in the Engliſh market.

When people buy bullion with current money at a determinate price, that operation, in conjunction with the courſe of exchange, ought naturally to mark the actual value of the pound ſterling with great exactneſs.

If therefore the price of ſtandard bullion in the Engliſh market, when no demand is found for the exportation of the metals, that is to ſay, when paper is found for paper upon exchange, and when merchants verſed in theſe matters judge exchange (that is, remittances) to be at par, if then ſilver bullion cannot be bought at a lower price than 65 pence the ounce, it is evident that this bullion might be bought with 65 pence in ſhillings, of which 65 might be coined out of the pound troy Engliſh ſtandard ſilver; ſince 65 per ounce implies 65 ſhillings for the 12 ounces or pound troy.

This plainly ſhows how ſtandard ſilver bullion ſhould ſell for 65 pence the ounce, in a country where the ounce of ſtandard ſilver in the coin is worth no more than 62; and were the market price of bullion to ſtand uniformly at 65 pence per ounce, that would ſhow the value of the pound ſterling to be tolerably fixed. All the heavy ſilver coin is now carried off; becauſe it was intrinſically worth more than the gold it paſſed for in currency. The ſilver therefore which remains is worn down to the market proportion of the metals, as has been ſaid; that is to ſay, 20 ſhillings in ſilver currency are worth 113 grains of fine gold, at the proportion of 1 to 14.5 between gold and ſilver. Now,

as 1 is to 14.5, ſo is 113 to 1638:

ſo the 20 ſhillings current weigh but 1638 grains fine ſilver, inſtead of 1718.7, which they ought to do according to the ſtandard.

Now let us ſpeak of ſtandard ſilver, ſince we are examining how far the Engliſh coin muſt be worn by uſe.

The pound troy contains 5760 grains. This, according to the ſtandard, is coined into 62 ſhillings; conſequently, every ſhilling ought to weigh 92.9 grains. Of ſuch ſhillings it is impoſſible that ever ſtandard bullion ſhould ſell at above 62 pence per ounce. If therefore ſuch bullion ſells for 65 pence, the ſhillings with which it is bought muſt weigh no more than 88.64 grains ſtandard ſilver; that is, they muſt loſe 4.29 grains, and are reduced to $\frac{1}{65}$ of a pound troy.

But it is not neceſſary that bullion be bought with ſhillings: no ſtipulation of price is ever made farther, than at ſo many pence ſterling per ounce. Does not this virtually determine the value of ſuch currency with regard to all the currencies in Europe? Did a Spaniard, a Frenchman, or a Dutchman, know the exact quantity of ſilver bullion which can be bought in the London market for a pound ſterling, would he inform himſelf any farther as to the intrinſic value of that money unit? would he not underſtand the value of it far better from that circumſtance than by the courſe of any exchange, ſince exchange does not mark the intrinſic value of money, but only the value of that money tranſported from one place to another?

The price of bullion, therefore, when it is not influenced by extraordinary demand, (ſuch as for the payment of a balance of trade, or for making an extraordinary proviſion of plate), but when it ſtands at what every body knows to be meant by the common market price, is a very tolerable meaſure of the value of the actual money ſtandard in any country.

If it be therefore true, that a pound ſterling cannot purchaſe above 1638 grains of fine ſilver bullion, it will require not a little logic to prove that it is really, or has been for theſe many years, worth any more; notwithſtanding that the ſtandard weight of it in England is regulated by the laws of the kingdom at 1718.7 grains of fine ſilver.

If to this valuation of the pound ſterling drawn from the price of bullion, we add the other drawn from the courſe of exchange; and by this we find that when paper is found for paper upon exchange, a pound ſterling cannot purchaſe above 1638 grains of fine ſilver in any country in Europe: upon theſe two authorities we may very ſafely conclude (as to the matter of fact at leaſt) that the pound ſterling is not worth more, either in London or in any other trading city; and if this be the caſe, it is juſt worth 20 ſhillings of 65 to the pound troy.

If therefore the mint were to coin ſhillings at that rate, and pay for ſilver bullion at the market price, that is, at the rate of 65 pence per ounce in thoſe new coined ſhillings, they would be in proportion to the gold; ſilver would be carried to the mint equally with gold, and would be as little ſubject to be exported or melted down.

It may be inquired in this place, how far the coining the pound troy into 65 ſhillings is contrary to the laws of England?

The moment a ſtate pronounces a certain quantity of gold to be worth a certain quantity of ſilver, and orders theſe reſpective quantities of each metal to be received as equivalents of each other, and as lawful money in payments, that moment gold is made a ſtandard as much as ſilver. If therefore too ſmall a quantity of gold be ordered or permitted to be conſidered as an equivalent for the unit, the ſilver ſtandard is from that moment debaſed; or indeed, more properly ſpeaking, all ſilver money is from that moment proſcribed; for who, from that time, will ever pay in ſilver, when he can pay cheaper in gold? Gold, therefore, by ſuch a law, is made the ſtandard, and all declarations to the contrary are againſt the matter of fact.

Were the king, therefore, to coin ſilver at 65 ſhillings in the pound, it is demonſtration, that by ſuch an act he would commit no adulteration upon the ſtandard: the adulteration is already committed. The ſtandard has deſcended to where it is by ſlow degrees, and by the operation of political cauſes only; and nothing prevents it from falling lower but the ſtandard of the gold coin. Let guineas be now left to ſeek their value as they did formerly, and let light ſilver continue to go by tale, we ſhall ſee the guineas up at 30 ſhillings in 20 years time, as was the caſe in 1695.

It is as abſurd to ſay that the ſtandard of Queen Elizabeth has not been debaſed by enacting that the Engliſh unit ſhall be acquitted with 113 grains of fine gold, as it would be to affirm that it would not be debaſed from what it is at preſent by enacting that a pound of butter ſhould everywhere be received in payment for a pound ſterling; although the pound ſterling ſhould continue to conſiſt of three ounces, 17 pennyweights, and 10 grains of ſtandard ſilver, according to the ſtatute of the 43d of Elizabeth. In that caſe, moſt debtors would pay in butter; and ſilver would, as at preſent, acquire a conventional value as a metal, but would be looked upon no longer as a ſtandard, or as money.

If therefore, by the law of England, a pound ſterling muſt conſiſt of 1718.7 grains troy of fine ſilver; by the law of England alſo, 113 grains of gold muſt be of the ſame value: but no law can eſtabliſh that proportion; conſequently, in which ever way a reformation be brought about, ſome law muſt be reverſed; conſequently, expediency, and not compliance with law, muſt be the motive in reforming the abuſe.

From what has been ſaid, it is not at all ſurpriſing that the pound ſterling ſhould in fact be reduced nearly to the value of the gold. Whether it ought to be kept at that value is another queſtion. All that we here decide is, that coining the pound troy into 65 ſhillings would reſtore the proportion of the metals, and render both ſpecies common in circulation. But reſtoring the weight and proportion of the coin is not the difficulty which prevents a reformation of the Engliſh coinage.

8. *Circumſtances to be attended to in a New Regulation of the Britiſh Coin.*

To people who do not underſtand the nature of ſuch operations, it may have an air of juſtice to ſupport the unit at what is commonly believed to be the ſtandard of Queen Elizabeth, viz. at 1718.7 grains of fine ſilver.

The regulating the ſtandard of both ſilver and gold to $\frac{11}{12}$ fine, and the pound ſterling to four ounces ſtandard ſilver, as it ſtood during the reign of Queen Mary I. has alſo its advantages, as Mr Harris has obſerved. It makes the crown-piece to weigh juſt one ounce, the ſhilling four pennyweights, and the penny eight grains: conſequently, were the new ſtatute to bear, that the weight of the coin ſhould regulate its currency upon certain occaſions, the having the pieces adjuſted to certain aliquot parts of weight would make weighing eaſy, and would accuſtom the common people to judge of the value of money by its weight, and not by the ſtamp.

In that caſe, there might be a conveniency in ſtriking the gold coins of the ſame weight with the ſilver; becauſe the proportion of their values would then conſtantly be the ſame with the proportion of the metals. The gold crowns would be worth at preſent, 3l. 12s. 6d. the half-crowns 1l. 16s. 3d. the gold ſhillings 14s. 6d. and the half 7s. 3d. This was anciently the practice in the Spaniſh mints.

The intereſts within the ſtate can be nowiſe perfectly protected, but by permitting converſions of value from the old to the new ſtandard, whatever it be, and by regulating the footing of ſuch converſions by act of parliament, according to circumſtances.

For this purpoſe, we ſhall examine thoſe intereſts which will chiefly merit the attention of government, when they form a regulation for the future of acquitting permanent contracts already entered into. Such as may be contracted afterwards will naturally follow the new ſtandard.

The landed intereſt is no doubt the moſt conſiderable in the nation. Let us therefore examine, in the firſt place, what regulations it may be proper to make, in order to do juſtice to this great claſs, with reſpect to the land tax on one hand, and with reſpect to their leſſees on the other.

The valuation of the lands of England was made many years ago, and reaſonably ought to be ſupported at the real value of the pound ſterling at that time, according to the principles already laid down. The general valuation, therefore, of the whole kingdom will riſe according to this ſcheme. This will be conſidered as an injuſtice; and no doubt it would be ſo, if for the future, the land tax be impoſed as heretofore, without attending to this circumſtance; but as that impoſition is annual, as it is laid on by the landed intereſt itſelf, who compoſe the parliament, it is to be ſuppoſed that this great claſs will at leaſt take care of their own intereſt.

Were the valuation of the lands to be ſtated according to the valuation of the pound ſterling of 1718.7 grains of ſilver, which is commonly ſuppoſed to be the ſtandard of Elizabeth, there would be no great injury done: this would raiſe the valuation only 5 per cent. and the land tax in proportion.

There is no claſs of inhabitants in all England ſo much at their eaſe, and ſo free from taxes, as the claſs of farmers. By living in the country, and by conſuming the fruits of the earth without their ſuffering any alienation, they avoid the effect of many exciſes, which, by thoſe who live in corporations, are felt upon many articles of their conſumption, as well as on thoſe which are immediately loaded with theſe impoſitions. For this reaſon it will not, perhaps, appear unreaſonable, if the additional 5 per cent. on the land tax were thrown upon this claſs, and not upon the landlords.

With reſpect to leaſes, it may be obſerved, that we have gone upon the ſuppoſition that the pound ſterling in the year 1728 was worth 1718.7 grains of fine ſilver, and 113 grains of fine gold.

There would be no injuſtice done the leſſees of all the lands in the kingdom, were their rents to be fixed at the mean proportion of theſe values. We have obſerved how the pound ſterling has been gradually diminiſhing in its worth from that time by the gradual riſe of the ſilver. This mean proportion, therefore, will nearly anſwer to what the value of the pound ſterling was in 1743; ſuppoſing the riſe of the ſilver to have been uniform.

It may be farther alleged in favour of the landlords, that the gradual debaſement of the ſtandard has been more prejudicial to their intereſt in letting their lands, than to the farmers in diſpoſing of the fruits of them. Proprietors cannot ſo eaſily raiſe their rents upon new leaſes, as farmers can raiſe the prices of their grain according to the debaſement of the value of the currency.

The pound ſterling, thus regulated at the mean proportion of its worth, as it ſtands at preſent, and as it ſtood in 1728, may be realized in 1678.6 grains of fine ſilver, and 115.76 grains fine gold; which is 2.4 per cent. above the value of the preſent currency. No injury, therefore, would be done to leſſees, and no unreaſonable gain would accrue to the landed intereſt, in appointing converſions of all land rents at 2½ per cent. above the value of the preſent currency.

Without a thorough knowledge of every circumſtance relating to Great Britain, it is impoſſible to lay down any plan. It is ſufficient here briefly to point out the principles upon which it muſt be regulated.

The next intereſt to be conſidered is that of the nation's creditors. The right regulation of their concerns will have a conſiderable influence in eſtabliſhing public credit upon a ſolid baſis, by making it appear to all the world, that no political operation upon the money of Great Britain can in any reſpect either benefit or prejudice the intereſt of thoſe who lend their money upon the faith of the nation. The regulating alſo the intereſt of ſo great a body, will ſerve as a rule for all creditors who are in the ſame circumſtances, and will upon other accounts be productive of greater advantages to the nation in time coming.

In 1749, a new regulation was made with the public creditors, when the intereſt of the whole redeemable national debt was reduced to 3 per cent. This circumſtance infinitely facilitates the matter with reſpect to this claſs, ſince, by this innovation of all former contracts, the whole national debt may be conſidered as contracted at, or poſterior to, the 25th December 1749.

Were the ſtate, by an arbitrary operation upon money (which every reformation muſt be), to diminiſh the value of the pound ſterling in which the parliament at that time bound the nation to acquit thoſe capitals and the intereſt upon them, would not all Europe ſay, That the Britiſh parliament had defrauded their creditors? If therefore the operation propoſed to be performed ſhould have a contrary tendency, viz. to augment the value of the pound ſterling with which the parliament at that time bound the nation to acquit thoſe capitals and intereſts, muſt not all Europe alſo agree, That the Britiſh parliament had defrauded the nation?

The convention with the ancient creditors of the ſtate, who, in conſequence of the debaſement of the ſtandard, might have juſtly claimed an indemnification for the loſs upon their capitals, lent at a time when the pound ſterling was at the value of the heavy ſilver, removes all cauſes of complaint from that quarter. There was in the year 1749 an innovation in all their contracts; and they are now to be conſidered as creditors only from the 25th of December of that year.

Let the value of the pound ſterling be inquired into during one year preceding and one poſterior to the tranſaction of the month of December 1749. The great ſums borrowed and paid back by the nation during that period, will furniſh data ſufficient for that calculation. Let this value of the pound be ſpecified in troy grains of fine ſilver and fine gold bullion, without mentioning any denomination of money according to the exact proportion of the metals at that time. And let this pound be called the *pound of national credit*.

This firſt operation being determined, let it be enacted, that the pound ſterling, by which the ſtate is to borrow for the future, and that in which the creditors are to be paid, ſhall be the exact mean proportion between the quantities of gold and ſilver above ſpecified, according to the actual proportion of the metals at the time ſuch payments ſhall be made: or that the ſums ſhall be borrowed or acquitted, one half in gold and one half in ſilver, at the reſpective requiſitions of the creditors or of the ſtate, when borrowing. All debts contracted poſterior to 1749 may be made liable to converſions.

The conſequence of this regulation will be the inſenſible eſtabliſhment of a bank money. Nothing would be more difficult to eſtabliſh, by a poſitive revolution, than ſuch an invariable meaſure; and nothing will be found ſo eaſy as to let it eſtabliſh itſelf by its own advantages. This bank money will be liable to much fewer inconveniencies that that of Amſterdam. There the perſons tranſacting muſt be upon the ſpot; here, the ſterling currency may, every quarter of a year, be adjuſted by the exchequer to this invariable ſtandard, for the benefit of all debtors and creditors who incline to profit of the ſtability of this meaſure of value.

This ſcheme is liable to no inconvenience from the variation of the metals, let them be ever ſo frequent or hard to be determined; becauſe upon every occaſion where there is the ſmalleſt doubt as to the actual proportion, the option competent to creditors to be paid half in ſilver and half in gold will remove.

Such a regulation will alſo have this good effect, that it will give the nation more juſt ideas of the nature of money, and conſequently of the influence it ought to have upon prices.

If the value of the pound ſterling ſhall be found to have been by accident leſs in December 1749 than it is at preſent; or if at preſent the currency be found below what it has commonly been ſince 1749; in juſtice to the creditors, and to prevent all complaints, the nation may grant them the mean proportion of the value of the pound ſterling from 1749 to 1760, or any other which may to parliament appear reaſonable.

This regulation muſt appear equitable in the eyes of all Europe; and the ſtrongeſt proof of it will be, that it will not produce the ſmalleſt effect prejudicial to the intereſt of the foreign creditors. The courſe of exchange with regard to them will ſtand preciſely as before.

A Dutch, French, or German creditor, will receive the ſame value for his intereſt in the Engliſh ſtocks as heretofore. This muſt ſilence all clamours at home, being the moſt convincing proof, that the new regulation of the coin will have made no alteration upon the real value of any man's property, let him be debtor or creditor.

The intereſt of every other denomination of creditors, whoſe contracts are of a freſh date, may be regulated upon the ſame principles. But where debts are of an old ſtanding, juſtice demands, that attention be had to the value of money at the time of contracting. Nothing but the ſtability of the Engliſh coin, when compared with that of other nations, can make ſuch a propoſal appear extraordinary. Nothing is better known in France than this ſtipulation added to obligations, *Argent au cours de ce jour;* that is to ſay, That the ſum ſhall be paid in coin of the ſame intrinſic value with what has been lent. Why ſhould ſuch a clauſe be thought reaſonable for guarding people againſt arbitrary operations upon the numerary value of the coin, and not be found juſt upon every occaſion where the numerary value of it is found to be changed, let the cauſe be what it will?

The next intereſt we ſhall examine is that of trade. When men have attained the age of 21, they have no more occaſion for guardians. This may be applied to traders; they can parry with their pen every inconvenience which may reſult to other people from the changes upon money, provided only the laws permit them to do themſelves juſtice with reſpect to their engagements. This claſs demands no more than a right to convert all reciprocal obligations into denominations of coin of the ſame intrinſic value with thoſe they have contracted in.

The next intereſt is that of buyers and ſellers; that is, of manufacturers with regard to conſumers, and of ſervants with reſpect to thoſe who hire their perſonal ſervice.

The intereſt of this claſs requires a moſt particular attention. They muſt, literally ſpeaking, be put to ſchool, and taught the firſt principles of their trade, which is buying and ſelling. They muſt learn to judge of price by the grains of ſilver and gold they receive: they are children of a mercantile mother, however warlike the father's diſpoſition. If it be the intereſt of the ſtate that their bodies be rendered robuſt and active, it is no leſs the intereſt of the ſtate that their minds be inſtructed in the firſt principles of the trade they exerciſe.

For this purpoſe, tables of converſion from the old ſtandard to the new muſt be made, and ordered to be put up in every market, in every ſhop. All duties, all exciſes, muſt be converted in the ſame manner. Uniformity muſt be made to appear everywhere. The ſmalleſt deviation from this will be a ſtumbling block to the multitude.

Not only the intereſt of the individuals of the claſs we are at preſent conſidering, demands the nation's care and attention in this particular; but the proſperity of trade, and the wellbeing of the nation, are alſo deeply intereſted in the execution.

The whole delicacy of the intricate combinations of commerce depends upon a juſt and equable vibration of prices, according as circumſtances demand it. The more, therefore, the induſtrious claſſes are inſtructed in the principles which influence prices, the more eaſily will the machine move. A workman then learns to ſink his price without regret, and can raiſe it without avidity. When principles are not underſtood, prices cannot gently fall, they muſt be pulled down; and merchants dare not ſuffer them to riſe, for fear of abuſe, even although the perfection of an infant manufacture ſhould require it.

The laſt intereſt is that of the bank of England, which naturally muſt regulate that of every other.

Had this great company followed the example of other banks, and eſtabliſhed a bank-money of an invariable ſtandard as the meaſure of all their debts and credits, they would not have been liable to any inconvenience upon a variation of the ſtandard.

The bank of England was projected about the year 1694, at a time when the current money of the nation was in the greateſt diſorder, and government in the greateſt diſtreſs both for money and for credit. Commerce was then at a very low ebb; and the only, or at leaſt the moſt profitable, trade of any, was jobbing in coin, and carrying backwards and forwards the precious metals from Holland to England. Merchants profited alſo greatly from the effects which the utter diſorder of the coin produced upon the price of merchandiſe.

At ſuch a juncture the reſolution was taken to make a new coinage; and upon the proſpect of this, a company was found, who, for an excluſive charter to hold a bank for 13 years, willingly lent the government upwards of a million ſterling at 8 per cent. (in light money we ſuppoſe), with a proſpect of being repaid both intereſt and capital in heavy. This was not all: part of the money lent was to be applied for the eſtabliſhment of the bank; and no leſs than 4000l. a-year was allowed to the company, above the full intereſt, for defraying the charge of the management.

Under ſuch circumſtances the introduction of bank-money was very ſuperfluous, and would have been very impolitic. That invention is calculated againſt the raiſing of the ſtandard: but here the bank profited of that riſe in its quality of creditor for money lent; and took care not to commence debtor by circulating their paper until the effect of the new regulation took place in 1695; that is, after the general re-coinage of all the clipped ſilver.

From that time till now, the bank of England has been the baſis of the nation's credit, and with great reaſon has been conſtantly under the moſt intimate protection of every miniſter.

The value of the pound ſterling, as we have ſeen, has been declining ever ſince the year 1601, the ſtandard being fixed to ſilver during all that century, while the gold was conſtantly riſing. No ſooner had the proportion taken another turn, and ſilver begun to riſe, than the government of England threw the ſtandard virtually upon the gold, by regulating the value of the guineas at the exact proportion of the market. By theſe operations, however, the bank has conſtantly been a gainer (in its quality of debtor) upon all the paper in circulation; and therefore has loſt nothing by not having eſtabliſhed a bank-money.

The intereſt of this great company being eſtabliſhed upon the principles we have endeavoured to explain, it is very evident, that the government of England never will take any ſtep in the reformation of the coin which in its conſequences can prove hurtful to the bank. Such a ſtep would be contrary both to juſtice and to common ſenſe. To make a regulation which, by raiſing the ſtandard, would prove beneficial to the public creditors, to the prejudice of the bank (which we may call the *public debtor*), would be an operation upon public credit like that of a perſon who is at great pains to ſupport his houſe by props on all ſides, and who at the ſame time blows up the foundation of it with gunpowder.

We may therefore conclude, that with regard to the bank of England, as well as every other private banker, the notes which are conſtantly payable upon demand muſt be made liable to a converſion at the actual value of the pound ſterling at the time of the new regulation.

That the bank will gain by this, is very certain; but the circulation of their notes is ſo ſwift, that it would be abſurd to allow to the then poſſeſſors of them that indemnification which naturally ſhould be ſhared by all thoſe through whoſe hands they have paſſed, in proportion to the debaſement of the ſtandard during the time of their reſpective poſſeſſion.

Beſides theſe conſiderations, which are in common to all ſtates, the government of Great Britain has one peculiar to itſelf. The intereſt of the bank, and that of the creditors, are diametrically oppoſite; every thing which raiſes the ſtandard hurts the bank; every thing which can ſink it hurts the creditors: and upon the right management of the one and the other, depends the ſolidity of public credit. For theſe reaſons, without the moſt certain proſpect of conducting a reſtitution of the ſtandard to the general advantage as well as approbation of the nation, no miniſter will probably ever undertake ſo dangerous an operation.

We ſhall now propoſe an expedient which may remove at leaſt ſome of the inconveniences which would reſult from ſo extenſive an undertaking as that of regulating the reſpective intereſts in Great Britain by a poſitive law, upon a change in the value of their money of account.

Suppoſe then, that, before any change is made in the coin, government ſhould enter into a tranſaction with the public creditors, and aſcertain a permanent value for the pound ſterling for the future, ſpecified in a determined proportion of the fine metals in common bullion, without any regard to money of account, or to any coin whatever.

This preliminary ſtep being taken, let the intended alteration of the ſtandard be proclaimed a certain time before it is to commence. Let the nature of the change be clearly explained, and let all ſuch as are engaged in contracts which are diſſolvable at will upon the preſtations ſtipulated, be acquitted between the parties, or innovated as they ſhall think proper; with certification, that, poſterior to a certain day, the ſtipulations formerly entered into ſhall be binding according to the denominations of the money of account in the new ſtandard.

As to permanent contracts, which cannot at once be fulfilled and diſſolved, ſuch as leaſes, the parliament may either preſcribe the methods and terms of converſion; or a liberty may be given to the parties to annul the contract, upon the debtor's refuſing to perform his agreement according to the new ſtandard. Contracts, on the other hand, might remain ſtable, with reſpect to creditors who would be ſatisfied with payments made on the footing of the old ſtandard. If the riſe intended ſhould not be very conſiderable, no great injuſtice can follow ſuch a regulation.

Annuities are now thoroughly underſtood, and the value of them is brought to ſo nice a calculation, that nothing will be eaſier than to regulate theſe upon the footing of the value paid for them, or of the ſubject affected by them. If by the regulation, land rents are made to riſe in denomination, the annuities charged upon them ought to riſe in proportion; if in intrinſic value, the annuity ſhould remain as it was.

9. *Regulations which the Principles of this Inquiry point out as expedient to be made by a new Statute for regulating the Britiſh Coin.*

Let us now examine what regulations it may be proper to make by a new ſtatute concerning the coin of Great Britain, in order to preſerve always the ſame exact value of the pound ſterling realized in gold and in ſilver, in ſpite of all the incapacities inherent in the metals to perform the functions of an invariable ſcale or meaſure of value.

1. The firſt point is to determine the exact number of grains of fine gold and fine ſilver which are to compoſe it, according to the then proportion of the metals in the London market.

2. To determine the proportion of theſe metals with the pound troy; and in regard that the ſtandard of gold and ſilver is different, let the mint price of both metals be regulated according to the pound troy fine.

3. To fix the mint price within certain limits; that is to ſay, to leave to the king and council, by proclamation, to carry the mint price of bullion up to the value of the coin, as is the preſent regulation, or to ſink it to per cent. below that price, according as government ſhall incline to impoſe a duty upon coinage.

4. To order, that ſilver and gold coin ſhall be ſtruck of ſuch denominations as the king ſhall think fit to appoint; in which the proportion of the metals above determined ſhall be conſtantly obſerved through every denomination of the coin, until neceſſity ſhall make a new general coinage unavoidable.

5. To have the number of grains of the fine metal in every piece marked upon the exergue, or upon the legend of the coin, in place of ſome initial letters of titles, which not one perſon in a thouſand can decypher; and to make the coin of as compact a form as poſſible, diminiſhing the ſurface of it as much as is conſiſtent with beauty.

6. That it ſhall be lawful for all contracting parties to ſtipulate their payments either in gold or ſilver coin, or to leave the option of the ſpecies to one of the parties.

7. That where no particular ſtipulation is made, creditors ſhall have power to demand payment, half in one ſpecies, half in the other; and when the ſum cannot fall equally into gold and ſilver coins, the fractions to be paid in ſilver.

8. That in buying and ſelling, when no particular ſpecies has been ſtipulated, and when no act in writing has intervened, the option of the ſpecies ſhall be competent to the buyer.

9. That all ſums paid or received by the king's receivers, or by bankers, ſhall be delivered by weight, if demanded.

10. That all money which ſhall be found under the legal weight, from whatever cauſe it may proceed, may be rejected in every payment whatſoever; or if offered in payment of a debt above a certain ſum, may be taken according to its weight, at the then mint price, in the option of the creditor.

11. That no penalty ſhall be incurred by thoſe who melt down or export the nation's coin; but that waſhing, clipping, or diminiſhing the weight of any part of it ſhall be deemed felony, as much as any other theft, if the perſon ſo degrading the coin ſhall afterwards make it circulate for lawful money.

To prevent the inconveniencies proceeding from the variation in the proportion between the metals, it may be provided,

12. That upon every variation of proportion in the market price of the metals, the price of both ſhall be changed, according to the following rule:

Let the price of the pound troy fine gold in the coin be called *G*.

Let the price of ditto in the ſilver be called *S*.

Let the new proportion between the market price of the metals be called *P*.

Then ſtate this formula:

$$\frac{G}{2P} + \frac{S}{2} = \text{to a pound troy fine ſilver, in ſterling currency.}$$

$$\frac{S}{2} + P + \frac{G}{2} = \text{to a pound troy fine gold, in ſterl. currency.}$$

This will be a rule for the mint to keep the price of the metals conſtantly at par with the price of the market; and coinage may be impoſed, as has been deſcribed, by fixing the mint price of them at a certain rate below the value of the fine metals in the coin.

13. As long as the variation of the market-price of the metals ſhall not carry the price of the riſing metal ſo high as the advanced price of the coin above the bullion, no alteration need be made on the denomination of either ſpecies.

14. So ſoon as the variation of the market price of the metals ſhall give a value to the riſing ſpecies, above the difference between the coin and the bullion; then the king ſhall alter the denominations of all the coin, ſilver and gold, adding to the coins of the riſing metal exactly what is taken from thoſe of the other. An example will make this plain:

Let us ſuppoſe that the coinage has been made according to the proportion of 14.5 to 1; that 20 ſhillings, or 4 crown-pieces, ſhall contain, in fine ſilver, 14.5 times as many grains as the guinea, or the gold pound, ſhall contain grains of fine gold. Let the new proportion of the metals be ſuppoſed to be 14 to 1. In that caſe, the 20 ſhillings, or the 4 crowns, will contain $\frac{1}{29}$ more value than the guinea. Now ſince there is no queſtion of making a new general coinage upon every variation, in order to adjuſt the proportion of the metals in the weight of the coins, that proportion might be adjuſted by changing their reſpective denominations according to this formula:

Let the 20 ſhillings, or 4 crowns, in coin, be called *S*. Let the guinea be called *G*. Let the difference between the old proportion and the new, which is $\frac{1}{29}$ be called *P*. Then ſay,

$$S - \frac{P}{2} - = \text{a pound ſterling, and } G + \frac{P}{2} = \text{a pound ſterl.}$$

By this it appears that all the ſilver coin muſt be raiſed in its denomination $\frac{1}{58}$, and all the gold coin muſt be lowered in its denomination $\frac{1}{58}$; yet ſtill S + G will be equal to two pounds ſterling, as before, whether they be conſidered according to the old or according to the new denominations.

But it may be obſerved, that the impoſition of coinage rendering the value of the coin greater than the value

value of the bullion, that circumſtance gives a certain latitude in fixing the new denominations of the coin, ſo as to avoid minute fractions. For, providing the deviation from the exact proportion ſhall fall within the advanced price of the coin, no advantage can be taken by melting down one ſpecies preferably to another; ſince, in either caſe, the loſs incurred by melting the coin muſt be greater than the profit made upon ſelling the bullion. The mint price of the metals, however, may be fixed exactly, that is, within the value of a farthing upon a pound of fine ſilver or gold. This is eaſily reckoned at the mint; although upon every piece in common circulation the fractions of farthings would be inconvenient.

15. That notwithſtanding of the temporary variations made upon the denomination of the gold and ſilver coins, all contracts formerly entered into, and all ſtipulations in pounds, ſhillings, and pence, may continue to be acquitted according to the old denominations of the coins, paying one-half in gold and one-half in ſilver: unleſs in the caſe where a particular ſpecies has been ſtipulated; in which caſe, the ſums muſt be paid according to the new regulation made upon the denomination of that ſpecies to the end that neither profit or loſs may reſult to any of the parties.

16. That notwithſtanding the alterations on the mint price of the metals, and in the denomination of the coins, no change ſhall be made upon the weight of the particular pieces of the latter, except in the caſe of a general re-coinage of one denomination at leaſt: that is to ſay, the mint muſt not coin new guineas, crowns, &c. of a different weight from thoſe already in currency, although by ſo doing the fractions might be avoided. This would occaſion confuſion, and the remedy would ceaſe to be of any uſe upon a new change in the proportion of the metals. But it may be found convenient, for removing the ſmall fractions in ſhillings and ſixpences, to recoin ſuch denominations altogether, and to put them to their integer numbers of twelve and of ſix pence, without changing in any reſpect their proportion of value to all other denominations of the coin: this will be no great expence, when the bulk of the ſilver coin is put into 5 ſhilling pieces.

By this method of changing the denomination of the coin, there never can reſult any alteration in the value of the pound ſterling; and although fractions of value may now and then be introduced, in order to prevent the abuſes to which the coin would otherwiſe be expoſed by the artifice of thoſe who melt it down, yet ſtill the inconvenience of ſuch fractions may be avoided in paying, according to the old denominations, in both ſpecies, by equal parts. This will alſo prove demonſtratively, that no change is thereby made in the true value of the national unit of money.

17. That it be ordered, that ſhillings and ſixpences ſhall only be current for 20 years; and all other coins, both gold and ſilver, for 40 years, or more. For aſcertaining which term, there may be marked, upon the exergue of the coin, the laſt year of their currency, in place of the date of their fabrication. This term elapſed, or the date effaced, that they ſhall have no more currency whatſoever; and, when offered in payment, may be received as bullion at the actual price of the mint, or refuſed, at the option of the creditor.

18. That no foreign coin ſhall have any *legal* currency, except as bullion at the mint price.

By theſe and the like regulations may be prevented, *1mo*, The melting or exporting of the coin in general. *2do*, The melting or exporting one ſpecies, in order to ſell it as bullion at an advanced price. *3tio*, The profit in acquitting obligations preferably in one ſpecies to another. *4to*, The degradation of the ſtandard, by the wearing of the coin, or by a change in the proportion between the metals. *5to*, The circulation of the coin below the legal weight. *6to*, The profit that other nations reap by paying their debts more cheaply to Great Britain than Great Britain can pay her's to them.

And the great advantage of it is, that it is an uniform plan, and may ſerve as a perpetual regulation, compatible with all kinds of denominations of coins, variations in the proportion of the metals, and with the impoſition of a duty upon coinage, or with the preſerving it free; and further, that it may in time be adopted by other nations, who will find the advantage of having their money of account preſerved perpetually at the ſame value, with reſpect to the denominations of all foreign money of account eſtabliſhed on the ſame principles.——But for a fuller diſcuſſion of this ſubject we muſt refer our readers to Mr Wheatley's Eſſay on the Theory of Money and Principles of Commerce. London 1807; and to a Treatiſe on the Coins of the Realm, in a letter to the king, by the Earl of Liverpool, London 1805.

A TABLE

A TABLE OF COINS,

Showing the Quantity of Fine Metal contained in them.

The number of grains of fine metal in every coin is ſought for in the regulations of the mint of the country where it is coined, and is expreſſed in the grains in uſe in that mint. From that weight it is converted into thoſe of other countries according to the following proportions:

3840 Troy grains, 4676.35 Paris grains, 5192.8 Holland aces or grains, and 4649.06 Colonia grains, are ſuppoſed to be equal weights; and the coins in the Table are converted according to thoſe proportions.

TABLE of COINS reduced to Grains of fine Metal according to the Troy, Paris, Colonia, and Holland weights.

		GOLD COINS.				SILVER COINS.			
		Troy.	Paris.	Colonia	Holland.	Troy.	Paris.	Colonia.	Holland.
English Coins.	1 A Guinea by ſtatute	118.651	144.46	143.65	160.45				
	2 A Crown by ſtatute	— —	— —	— —	— —	429.68	523.2	520.2	581.
	3 A ſhilling by ſtatute	— —	— —	— —	— —	85.935	104.65	104.	116.2
	4 A Silver Pound Sterling by ſtatute 1601	— —	— —	— —	— —	1718.7	2093.	2080.8	2324.1
	5 A Gold Pound Sterling by ſtatute 1728	113.	137.61	136.8	152.8				
	6 A Silver Pound Sterling in currency=$\frac{20}{65}$lb. Troy	— —	— —	— —	— —	1639.38	1996.4	1984.7	2216.
	7 A Silver Pound Sterling at the proportion of gold to ſilver as 1 to 14½	113.	137.61	136.8	152.8	1638.5	1995.3	1983.7	2215.7
	8 A Gold Pound Sterling at the ſame proportion of 1 to 14½	118.4	144.18	143.34	160.11	1718.7	2093.	2080.8	2324.1
	9 A Pound Sterling at the mean proportion in gold and in ſilver	115.769	140.98	140 16	156.55	1678.6	2044.2	2032.2	2269.9
	10 A Shilling current=$\frac{1}{65}$ of a pound Troy	— —	— —	— —	— —	81.961	99.8	99.	110.82
	11 A Guinea in Silver or 21 Shillings ſtandard weight	— —	— —	— —	— —	1804.6	2197.6	2184.8	2440.3
	12 A Guinea at the proportion of 1 to 14½, worth in ſilver	— —	— —	— —	— —	1720.4	2095.1	2082.8	2326.4
	13 A Pound Troy, or 12 ounces Engliſh weight	5760.	7019.2	6973.5	7789.2				
French Coins.	1 A Louis d'or	113.27	137.94	137.13	153.17				
	2 A Crown of ſix livres	— —	— —	— —	— —	409.94	499.22	496.3	554.3
	3 A Crown of three ditto	— —	— —	— —	— —	204.97	249.61	248.15	277.1
	4 A Livre	— —	— —	— —	— —	68.34	83.23	82.74	92.42
	5 A Louis d'or, or 24 livres in ſilver	— —	— —	— —	— —	1639.7	1996.9	1985.2	2217.4
	6 A Marc of Paris weight, fine gold or ſilver	3783.87	4608.	4581.1	5116.9	3783.87	4608.	4581.1	5116.9
	7 A Marc of gold coin effective weight, in fine	3398.3	4138.5	4114.3	4593.4				
	8 A Marc of ſilver coin effective weight, in fine	— —	— —	— —	— —	3402.3	4143.4	4119.2	4600.9
German Coins.	1 Carolin legal weight	115.45	140.6	139.78	156.12				
	2 A Ducat of the Empire ditto	52.8	64.37	64.	71.48				
	3 A Florin of Convention	— —	— —	— —	— —	179.73	218.87	217.6	243.
	4 A Dollar of Convention	— —	— —	— —	— —	269.59	328.31	326.4	364.5
	5 A Dollar of Exchange, the Carolin= 9 flor. 42 kreutzers	17.85	21.74	21.615	24.14				
	6 A Florin current=$\frac{1}{11}$ of a Carolin	10.54	12.84	12.77	14.26				
	7 A Carolin in ſilver, at the proportion of 1 to 14½	— —	— —	— —	— —	1674.	2038.6	2026.8	2263.8
Dutch Coins.	1 Dutch Ducat	51.76	6.3	62.67	70.				
	2 A Florin in Silver	— —	— —	— —	— —	148.	180.3	179.2	200.21

UNIVERSAL TABLE

Of the preſent State of the REAL and IMAGINARY MONEYS of the WORLD.

† This mark is prefixed to the Imaginary Money, or Money of Account.

All Fractions in the Value Engliſh are Parts of a PENNY.

= This mark ſignifies *is*, *make*, or *equal to*.

ENGLAND AND SCOTLAND.

London, *Briſtol*, *Liverpool*, &c.
Edinburgh, *Glaſgow*, *Aberdeen*, &c.

		£.	s.	d.
A Farthing	- - -	0	0	$0\frac{1}{4}$
2 Farthings	= a Halfpenny	0	0	$0\frac{1}{2}$
2 Halfpence	a Penny	0	0	1
4 Pence	a Groat	0	0	4
6 Pence	a Half Shilling	0	0	6
12 Pence	a Shilling	0	1	0
5 Shillings	a Crown	0	5	0
20 Shillings	† a Pound Sterling	1	0	0
21 Shillings	a Guinea	1	1	0

IRELAND.

Dublin, *Cork*, *Londonderry*, &c.

A Farthing	- - -	0	0	$0\frac{3}{13}$
2 Farthings	= a Halfpenny	0	0	$0\frac{6}{13}$
2 Halfpence	a Penny	0	0	$0\frac{12}{13}$
$6\frac{1}{2}$ Pence	a Half Shilling	0	0	6
12 Pence	† a Shilling Iriſh	0	0	$11\frac{3}{40}$
13 Pence	a Shilling	0	1	0
65 Pence	a Crown	0	5	0
20 Shillings	† a Pound Iriſh	0	18	$5\frac{1}{2}$
$22\frac{3}{4}$ Shillings	a Guinea	1	1	0

FLANDERS AND BRABANT.

Ghent, *Oſtend*, &c. *Antwerp*, *Bruſſels*, &c.

† A Pening	- - -	0	0	$0\frac{9}{160}$
4 Peningens	= an Urche	0	0	$0\frac{4}{90}$
8 Peningens	† a Grote	0	0	$0\frac{9}{20}$
2 Grotes	a Petard	0	0	$0\frac{9}{10}$
6 Petards	† a Scalin	0	0	$5\frac{2}{5}$
7 Petards	a Scalin	0	0	$9\frac{3}{10}$
40 Grotes	† a Florin	0	1	6
$17\frac{1}{2}$ Scalins	a Ducat	0	9	3
240 Grotes	† a Pound Flem.	0	9	0

HOLLAND AND ZEALAND.

Amſterdam, *Rotterdam*, *Middleburg*, *Fluſhing*, &c.

† A Pening	- - -	0	0	$0\frac{21}{320}$
8 Peningens	= † a Grote	0	0	$0\frac{21}{40}$
2 Grotes	a Stiver	0	0	$1\frac{1}{20}$
6 Stivers	a Scalin	0	0	$6\frac{3}{10}$
20 Stivers	a Guilder	0	1	9
50 Stivers	a Rixdollar	0	4	$4\frac{1}{4}$

HOLLAND, &c.

		£.	s.	d.
60 Stivers	= a Dry Guilder	0	5	3
105 Stivers	a Ducat	0	9	3
6 Guilders	† a Pound Flem.	0	10	6

EUROPE, Northern Parts.

GERMANY.

HAMBURG. *Altona*, *Lubec*, *Bremen*, &c.

† A Trying	= - -	0	0	$0\frac{3}{128}$
2 Trylings	† a Sexling	0	0	$0\frac{3}{64}$
2 Sexlings	a Fening	0	0	$0\frac{3}{32}$
12 Fenings	a Shilling Lub.	0	0	$1\frac{1}{8}$
16 Shillings	† a Marc	0	1	6
2 Marcs	a Slet Dollar	0	3	0
3 Marcs	a Rixdollar	0	4	6
$6\frac{1}{4}$ Marcs	a Ducat	0	9	$4\frac{1}{2}$
120 Shillings	† a Pound Flem.	0	11	3

HANOVER. *Lunenburg*, *Zell*, &c.

† A Fening	= - - -	0	0	$0\frac{7}{48}$
3 Fenings	a Dreyer	0	0	$0\frac{7}{16}$
8 Fenings	a Marien	0	0	$0\frac{1}{6}$
12 Fenings	a Groſh	0	0	$0\frac{3}{4}$
8 Groſhen	a Half Gulden	0	1	2
16 Groſhen	a Gulden	0	2	4
24 Groſhen	† a Rixdollar	0	3	6
32 Groſhen	a Double Gulden	0	4	8
4 Guldens	a Ducat	0	9	2

SAXONY AND HOLSTEIN.

Dreſden, *Leipſic*, &c. *Wiſmar*, *Keil*, &c.

† An Heller	= - - -	0	0	$0\frac{7}{96}$
2 Hellers	a Fening	0	0	$0\frac{7}{48}$
6 Hellers	a Dreyer	0	0	$0\frac{7}{16}$
16 Hellers	a Marien	0	0	$1\frac{1}{6}$
12 Fenings	a Groſh	0	0	$1\frac{3}{4}$
16 Groſhen	a Gould	0	2	4
24 Groſhen	† a Rixdollar	0	3	6
32 Groſhen	a Specie Dollar	0	4	8
4 Goulds	a Ducat	0	9	4

BRANDENBURG AND POMERANIA.

Berlin, *Potſdam*, &c. *Stetin*, &c.

† A Denier	= - - -	0	0	$0\frac{2}{270}$
9 Deniers	a Polchen	0	0	$0\frac{7}{30}$
18 Deniers	a Groſh	0	0	$0\frac{7}{15}$
3 Polchens	an Abraſs	0	0	$0\frac{7}{10}$
20 Groſhen	† a Marc	0	0	$9\frac{1}{3}$

EUROPE, Northern Parts.

GERMANY.

BRANDENBURG, &c.

		£.	s.	d.
30 Groſhen	a Florin	0	1	2
90 Groſhen	†a Rixdollar	0	3	6
108 Groſhen	an Albertus	0	4	2
8 Florins	a Ducat	0	9	4

COLOGN. *Mentz, Triers, Liege, Munich, Munſter, Paderbourn,* &c.

A Dute		0	0	$0\frac{7}{80}$
3 Dutes =	a Cruitzer	0	0	$0\frac{21}{80}$
2 Cruitzers	an Albus	0	0	$0\frac{21}{40}$
8 Dutes	a Stiver	0	0	$0\frac{7}{10}$
3 Stivers	a Plapert	0	0	$2\frac{1}{10}$
4 Plaperts	a Copſtuck	0	0	$2\frac{2}{5}$
40 Stivers	a Guilder	0	2	4
2 Guilders	a Hard Dollar	0	4	8
4 Guilders	a Ducat	0	9	4

BOHEMIA, SILESIA, AND HUNGARY.
Prague, Breſlaw, Preſburg, &c.

A Fening		0	0	$0\frac{7}{80}$
2 Fenings =	a Dreyer	0	0	$0\frac{3}{30}$
3 Fenings	a Groſh	0	0	$0\frac{7}{20}$
4 Fenings	a Cruitzer	0	0	$0\frac{7}{15}$
2 Cruitzers	a White Groſh	0	0	$0\frac{14}{15}$
60 Cruitzers	a Gould	0	2	4
90 Cruitzers	†a Rixdollar	0	3	6
2 Goulds	a Hard Dollar	0	4	8
4 Goulds	a Ducat	0	9	4

AUSTRIA AND SWABIA.
Vienna, Trieſte, &c. *Augſburg, Blenheim,* &c.

A Fening		0	0	$0\frac{7}{80}$
2 Fenings =	a Dreyer	0	0	$0\frac{7}{30}$
4 Fenings	a Cruitzer	0	0	$0\frac{7}{15}$
14 Fenings	a Groſh	0	0	$0\frac{19}{30}$
4 Cruitzers	a Batzen	0	0	$1\frac{13}{15}$
15 Batzen	a Gould	0	2	4
90 Cruitzers	†a Rixdollar	0	3	6
30 Batzen	a Specie dollar	0	4	8
60 Batzen	a Ducat	0	9	4

FRANCONIA. *Francfort, Nuremburg, Dettingen,* &c.

A Fening		0	0	$0\frac{7}{80}$
4 Fenings	a Cruitzer	0	0	$0\frac{7}{15}$
3 Cruitzers	a Keyſer Groſh	0	0	$1\frac{2}{5}$
4 Cruitzers	a Batzen	0	0	$1\frac{13}{15}$
15 Cruitzers	an Ort Gould	0	0	7
16 Cruitzers	a Gould	0	2	4
90 Cruitzers	†a Rixdollar	0	3	6
2 Goulds	a Hard Dollar	0	4	8
240 Cruitzers	a Ducat	0	9	4

POLAND AND PRUSSIA.
Cracow, Warſaw, &c. *Dantzic, Koningſberg,* &c.

A Shelon		0	0	$0\frac{7}{45}$
3 Shelons =	a Groſh	0	0	$0\frac{7}{15}$
5 Groſhen	a Couſtic	0	0	$2\frac{1}{3}$
3 Couſtics	a Tinſe	0	0	7

EUROPE, Northern Parts.

POLAND, &c.

		£.	s.	d.
18 Groſhen =	an Ort	0	0	$8\frac{2}{5}$
30 Groſhen	a Florin	0	1	2
90 Groſhen	†a Rixdollar	0	3	6
8 Florins	a Ducat	0	9	4
5 Rixdollars	a Frederic d'Or	0	17	6

LIVONIA.
Riga, Revel, Narva, &c.

A Blacken		0	0	$0\frac{7}{96}$
6 Blackens =	a Groſh	0	0	$0\frac{7}{15}$
9 Blackens	a Vording	0	0	$0\frac{7}{10}$
2 Groſhen	a Whiten	0	0	$0\frac{14}{15}$
6 Groſhen	a Marc	0	0	$2\frac{4}{5}$
30 Groſhen	a Florin	0	1	2
90 Groſhen	† a Rixdollar	0	3	6
108 Groſhen	an Albertus	0	4	$2\frac{6}{15}$
64 Whitens	a Copperplate Dollar	0	5	0

DENMARK, ZEALAND, AND NORWAY.
Copenhagen, Sound, &c. *Bergen, Drontheim,* &c.

A Skilling		0	0	$0\frac{9}{16}$
6 Skillings =	a Duggen	0	0	$3\frac{3}{8}$
16 Skillings	†a Marc	0	0	9
20 Skillings	a Rixmarc	0	0	$11\frac{1}{4}$
24 Skillings	a Rixort	0	1	$1\frac{1}{2}$
4 Marcs	a Crown	0	3	0
6 Marcs	a Rixdollar	0	4	6
11 Marcs	a Ducat	0	8	3
14 Marcs	a Hatt Ducat	0	10	6

SWEDEN AND LAPLAND.
Stockholm, Upſal, &c. *Thorn,* &c.

† A Runſtick		0	0	$0\frac{7}{36}$
2 Runſticks =	a Stiver	0	0	$0\frac{7}{18}$
8 Runſticks	a Copper Marc	0	0	$1\frac{5}{9}$
3 Copper Marcs	a Silver Marc	0	0	$4\frac{2}{3}$
4 Copper Marcs	a Copper Dollar	0	0	$6\frac{2}{9}$
9 Copper Marcs	a Caroline	0	1	2
3 Copper Dollars	a Silver Dollar	0	1	$6\frac{2}{3}$
3 Silver Dollars	a Rixdollar	0	4	8
2 Rixdollars	a Ducat	0	9	4

RUSSIA AND MUSCOVY.
Peterſburg, Archangel, &c. *Moſcow,* &c.

A Poluſca		0	0	$0\frac{27}{200}$
2 Poluſcas =	a Denuſca	0	0	$0\frac{27}{100}$
2 Denuſcas	†a Copec	0	0	$0\frac{27}{50}$
3 Copecs	an Altin	0	0	$1\frac{31}{50}$
10 Copecs	a Grievener	0	0	$5\frac{2}{5}$
25 Copecs	a Polpotin	0	1	$1\frac{1}{2}$
50 Copecs	a Poltin	0	2	3
100 Copecs	a Ruble	0	4	6
2 Rubles	a Xervonitz	0	9	0

BASIL. *Zurich, Zug,* &c.

A Rap		0	0	$0\frac{1}{24}$
3 Rapen =	a Fening	0	0	$0\frac{1}{8}$
4 Fenings	a Cruitzer	0	0	$0\frac{1}{2}$
12 Fenings	†a Sol	0	0	$1\frac{1}{2}$

15 Fenings

EUROPE, Southern Parts.

SWITZERLAND.

BASIL, &c.

			£.	s.	d.
15 Fenings	=	a Coarſe Batzen	0	0	$1\frac{7}{8}$
18 Fenings		a Good Batzen	0	0	$2\frac{1}{4}$
20 Sols	†	a Livre -	0	2	6
60 Cruitzers		a Gulden -	0	2	6
108 Cruitzers		a Rixdollar -	0	4	6

St GALL. *Apenſal*, &c.

A Heller		- - -	0	0	$0\frac{1}{16}$
2 Hellers	=	a Fening -	0	0	$0\frac{1}{8}$
4 Fenings		a Cruitzer -	0	0	$0\frac{1}{2}$
12 Fenings	†	a Sol -	0	0	$1\frac{1}{2}$
4 Cruitzers		a Coarſe Batzen	0	0	2
5 Cruitzers		a Good Batzen	0	0	$2\frac{1}{2}$
20 Sols	†	a Livre -	0	2	6
60 Cruitzers		a Gould -	0	2	6
102 Cruitzers		a Rixdollar -	0	4	3

BERN. *Lucern*, *Neufchatel*, &c.

A Denier		- -	0	0	$0\frac{1}{10}$
4 Deniers	=	a Cruitzer -	0	0	$0\frac{2}{5}$
3 Cruitzers	†	a Sol -	0	0	$1\frac{1}{5}$
4 Cruitzers		a Plapert -	0	0	$1\frac{3}{5}$
5 Cruitzers		a Gros -	0	0	2
6 Cruitzers		a Batzen -	0	0	$2\frac{2}{5}$
20 Sols	†	a Livre -	0	2	0
75 Cruitzers		a Gulden -	0	2	6
135 Cruitzers		a Crown -	0	4	6

GENEVA. *Pekay*, *Bonne*, &c.

A Denier		- -	0	0	$0\frac{1}{32}$
2 Deniers	=	a Denier current	0	0	$0\frac{1}{16}$
12 Deniers		a Small Sol -	0	0	$0\frac{3}{8}$
12 Deniers current		a Sol current	0	0	$0\frac{3}{4}$
12 Small Sols	†	a Florin -	0	0	$4\frac{1}{2}$
20 Sols current	†	a Livre current	0	1	3
$10\frac{1}{2}$ Florins		a Patacon -	0	3	$11\frac{1}{4}$
$15\frac{3}{4}$ Florins		a Croiſade -	0	5	$10\frac{7}{8}$
24 Florins		a Ducat -	0	9	0

FRANCE and NAVARRE.

Liſle, *Cambray*, *Valenciennes*, &c.

A Denier		- -	0	0	$0\frac{1}{24}$
12 Deniers	=	a Sol -	0	0	$0\frac{1}{2}$
15 Deniers	†	a Patard -	0	0	$0\frac{5}{8}$
15 Patards	†	a Piette -	0	0	$9\frac{3}{4}$
20 Sols		a Livre Tournois	0	0	10
20 Patards	†	a Florin -	0	1	$0\frac{1}{2}$
60 Sols		an Ecu of Ex.	0	2	6
$10\frac{1}{2}$ Livres		a Ducat -	0	9	3
24 Livres		a Louis d'Or	1	0	0

Dunkirk, *St Omers*, *St Quintin*, &c.

A Denier		- -	0	0	$0\frac{1}{24}$
12 Deniers	=	a Sol -	0	0	$0\frac{1}{2}$
15 Deniers	†	a Patard -	0	0	$0\frac{5}{8}$
15 Sols	†	a Piette -	0	0	$7\frac{1}{2}$
20 Sols	†	a Livre Tournois	0	0	10
3 Livres		an Ecu of Ex.	0	2	6
24 Livres		a Louis d'Or	1	0	0
$25\frac{1}{2}$ Livres		a Guinea -	1	1	0
$32\frac{2}{5}$ Livres		a Moeda -	1	7	0

Paris, *Lyons*, *Marſeilles*, &c. *Bourdeaux*, *Bayonne*, &c.

			£.	s.	d.
A Denier		- -	0	0	$0\frac{1}{24}$
3 Deniers	=	a Liard -	0	0	$0\frac{1}{8}$
2 Liards		a Dardene -	0	0	$0\frac{1}{4}$
12 Deniers		a Sol -	0	0	$0\frac{1}{2}$
20 Sols	†	a Livre Tournois	0	0	10
60 Sols		an Ecu of Ex.	0	2	6
6 Livres		an Ecu -	0	5	0
10 Livres	†	a Piſtole -	0	8	4
24 Livres		a Louis d'Or	1	0	0

EUROPE, Southern Parts.

PORTUGAL. *Liſbon*, *Oporto*, &c.

† A Re		- -	0	0	$0\frac{27}{400}$
10 Rez	=	a Half Vintin	0	0	$0\frac{27}{40}$
20 Rez		a Vintin -	0	0	$1\frac{7}{20}$
5 Vintins		a Teſtoon -	0	0	$6\frac{3}{4}$
4 Teſtoons		a Cruſade of Ex.	0	2	3
24 Vintins		a New Cruſade	0	2	$8\frac{2}{5}$
10 Teſtoons	†	a Milre -	0	5	$7\frac{1}{2}$
48 Teſtoons		a Moeda -	1	7	0
64 Teſtoons		a Joaneſe -	1	16	0

SPAIN and CATALONIA.

Madrid, *Cadiz*, *Seville*, &c. *New Plate.*

A Maravedie		- -	0	0	$0\frac{43}{272}$
2 Maravedies	=	a Quartil -	0	0	$0\frac{33}{136}$
34 Maravedies		a Rial -	0	0	$5\frac{3}{8}$
2 Rials		a Piſtarine -	0	0	$10\frac{3}{4}$
8 Rials	†	a Piaſtre of Ex.	0	3	7
10 Rials		a Dollar -	0	4	6
375 Maravedies	†	a Ducat of Ex.	0	4	$11\frac{1}{2}$
32 Rials	†	a Piſtole of Ex.	0	14	4
36 Rials		a Piſtole -	0	16	9

Gibraltar, *Malaga*, *Denia*, &c. *Velon.*

† A Maravedie		- -	0	0	$0\frac{23}{272}$
2 Maravedies	=	an Ochavo -	0	0	$0\frac{23}{136}$
4 Maravedies	†	a Quartil -	0	0	$0\frac{23}{68}$
34 Maravedies	†	a Rial Velon	0	0	$2\frac{7}{8}$
15 Rials		a Piaſtre of Ex.	0	3	7
512 Maravedies	†	a Piaſtre -	0	3	7
60 Rials	†	a Piſtole of Ex.	0	14	4
2048 Maravedies		a Piſtole of Ex.	0	16	9
78 Rials		a Piſtole -	0	16	9

Barcelona, *Saragoſſa*, *Valencia*, &c. *Old Plate.*

A Maravedie		- -	0	0	$0\frac{27}{128}$
16 Maravedies	=	a Soldo -	0	0	$3\frac{3}{8}$
2 Soldos		a Rial Old Plate	0	0	$6\frac{3}{4}$
20 Soldos	†	a Libra -	0	5	$7\frac{1}{2}$
24 Soldos	†	a Ducat -	0	6	9
16 Soldos	†	a Dollar -	0	4	6
22 Soldos	†	a Ducat -	0	6	$2\frac{1}{4}$
21 Soldos	†	a Ducat -	0	5	$10\frac{7}{8}$
60 Soldos		a Piſtole -	0	16	9

ITALY.

GENOA. *Novi*, &c. CORSICA. *Baſtia*, &c.

A Denari		- -	0	0	$0\frac{43}{1200}$
12 Denari	=	a Soldi -	0	0	$0\frac{43}{100}$
4 Soldi		a Chevalet	0	0	$1\frac{18}{25}$
20 Soldi	†	a Lire -	0	0	$8\frac{3}{5}$
30 Soldi		a Teſtoon -	0	1	$0\frac{9}{10}$

EUROPE, Southern Parts.

ITALY.

GENOA, &c.

			£.	s.	d.
5 Lires	=	a Croiſade -	0	3	7
115 Soldi		† a Pezzo of Ex.	0	4	2
6 Teſtoons		a Genouine	0	6	2
20 Lires		a Piſtole -	0	14	4

PIEDMONT, SAVOY, AND SARDINIA.

Turin, *Chamberry*, *Cagliari*, &c.

A Denari	-	- -	0	0	$0\frac{1}{16}$
3 Denari	=	a Quatrini -	0	0	$0\frac{3}{16}$
12 Denari		a Soldi -	0	0	$0\frac{3}{4}$
12 Soldi		† a Florin -	0	0	9
20 Soldi		† a Lire -	0	1	3
6 Florins		a Scudi -	0	4	6
7 Florins		a Ducatoon -	0	5	3
13 Lires		a Piſtole -	0	16	3
16 Lires		a Louis d'Or	1	0	0

Milan, *Modena*, *Parma*, *Pavia*, &c.

A Denari	-	- -	0	0	$0\frac{3}{82}$
3 Denari	—	a Quatrini -	0	0	$0\frac{9}{82}$
12 Denari		a Soldi -	0	0	$0\frac{18}{41}$
20 Soldi		† a Lire -	0	0	$8\frac{32}{41}$
115 Soldi		a Scudi current	0	4	$2\frac{1}{2}$
117 Soldi		† a Scudi of Ex.	0	4	3
6 Lires		a Philip -	0	4	$4\frac{1}{2}$
22 Lires		a Piſtole -	0	16	0
23 Lires		a Spaniſh Piſtole	0	16	9

Leghorn, *Florence*, &c.

A Denari	-	- -	0	0	$0\frac{5}{144}$
4 Denari	=	a Quatrini -	0	0	$0\frac{5}{36}$
12 Denari		a Soldi -	0	0	$0\frac{5}{12}$
5 Quatrini		a Craca -	0	0	$0\frac{25}{36}$
8 Cracas		a Quilo -	0	0	$5\frac{5}{9}$
20 Soldi		† a Lire -	0	0	$8\frac{1}{3}$
6 Lires		a Piaſtre of Ex.	0	4	2
$7\frac{1}{2}$ Lires		a Ducat -	0	5	$2\frac{1}{2}$
22 Lires		a Piſtole -	0	15	6

ROME. *Civita Vecchia*, *Ancona*.

A Quatrini		- -	0	0	$0\frac{3}{10}$
5 Quatrini	=	a Bayoc -	0	0	$0\frac{3}{4}$
8 Bayocs		a Julio -	0	0	6
10 Bayocs		a Stampt Julio	0	0	$7\frac{1}{2}$
24 Bayocs		a Teſtoon -	0	1	6
10 Julios		a Crown current	0	5	0
12 Julios		† a Crown ſtampt	0	6	0
18 Julios		a Chequin -	0	9	0
31 Julios		a Piſtole -	0	15	6

NAPLES. *Gaeta*, *Capua*, &c.

A Quatrini		- -	0	0	$0\frac{2}{15}$
3 Quatrini	=	a Grain -	0	0	$0\frac{2}{5}$
10 Grains		a Carlin -	0	0	4
40 Quatrini		a Paulo -	0	0	$5\frac{1}{3}$
20 Grains		a Tarin -	0	0	8
40 Grains		a Teſtoon -	0	1	4
100 Grains		a Ducat of Ex.	0	3	4
23 Tarins		a Piſtole -	0	15	4
25 Tarins		a Spaniſh Piſtole	1	16	9

EUROPE, Southern Parts.

ITALY.

SICILY AND MALTA. *Palermo*, *Meſſina*, &c.

			£.	s.	d.
A Pichila	-	- -	0	0	$0\frac{1}{39}$
6 Pichili	=	a Grain -	0	0	$0\frac{2}{13}$
8 Pichili		a Ponti -	0	0	$0\frac{8}{39}$
10 Grains		a Carlin -	0	0	$1\frac{7}{13}$
20 Grains		a Tarin -	0	0	$3\frac{1}{13}$
6 Tarins		† a Florin of Ex.	0	1	$7\frac{6}{13}$
13 Tarins		a Ducat of Ex.	0	3	4
60 Carlins		† an Ounce -	0	7	$8\frac{4}{13}$
2 Ounces		a Piſtole -	0	15	4

Bologna, *Ravenna*, &c.

A Quatrini	-	- -	0	0	$0\frac{1}{10}$
6 Quatrini	=	a Bayoc -	0	0	$0\frac{3}{5}$
10 Bayocs		† a Julio -	0	0	6
20 Bayocs		a Lire -	0	1	0
3 Julios		a Teſtoon -	0	1	6
80 Bayocs		a Schudi of Ex.	0	4	3
105 Bayocs		a Ducatoon -	0	5	3
100 Bayocs		a Crown -	0	5	0
31 Julios		a Piſtole -	0	15	6

VENICE. *Bergham*, &c.

A Picoli	-	- -	0	0	$0\frac{1}{36}$
12 Picoli	=	a Soldi -	0	0	$0\frac{1}{3}$
$6\frac{1}{2}$ Soldi		† a Gros -	0	0	$2\frac{1}{6}$
18 Soldi		a Jule -	0	0	6
20 Soldi		† a Lire -	0	0	$6\frac{2}{3}$
3 Jules		a Teſtoon -	0	1	6
124 Soldi		a Ducat current	0	3	$5\frac{1}{3}$
24 Gros		† a Ducat of Ex.	0	4	4
17 Lires		a Chequin -	0	9	2

TURKEY. *Morea*, *Candia*, *Cyprus*, &c.

A Mangar	-	- -	0	0	$0\frac{3}{20}$
4 Mangars	=	† an Aſper -	0	0	$0\frac{3}{5}$
3 Aſpers		a Parac -	0	0	$0\frac{4}{5}$
5 Aſpers		a Beſtic -	0	0	3
10 Aſpers		an Oſtic -	0	0	6
20 Aſpers		a Solota -	0	1	0
80 Aſpers		† a Piaſtre -	0	4	0
100 Aſpers		a Caragrouch -	0	5	0
10 Solotas		a Xeriff -	0	10	0

ARABIA. *Medina*, *Mecca*, *Mocha*, &c.

A Carret	-	- -	0	0	$0\frac{1}{8}$
$5\frac{1}{2}$ Carrets	=	a Caveer -	0	0	$0\frac{125}{200}$
7 Carrets		a Comaſhee -	0	0	$0\frac{9}{10}$
80 Carrets		a Larin -	0	0	$10\frac{1}{8}$
18 Comaſhees		an Abyſs -	0	1	$4\frac{1}{5}$
60 Comaſhees		† a Piaſtre -	0	4	6
80 Caveers		a Dollar -	0	4	6
100 Comaſhees		a Sequin -	0	7	6
80 Larins		† a Tomond -	3	7	6

PERSIA. *Iſpahan*, *Ormus*, *Gombroon*, &c.

A Coz	-	- - -	0	0	$0\frac{2}{5}$
4 Coz	-	a Biſti -	0	0	$1\frac{3}{5}$
10 Coz		a Shahee -	0	0	4
20 Coz		a Mamooda -	0	0	8
25 Coz		a Larin -	0	0	10
4 Shahees		an Abaſhee -	0	1	4

			£.	s.	d.
5 Abaſhees	=	an Or	0	8	6
12 Abaſhees		a Bovello	0	16	0
50 Abaſhees		† a Tomond	3	6	8

ASIA.

MOGUL.

GUZZERAT. *Surat, Cambay, &c.*

A Pecka			0	0	$0\frac{15}{64}$
2 Peckas	=	a Pice	0	0	$0\frac{15}{32}$
4 Pices		a Fanam	0	0	$1\frac{7}{8}$
5 Pices		a Viz	0	0	$2\frac{11}{32}$
10 Pices		an Ana	0	0	$7\frac{1}{2}$
4 Anas		a Rupee	0	2	6
2 Rupees		an Engliſh Crown	0	5	0
14 Anas		a Pagoda	0	8	9
4 Pagodas		a Gold Rupee	1	15	0

MALABAR.

Bombay, Dabul, &c.

† A Budgrook			0	0	$0\frac{27}{800}$
2 Budgrooks	=	† a Re	0	0	$0\frac{27}{400}$
5 Rez		a Pice	0	0	$0\frac{27}{80}$
16 Pices		a Laree	0	0	$5\frac{2}{5}$
20 Pices		a Quarter	0	0	$6\frac{3}{4}$
240 Rez		a Xeraphim	0	1	$4\frac{1}{5}$
4 Quarters		a Rupee	0	2	3
14 Quarters		a Pagoda	0	8	0
60 Quarters		a Gold Rupee	1	15	0

Goa, Viſapour, &c.

† A Re			0	0	$0\frac{27}{400}$
2 Rez	=	a Bazaraco	0	0	$0\frac{27}{200}$
2 Bazaracos		a Pecka	0	0	$0\frac{27}{100}$
20 Rez		a Vintin	0	0	$1\frac{7}{20}$
4 Vintins		a Laree	0	0	$5\frac{2}{5}$
3 Larees		a Xeraphim	0	1	$4\frac{1}{5}$
42 Vintins		a Tangu	0	4	6
4 Tangus		a Paru	0	18	0
8 Tangus		a Gold Rupee	1	15	0

COROMANDEL. *Madraſs, Pondicherry, &c.*

A Caſh			0	0	$0\frac{5}{32}$
5 Caſh	=	a Viz	0	0	$0\frac{3}{16}$
2 Viz		a Pice	0	0	$0\frac{3}{8}$
6 Pices		a Pical	0	0	$2\frac{1}{4}$
8 Pices		a Fanam	0	0	3
10 Fanams		a Rupee	0	2	6
2 Rupees		an Engliſh Crown	0	5	0
36 Fanams		a Pagoda	0	8	9
4 Pagodas		a Gold Rupee	1	15	0

BENGAL. *Callicut, Calcutta, &c.*

A Pice			0	0	$0\frac{5}{32}$
4 Pices	=	a Fanam	0	0	$0\frac{5}{8}$
6 Pices		a Viz	0	0	$0\frac{15}{16}$
12 Pices		an Ana	0	0	$1\frac{7}{8}$
10 Anas		a Fiano	0	1	$6\frac{3}{4}$
16 Anas		a Rupee	0	2	6
2 Rupees		a French Ecu	0	5	0
2 Rupees		an Engliſh Crown	0	5	0
56 Anas		a Pagoda	0	8	9

ASIA.

SIAM. *Pegu, Malacca, Cambodia, Sumatra, Java, Borneo, &c.*

			£.	s.	d.
A Cori			0	0	$0\frac{1}{40000}$
800 Cori	=	a Fettee	0	0	$0\frac{3}{50}$
125 Fettees		a Sateleer	0	0	$7\frac{1}{2}$
250 Fettees		a Sooco	0	1	3
500 Fettees		a Tical	0	2	6
900 Fettees		a Dollar	0	4	6
2 Ticals		a Rial	0	5	0
4 Soocos		an Ecu	0	5	0
8 Sateleers		a Crown	0	5	0

CHINA. *Pekin, Canton, &c.*

A Caxa			0	0	$0\frac{2}{25}$
10 Caxa	=	a Candereen	0	0	$0\frac{4}{5}$
10 Candereens		a Mace	0	0	8
35 Candereens		a Rupee	0	2	6
2 Rupees		a Dollar	0	4	6
70 Candereens		a Rixdollar	0	4	$4\frac{1}{2}$
7 Maces		an Ecu	0	5	0
2 Rupees		a Crown	0	5	0
10 Maces		† a Tale	0	6	8

JAPAN. *Jeddo, Meaco, &c.*

A Piti			0	0	$0\frac{1}{5}$
20 Pitis	=	a Mace	0	0	4
15 Maces		an Ounce Silver	0	4	$10\frac{1}{3}$
20 Maces		a Tale	0	6	8
30 Maces		an Ingot	0	9	$8\frac{2}{3}$
13 Ounces Silver		an Ounce Gold	3	3	0
2 Ounces Gold		a Japaneſe	6	6	0
2 Japaneſes		a Double	12	12	0
21 Ounces Gold		† a Cattee	66	3	0

AFRICA.

EGYPT. *Old and New Cairo, Alexandria, Sayde, &c.*

An Aſper			0	0	$0\frac{5}{9}$
3 Aſpers	=	a Medin	0	0	$1\frac{2}{3}$
24 Medins		an Italian Ducat	0	3	4
80 Aſpers		† a Piaſtre	0	4	0
30 Medins		a Dollar	0	4	6
96 Aſpers		an Ecu	0	5	0
32 Medins		a Crown	0	5	0
200 Aſpers		a Sultanin	0	10	0
70 Medins		a Pargo Dollar	0	10	0

BARBARY. *Algiers, Tunis, Tripoli, Una, &c.*

An Aſper			0	0	$0\frac{5}{9}$
3 Aſpers	=	a Medin	0	0	$1\frac{2}{3}$
10 Aſpers		a Rial old Plate	0	0	$6\frac{3}{4}$
2 Rials		a Double	0	1	$1\frac{1}{2}$
4 Doubles		a Dollar	0	4	6
24 Medins		a Silver Chequin	0	3	4
30 Medins		a Dollar	0	4	6
180 Aſpers		a Zequin	0	8	10
13 Doubles		a Piſtole	0	16	9

MOROCCO. *Santa Cruz, Mequinez, Fez, Tangiers, Sallee, &c.*

A Fluce			0	0	$0\frac{1}{12}$
24 Fluces	=	a Blanquin	0	0	2

4 Blanquils.

AFRICA.

MOROCCO, &c.

			£.	s.	d.
4 Blanquils	=	an Ounce -	0	0	8
7 Blanquils		an Octavo -	0	1	2
14 Blanquils		a Quarto -	0	2	4
2 Quartos		a Medio -	0	4	8
28 Blanquils		a Dollar -	0	4	6
54 Blanquils		a Xequin -	0	9	0
100 Blanquils		a Piſtole -	0	16	9

AMERICA. WEST-INDIES.

ENGLISH. *Jamaica, Barbadoes, &c.*

			£.	s.	d.
† Halfpenny		- -	0	0	$0\frac{57}{160}$
2 Halfpence	=	† a Penny -	0	0	$0\frac{57}{80}$
$7\frac{1}{2}$ Pence		a Bit -	0	0	$5\frac{3}{8}$
12 Pence		† a Shilling -	0	0	$8\frac{11}{20}$
75 Pence		a Dollar -	0	4	6
7 Shillings		a Crown -	0	5	0
20 Shillings		† a Pound -	0	14	3
24 Shillings		a Piſtole -	0	16	9
30 Shillings		a Guinea -	1	1	0

FRENCH. *St Domingo, Martinico, &c.*

			£.	s.	d.
† A Half Sol		- -	0	0	$0\frac{117}{640}$
2 Half Sols	=	† a Sol -	0	0	$0\frac{117}{320}$
$7\frac{1}{2}$ Sols		a Half Scalin	0	0	$2\frac{11}{16}$
15 Sols		a Scalin -	0	0	$5\frac{3}{8}$
20 Sols		† a Livre -	0	0	$7\frac{5}{16}$
7 Livres		a Dollar -	0	4	6
8 Livres		an Ecu -	0	4	$10\frac{1}{2}$
26 Livres		a Piſtole -	0	16	9
32 Livres		a Louis d'Or	1	0	0

AMERICA. CONTINENT.

ENGLISH. *Nova Scotia, Virginia, New England, &c.*

		£.	s.	d.
† A Penny	- - -	0	0	1
12 Pence -	† a Shilling -	0	1	0
20 Shillings	† a Pound -	1	0	0
2 Pounds				
3 Pounds				
4 Pounds				
5 Pounds				
6 Pounds				
7 Pounds				
8 Pounds				
9 Pounds				
10 Pounds				

The value of the Currency alters according to the Plenty or Scarcity of Gold and Silver Coins that are imported.

Canada, Florida, Cayenne, &c.

† A Denier		
12 Deniers	=	† a Sol.
20 Sols		† a Livre.
2 Livres		
3 Livres		
4 Livres		
5 Livres		
6 Livres		
7 Livres		
8 Livres		
9 Livres		
10 Livres		

The value of the Currency alters according to the Plenty or Scarcity of Gold and Silver Coins that are imported.

Note. For all the *Spaniſh*, *Portugueſe*, *Dutch*, and *Daniſh* Dominions, either on the Continent or in the Weſt Indies, ſee the Moneys of the reſpective nations.

Money, Monk.

Ancient MONEY. See COINS and MEDALS.

Paper MONEY. See the article BANK.

MONK anciently denoted, "a perſon who retired from the world to give himſelf up wholly to God, and to live in ſolitude and abſtinence." The word is derived from the Latin *monachus*, and that from the Greek *μοναχος*, "ſolitary;" of *μονος*, *ſolus*, "alone."

The origin of monks ſeems to have been this: The perſecutions which attended the firſt ages of the Goſpel forced ſome Chriſtians to retire from the world, and live in deſerts and places moſt private and unfrequented, in hopes of finding that peace and comfort among beaſts which were denied them among men. And this being the caſe of ſome very extraordinary perſons, their example gave ſo much reputation to retirement, that the practice was continued when the reaſon of its commencement ceaſed. After the empire became Chriſtian, inſtances of this kind were numerous; and thoſe whoſe ſecurity had obliged them to live ſeparately and apart, became afterwards united into ſocieties. We may alſo add, that the myſtic theology, which gained ground towards the cloſe of the third century, contributed to produce the ſame effect, and to drive men into ſolitude for the purpoſes of enthuſiaſtic devotion.

The monks, at leaſt the ancient ones, were diſtinguiſhed into *ſolitaries*, *cœnobites*, and *ſarabaites*.

The *ſolitary* are thoſe who live alone, in places remote from all towns and habitations of men, as do ſtill ſome of the hermits. The *cœnobites* are thoſe who live in community with ſeveral others in the ſame houſe, and under the ſame ſuperiors. The *ſarabaites* were ſtrolling monks, having no fixed rule or reſidence.

Monk.

The houſes of monks again were of two kinds, viz. *monaſteries* and *lauræ*. See MONASTERY and LAURA.

Thoſe we call monks now-a-days are cœnobites, who live together in a convent or monaſtery, who make vows of living according to a certain rule eſtabliſhed by the founder, and wear a habit which diſtinguiſhes their order.

Thoſe that are endowed, or have a fixed revenue, are moſt properly called monks, *monachi;* as the Chartreux, Benedictines, Bernardines, &c. The Mendicants, or thoſe that beg, as the Capuchins and Franciſcans, are more properly called *religious* and *friars;* though the names are frequently confounded.

The firſt monks were thoſe of St Anthony; who, towards the cloſe of the fourth century, formed them into a regular body, engaged them to live in ſociety with each other, and preſcribed to them fixed rules for the direction of their conduct. Theſe regulations, which Anthony had made in Egypt, were ſoon introduced into Paleſtine and Syria by his diſciple Hilarion. Almoſt about the ſame time, Aones or Eugenius, with their companions Gaddanas and Azyzas, inſtituted the monaſtic order in Meſopotamia and the adjacent countries; and their example was followed with ſuch rapid ſucceſs, that

that in a ſhort time the whole eaſt was filled with a lazy ſet of mortals, who, abandoning all human connexions, advantages, pleaſures, and concerns, wore out a languiſhing and miſerable life amidſt the hardſhips of want, and various kinds of ſuffering, in order to arrive at a more cloſe and rapturous communication with God and angels.

From the eaſt this gloomy inſtitution paſſed into the weſt, and firſt into Italy and its neighbouring iſlands; though it is uncertain who tranſplanted it thither. St Martin, the celebrated biſhop of Tours, erected the firſt monaſteries in Gaul, and recommended this religious ſolitude with ſuch power and efficacy, both by his inſtructions and his example, that his funeral is ſaid to have been attended by no leſs than 2000 monks. From hence the monaſtic diſcipline extended gradually its progreſs through the other provinces and countries of Europe. There were beſides the monks of St Baſil (called in the Eaſt *Calogeri*, from καλος γερων, "good old man") and thoſe of St Jerome, the hermits of St Auguſtine, and afterwards thoſe of St Benedict and St Bernard; at length came thoſe of St Francis and St Dominic, with a legion of others; all which ſee under their proper heads, Benedictines, &c.

Towards the cloſe of the fifth century, the monks, who had formerly lived only for themſelves in ſolitary retreats, and had never thought of aſſuming any rank among the ſacerdotal order, were now gradually diſtinguiſhed from the populace, and endowed with ſuch opulence and honourable privileges that they found themſelves in a condition to claim an eminent ſtation among the ſupports and pillars of the Chriſtian community. The fame of their piety and ſanctity was ſo great, that biſhops and preſbyters were often choſen out of their order; and the paſſion of erecting edifices and convents, in which the monks and holy virgins might ſerve God in the moſt commodious manner, was at this time carried beyond all bounds. However their licentiouſneſs, even in this century, was become a proverb; and they are ſaid to have excited the moſt dreadful tumults and ſeditions in various places. The monaſtic orders were at firſt under the immediate juriſdiction of the biſhops, from which they were exempted by the Roman pontiff about the end of the 7th century; and the monks, in return, devoted themſelves wholly to advance the intereſts and to maintain the dignity of the biſhop of Rome. This immunity which they obtained was a fruitful ſource of licentiouſneſs and diſorder, and occaſioned the greateſt part of the vices with which they were afterwards ſo juſtly charged. In the 8th century the monaſtic diſcipline was extremely relaxed both in the eaſtern and weſtern provinces, and all efforts to reſtore it were ineffectual. Nevertheleſs, this kind of inſtitution was in the higheſt eſteem, and nothing could equal the veneration that was paid about the cloſe of the 9th century to ſuch as devoted themſelves to the ſacred gloom and indolence of a convent. This veneration induced ſeveral kings and emperors to call them to their courts, and to employ them in civil affairs of the greateſt moment. Their reformation was attempted by Louis the Meek, but the effect was of ſhort duration. In the 11th century they were exempted by the popes from the authority of their ſovereigns, and new orders of monks were continually eſtabliſhed; inſomuch that in the council of Lateran that was held in the year 1215, a decree was paſſed, by the advice of Innocent III. to prevent any new monaſtic inſtitutions; and ſeveral were entirely ſuppreſſed. In the 15th and 16th centuries, it appears, from the teſtimonies of the beſt writers, that the monks were generally lazy, illiterate, profligate, and licentious epicures, whoſe views in life were confined to opulence, idleneſs, and pleaſure. However, the Reformation had a manifeſt influence in reſtraining their exceſſes, and rendering them more circumſpect and cautious in their external conduct.

Monks are diſtinguiſhed by the colour of their habits into *black*, *white*, *gray*, &c. Among the monks, ſome are called *monks of the choir*, others *profeſſed monks*, and others *lay monks*; which laſt are deſtined for the ſervice of the convent, and have neither clericate nor literature.

Cloiſtered MONKS, are thoſe who actually reſide in the houſe: in oppoſition to *extra*-monks, who have benefices depending on the monaſtery.

Monks are alſo diſtinguiſhed into *reformed*, whom the civil and eccleſiaſtical authority have made maſters of ancient convents, and put in their power to retrieve the ancient diſcipline, which had been relaxed; and *ancient*, who remain in the convent, to live in it according to its eſtabliſhment at the time when they made their vows, without obliging themſelves to any new reform.

Anciently the monks were all laymen, and were only diſtinguiſhed from the reſt of the people by a particular habit and an extraordinary devotion. Not only the monks were prohibited the prieſthood, but even prieſts were expreſsly prohibited from becoming monks, as appears from the letters of St Gregory. Pope Syricius was the firſt who called them to the clericate, on occaſion of ſome great ſcarcity of prieſts, that the church was then ſuppoſed to labour under: and ſince that time, the prieſthood has been uſually united to the monaſtical profeſſion.

Monk, *George*, a perſonage memorable for having been the principal agent in reſtoring Charles II. to his crown, was deſcended from a very ancient family, and born in Devonſhire in 1608. Being an unprovided younger ſon, he dedicated himſelf to arms from his youth, and obtained a pair of colours in the expedition to the Iſle of Rhée: he ſerved afterwards in the Low Countries with reputation, in both King Charles's northern expeditions; and did ſuch ſervice in quelling the Iriſh rebellion, that he was appointed governor of Dublin, but was ſuperſeded by parliamentary authority. Being made major-general of the Iriſh brigade employed in the ſiege of Nantwich in Cheſhire, he was taken priſoner by Sir Thomas Fairfax, and remained confined in the Tower of London until the year 1646; when, as the means of obtaining liberty, he took the covenant, and accepted a command in the Iriſh ſervice under the parliament. He obtained the command in chief of all the parliamentary forces in the north of Ireland, where he did ſignal ſervices, until he was called to account for a treaty made with the Iriſh rebels; a circumſtance which was only obliterated by his future good fortune. He ſerved in Scotland under Oliver Cromwell with ſuch ſucceſs, that he was left there as commander in chief; and he was one of the commiſſioners for uniting that kingdom with the new erected commonwealth.

He ſerved at ſea alſo againſt the Dutch; and was treated ſo kindly on his return, that Oliver is ſaid to have grown jealous of him. He was, however, again ſent to Scotland as commander in chief, and continued there five years; when he diſſembled ſo well, and improved circumſtances ſo dexterouſly, that he aided the deſires of a wearied people, and reſtored the king without any diſturbance: for which he was immediately rewarded both with honours and profit: (See Britain, N° 194, &c.). He was created duke of Albemarle, with a grant of 7000l. per annum eſtate, beſide other emoluments; and enjoyed the confidence of his maſter without forfeiting that of the people. After his death in 1670, there was publiſhed a treatiſe compoſed by him while he remained priſoner in the Tower, entitled, "Obſervations on Military and Political Affairs," a ſmall folio.

Monk-Fiſh. See Squalus, Ichthyology *Index.*

Monk's Head, or *Wolf's bane.* See Aconitum, Botany *Index.*

MONKEY. See Simia, Mammalia *Index.*

MONMOUTH, James, Duke of, ſon to Charles II. by Mrs Lucy Walters, was born at Rotterdam in 1649. Upon the Reſtoration, he was called over to England, where the king received him with all imaginable joy, created him earl of Orkney (which was changed into that of Monmouth), and he took his ſeat in the houſe of peers in the enſuing ſeſſion of parliament. He married Anne, the heireſs of Francis earl of Buccleugh; and hence it came to paſs that he had alſo the title of *Buccleugh*, and took the ſurname of *Scot*, according to the cuſtom of Scotland. In 1668 his father made him captain of his life-guard of horſe; and in 1672 he attended the French king in the Netherlands, and gave proofs of bravery and conduct. In 1673 the king of France made him lieutenant-general of his army, with which he came before Maeſtricht, and behaved himſelf with incredible gallantry, being the firſt who entered it himſelf. He returned to England, was received with all poſſible reſpect, and was received chancellor of the univerſity of Cambridge. After this he went to aſſiſt the prince of Orange to raiſe the ſiege of Mons, and did not a little contribute towards it. He returned to England; and was ſent in quality of his father's general, to quell an inſurrection in Scotland, which he effected; but ſoon after he fell into diſgrace; for, being a Proteſtant, he was deluded into ambitious ſchemes, upon the hopes of the excluſion of the duke of York: he conſpired againſt his father and the duke; and when the latter came to the throne by the title of *James II.* he openly appeared in arms, encouraged by the Proteſtant army; but coming to a deciſive battle before he had ſufficient forces to oppoſe the royal army, he was defeated, taken ſoon after concealed in a ditch, tried for high treaſon, condemned, and beheaded in 1685, aged 36. See Britain, N° 242, 249—265.

Monmouth, the capital of the county of Monmouthſhire in England, 129 miles from London, and 33 miles from Briſtol. It has its name from its ſituation at the conflux of the Monow or Mynwy, and the Wye, over each of which it has a bridge, and a third over the Frothy. Here was a caſtle in William the Conqueror's time which Henry III. took from John baron of Monmouth. It afterwards came to the houſe of Lancaſter, who beſtowed many privileges upon the town. Here Henry V. ſurnamed *of Monmouth*, was born. The famous hiſtorian Geoffrey was alſo born at this place. Formerly it gave the title of *earl* to the family of Carey, and of *duke* to King Charles the Second's eldeſt natural ſon; but now of *earl* to the Mordaunts, who are alſo earls of Peterborough. It contained 3345 inhabitants in 1801, is well built, carries on a conſiderable trade with Briſtol by means of the Wye, and has a weekly market, and three fairs.

MONMOUTHSHIRE, a county of England; anciently reckoned a part of Wales, but in Charles II.'s time taken into the Oxford circuit, and made an Engliſh county. It is bounded on the north by Herefordſhire, on the eaſt by Glouceſterſhire, on the ſouth by the river Severn, and on the weſt by the Welſh counties of Brecknock and Glamorgan. Its extent from north to ſouth is about 30 miles, from eaſt to weſt 26, and in circumference 110. It is ſubdivided into ſix hundreds, and 127 pariſhes. In 1801, this county contained 8948 houſes, and 9903 families. The whole population amounted to 45,582 perſons. It ſends only three members to parliament, that is, one for Monmouth, and two for the county. The air is temperate and healthy; and the ſoil fruitful, though mountainous and woody. The hills feed ſheep, goats, and horned cattle; and the valleys produce plenty of graſs and corn. This county is extremely well watered by ſeveral fine rivers; for, beſides the Wye, which parts it from Glouceſterſhire, the Mynow, which runs between it and Herefordſhire, and the Rumney, which divides it from Glamorganſhire, it has, peculiar to itſelf, the Uſk, which enters this county a little above Abergavenny, runs moſtly ſouthward, and falls into the Severn by the mouth of the Ebwith; which laſt river runs from north to ſouth, in the weſtern ſide of the county. All theſe rivers, eſpecially the Wye and Uſk, abound with fiſh, particularly ſalmon and trout.

MONOCEROS, Unicorn, in *Aſtronomy*, a ſouthern conſtellation formed by Hevelius, containing in his catalogue 19 ſtars, and in the Britannic Catalogue 31.

Monoceros. See Monodon, Cetology *Index.*

MONOCHORD; an inſtrument by which the ſeveral proportions of muſical ſounds and intervals, as well in the natural as in tempered ſcales are tried. Originally it had, as its name implies, only one ſtring; but it is better conſtructed with two; for, by means of this additional ſtring, we have an opportunity of judging of the harmony of two tempered notes in every poſſible variety of temperament.

The reader who may wiſh for further information reſpecting the conſtruction and uſe of monochords, may conſult the appendix to Mr Atwood's Treatiſe on Rectilinear Motion, and Mr Jones's obſervations on the ſcale of muſic, monochord, &c. in his Phyſiological Diſquiſitions.

Monochord is alſo uſed for any muſical inſtrument that conſiſts of only one ſtring or chord; in this ſenſe the trumpet marine may properly be called a *monochord.*

MONOCULUS, a genus of inſects of the order of *aptera.* See Entomology *Index.*

MONODON, a genus of fiſhes belonging to the order of *cete.* See Cetology *Index.*

MONODY, in ancient poetry, a mournful kind of ſong,

ſong, ſung by a perſon all alone, to give vent to his grief. The word is derived from μονος, "alone," and αδω, "I ſing."

MONOECIA, from μονος, *alone*, and οικος, a *houſe*; the name of the 21ſt claſs in Linnæus's ſexual method. See BOTANY.

MONOGAMY, compounded of μονος, *ſolus*, and γαμος, "marriage," the ſtate or condition of thoſe who have only married once, or are reſtrained to a ſingle wife. See POLYGAMY.

MONOGLOSSUM, in *Ancient Geography*, a mart town of the Hither India, ſituated on the Sinus Canthi, into which the Indus empties itſelf. Said to be Mangalor on the coaſt of Malabar. E. Long. 74°, N. Lat. 13°.

MONOGRAM, a character or cypher, compoſed of one, two, or more letters interwoven; being a kind of abbreviation of a name, anciently uſed as a ſeal, badge, arms, &c.

MONOGYNIA, from μονος, *alone*, and γυνη, a *woman*; the name of the firſt order or ſubdiviſion in the firſt 13 claſſes of Linnæus's ſexual method; conſiſting of plants which, beſides their agreement in their claſſic character, generally derived from the number of their ſtamina, have only one ſtyle.

MONOMOTAPA, a country of Africa, has the maritime kingdom of Sofala on the eaſt, the river Del Spiritu Santo on the ſouth, the mountains of Caffraria on the weſt, and the river Cauma on the north, which parts it from Monemugi. The air of this country is very temperate; the land fertile in paſtures and all the neceſſaries of life, being watered by ſeveral rivers. The inhabitants are rich in black cattle, which they value more than gold. They have a vaſt number of elephants, as appears from the great quantity of ivory that is exported from thence. There is alſo a conſiderable trade in gold duſt.—The inhabitants are lovers of war, which is the employment followed by all thoſe who do not apply themſelves to commerce. This country is divided into ſeven provinces or petty kingdoms, vaſſals to the king; viz. Monomotapa Proper, Quiteve, Manica, Inhambana, Inhemior, Sabia, and Sofala.

MONOPETALOUS, in *Botany*, a term applied to flowers that have only one petal or flower-leaf.

MONOPHYSITES, (from μονος, *ſolus*, and φυσις, *natura*), a general name given to all thoſe ſectaries in the Levant who only own one nature in Jeſus Chriſt; and who maintain, that the divine and human natures of Chriſt were ſo united as to form only one nature, yet, without any change, confuſion, or mixture of the two natures.

The *Monophyſites*, however, properly ſo called, are the followers of Severus, a learned monk of Paleſtine, who was created patriarch of Antioch in 513, and Petrus Fullenſis.

The Monophyſites were encouraged by the emperor Anaſtaſius, but depreſſed by Juſtin and ſucceeding emperors. However, this ſect was reſtored by Jacob Baradæus an obſcure monk, inſomuch that when he died biſhop of Edeſſa, A. D. 588, he left it in a moſt flouriſhing ſtate in Syria, Meſopotamia, Armenia, Egypt, Nubia, Abyſſinia, and other countries. The laborious efforts of Jacob were ſeconded in Egypt and the adjacent countries, by Theodoſius biſhop of Alexandria; and he became ſo famous that all the Monophyſites of the eaſt conſidered him as their ſecond parent and founder, and are to this day called *Jacobites*, in honour of their new chief. The Monophyſites are divided into two ſects or parties, the one African, the other Aſiatic; at the head of the latter is the patriarch of Antioch, who reſides for the moſt part in the monaſtery of St Ananias, near the city of Merdin: the former are under the juriſdiction of the patriarch of Alexandria, who generally reſides at Grand Cairo, and are ſubdivided into Cophts and Abyſſinians. From the 15th century downwards, all the patriarchs of the Monophyſites have taken the name of *Ignatius*, in order to ſhow that they are the lineal ſucceſſors of Ignatius, who was biſhop of Antioch in the firſt century, and conſequently the lawful patriarch of Antioch. In the 17th century, a ſmall body of the Monophyſites in Aſia abandoned for ſome time the doctrine and inſtitution of their anceſtors, and embraced the communion of Rome: but the African Monophyſites, notwithſtanding that poverty and ignorance which expoſed them to the ſeductions of ſophiſtry and gain, ſtood firm in their principles, and made an obſtinate reſiſtance to the promiſes, preſents, and attempts employed by the papal miſſionaries to bring them under the Roman yoke: and in the 18th century, thoſe of Aſia and Africa have perſiſted in their refuſal to enter into the communion of the Romiſh church, notwithſtanding the earneſt entreaties and alluring offers that have been made from time to time by the pope's legates, to conquer their inflexible conſtancy. The Monophyſites propagate their doctrine in Aſia with zeal and aſſiduity, and have not long ago gained over to their communion a part of the Neſtorians, who inhabit the maritime coaſts of India.

MONOPOLY, one or more perſons making themſelves the ſole maſters of the whole of a commodity, manufacture, and the like, in order to make private advantage of it, by ſelling it again at a very advanced price. Or it is a licenſe or privilege allowed by the king for the ſole buying and ſelling, making, working, or uſing any thing whatſoever.—Monopolies had been carried to an enormous height during the reign of Queen Elizabeth; and were heavily complained of by Sir Edward Coke, in the beginning of the reign of King James I.: but were in great meaſure remedied by ſtatute 21 Jac. I. c. 3. which declares ſuch monopolies to be contrary to law, and void; (except as to patents, not exceeding the grant of 14 years, to the authors of new inventions; and except alſo patents concerning printing, ſaltpetre, gunpowder, great ordnance, and ſhot); and monopoliſts are puniſhed with the forfeiture of treble damages and double coſts, to thoſe whom they attempt to diſturb; and if they procure any action, brought againſt them for theſe damages, to be ſtayed by any extrajudicial order, other than of the court wherein it is brought, they incur the penalties of *præmunire*. Combinations alſo among victuallers or artificers, to raiſe the price of proviſions, or any commodities, or the rate of labour, are in many caſes ſeverely puniſhed by particular ſtatutes; and, in general, by ſtatute 2 and 3 Edward VI. c. 15. with the forfeiture of 10l. or 20 days impriſonment, with an allowance of only bread and water, for the firſt offence; 20l. or the pillory for the ſecond; and 40l. for the third, or elſe the pillory, loſs of one ear, and perpetual infamy. In the ſame manner, by a conſtitution of the emperor Zeno, all monopolies and combinations to keep up the price of merchandiſe, proviſions, or workmanſhip, were prohibited, upon pain of forfeiture of goods and perpetual baniſhment.

MONOSYLLABLE, in *Grammar*, a word that conſiſts only of one ſyllable, and is compoſed either of one or more letters pronounced at the ſame time. The too frequent uſe of monoſyllables has a very bad effect in Engliſh poetry, as Mr Pope both intimates and exemplifies in the ſame verſe, viz.

"And ten ſlow words oft creep in one dull line."

MONOTHELITES, (compounded of μονος, "ſingle," and ϑελημα, "will," of ϑελω, *volo*, "I will,") an ancient ſect, which ſprung out of the Eutychians; thus called, as only allowing of one will in Jeſus Chriſt.

The opinion of the Monothelites had its riſe in 630, and had the emperor Heraclius for an adherent: it was the ſame with that of the Acephalous Severians. They allowed of two wills in Chriſt, conſidered with regard to the two natures; but reduced them to one, by reaſon of the union of the two natures; thinking it abſurd there ſhould be two free wills in one and the ſame perſon. They were condemned by the ſixth general council in 680, as being ſuppoſed to deſtroy the perfection of the humanity of Jeſus Chriſt, depriving it of will and operation. Their ſentiments were afterwards embraced by the Maronites.

MONOTONY, an uniformity of ſound, or a fault in pronunciation, when a long ſeries of words is delivered in one unvaried tone. See READING.

MONOTROPA, BIRD'S-NEST; a genus of plants belonging to the monandria claſs; and in the natural method ranking with thoſe of which the order is doubtful. See BOTANY *Index*.

MONREAL. See MONTREAL.

MONRO, DR ALEXANDER, ſenior, a celebrated phyſician and anatomiſt, was the ſon of Mr John Monro, who was for ſome years a ſurgeon in the army under King William in Flanders, and who afterwards ſettled as a ſurgeon in Edinburgh. The ſubject of this biographical ſketch was born in London in 1697.

He ſhowed an early inclination to the ſtudy of phyſic; and the father, after giving him the beſt education that Edinburgh then afforded, ſent him ſucceſſively to London, Paris, and Leyden, to improve himſelf further in his profeſſion. At London, he attended the lectures of Meſſrs Hawkſbee and Whiſton on experimental philoſophy, and the anatomical demonſtrations of Mr Cheſelden. At Paris he attended the hoſpitals, and the lectures on the different branches of phyſic and ſurgery; and towards the end of autumn 1718, he went to Leyden, and ſtudied under the great Boerhaave.

On his return to Edinburgh in autumn 1719, Meſſrs Drummond and Macgill, who were then conjunct nominal profeſſors and demonſtrators of anatomy to the Surgeons Company, having reſigned in his favour, his father prevailed on him to read ſome public lectures on anatomy, and to illuſtrate them by ſhowing the curious anatomical preparations which he had made and ſent home when abroad. He at the ſame time perſuaded Dr Alſton, then a young man, to give ſome public lectures on botany. Accordingly, in the beginning of the winter 1720, theſe two young profeſſors began to give regular courſes of lectures, the one on the materia medica and botany, the other on anatomy and ſurgery; which were the firſt regular courſes of lectures on any of the branches of medicine that had ever been read at Edinburgh, and may be looked upon as the opening of that medical ſchool which has ſince acquired ſuch great reputation all over Europe.

In ſummer 1721 and 1722, Dr Monro, by the perſuaſion of his father, read ſome lectures on chirurgical ſubjects, particularly on wounds and tumours, which he never would publiſh, having written them in a hurry and before he had much experience; but inſerted from time to time the improvements he thought might be made in ſurgery, in the volumes of Medical Eſſays and Obſervations to be hereafter mentioned.

About the year 1720, his father communicated to the phyſicians and ſurgeons at Edinburgh, a plan which he had long formed in his own mind, of having the different branches of phyſic and ſurgery regularly taught at Edinburgh; which was highly approved of by them, and by their intereſt regular profeſſorſhips of anatomy and medicine were inſtituted in the univerſity. His ſon, Dr Monro, was firſt made univerſity profeſſor of anatomy; and two or three years afterwards, Drs Sinclair, Rutherford, Innes, and Plummer, were made profeſſors of medicine; the profeſſorſhip of materia medica and botany, which Dr Alſton then held, having been added to the univerſity many years before. Immediately after theſe gentlemen were elected profeſſors, they began to deliver regular courſes of lectures on the different branches of medicine, and they and their ſucceſſors have uniformly continued ſo to do every winter.

The plan for a medical education at Edinburgh was ſtill incomplete without an hoſpital, where ſtudents could ſee the practice of phyſic and ſurgery, as well as hear the lectures of the profeſſors. A ſcheme was therefore propoſed by Dr Monro's father, and others, particularly the members of the Royal College of Phyſicians and Board of Surgeons, for raiſing by ſubſcription a fund for building and ſupporting an hoſpital for the reception of diſeaſed poor; and our author publiſhed a pamphlet ſetting forth the advantages that would attend ſuch an inſtitution. In a ſhort time a conſiderable ſum of money was raiſed, a ſmall houſe was fitted up, and patients were admitted into it, and regularly attended by many of the phyſicians and ſurgeons in town. The fund for this charity increaſing very conſiderably, in a great meaſure from the activity and influence of that very worthy citizen and magiſtrate George Drummond, Eſq. the foundation was laid of the preſent large, commodious, and uſeful hoſpital, the *Royal Infirmary*; in the planning of which Dr Monro ſuggeſted many uſeful hints, and in particular the elegant room for chirurgical operations was deſigned and executed under his direction. Provoſt Drummond and he were nominated the building committee; and the fabric was entirely completed in a ſhort ſpace of time. It has ſince been ſo largely endowed, as to be capable of receiving a great number of diſeaſed poor, whoſe caſes the ſtudents of phyſic and ſurgery have an opportunity of ſeeing daily treated with the greateſt attention and care by phyſicians and ſurgeons eminent in their profeſſion; and a regiſter of the particulars of all the caſes which have been
received

received into the houſe ſince its firſt opening has been kept, in books appropriated for that purpoſe, for the uſe of the ſtudents.

In order to make the hoſpital of ſtill farther uſe to the ſtudents, Dr Monro frequently, while he continued profeſſor of anatomy, gave lectures on the chirurgical caſes; and Dr Rutherford, then profeſſor of the practice of phyſic, began, in the year 1748, to deliver clinical lectures, to be continued every winter, on the moſt remarkable caſes in the hoſpital.

Dr Monro, though he was elected profeſſor of anatomy in the year 1721, was not received into the univerſity till the year 1725, when he was inducted along with that great mathematician the late Mr Colin Maclaurin, with whom he ever lived in the ſtricteſt friendſhip. From this time he regularly every winter gave a courſe of lectures on anatomy and ſurgery, from October to May, upon a moſt judicious and comprehenſive plan: A taſk in which he perſevered with the greateſt aſſiduity, and without the leaſt interruption, for near 40 years; and ſo great was the reputation he had acquired, that ſtudents flocked to him from the moſt diſtant corners of his majeſty's dominions.

In 1759, our profeſſor entirely relinquiſhed the buſineſs of the anatomical theatre to his ſon Dr Alexander, who had returned from abroad, and had aſſiſted him in the courſe of lectures the preceding year. But after this reſignation, he ſtill endeavoured to render his labours uſeful to mankind, by reading clinical lectures at the hoſpital for the improvement of the ſtudents; of which Dr Duncan, who was one of his pupils, has given the following account. "There I had myſelf the happineſs of being a pupil, who profited by the judicious conduct of his practice, and was improved by the wiſdom and acuteneſs of his remarks. I have indeed to regret that I attended only the laſt courſe of lectures in which he had ever a ſhare, and at a time when he was ſubjected to a diſeaſe which proved at length fatal. Still, however, from what I ſaw and from what I heard, I can venture to aſſert, that it is hardly poſſible to conceive a phyſician more attentive to practice, or a preceptor more anxious to communicate inſtructions. His humanity, in the former of theſe characters, led him to beſtow the moſt anxious care on his patients while they were alive; and his zeal in the latter induced him to make them the ſubject of uſeful leſſons when they happened to die.—In the different ſtations of phyſician, of lecturer, and of manager in the hoſpital, he took every meaſure for inquiring into the cauſes of diſeaſes by diſſection.—He perſonally attended the opening of every body; and he not only dictated to the ſtudents an accurate report of the diſſection, but with nice diſcrimination contraſted the diſeaſed and ſound ſtate of every organ. Thus, in his own perſon, he afforded to the ſtudents a conſpicuous example of the advantages of early anatomical purſuits, as the happieſt foundation for a medical ſuperſtructure. His being at once engaged in two departments, the anatomical theatre and clinical chair, furniſhed him with opportunities both on the dead and living body, and placed him in the moſt favourable ſituation for the improvement of medicine; and from theſe opportunities he derived every poſſible advantage which they could afford."

His father, old Mr Monro, lived to an advanced age; and enjoyed the unſpeakable pleaſure of beholding a ſon, eſteemed and regarded by mankind, the principal actor in the execution of his favourite plan, the great object of his life, the founding a ſeminary of medical education in his native country: The ſon, who ſurvived him near 30 years, had the ſatisfaction to behold this ſeminary of medical education frequented yearly by 300 or 400 ſtudents, many of whom came from the moſt diſtant corners of his majeſty's dominions, and to ſee it arrive to a degree of reputation far beyond his moſt ſanguine hopes, being equalled by few, and inferior to none, in Europe.

Dr Monro was not only very active in the line of his own profeſſion, but as a citizen and general member of the community; for, after he had reſigned the anatomical chair to his ſon, he executed with the ſtricteſt punctuality the duties of ſeveral engagements both of a civil and political nature: He was a director of the Bank of Scotland, a juſtice of the peace, a commiſſioner of high roads, &c. At length, after a life ſpent in the moſt active induſtry, he became afflicted with a tedious and painful diſeaſe, which he bore with equal courage and reſignation till his death, which happened on July 10. 1767, in the 70th year of his age.

Of his works, the firſt in order is his Oſteology, which was written for the uſe of ſtudents, but is capable alſo of affording inſtruction to the oldeſt and moſt experienced practitioner; as, beſides a minute deſcription of the parts copied from nature, it everywhere abounds with new and important obſervations immediately applicable to practice. It has been tranſlated into many different languages; has paſſed through numerous editions; and has been reprinted in foreign countries in the moſt ſuperb manner, accompanied with elegant and maſterly engravings. His deſcription of the Lacteal Sac and Thoracic Duct contains the moſt accurate account of that important part of the body which has been yet publiſhed; and his Anatomy of the Nerves will tranſmit to poſterity an excellent example of accurate diſſection, faithful deſcription, and ingenious reaſoning. The ſix volumes of Medical Eſſays and Obſervations, publiſhed by a ſociety in Edinburgh, are univerſally known and eſteemed. To that ſociety he was appointed ſecretary; but, after the publication of the firſt volume, to which he had largely contributed, the members growing remiſs in their attendance, he became the ſole collector and publiſher of the work: To him we are therefore in a great meaſure indebted for thoſe numerous and important diſcoveries with which this publication has enriched every department of medical knowledge. In the two firſt volumes of the Phyſical and Literary Eſſays, publiſhed by the phyſical ſociety of Edinburgh, in which he had the rank of one of the preſidents, we find ſeveral papers written by him, which are not the leaſt ornaments of that collection. His account of the Succeſs of Inoculation in Scotland may be conſidered as his laſt publication: It demonſtrates his extenſive correſpondence and indefatigable induſtry, and has had great influence in promoting that ſalutary practice. Beſides theſe, he was alſo the author of ſeveral other elegant and maſterly productions, which were either never publiſhed, or were publiſhed without his knowledge and from incorrect copies. A collection of all his works, properly arranged, corrected, and illuſtrated with copperplates, has been publiſhed by Dr

Alexander Monro, his ſon and ſucceſſor in the anatomical chair, in a ſplendid quarto volume, printed for Elliot, Edinburgh, 1781; to which is prefixed a life of the author, by another of his ſons, Dr Donald, phyſician in London. The obſervation of an excellent judge, the illuſtrious Haller, concerning our author's Medical Eſſays and Obſervations, which now form a part of this collection, may with no leſs juſtice be applied to the whole: "It is a book which ought to be in the poſſeſſion of every medical practitioner."

MONS, an ancient, large, handſome, rich, and very ſtrong city of the Auſtrian Netherlands, in Hainault. There is a chapter, conſiſting of 30 ladies of diſtinction, who have the liberty of leaving the community when they intend to marry. They have ſeveral manufactures, and a good trade. It was taken by the allies in 1709, and by the French in July 1746; but rendered back by the treaty of Aix-la-Chapelle, after the fortifications were demoliſhed. It ſtands partly on a hill, and partly on a plain in a marſhy ſoil, on the rivers Haine and Trouilli, by which the country about it may be overflowed at pleaſure. It was taken by the French in 1794. E. Long. 4. 31. N. Lat. 50. 25.

MONS Sacer, in *Ancient Geography*, a mountain of the Sabines beyond the Anio, to the eaſt of Rome; whither the common people retired once and again to avoid the tyranny of the Patricians. From this ſeceſſion, and the altar of *Jupiter Terribilis* erected there, the mountain took its name.

MONSEIGNEUR, in the plural *Meſſeigneurs*, a title of honour and reſpect uſed by the French in writing to perſons of ſuperior rank or quality, before the late abolition of all ranks.

Dukes, peers, archbiſhops, biſhops, and preſidents *à la mortier*, were complimented with the title of *Monſeigneur*. In the petitions preſented to the ſovereign courts, they uſed the term *Meſſeigneurs*.

MONSEIGNEUR, abſolutely uſed, was a title reſtrained to the dauphin of France. This cuſtom was unknown till the time of Louis XIV. before which the dauphin was ſtyled *Monſieur le Dauphin*.

MONSELEMINES, a people inhabiting that part of Biledulgerid, which borders on the territories of the emperor of Morocco. They are a mixed race, deſcended from the ancient Arabs and fugitive Moors. Their country extends from about 90 miles beyond Cape Non, to the diſtance of 60 miles from St Croix. It is moſtly fertile; and, with little cultivation, produces the neceſſaries of life. A number of ſtreams water the plains, which abound with fig, date, palm, and almond trees. The gardens produce excellent grapes, which the Jews convert into brandy after they have been dried by the Arabs.

The Monſelemine territory is very populous, and would be much more ſo, were it not for the almoſt continual wars in which the people are engaged againſt the emperor of Morocco; for, as this country is the retreat of the rich Moors, who wiſh to fly from the tyranny of the emperor, they are too well acquainted with the Mooriſh cuſtoms to be ſurpriſed by that prince. As ſoon as a Mooriſh army takes the field, the inhabitants mount their horſes, and occupy the paſſes of the mountains; while the women and ſlaves retire to the interior parts of the country, or to the deſert, if they are hard preſſed. Their horſes, which they break in an admirable manner, are ſaid to be the beſt in the world; obedient to the voice of their maſter, and allowing no ſtranger to mount them.

The people derive their name and origin from one Moſeilama, who was contemporary with Mahomet. They reſpect the prophet, as do other Mahometans; but neither believe that he was infallible, nor that his deſcendants are all inſpired by God, nor that their will ſhould be a law, nor that ſuch faith is neceſſary in order to be a good Mahometan. The influence of their high prieſt is nearly deſpotic; for though he has no troops, he may command the nation, and peace and war depend upon his will. He has no property, yet every thing is at his diſpoſal; he requires nothing from any, yet all are diſpoſed to give him.

The Monſelemines, on Friday, meet in their moſques for prayer, and the ſame is likewiſe the day of their principal market, when their goods are expoſed to ſale in the public ſquares. They never attempt to make proſelytes; and they treat their Chriſtian ſlaves with humanity, which may perhaps be owing to the avarice of their maſters. The Jews are allowed among them the free exerciſe of their religion. Polygamy is permitted among them; but the ſituation of the women is more reſpectable, and they are not ſo much ſecluded as among the Moors, mingling more in ſociety, walking at large, and viſiting their friends. The Monſelemine children are brought up with great care, and are not obliged to exhibit proofs of their courage till they can be conſidered as men.

MONSIEUR, in the plural *Meſſieurs*, a term or title of civility, uſed by the French in ſpeaking to their equals, or thoſe a little below them, anſwering to *Mr* or *Sir* among the Engliſh.

MONSIEUR, abſolutely uſed, was a title or quality appropriated to the ſecond ſon of France, or the king's brother. The king was alſo called *Monſieur*, but that only by the children of France.

MONSONIA, a genus of plants belonging to the polyadelphia claſs. See BOTANY *Index*.

MONSOON, a regular or periodical wind, in the Eaſt Indies, blowing conſtantly the ſame way, during ſix months of the year, and the contrary way the remaining ſix.

In the Indian ocean, the winds are partly general, and blow all the year round the ſame way, as in the Ethiopic ocean; and partly periodical, i. e. half the year blow one way, and the other half year on the oppoſite points: and thoſe points and times of ſhifting differ in different parts of this ocean. Theſe latter are what we call *monſoons*.

The ſhifting of theſe monſoons is not all at once; and in ſome places the time of the change is attended with calms, in others with variable winds, and particularly thoſe of China, at ceaſing to be weſterly, are very ſubject to be tempeſtuous; and ſuch is their violence, that they ſeem to be of the nature of the Weſt India hurricanes, and render the navigation of thoſe ſeas very unſafe at that time of the year. Theſe tempeſts the ſeamen call the *breaking up of the monſoons*.

Monſoons, then, are a ſpecies of what we otherwiſe call *trade winds*. They take the denomination *monſoon* from an ancient pilot, who firſt croſſed the Indian ſea by means hereof. Though others derive the name from

from a Portugueſe word ſignifying motion or change of wind and ſea.

Lucretius and Apollonius make mention of annual winds which ariſe every year, *eteſia flabria*, which ſeem to be the ſame with what in the Eaſt Indies we now call *monſoons*. For the phyſical cauſe of theſe winds, ſee METEOROLOGY.

MONSTER; a birth or production of a living being, degenerating from the proper and uſual diſpoſition of parts in the ſpecies to which it belongs: As, when there are too many members, or too few; or ſome of them are extravagantly out of proportion, either on the ſide of defect or exceſs. The word comes from the Latin *monſtrum*, of *monſtrando*, "ſhowing." Whence alſo the box wherein relicks were anciently kept to be ſhown, was called *monſtrum*. Dugdale mentions an inventory of the church of York with this article, *Item unum monſtrum cum oſſibus ſancti Petri in beryl, et crucifixo in ſummitate.*

Ariſtotle defines a monſter to be a defect of nature, when, acting towards ſome end, it cannot attend to it, from ſome of its principles being corrupted.

Monſters do not propagate their kind; for which reaſon ſome rank *mules* among the number of monſters, as alſo *hermaphrodites*.

Females which bring forth twins, are found moſt liable to produce monſters. The reaſon, probably, is owing to this; that though the twins are covered with one common chorion, yet they have each their ſeparate amnios, which by their contiguity may chance to grow together, and ſo occaſion a confuſion or blending of the parts. Hence ſo many double creatures.

Various theories have been propoſed by philoſophers and phyſiologiſts to account for the production of monſters. But after all, it muſt be confeſſed, that we are very little acquainted with thoſe deviations from the ordinary courſe of nature. For each organized being there appears to exiſt a primitive germ or model of the different ſpecies drawn by the Creator, determined by forms and ſexes, and realized in the individuals of both ſexes, which muſt unite in order to their reproduction. From this model nature never departs, unleſs when compelled by circumſtances which derange the primitive organization common to the ſpecies, and produce what are called *monſters*.

With reſpect to ſtructure, monſters are of various kinds. Some have an exceſs or defect in certain parts; ſuch as thoſe which are called *acephalous*, or who want the head; thoſe which have two heads, two arms, two legs, and one body, or which have two bodies and one head, or which have three legs; and thoſe which want the arms or the legs. Others err through an extraordinary and deformed conformation, through an unnatural union of certain parts or viſcera, through a great derangement in one or more of their members, and through the extraordinary place which theſe often occupy in conſequence of this derangement or tranſpoſition. The monſter deſcribed by Dr Eller of the academy of Berlin was of this kind. It was a fœtus of nine months, 28 inches long, with an enormous head and frightful countenance; and in the middle of a broad and vaſt forehead it had a reddiſh eye, without either eyebrows or eyelids, and ſunk deep into a ſquare hole. Immediately below this eye was an excreſcence which ſtrongly reſembled a penis with a glans, a prepuce, and an urethra: the part covered with hair was likewiſe below the nape of the neck. In other monſters we meet with the unnatural union of ſome parts, which from their deſtination and functions, ought always to be ſeparate; and the ſeparation of other parts, which, for the ſame reaſons, ought conſtantly to be united. The reader may ſee the different ways in which the formation of monſters takes place, in four memoirs by M. Lemery, inſerted in *L'Hiſtoire de l'Academie des Sciences*, 1738 and 1739. M. du Verney has likewiſe publiſhed a memoir on the ſame ſubject.

In the volume publiſhed by the Academy of Sciences in 1724, mention is made by M. Geoffroy of a monſter born in Barrois 1722. This monſtrous production conſiſted of two children without the inferior extremities, joined together by a common navel: each of them had a nurſe, ſucked, and eat pap; and the one ſucked while the other ſlept. The reader may likewiſe conſult the ſecond part of Winſlow's Memoirs on Monſters, inſerted in the volume publiſhed by the Academy of Sciencés in 1734, where he will find the hiſtory of two very extraordinary twin monſters, who evidenced during their life a great difference in their moral and phyſical qualities. We are obliged ſimply to refer to theſe Memoirs, as they are too long for abridgement.

It is obſerved by Haller, that in ſome monſters the natural ſtructure is changed by ſome ſhock or paſſion: in others the ſtructure, independent of any accident, is originally monſtrous; ſuch as when all the members are reverſed from left to right, when the perſon has ſix fingers, and in many other inſtances. M. de Maupertuis mentions, that there is at Berlin a family who have had ſix fingers on each hand for ſeveral generations. M. de Riville ſaw an inſtance of this at Malta, of which he has given a deſcription. M. Renou, ſurgeon at Pommeraye in Anjou, has publiſhed an account of ſome families with ſix fingers, which are to be found in ſeveral pariſhes of the Lower Anjou, and which have exiſted there from time immemorial. This deformity is perpetuated in theſe families even when they intermarry with perſons who are free from it. Whether the propagation of theſe ſupernumerary organs, which are not only uſeleſs but inconvenient and even diſagreeable, be owing to the father or mother, their children of both ſexes are ſubject to it indiſcriminately. A father and mother with ſix fingers frequently have a part, and ſometimes the whole of their children, free from this deformity; but it again makes its appearance, and in a very great degree, in the third generation. From this it appears, that this fault in the conformation is hereditary. M. Reaumur has likewiſe publiſhed the hiſtory of a family in the iſland of Malta, the children of which are born with ſix fingers and ſix toes. But it deſerves to be inquired, Whether theſe ſupernumerary fingers are real fingers? The reader may here conſult the *Journal de Phyſique* for November 1774, p. 372. This variety of *ſexdigitary* hands and feet is not comprehended in the *Recherches ſur quelques conformations monſtrueuſes des doigts dans l'homme*, which is inſerted in the Memoirs of the Academy of Sciences for 1771. In the *Journal de Phyſique* for Auguſt 1776, we find a deſcription of a double uterus and vagina obſerved in a woman who died in childbed, by Dr Purcell of Dublin; and in that for June

1788, we have an account of a man with ſeven fingers on each hand, by Baron Dietrich.

Several monſtrous productions are to be ſeen in the cabinet at Chantilly. 1. Two calves joined together in the body, with each a ſeparate head and neck, and four legs in whole. 2. Two calves united only by the pelvis, with only one anus and one tail: the whole is ſupported by ſix legs, four before and two behind. 3. A lamb with ſix legs, four of which are behind. 4. The ſkeleton of a ram, which has likewiſe ſix legs. 5. A hermaphrodite deer. 6. The head of a foal, which has only one eye in the middle of the forehead. 7. Some leverets with ſix and eight legs. 8. A puppy, the lips of which are divided four-fold. 9. Some fœtuſes of a hog which have a kind of tube upon their forehead one or two inches long; and another, the hinder part of which is double in every thing. 10. Two double human fœtuſes joined by the belly, with four arms and three legs. 11. A young chicken with two bodies and one head. 12. A pigeon and a duck, each with two bills. 13. A duck with two heads. 14. A pigeon with four feet. 15. A capon with three feet; the third being fixed to the anus. 16. Two heads of a calf joined together, each of them with two ears: theſe two heads were both fixed to one neck. 17. In the *Menagerie* at Chantilly there was formerly to be ſeen a cow with five feet, the fifth of which was connected with the dug. 18. A rabbit without ears. 19. Two cats, each having two heads. 20. Two leverets newly brought forth, well ſhaped in the body and legs, but connected together by means of only one head. 21. Several eggs, in the figure of which there occur ſome monſtrous appearances and extraordinary deformities, ſufficient to ſhow that they are contrary to the eſtabliſhed form of nature.

Mr Home, ſurgeon, ſome time ago preſented to Mr John Hunter, the *double ſkull* of a child, born at Calcutta in May 1783 of poor parents aged 30 and 35, and which lived to be nearly two years old. The body of this child was naturally formed: but the head had the phenomenon of appearing double; another head of the ſame ſize, and almoſt equally perfect, being attached to its upper part. In this extraneous and preternatural head no pulſation could be felt in the arteries of the temples. But the ſuperficial veins were very evident; one of the eyes had been hurt by the fire, upon which the midwife, in her firſt alarm, threw the child: the other moved readily; but the iris was not affected by the approach of any thing to it. The external ears of this head were very imperfect; the tongue adhered to the lower jaw, except for about half an inch at the lip, which was looſe; the jaw was capable of motion, but there were no teeth. The child was ſhown about the ſtreets of Calcutta for a curioſity; but was rendered unhealthy by confinement, and died at laſt of a bite of the *cobra de capello*. It was dug up by the Eaſt India Company's agent for ſalt at Tumloek, and the ſkull is now in the muſeum of Mr Hunter.

Among the monſtrous productions of the animal kingdom, we may rank thoſe individuals which ought only to poſſeſs one ſex, but in which we obſerve the union or the appearance of two. See the articles ANDROGYNES and HERMAPHRODITE.

M. Fabri arranges mutilations of the members, diſtortions, gibboſities, tumors, diviſions of the lips or of the palate, compreſſions of the cranium, and many other deformities of this kind, in the claſs of *morbific* monſtruoſities. In that which he calls *connatural (connaturelle)* monſtruoſities, are placed the plurality, tranſpoſition, and inſertion of the parts. To explain theſe facts, a great many writers have had recourſe to the effect of the imagination of pregnant women.—The cauſes of the firſt claſs of monſtruoſities are diſcuſſed by M. Fabri, who obſerves, that ſome of them are *internal* with regard to the mother, and others *external*. By an *internal cauſe* he here means all thoſe depravations or morbific principles which can affect the fluids, and which vitiate the form and ſtructure of the ſolids; in particular the uterus, in which ſuch depravations have often been found to occur. To theſe he adds violent affections of the mind, ſpaſmodic contractions, hyſteric convulſions, and the many inconveniences of this kind to which women are extremely ſubject. External cauſes comprehend every thing which can act externally upon the fœtus contained in the uterus, ſuch as the preſſure of the clothes; and in ſhort every thing which prevents the free dilatation of the belly in women that are pregnant, violent motions, falls, blows, and all accidents of this kind. Theſe external cauſes, and eſpecially the firſt, compreſs the fœtus in the womb, and oblige it to remain in a very confined ſituation. This according to the obſervation of Hippocrates, produces thoſe embryos which are born with ſome entire part wounded. M. Fabri maintains, that all deformities of the fœtus proceed from ſome mechanical and accidental cauſes.

The name of *monſters* is likewiſe given to animals enormous for bulk; ſuch as the elephant among terreſtrial quadrupeds, and the ſhark and the whale among ſea animals; to other animals remarkable for fierceneſs and cruelty; and to animals of an extraordinary ſpecies, which, we are told, ariſes from the copulation of one animal with another of a different genus. According to the report of travellers, Africa abounds with monſters of this kind; and accounts of the Eaſt are full of deſcriptions of ſea monſters, which, however, are ſeldom to be ſeen, ſuch as *ſea men*, *mermaids*, *&c.*

Monſters are more common and more extraordinary in the vegetable than in the animal kingdom, becauſe the different juices are more eaſily deranged and confounded together. Leaves are often ſeen, from the internal parts of which other leaves ſpring forth, and it is not uncommon to ſee flowers of the ranunculus from the middle of which iſſues a ſtalk bearing another flower. M. Bonnet informs us, that in certain warm and rainy years he has frequently met with monſters of this kind in roſe trees. This obſerver ſaw a roſe, from the centre of which iſſued a ſquare ſtalk of a whitiſh colour, tender, and without prickles, which at its top bore two flower buds oppoſite to each other, and totally deſtitute of a calyx; a little above the buds iſſued a petal of a very irregular ſhape. Upon the prickly ſtalk which ſupported the roſe, a leaf was obſerved which had the ſhape of a trefoil, together with a broad flat pedicle. In the memoirs of the Academy of Sciences for 1707, p. 448, mention is made of a roſe, from the centre of the leaves of which iſſued a roſe branch two or three inches long, and furniſhed with leaves. See the ſame Memoirs for 1749, p. 44. and for 1724, p. 20. In the Memoirs for 1775, a very ſingular inſtance is mentioned of a monſtruoſity obſerved by M. Duhamel, in an apple-tree ingrafted with clay. At the place of the inſertion, there appeared a bud which produced a ſtalk and ſome leaves; the ſtalk and the pedicle of the leaves were of a pulpy ſubſtance, and had the moſt perfect reſemblance both in taſte and ſmell to the pulp of a green apple. An extraordinary *chamæmelum* is mentioned in the *Acta Helvetica*. M. Bonnet, in his *Recherches ſur l'uſage des feuilles*, mentions likewiſe ſome monſtrous productions which have been found in fruits with kernels, analogous in their nature to thoſe which occur in the flowers of the ranunculus and of the roſe tree. He has ſeen a pear, from the eye of which iſſued a tuft of 13 or 14 leaves, very well ſhaped, and many of them of the natural ſize. He has ſeen another pear which gave riſe to a ligneous and knotty ſtalk, on which grew another pear ſomewhat larger than the firſt.—The ſtalk had probably flouriſhed, and the fruit had formed. The *lilium album polyanthos*, obſerved ſome years ago at Breſlaw, which bore on its top a bundle of flowers, conſiſting of 102 lilies all of the common ſhape, is well known. M. Reynier has mentioned ſome individuals monſtrous with reſpect to the flower, in the *Journal de Phyſique et d'Hiſtoire Naturelle*, for November 1785. He has likewiſe mentioned a monſtrous tulip which is ſeen in the gardens of ſome amateurs; juniper berries with horns; a balſamine with three ſpurs, &c.

Theſe vegetable productions which are ſo extraordinary, and ſo contrary to the common courſe of things, do nevertheleſs preſent deviations ſubject to particular laws, and reducible to certain principles, by diſtinguiſhing ſuch as are perpetuated either by ſeed or by tranſplanting, from thoſe which ſeem to be only accidental. Monſtruoſities which are perpetuated exiſt in the original organization of the ſeed of the plant, ſuch as marked or curled leaves, &c. The word *monſter* is more properly applied to thoſe irregularities in plants, which ariſe from frequent tranſplantation, and from a particular culture, ſuch as double flowers, &c.: but thoſe monſtruoſities which are not perpetuated, and which ariſe from accidental and tranſient cauſes deranging the primitive organization of the plant when it comes to be unfolded, as is the effect of diſeaſes, of heat or cold, of a ſuperfluity or ſcarcity of juices, of a depravation of the veſſels contributing to nutrition, of the ſting of inſects, of contuſions and natural graffs, retain alſo the name of *monſters*. Of this kind are knobs or ſwellings, ſtunting, gall nuts, certain ſtreaks, and other ſimilar defects.

MONT-BLANC. See *MONT-Blanc*.

MONTAGUE, LADY MARY WORTLEY, accompanied her huſband who was ſent on an embaſſy to Conſtantinople in the beginning of the 18th century. On her return ſhe introduced the practice of inoculation into England, and thence acquired great celebrity. She cultivated the belles lettres; and at one period of her life ſhe was the friend of Pope, and at another his enemy. While they were at enmity with each other, Lady Mary Montague embraced every opportunity of defaming the poet, who well knew how to take revenge. Both of them carried their animoſity to ſo great a height, that they became the ſubject of public converſation. After a long life, full of ſingular and romantic adventures, ſhe died about the year 1760. From her we have *Letters*, written during her travels from the year 1716 to the year 1718. They have been tranſlated into French, and publiſhed at Rotterdam 1764, and at Paris 1783, one vol. 12mo. They are compoſed in a lively, intereſting, and agreeable ſtyle, and contain many curious facts relating to the manners and government of the Turks, which are nowhere elſe to be found. The Baron de Tott, who lived many years at Conſtantinople, attacked them with great ſeverity; but they have been defended with equal zeal by M. Guis of Marſeilles, who has publiſhed a valuable work on Turkey. It need not appear extraordinary, that perſons who have viſited the ſame country ſhould not ſee things in the ſame light. How few travellers agree in their accounts of the ſame objects, which they nevertheleſs pretend to have ſeen and to have examined with attention.

MONTAGUE, *Edward Wortley*, ſon of the former, paſſed through ſuch variegated ſcenes, that a bare recital of them would ſavour of the marvellous. From Weſtminſter ſchool, where he was placed for education, he ran away three ſeveral times. He exchanged clothes with a chimney-ſweeper, and he followed for ſome time that ſooty occupation. He next joined himſelf to a fiſherman, and cried flounders in Rotherhithe. He then ſailed as a cabin boy to Spain; where he had no ſooner arrived, than he ran away from the veſſel, and hired himſelf to a driver of mules. After thus vagabondizing it for ſome time, he was diſcovered by the conſul, who returned him to his friends in England. They received him with a joy equal to that of the father of the prodigal ſon in the goſpel. A private tutor was employed to recover thoſe rudiments of learning which a life of diſſipation, of blackguardiſm, and of vulgarity, might have obliterated. Wortley was ſent to the Weſt Indies, where he remained ſome time; then returned to England, acted according to the dignity of his birth, was choſen a member, and ſerved in two ſucceſſive parliaments. His expences exceeding his income, he became involved in debt, quitted his native country, and commenced that wandering traveller he continued to the time of his death. Having viſited moſt of the eaſtern countries, he contracted a partiality for their manners. He drank little wine, a great deal of coffee; wore a long beard; ſmoked much: and, even whilſt at Venice, he was habited in the eaſtern ſtyle. He ſat croſs-legged in the Turkiſh faſhion through choice. With the Hebrew, the Arabic, the Chaldaic, and the Perſian languages, he was as well acquainted as with his native tongue. He publiſhed ſeveral pieces. One on the "Riſe and Fall of the Roman Empire." Another an exploration of "The Cauſes of Earthquakes." As this gentleman was remarkable for the uncommon incidents which attended his life, the cloſe of that life was no leſs marked with ſingularity. He had been early married to a woman who aſpired to no higher a character than that of an induſtrious waſherwoman. As the marriage was ſolemnized in a frolic, Wortley never deemed her ſufficiently the wife of his boſom to cohabit with her. She was allowed a maintenance. She lived contented, and was too ſubmiſſive to be troubleſome on account of the conjugal rites. Mr Montague, on the other hand, was a perfect patriarch in his manners. He had wives of almoſt every nation. When he was with Ali Bey in Egypt, he had his houſehold of Egyptian females, each ſtriving who ſhould be the happy ſhe who could gain the greateſt aſcendency over this Anglo-Eaſtern baſhaw. At Conſtantinople, the Grecian women had charms to captivate this unſettled wanderer. In Spain a Spaniſh brunette, in Italy the olive-complexioned female, were ſolicited to partake the honours of the bridal bed. It may be aſked what became of this group of wives? Mr Montague was continually ſhifting the place, and conſequently varying the ſcene. Did he travel with his wives as the patriarchs did with their flocks and herds? No ſuch thing. Wortley, conſidering his wives as bad travelling companions, generally left them behind him. It happened, however, that news reached his ears of the death of the original Mrs Montague the waſherwoman. Wortley had no iſſue by her; and without iſſue male, a very large eſtate would revert to the ſecond ſon of Lord Bute. Wortley owing the family no obligations, was determined, if poſſible, to defeat their expectations. He reſolved to return to England and marry. He acquainted a friend with his intentions: and he commiſſioned that friend to advertiſe for any young decent woman who might be in a pregnant ſtate. Several ladies anſwered it. One out of the number was ſelected, as being the moſt eligible object. She waited with eagerneſs for the arrival of her expected bridegroom; but, behold, whilſt he was on his journey, death very impertinently arreſted him in his career.

MONTAGUE *Iſland*, one of the Hebrides, in the South ſea near Sandwich iſland. E. Long. 168. 37. S. Lat. 17. 26.

MONTAIGNE, MICHEL DE, a French gentleman, was born in Perigord in 1533. His father educated him with great care, and made him learn Latin as other children learn their mother tongue. His tutors were Nicholas Gronchi, who wrote *De Comitiis Romanorum;* William Guerenti, who wrote on Ariſtotle; George Buchanan; and M. Anthony Muret. He was alſo taught Greek by way of recreation; and becauſe ſome think that ſtarting children out of their ſleep ſpoils their underſtanding, he was awakened every morning with the ſound of muſic. He was counſellor for a while in the parliament of Bourdeaux; afterwards made mayor of Bourdeaux. He publiſhed his *Eſſays*, ſo much known in the world, in 1580. Montaigne had a great deal of wit and ſubtlety, but no ſmall ſhare of conceit and vanity. The learned and ingenious are much divided in their opinion about his works. He died in 1592.

MONTALCINO, a ſmall populous town of Italy in Tuſcany, and in the territory of Sienna, with a biſhop's ſee. It is ſeated on a mountain, 17 miles ſouth-eaſt of Sienna, and 44 ſouth-eaſt of Florence. E. Long. 11. 30. N. Lat. 43. 7.

MONTALTO, an epiſcopal town of Italy, in the Marca of Ancona; ſeated on the river Monacio, 10 miles north of Aſcoli, and 45 ſouth of Ancona. E. Long. 13. 30. N. Lat. 42. 54.

MONTANISTS, Chriſtian heretics, who ſprang up about the year 171, in the reign of the emperor Marcus Aurelius. They were ſo called from their leader, the hereſiarch Montanus, a Phrygian by birth; whence they are ſometimes ſtyled *Phrygians* and *Cataphrygians*.

Montanus, it is ſaid, embraced Chriſtianity in hopes of riſing to the dignities of the church. He pretended to inſpiration; and gave out, that the Holy Ghoſt had inſtructed him in ſeveral points, which had not been revealed to the apoſtles. Priſcilla and Maximilla, two enthuſiaſtic women of Phrygia, preſently became his diſciples; and in a ſhort time he had a great number of followers. The biſhops of Aſia being aſſembled together, condemned his prophecies, and excommunicated thoſe who diſperſed them. Afterwards they wrote an account of what had paſſed to the weſtern churches, where the pretended prophecies of Montanus and his followers were likewiſe condemned.

The Montaniſts, finding themſelves expoſed to the cenſure of the whole church, formed a ſchiſm, and ſet up a diſtinct ſociety under the direction of thoſe who called themſelves *prophets*. Montanus, in conjunction with Priſcilla and Maximilla, was at the head of the ſect.

Theſe ſectaries made no alteration in the creed. They only held that the Holy Spirit made Montanus his organ for delivering a more perfect form of diſcipline than what was delivered by the apoſtles. They refuſed communion for ever to thoſe who were guilty of notorious crimes, and believed that the biſhops had no authority to reconcile them. They held it unlawful to fly in time of perſecution. They condemned ſecond marriages, allowed the diſſolution of marriage, and obſerved three lents.

The Montaniſts became ſeparated into two branches, one of which were the diſciples of Proclus and the other of Æſchines. The latter are charged with following the heterodoxy of Praxes and Sabellius concerning the Trinity.

MONTARGIS, a conſiderable town of France, in the Orleannois, and capital of the Gatinois; ſeated on the river Loire, 62 miles ſouth of Paris. E. Long. 2. 36. N. Lat. 48. 1.

MONTAUBAN, a conſiderable town of France in Guienne, and territory of Quercy, ſeated on the river Tarne, 20 miles north of Toulouſe. E. Long. 1. 27. N. Lat. 43. 56.

MONTBAZON, a town of France, in Touraine, 135 miles ſouth-weſt of Paris. E. Long. 0. 45. N. Lat. 47. 17.

MONTBELLIARD, a ſtrong town of France, capital of a province of the ſame name, between Alſace and the Franche Compte, ſeated near the rivers Alaine and Doux, 33 miles weſt of Baſle, and 45 north-eaſt of Bezançon. E. Long. 6. 30. N. Lat. 47. 31.

MONTBLANC, a town of Spain in the province of Catalonia, 15 miles north of Tarragon. E. Long. 1. 5. N. Lat. 41. 20.

MONTBRISION, a conſiderable town of France, and capital of Forez, ſeated on the river Veziza, 40 miles weſt of Vienne, and 250 ſouth by eaſt of Paris. E. Long. 4. 27. N. Lat. 45. 32.

MONTECCHIO, a conſiderable town of Italy, in the duchy of Reggio, 10 miles ſouth-eaſt of Parma, and eight north-weſt of Reggio. E. Long. 15. 54. N. Lat. 38. 8.

MONTE-FALCO, a town of Italy, in the territory of the Church and duchy of Spoletto; ſeated on a mountain near the river Clitunno, 12 miles weſt of Spoletto. E. Long. 12. 40. N. Lat. 42. 58.

MONTE-Falcone, a town of Italy, in Fruili, with a caſtle. It belongs to the Venetians, and is near the river Ponzano, 10 miles north-weſt of Aquileia, and 12 north-weſt of Trieſte. E. Long. 13. 0. N. Lat. 46. 4.

MONTE-Fiaſcone, a ſmall but populous town of Italy, in the territory of the Church, with a biſhop's ſee; ſeated on a mountain, near the lake Bolſena, in a country abounding with excellent wine, 12 miles ſouth-weſt of Orvieto, and 45 north-weſt of Rome. E. Long. 12. 4. N. Lat. 42. 26.

MONTE-Marano, a populous town of Italy, in the kingdom of Naples, and in the Farther Principato; ſeated on the river Calore, 18 miles ſouth of Benevento. E. Long. 15. 0. N. Lat. 40. 48.

MONTE-Mor-o-novo, or *Monte-major-el-novo*, a conſiderable town of Portugal, on the road from Liſbon to Badajoz. W. Long. 9. 35. N. Lat. 38. 42.

MONTE-Mor-o-velho, or *Monte-major-el-velho*, a town of Portugal in the province of Beira, with a very large caſtle, ſeated in a fertile country, 10 miles ſouth-weſt of Coimbra, and 83 north of Liſbon. W. Long. 8. 9. N. Lat. 40. 5.

MONTE-Peloſo, an epiſcopal town of Italy, in the kingdom of Naples, and in the Baſilicata; ſeated on a mountain near the river Baſiento, 14 miles eaſt of Cirenza. E. Long. 16. 28. N. Lat. 40. 46.

MONTE-Pulſiano, a town of Italy, in Tuſcany, with a biſhop's ſee; ſeated on a high mountain, near the river Chiana, in a country noted for excellent wine, 25 miles ſouth-eaſt of Sienna, and 50 ſouth by eaſt of Florence. E. Long. 11. 49. N. Lat. 43. 10.

MONTE-Sancto, formerly called *Mount Athos*, a mountain of Turkey in Europe, on the gulf of Conteſſa. It is called Monte-Sancto, or the Holy Mount, becauſe there are 22 monaſteries thereon, in which are 4000 monks, who never ſuffer a woman to come near them. It is 17 miles ſouth of Salonichi. E. Long. 24. 39. N. Lat. 40. 27.

MONTE-Verde, a town of Italy, in the kingdom of Naples, and in the Farther Principato, with a biſhop's ſee: 60 miles eaſt of Naples. E. Long. 15. 42. N. Lat. 40. 51.

MONTEGO BAY, a flouriſhing town on the north ſide of Jamaica. It has a very conſiderable commerce; 150 veſſels clear out annually. The harbour is capacious; but expoſed to north winds, which at certain times in the year blow with great violence. In June 1795, a fire conſumed an immenſe quantity of ſtores, and great part of the town. W. Long. 77. 50. N. Lat. 18. 29.

MONTESA, a very ſtrong town of Spain, in the kingdom of Valencia. It is the ſeat of an order of knighthood of the ſame name; and is five miles from Xativa. W. Long. 0. 30. N. Lat. 39. 0.

MONTESQUIEU, CHARLES DE SECONDAT, BARON, a moſt illuſtrious Frenchman, deſcended from an ancient and noble family of Guienne, was born at the caſtle of La Brede, near Bourdeaux, in 1689. The greateſt care was taken of his education; and at the age of 20 he had actually prepared materials for his Spirit of Laws, by well digeſted extracts from thoſe immenſe volumes of civil law which he had ſtudied, not barely as a civilian, but as a philoſopher. He became a counſellor of the parliament of Bourdeaux in 1714, and was received preſident à mortier two years after. In 1721 he publiſhed his Perſian Letters; in which, under the ſcreen of Oriental manners, he ſatirized thoſe of France, and treated of ſeveral important ſubjects by delicate tranſient glances: he did not avow this publication; but was no ſooner pointed out as the author, than zeal without knowledge, and envy under the maſk of it, united at once againſt the Perſian Letters. He was received into the French academy in 1728; and having previouſly quitted his civil employments, he entirely devoted himſelf to his genius, and was no longer a magiſtrate, but a man of letters. Having thus ſet himſelf at liberty, he travelled through Germany, Italy, Switzerland, Holland, and England, in which laſt country he reſided three years, and contracted intimacies with the greateſt men then alive; for Locke and Newton were dead. The reſult of his obſervations was, "that Germany was fit to travel in, Italy to ſojourn in, England to think in, and France to live in." On his return he retired for two years to his eſtate at La Brede, where he finiſhed his work On the Cauſes of the Grandeur and Declenſion of the Romans; which appeared in 1734. The reputation acquired by this laſt work only cleared the way for his greater undertaking, the Spirit of Laws, which was printed at Geneva in 2 vols. 4to, 1750. This was immediately attacked by the adverſaries of his Perſian Letters, in a multitude of anonymous pamphlets; containing all the reproaches to which a liberal mind is expoſed from craft and ignorance. M. Monteſquieu drew up a defence of this work; which for truth, moderation, and delicacy of ridicule, may be regarded as a model in its way. This great man was peaceably enjoying that fulneſs of eſteem which his great merits had procured him, when he fell ſick at Paris, and died on the 10th of February 1755.—The following character of this great man is drawn by Lord Cheſterfield. "His virtues did honour to human nature, his writings juſtice. A friend to mankind, he aſſerted their undoubted and unalienable rights with freedom, even in his own country; whoſe prejudices in matters of religion and government he had long lamented, and endeavoured, not without ſome ſucceſs, to remove. He well knew, and juſtly admired, the happy conſtitution of this country, where fixed and known laws equally reſtrain monarchy from tyranny, and liberty from licentiouſneſs. His works will illuſtrate his name, and ſurvive him, as long as right reaſon, moral obligation, and the true ſpirit of laws, ſhall be underſtood, reſpected, and maintained." As to his perſonal qualities, we are told by his eulogiſt, M. d'Alembert, that "he was of a ſweet, gay, and even temper. His converſation was ſpirited, agreeable, and inſtructive. Nobody told a ſtory in a more lively manner, or with more grace and leſs affectation. He had frequent abſence of mind; but always awaked from it by ſome unexpected ſtroke that re-animated the languiſhing converſation. Though he lived with the great, he retired whenever he could to his eſtate in the country, and there met his books, his philoſophy, and his repoſe. Surrounded at his leiſure hours with peaſants, after having ſtudied man in the commerce of the world, he ſtudied him in thoſe ſimple people ſolely inſtructed by nature. With them he cheerfully converſed; he endeavoured, like Socrates, to find out their genius, and appeared as happy with them as in the moſt brilliant aſſemblies; eſpecially when he reconciled their differences, and by his beneficence relieved them from their diſtreſſes."

Beſides the works already mentioned, M. Monteſquieu wrote ſeveral ſmall pieces, as the Temple of Gnidus, Lyſimachus, and an Eſſay upon Taſte, which is left unfiniſhed. His works have been collected ſince his death, and printed at Paris in a ſplendid edition, in quarto. They have likewiſe all of them been tranſlated into Engliſh.

MONTEZUMA, or MONTEÇUMA, was emperor or king of Mexico when Cortez invaded that country in 1518, invited thither, as he pretended, by the inhabitants, whoſe children Montezuma, in the blindneſs of his ſuperſtition, had ſacrificed to his idols. The warlike animals on which the Spaniſh officers were mounted, the artificial thunder with which they were armed, the wooden caſtles on which they had croſſed the ocean, the armour with which they were covered. the victories which they gained wherever they went; all theſe circumſtances, added to that fooliſh diſpoſition to wonder which always characterizes a ſimple people, ſo operated upon the minds of the Mexicans, that when Cortez arrived at the city of Mexico, he was received by Montezuma as his maſter, and by the inhabitants as a god. At firſt they fell down in the ſtreets when a Spaniſh valet paſſed by; but by degrees the court of Montezuma grew familiar with the ſtrangers, and ventured to treat them as men. Montezuma, unable to expel them by force, endeavoured to inſpire them with confidence at Mexico by expreſſions of friendſhip, while he employed ſecret means to weaken their power in other quarters. With this view, one of his generals, who had private orders to that purpoſe, attacked a party of the Spaniards who were ſtationed at Vera Cruz; and, although his troops were unſucceſsful, yet three or four of the Spaniards were killed. The head of one of them was carried to Montezuma. In conſequence of this, Cortez did what has been reckoned one of the boldeſt political ſtrokes that ever was performed. He ran to the palace, followed by fifty of his troops; and, by perſuaſion and threats, carried the emperor priſoner into the Spaniſh quarters. He afterwards obliged him to deliver up thoſe who had attacked his troops at Vera Cruz: and, like a general who puniſhes a common ſoldier, he loaded Montezuma with chains. He next obliged him to acknowledge himſelf in public the vaſſal of Charles V.; and, in name of tribute for this homage, Cortez received 600,000 merks of pure gold. Montezuma ſoon afterwards fell a ſacrifice to his ſubmiſſion to the Spaniards. He and Alvaro, the lieutenant of Cortez, were beſieged in the palace by 200,000 Mexicans. The emperor propoſed to ſhow himſelf to his ſubjects, that he might perſuade them to deſiſt from the attack: but the Mexicans no longer conſidered him in any other light but as the ſlave of foreign conquerors. In the midſt of his ſpeech, he received a blow with a ſtone which wounded him mortally; and he expired ſoon after, A. D. 1520.—See CORTEZ. This unfortunate prince left two ſons and three daughters, who embraced the Chriſtian faith. The eldeſt received baptiſm, and obtained from Charles V. lands, revenues, and the title of count de Montezuma. He died in 1608; and his family is one of the moſt powerful in Spain.

MONTFERRAT, a province of Italy, with the title of a duchy; bounded on the eaſt by the duchy of Milan, and part of the territory of Genoa; on the north, by the Vercelleſe and Canaveſe; on the weſt, by Piedmont properly ſo called; and on the ſouth by the territory of Genoa, from whence it is ſeparated by the Apennine mountains. It contains 200 towns and caſtles; and is very fertile and well cultivated, abounding in corn, wine, oil, and ſilk. It belongs to the king of Sardinia, and Caſal is the capital town.

MONTFORT, a town of France, in Upper Bretagne, ſeated on the River Men, 12 miles from Rennes. W. Long. 1. 58. N. Lat. 48. 8.

MONTFORT, a handſome and ſtrong town of the Netherlands, in the United Provinces, with an ancient caſtle; ſeated on the river Yſſel, ſeven miles from Utrecht. E. Long. 5. 0. N. Lat. 52. 4.

MONTFORT, a town of Germany, in the circle of Suabia, on the confines of Tirol, 16 miles ſouth of Lindow, and the lake Conſtance. It is capital of a country of the ſame name, which has been almoſt all purchaſed by the houſe of Auſtria. E. Long. 9. 51. N. Lat. 47. 22.

MONTFORT-DE-LEMOS, an ancient town of Spain, in the kingdom of Galicia, with a magnificent caſtle, where the Comarca of Lemos reſides. It is ſeated in a fertile country, 25 miles north-eaſt of Orenſa, and 55 ſouth-eaſt of Compoſtella. W. Long. 7. 9. N. Lat. 42. 28.

MONTFORT-L'AMULY, a town in the Iſle of France, with the title of a duchy, 25 miles from Paris. E. Long. 2. 50. N. Lat. 48. 45.

MONTGATZ, a town of Lower Hungary, in the county of Pereczas, with a ſtrong fortreſs. It is encompaſſed with a great moraſs, and art and nature have rendered it almoſt impregnable. It was defended by the princeſs Ragotſky, wife of Count Tekeli, when beſieged by an army of the imperialiſts, who were obliged to raiſe the ſiege in 1688. E. Long. 21. 55. N. Lat. 46. 26.

MONTGERON, LOUIS-BASILE-CARRE DE, was born at Paris in 1686: his father was maſter of requeſts. He was ſcarcely 25 years of age when he purchaſed the place of counſellor in parliament, where by his wit and external qualifications he gained conſiderable reputation. Deeply engaged in all the vices which flow from irreligion, he was converted by an extraordinary circumſtance. He went on the 7th of September 1731 to the tomb of Deacon Paris, with an intention to examine, with the rigour of the ſevereſt critic, the miracles which were reported to be performed there. But, according to his own account, he felt himſelf ſuddenly beat to the earth by innumerable flaſhes of light with which he was ſurrounded. His incredulity was converted into flaming zeal, and he became the apoſtle of the ſaint whom he formerly ridiculed. From that moment he devoted himſelf to the fanaticiſm of *convulſions*, with the ſame impetuoſity of character with which he had run into the moſt ſhameful exceſſes. He had not long been the diſciple of Janſeniſm when he ſuffered perſecution. When the chamber of inqueſts was baniſhed in 1732, he was ſent into the mountains of Auvergne; which, inſtead

ſtead of cooling, tended rather to inflame his zeal. During his exile, he formed the plan of collecting the proofs of the miracles wrought at the tomb of the abbé Paris, and of compoſing what he called a *Demonſtration* of them. On his return to Paris, he prepared to execute this plan; and on the 29th of July 1737, he actually preſented to the king at Verſailles a volume in quarto ſuperbly bound. This work he accompanied with a ſpeech, which is a mixture of zeal and argument in a tolerable ſtyle. In conſequence of this work, which ſome conſider as a maſterpiece of eloquence, and others as a maſs of abſurdities, he was committed to the Baſtile. After a few months confinement, he was ſent to an abbey of Benedictine monks in the dioceſe of Avignon; whence he was in a ſhort time carried to Viviers. He was afterwards confined in the citadel of Valence, where he died, A. D. 1574, aged 68. The work which he preſented to the king was entitled *La verité des Miracles operées par l'interceſſion de M. Paris*, &c. &c.—The critics, even to this day, ſeem to be guided in their opinion concerning this book either by hatred or by enthuſiaſm. "It would be extremely raſh (ſays the abbé de St Pierre, in the ſecond volume of his *Annales*, p. 593.) to maintain with the Moliniſts, that no miraculous cure was ever performed at the tomb of the abbé Paris; and to ſay with the Janſeniſts, that theſe cures were performed by a ſupernatural power, would be the height of fanaticiſm. The truth is, (adds the ſame author), that no miracle appears ever to have been performed at this tomb except in the cure of the human body; in all other caſes, there would have been the want of that imagination on which the whole miracle depended." Thus, although Montgeron ventured to compare theſe prodigies with the miracles of Jeſus Chriſt and his apoſtles, yet we find no perſon raiſed from the dead, no multiplication of loaves, no command obeyed by the elements, and no blind or deaf reſtored to their ſight or hearing. It belongs to the Author of nature alone, or to thoſe who have derived power from him, to work ſuch miracles as are recorded by the evangeliſts, or in the hiſtory of the apoſtles. Montgeron added a ſecond and third volume on the ſame ſubject: he left alſo in manuſcript a work which he compoſed in priſon *contre les Incredules*. Religion, it muſt be confeſſed, has had much more powerful advocates. Fortunately Paſcal and Boſſuet are among the number: and it could well have wanted both Paris and Montgeron, whatever virtues they might poſſeſs in other reſpects.

MONTGOMERY, the capital of a county of the ſame name in North Wales, 158 miles from London, took its name from Roger de Montgomery earl of Shrewſbury, who built the caſtle. It is called by the Welſh *Tre Valdwin*, that is, Baldwin's town; having been built by Baldwin, lieutenant of the marches of Wales, in the reign of William I. The Welſh, after having put the garriſon to the ſword, demoliſhed it in 1095; but Henry III. rebuilt it, and granted it the privileges of a free borough, with other liberties. It is a tolerably well built town, in a healthful ſituation and fertile ſoil, with 947 inhabitants in 1801.

MONTGOMERYSHIRE, a county of North Wales, 40 miles in length and 37 in breadth; bounded on the north by Merionethſhire and Denbighſhire, on the north-eaſt and eaſt by Shropſhire, on the ſouth by Radnorſhire and Cardiganſhire, and on the weſt by the laſt-mentioned county and part of Merionethſhire. It is divided into ſix hundreds; and contains five market towns, 47 pariſhes, and 47,978 inhabitants. It lies in the three ſeveral dioceſes of St Aſaph, Bangor, and Hereford; but ſends only two members to parliament, one for the county, and one for the town of Montgomery. The air is pleaſant and ſalubrious; but this county, being extremely mountainous, is not very fertile, except in the valleys, which afford ſome corn and plenty of paſture; but the ſouth, ſouth-eaſt, and north-eaſt parts, being more level, are extremely fruitful, eſpecially a pleaſant vale, watered by the Severn.

MONTH, the twelfth part of a year. See CHRONOLOGY, N° 17.

MONTH, in its proper acceptation, is that ſpace of time which the moon takes up in paſſing from any certain point to the ſame again, which is called a *periodical month;* or it is the ſpace of time between two conjunctions of the moon with the ſun, which is called a *ſynodical month*. That ſpace of time which the ſun takes up in paſſing through one ſign or 12th part of the zodiac, is alſo called (but improperly) a *month*. So that there are two ſorts of months; *lunar*, which are meaſured by the moon; and *ſolar*, which are meaſured by the ſun. The lunar periodical month conſiſts of 27 days 7 hours 43 minutes 5 ſeconds: The lunar ſynodical month is 29 days 12 hours 44 minutes 3 ſeconds and 11 thirds. A ſolar month contains, upon a mean calculation, 30 days 10 hours 29 minutes 5 ſeconds.

The Jews, Greeks, and Romans, made uſe of lunar ſynodical months; but, to avoid fractions, they conſiſted alternately of 29 and 30 days. The former, the Romans called *cavi*, and the Greeks χοιλοι; the latter were termed *pleni* and πληρεις.

1. The Hebrew months were ranged differently in their ſacred and in their civil year.

Order of the Sacred Year.

1	*Niſan*	Anſwering to our	March.
2	*Jair*		April.
3	*Sivan*		May.
4	*Thammuz*		June.
5	*Ab*		July.
6	*Elul*		Auguſt.
7	*Tiſri*		September.
8	*Marſchevan*		October.
9	*Caſleu*		November.
10	*Thebet*		December.
11	*Sebat*		January.
12	*Adar*		February.

Order of the Civil Year.

1	*Tiſri*	Anſwering to our	September.
2	*Marſchevan*		October.
3	*Caſleu*		November.
4	*Thebet*		December.
5	*Sebat*		January.
6	*Adar*		February.
7	*Niſan*		March.
8	*Jair*		April.
9	*Sivan*		May.
10	*Thammuz*		June.
11	*Ab*		July.
12	*Elul*		Auguſt.

Theſe months being lunar cannot exactly anſwer to our ſolar months; but every Jewiſh month muſt be conceived to anſwer to two of ours, and partake of both. As theſe 12 lunar months conſiſted only of 354 days, the Jews, in order to bring it nearer to the true year, took care every three years to intercalate a 13th month into the number, which they called *Ve-adar*, or the ſecond Adar. The new moon was always the beginning of the month; and it is ſaid the Jews had people poſted on elevated places, to give notice to the Sanhedrim as ſoon as ſhe made her appearance: After this, proclamation was made by ſound of trumpet, and "the feaſt of the new moon, the feaſt of the new moon," reſounded amongſt the people.

The ancient Hebrew months were of 30 days each, excepting the laſt, which conſiſted of 35; ſo that the year contained 365 days, with an intercalary month at the end of 120 years, which, by abſorbing the odd hours which remained at the concluſion of each year, brought it back nearly to its proper place. This regulation of the year was borrowed from the Egyptians.

2. The months of the Athenian year, as we have before obſerved, conſiſted alternately of 29 and 30 days. The firſt month, according to Meton's reformation of the kalendar, began with the firſt new moon after the the ſummer ſolſtice, and was called *hecatombæon*, anſwering to the latter half of June, and the former half of July. The order of the months, with the number of days in each, are as follow:

1 *Hecatombæon*,	30	7 *Poſidion*,	30
2 *Metageitnion*,	29	8 *Gamelion*,	29
3 *Boedromion*,	30	9 *Elaphebolion*,	30
4 *Mæmacterion*,	29	10 *Munichion*,	29
5 *Panepſion*,	30	11 *Thargelion*,	30
6 *Antheſterion*,	29	12 *Scirrophorion*,	29

Each month was divided into three decades of days called δεχημερα. The firſt was called Μηνος αρχομενου or ισαμενου, or the decade of the beginning of the month; the ſecond was Μηνος μεσουντος or the decade of the middle; and the third was Μηνος φθινοντος, παυομενου or ληγοντος, the decade of the expiring month.

The firſt day of the firſt decade was termed νεομηνια, becauſe the firſt month began with the new moon; the ſecond day was δευτερα ισαμενου; the third τριτη ισαμενου, &c. The firſt day of the ſecond decade was πρωτη μεσουντος, the ſecond δευτερα μεσουντος, &c.—the days of this decade were alſo called πρωτη επι δεκα, δευτερα επι δεκα, &c. The firſt day of the third decade was πρωτη επ' εικαδι; the ſecond was δευτερα επ' εικαδι, &c. i. e. the firſt, ſecond, &c. after 20, becauſe the laſt decade began on the 20th day. This decade was alſo counted by inverſion thus; φθινοντος δεκατη the 21ſt, φθινοντος εννατη the 22d, φθινοντος ογδοη the 23d, and ſo of the reſt to the laſt day of the month, which was called ενη και νεα, the old and the new, becauſe one part of that day belonged to the old and the other to the new moon; but after the time of Demetrius, the laſt day of the month was called from him Δημητριας; it ſometimes was named τριακας.

The Grecian months, thus conſiſting of 29 and 30 days alternately, fell ſhort of the ſolar year 11 days 6 hours. To remedy this defect, the cycle of four years, called τετραετηρις, was invented.—In this cycle, after the firſt two years, they added an intercalated month called εμβολιμος, conſiſting of 22 days; and again, after the expiration of two years more, they inſerted another month of 23 days, the fourth part of a day having in the ſpace of four years amounted to a whole day. See YEAR.

3. The Roman year under Romulus conſiſted of 10 months only, and began with March, which contained 31 days; then followed April which had 30, May 31, June 30, *Quintilis* 31, *Sextilis* 30, September 30, October 31, November 30, December 30. Theſe 10 months containing no more than 304 days, this account was in a ſhort time found to be deficient. Numa Pompilius, therefore, took away one day from each of theſe ſix months, April, June, *Sextilis*, September, November, December; and to the ſix days thus obtained he added 51, which was the number that Romulus's year, in his opinion, wanted to make it perfect. Numa had now 57 days to diſpoſe of; he therefore divided them, and conſtituted two other months, January and February; the former conſiſting of 29 and the latter of 28 days. The month of January, which he placed at the winter ſolſtice, he made inſtead of March to begin the year. Thus Numa's year conſiſted of 355 days: but this being found 10 days 6 hours ſhort of the ſolar year, he made uſe of the intercalation of 90 days at the expiration of eight years perpetually; which number, being made up of the 11 days and a quarter, kept the year pretty well to its place. The beginning of the year in Julius Cæſar's time had anticipated its true place 67 whole days: theſe he intercalated betwixt November and December: ſo that the year conſiſted, for this one time, of 15 months or 445 days. This reformation was called the *Julian correction*, and this year the *year of confuſion*. At the end of 12 years, by the ignorance of prieſts, who did not underſtand intercalation, 12 days had been intercalated for nine. This was obſerved by Auguſtus Cæſar, and rectified, by ordering 12 years to paſs without any intercalary days. The order and ſucceſſion of months was the ſame as that of Numa: But January, March, May, *Quintilis*, *Sextilis*, October, and December, had each 31 days; April, June, September 30, and February, in common years, 28; but every fourth year or biſſextile 29. This, with a very little difference, is the account obſerved at preſent. *Quintilis*, in compliment to Julius Cæſar was called *July*, becauſe in this month he was born; and *Sextilis*, in honour of Auguſtus, was called Auguſt; both which names are ſtill continued.—See YEAR.

Each month by the Romans was divided into *kalends*, *nones*, and *ides*, all of which were reckoned backwards. The *kalends* were the firſt day of the month. The *nones* fell on the ſeventh, and the *ides* on the 15th, of March, May, July, October—but in all other months the *nones* were on the fifth, and the *ides* on the 13th. For the more eaſy comprehenſion of the Roman manner of dating, according to this diviſion of the months, here follows a table.

	March May July October	January Auguſt December	April June September November	February.
1	*Kalendæ*	*Kalendæ*	*Kalendæ*	*Kalendæ*
2	6	4	4	4
3	5	3	3	3
4	4	*Prid. Non.*	*Prid. Non.*	*Prid. Non.*
5	3	*Nonæ*	*Nonæ*	*Nonæ*
6	*Prid. Non.*	8	8	8
7	*Nonæ*	7	7	7
8	8	6	6	6
9	7	5	5	5
10	6	4	4	4
11	5	3	3	3
12	4	*Prid. Idus*	*Prid. Idus*	*Prid. Idus*
13	3	*Idus*	*Idus*	*Idus*
14	*Prid. Idus*	19	18	16
15	*Idus*	18	17	15
16	17	17	16	14
17	16	16	15	13
18	15	15	14	12
19	14	14	13	11
20	13	13	12	10
21	12	12	11	9
22	11	11	10	8
23	10	10	9	7
24	9	9	8	6
25	8	8	7	5
26	7	7	6	4
27	6	6	5	3
28	5	5	4	*Prid. Kal.*
29	4	4	3	
30	3	3	*Prid. Kal.*	
31	*Prid. Kal.*	*Prid. Kal.*		

N. B. Every leap year, February conſiſting of 29 days, the 24th and 25th of that month are written *ſexto Kal. Mart.*; hence leap year is called *Biſſextilis*.

MONTIA, a genus of plants belonging to the triandria claſs, and in the natural method ranking with thoſe of which the order is doubtful. See BOTANY *Index*.

MONTINIA, a genus of plants belonging to the diœcia claſs. See BOTANY *Index*.

MONTMEDI, a ſmall but ſtrong town of France, in Luxemburg, ſeated on the river Chire, which divides it into the upper and lower towns. It is 22 miles ſouth-eaſt of Sedan, 27 ſouth-weſt of Luxemburg, and 135 north-eaſt of Paris. E. Long. 5. 23. N. Lat. 49. 32.

MONTMORENCI, FRANÇOIS HENRY DE. See LUXEMBURG.

MONTMORENCY, a town of France, with the title of a duchy, remarkable for the tombs of the dukes of this name. It is ſeated on a hill, near a large valley, fertile in fruits, eſpecially excellent cherries. E. Long. 2. 24. N. Lat. 48. 59.

MONTPELIER, one of the fineſt towns of France, and the moſt conſiderable in the department of Herault, excepting Thoulouſe, is ſituated in E. Long. 3. 58. N. Lat. 43. 37. This town has been long famous for its ſalubrious air, and on this account has been the frequent reſort of invalids. But the climate, according to ſome travellers, is conſiderably changed, having at times conſtant rains for three months together, and often very thick fogs. Its ſituation, though on an eminence, never could be healthy; for between it and the Mediterranean (which is about three leagues diſtant) it is one continued marſh, covered with noxious vapours, which, when the ſea breeze ſets in, blows directly on the town and the country adjacent; of the ſad effects of which, its unhealthy inhabitants, with their meagre looks, are the moſt convincing proofs.

This city ſtands upon a riſing ground fronting the Mediterranean; on the other ſide is an agreeable plain, extending about the ſame diſtance towards the mountains of the Cevennes. It is reckoned well built, yet the ſtreets are in general narrow and the houſes dark. The inhabitants, many of whom are Proteſtants, are ſuppoſed to amount to 40,000, are ſociable, gay, and good tempered. The trade of Montpelier is very extenſive in wine, cordials, oil, verdigris, and ſaltpetre;—and the manufactures in ſilk and woollen goods are conſiderable. The markets are well ſupplied with fiſh, poultry, butcher's meat, and game, at reaſonable rates. The wine of the country is ſtrong and harſh: Burgundy is dear, and ſo is ſweet wine of Frontignan, though made in the neighbourhood of Cette. Liquors of various ſorts are compounded and diſtilled at Montpelier. The environs are extremely pleaſant, having on one ſide La Place de Peyrou, which forms a fine terrace. From thence on a clear day, may be ſeen to the eaſtward the Alps, which form the frontiers of Italy; to the ſouth-weſt, the Pyrenean mountains, which form thoſe of Spain, both at about 50 leagues diſtant; and to the ſouthward a moſt extenſive view of the Mediterranean. Not far from thence is a noble aqueduct, with a double tier of arches; by this, water is brought from a mountain at three leagues diſtance, into two baſons in a ſmall elegant temple at the weſt end of the town. Here alſo is a royal garden, where on certain days public lectures were formerly held on botany. On the other ſide of the town is the eſplanade, a beautiful walk, bordered on each ſide by olive trees, from whence there is a pleaſing proſpect of the ſea and the country adjacent to the town. Previous to the revolution, Montpelier had a univerſity, an academy of ſciences, and it was the ſee of a biſhop.

MONTREAL, an iſland of North America, in the river St Lawrence, ten leagues in length, and four leagues broad, and about 60 miles above Quebec. It was taken from the French by generals Amherſt and Murray on the 8th of September 1760. The ſoil of the iſland is exceedingly rich and good, producing all kinds of European fruits and vegetables in great abundance, with variety of garden fruits. The ſouth ſide is the moſt inhabited, and of courſe beſt cultivated; and beſides the ſettlements, which are numerous, the iſland is adorned with villas, for the retirement of the more wealthy merchants during the ſummer ſeaſon. Since this place has been in the poſſeſſion of Britain, it has ſuffered much by fires, the houſes being moſtly built of wood.

The town of MONTREAL, ſituated on this iſland, and formerly called *Ville Marie*, is the ſecond place in Canada for extent, buildings and ſtrength; and beſides poſſeſſing the advantage of a leſs rigorous climate, for

delightfulneſs

delightfulneſs of ſituation is infinitely preferable to Quebec. It ſtands on the ſide of a hill, ſloping to the ſouth, with many agreeable villas upon it, which, with the iſland of St Helen, and the river (which is here about two miles broad), form a moſt charming landſcape. Though the city is not very broad from north to ſouth, it covers a great length of ground from eaſt to weſt, and is nearly as large and populous as Quebec. The ſtreets are regular, forming an oblong ſquare; the houſes well built, and in particular the public edifices, which far exceed thoſe of the capital in beauty and commodiouſneſs; the reſidence of the knights hoſpitallers being extremely magnificent.—There are ſeveral gardens within the walls, in which, however, the proprietors have conſulted uſe more than elegance, particularly thoſe of the Siſters of the Congregation, the Nunnery Hoſpital, the Recollets, Jeſuit Seminary, and Governor. The number of inhabitants is ſaid to be between 5000 and 6000. By the ſituation of the place, the inhabitants are well ſupplied with all kinds of river fiſh, ſome of which are unknown to Europeans, being peculiar to the rivers and lakes of this country. They have likewiſe plenty of black cattle, horſes, hogs, and poultry. The neighbouring ſhores ſupply them with a great variety of game in the different ſeaſons; and the iſland abounds with ſprings of good water and numerous rivulets. The trade in furs is conſiderable, and veſſels of 200 tons can come up to the town.

MONTREAL, a town of Spain, in the kingdom of Arragon, with a caſtle, ſeated on the river Xiloea, 25 miles north-weſt of Terville, and 40 ſouth-eaſt of Calataud. W. Long. 1. 2. N. Lat. 41. 9.

MONTREAL, a town of Sicily, and in the valley of Mazara, with an archbiſhop's ſee; ſeated on a rivulet, five miles weſt of Palermo, and 50 north-eaſt of Mazara. E. Long. 13. 31. N. Lat. 38. 14.

MONTREAL, or **MOUNT ROYAL**, a fortreſs of Germany, in the circle of the Lower Rhine, and electorate of Triers; ſeated on the river Moſelle, 22 miles north-eaſt of Triers. E. Long. 7. 6. N. Lat. 49. 59.

MONTROSE, a handſome town of North Britain, in the ſhire of Angus, ſituated at the mouth of the river Eſk, on the German ocean, 46 miles north-eaſt of Edinburgh. The houſes are neat, and many of them in the modern taſte. The moſt remarkable public buildings are, the town-houſe, the church, and an elegant epiſcopal chapel.—Montroſe is a parliament town, and a dukedom in the family of Graham. It ſtands between two rivers, the ſouth and north Eſks, over the latter of which there is a handſome ſtone bridge, and over the former there is one of wood. The ſalmon fiſheries on theſe rivers are very extenſive, and form a conſiderable branch of commerce. The harbour is a fine ſemicircular baſon defended by a handſome ſtone pier. A great number of trading veſſels belong to this port. The population of Montroſe in 1801 amounted to nearly 8000. W. Long. 2. 32. N. Lat. 36. 40.

MONTROSE, *Marquis of*. See GRAHAM; and BRITAIN, N° 137, 138, 143, 265.

MONTSERRAT, a mountain of Spain, in Catalonia, one of the moſt ſingular in the world for ſituation, ſhape, and compoſition. It ſtands ſingle, towering over a hilly country like a pile of grotto work or Gothic ſpires; and its height ſo great, that to a beholder on the top the neighbouring mountains appear to be ſunk to a level with the plain. It is compoſed of ſteep rocks, which at a diſtance ſeem indented; whence it is ſaid to have received the name *Montſerrat* from the Latin word *ſerra*, a "ſaw." It is impoſſible to deſcribe the beauty, richneſs, and variety, of the landſcapes diſcovered from the moſt elevated point: but the extenſiveneſs of the proſpect may be conceived by the reader, upon being told that the iſlands of Minorca and Majorca, which are at the diſtance of 60 leagues, are diſcovered from this elevation.

Montſerrat is particularly famous for the adoration that is paid to an image of the Virgin, which according to tradition was found in a cave in this mountain by ſome ſhepherds in the year 880. Over this image, Guthred earl of Barcelona cauſed a monaſtery and chapel to be erected; but after remaining in this receptacle upwards of 700 years, Philip II. and Philip III. built a magnificent church for its reception. Innumerable and aſtoniſhing miracles are aſcribed to this holy image. The convent or monaſtery is ſituated in a nook of the mountain; it ſeems as if vaſt torrents of water, or ſome violent convulſion of nature, had ſplit the eaſtern face of Montſerrat, and formed in the cleft a ſufficient platform to build the monaſtery upon. The river Llobregat roars at the bottom, and perpendicular walls of rock of prodigious height, riſe from the water edge near half way up the mountain. Upon theſe maſſes of white ſtone reſts the ſmall piece of level ground which the monks inhabit. Cloſe behind the abbey, and in ſome parts impending over it, huge cliffs ſhoot up in a ſemicircle to a ſtupendous elevation: their ſummits are ſplit into ſharp cones, pillars, pipes, and other odd ſhapes, blanched and bare; but the interſtices are filled up with foreſts of evergreen and deciduous trees and plants. Fifteen hermitages are placed among the woods; nay, ſome of them on the very pinnacles of the rocks, and in cavities hewn out of the loftieſt of theſe pyramids.

The monaſtery is one of the 45 religious houſes of the Spaniſh congregation of the order of St Benedict; their general chapter is held every fourth year at Valladolid, where the deputies chooſe abbots and other dignitaries for the enſuing quadrennium. In this monaſtery, they elect for abbot a Catalan and a Caſtilian alternately. Their poſſeſſions are great, conſiſting of nine villages lying to the ſouth of the mountain; but the king has lately curtailed their income about 6000 livres a-year, by appropriating to his own uſe the beſt houſe in each village, ſome of which, with their tythes, are worth 200 dollars per annum. Their original foundation, in 866, gave them nothing but the mountain; and to donations and economy they owe the great increaſe of their landed property. They are bound to feed and harbour for three days all poor pilgrims that come up and pay their homage to the Virgin; and the allowance is a luncheon of bread in the morning, as much more, with broth at noon, and bread again at night. Sometimes, on particular feſtivals, 7000 perſons arrive in one day; but people of condition pay a reaſonable price for what they eat.—The number of profeſſed monks, according to Mr Swinburne, is 76 (according to M. Bourgoanne 60); of lay brothers, 28; and of ſinging boys 25; beſides phyſician, ſurgeon, and ſervants. The church is a gloomy edifice; and the gilding is much ſullied with the

Montſerrat

the ſmoke of 85 lamps of ſilver, of various forms and ſizes, that hang round the cornice of the ſanctuary. Funds have been bequeathed by different devotees for furniſhing them with oil. The choir above ſtairs is decorated with the life of Chriſt, in good wooden carving. A gallery runs on each ſide of the chancel, for the convenience of the monks. A large iron grate divides the church from the chapel of the Virgin, where the image ſtands in a niche over the altar, before which burn four tapers in large ſilver candleſticks, the preſent of the duke of Medina Celi. In the ſacriſty, and paſſages leading to it, are preſſes and cupboards full of relicks and ornaments of gold, ſilver, and precious ſtones; they point out, as the moſt remarkable, two crowns for the virgin and her ſon, of ineſtimable value; ſome large diamond rings; an excellent cameo of Meduſa's head; the Roman emperors in alabaſter; and the ſword of St Ignatius. But as no offerings to this miraculous ſtatue can be rejected or otherwiſe diſpoſed of, the ſhelves are crowded with moſt whimſical *ex votos*, viz. ſilver legs, fingers, breaſts, ear-rings, watches, two wheeled chaiſes, boats, carts, and ſuch like trumpery.

On different parts of the mountain, as already noticed, are a number of hermitages. Each of theſe ſolitary retreats, which at a diſtance ſeem deſtitute of every thing, has a chapel, a cell, a well in the rock, and a little garden. The inhabitant of one of them, which is dedicated to St Beneto, has the privilege of making an annual entertainment on a certain day; on which day all the other hermits are invited, when they receive the ſacrament from the hands of the mountain vicar, and after divine ſervice dine together. They meet alſo at this hermitage, on the days of the ſaints to which their ſeveral hermitages are dedicated, to ſay maſs and commune with each other. But at other times they live in a very ſolitary and recluſe manner, perform various penances, and adhere to very rigid rules of abſtinence; nor do they ever eat fleſh; nor are they allowed to keep within their walls either dog, cat, bird, or any living thing, leſt their attention ſhould be withdrawn from heavenly to earthly affections. Moſt of theſe hermits are ſaid to be perſons of fortune and family, diſguſted with the world, who have retired thither to devote themſelves to meditation, ſelf-denial, and contrition.

MONTSERRAT, one of the Caribbee iſles, belonging to Great Britain. It is a very ſmall, but very pleaſant iſland, ſo called by Columbus from its reſemblance to the famous mountain near Barcelona in Catalonia. It lies in W. Long. 61. 0. N. Lat. 16. 50. having Antigua to the north-eaſt, St Chriſtopher's and Nevis to the north-weſt, and Guadaloupe lying ſouth-ſouth-eaſt at the diſtance of about nine leagues. It is about nine miles in diameter, and is ſuppoſed to contain about 40,000 or 50,000 acres. The climate is warm, but leſs ſo than Antigua, and is eſteemed very healthy. The ſurface is mountainous, but with pleaſant, rich, and fertile valleys; the hills are covered with cedars and other fine trees. Here are all the animals as well as vegetables and fruits that are to be found in the other iſlands. The inhabitants raiſed formerly a conſiderable quantity of indigo. The produce now is chiefly cotton, rum, and ſugar. There is no good harbour, but three tolerable roads, at Plymouth, Old Harbour, and Ker's Bay.

Monument || Moon.

MONUMENT, in *Architecture*, a building deſtined to preſerve the memory, &c. of the perſon who raiſed it, or the perſon for whom it was raiſed; ſuch are a mauſoleum, a triumphal arch, a pyramid, &c.

MOOD, or MODE. See MODE.

MOODS of Syllogiſm. See LOGIC, N° 85.

MOOD, or *Mode*, in *Grammar*, the different manner of conjugating verbs See GRAMMAR.

MOON, (*Luna* ☽), in *Aſtronomy*, one of the heavenly bodies, uſually ranked among the planets; but with more propriety accounted a ſatellite, or ſecondary planet.

Among the ancients, the moon was an object of prime regard.—By the *Hebrews* ſhe was more regarded than the ſun, and they were more inclined to worſhip her as a deity. The new moons, or firſt days of every month, were kept as feſtivals among them, which were celebrated with ſound of trumpets, entertainments, and ſacrifice. (See Numb. xviii. 11. x. 16. 1 Sam. xx. 5—18.). People were not obliged on theſe days to reſt. The feaſts of new moons were a miniature repreſentation of the feaſt of trumpets, which was held on the firſt of the month Tiſri, which was the beginning of the civil year. The Jews not being acquainted with the phyſical cauſe of eclipſes, looked upon them, whether of ſun or moon, as ſigns of the divine diſpleaſure. The Grecians looked upon the moon as favourable to marriage; and the full moons, or the times of conjunction of ſun and moon, were held the moſt lucky ſeaſons for celebrating marriages; becauſe they imagined the moon to have great influence over generation. The full moon was held favourable for any undertakings by the Spartans: And no motive could induce them to enter upon an expedition, march an army, or attack an enemy, till the full of the moon. The moon was ſuppoſed both by Greeks and Romans to preſide over child-birth. The patricians at Rome wore a creſcent on their ſhoes, to diſtinguiſh them from the other orders of men. This creſcent was called *Lunula*. Some ſay it was of ivory, others that it was worked upon the ſhoe, and others that it was only a particular kind of fibula or buckle.

For the aſtronomical phenomena connected with the moon, ſee ASTRONOMY *Index*.

Harveſt-MOON.—It is remarkable, that the moon, during the week in which ſhe is full in harveſt, riſes ſooner after ſunſetting than ſhe does in any other full moon week in the year. By doing ſo, ſhe affords an immediate ſupply of light after ſunſet, which is very beneficial to the farmers for reaping and gathering in the fruits of the earth: and therefore they diſtinguiſh this full moon from all the others in the year, by calling it the *harveſt-moon*.

Influence of the MOON on the Human Body.—The famous Dr Mead was a believer in the influence of the ſun and *moon* on the *human body*, and publiſhed a book to this purpoſe, entitled *De Imperio Solis ac Lunæ in Corpore humano:* but this opinion has been exploded by moſt philoſophers, as equally unreaſonable in itſelf, and contrary to fact. As the moſt accurate and ſenſible barometer is not affected by the various poſitions of the moon, it is not thought likely that the human body ſhould be affected by them. Several learned and ingenious men, however, ſtill conſider Dr Mead's doctrine as far from being unfounded.

MOON, *Influence of, on the Earth's Atmoſphere.*—It has

has been the opinion of the vulgar in almoſt all ages and countries, that the changes which take place in the ſtate of our atmoſphere, or the changes of the weather, depend in a great meaſure on certain ſituations of the moon. This particular opinion is alluded to by Virgil (A), and is applied in the ſhepherd of Banbury's rules for judging of the weather (B). We have, under METEOROLOGY, N° 90 to 92, given the reſult of ſome obſervations on the connection between the changes of the moon and thoſe of the weather.

It can ſcarcely be doubted that an opinion ſo generally received muſt be founded on ſomething more than fancy or prejudice; and indeed the obſervations of ſeveral eminent meteorologiſts within the laſt thirty years have contributed materially to favour this opinion. Independent of actual obſervation, it appears reaſonable to infer, that a body ſo large, and ſo near the earth, as the moon, whoſe gravitating influence on the earth's ſurface in producing the *flux and reflux of the ſea*, cannot be altogether inactive with reſpect to the air, a fluid much more ſuſceptible of changes than the ſea.

We have already noticed (METEOROLOGY, N° 14.) the theory of Mr Luke Howard, on the moon's influence on the mercury of the barometer, and we are now to give a ſhort account of what has been advanced on her general influence by the philoſophers of the continent. Among theſe, Signior Toaldo may be ſaid to have led the way.

From obſervations made at Padua, during fifty years, on the ſtate of the weather that correſponded to certain changes of the moon, he found that theſe changes were always accompanied by good or bad weather; and he at length became enabled to foretel with ſome degree of certainty what would be the ſtate of the atmoſphere that ſhould follow any ſituation of the moon. There are ten ſituations of the moon, which, according to Toaldo, are capable of producing a ſenſible effect on the earth's atmoſphere. Theſe are the *ſyzigies* * or new and full moon; the quadratures; the *apſides*, or apogee and perigee; the *luniſtices*, or theſe points when the moon is neareſt to our zenith and at the greateſt diſtance from it; and the moon's *equinoxes*. There are three different relations of the moon's motion producing a correſponding number of revolutions, each having a certain duration, and each correſponding to ſome of the above ten ſituations, as it will be ſeen by the following table.

* See *Aſtronomy*, N° 90.

Revolutions.	Situations.
1. *Synodical*, in regard to the ſun; continues 29 days 12 hours 44 minutes.	New moon. Firſt quarter. Full moon. Laſt quarter.
2. *Anomaliſtic*, in regard to the moon's courſe; continues 27 days 13 hours 43 minutes.	Apogeum. Perigeum.
3. *Periodical*, in regard to the moon's paſſing the equator; continues 27 days, 7 hours, 43 minutes.	Aſcending equinoxes. Northern luniſtices. Deſcending equinoxes. Southern luniſtices.

Sig. Toaldo has calculated a ſeries of probabilities that a change of weather will take place on the approach of any one of theſe ten ſituations, and theſe he has expreſſed in a tabular form as follows.

That a change will take place at	New moon	is	6:1
	Firſt quarter		5:2
	Full moon		5:2
	Laſt quarter		5:4
	Perigeum		7:1
	Apogeum		4:1
	Aſcending equinox		13:4
	Northern luniſtice		11:4
	Deſcending equinox		11:4
	Southern luniſtice		3:1

In general, each of the ten ſituations changes the weather that prevailed under the preceding ſituation, and it ſeldoms happen that a change of weather takes place without a correſponding change in the lunar ſituations. From the inequality of their revolutions, theſe ſituations are often combined, and by this union their effect in producing changes of the atmoſphere is greatly increaſed, eſpecially when a union takes place between the ſyzigies and apſides. Thus,

That a change will follow	New moon with perigee	is	33:1
	Ditto with apogee		7:1
	Full moon with perigee		10:1
	Ditto with apogee		8:1

Theſe combined ſituations are generally accompanied or followed by ſtorms and tempeſts, eſpecially when they take place near the moon's paſſage over the equator. This is more particularly the caſe in the months of March and September, and we find that at the new and full moon in theſe months, the weather takes a certain character, by which it is diſtinguiſhed for the ſucceeding three or ſix months. The ſame takes place at the ſolſtices, eſpecially at the winter ſolſtice. The new moon does not always, however, produce a change of weather; and this want of effect is moſt likely to happen at thoſe new moons which are moſt diſtant from the apſides.

Though Toaldo conſiders it as perfectly aſcertained that each ſucceeding ſituation of the moon alters that ſtate of the atmoſphere which had been produced by the preceding ſituation; it muſt, however, be obſerved that ſome ſituations of the moon favour good and others bad weather. Thus the perigee, the new and full moon, the paſſage over the equator, and the northern luniſtice are favourable to bad weather, while the apogee

---

(A) ———" lunaſque ſequentes
Ordine reſpicies; nunquam te craſtina fallet
Hora, neque inſidiis noctis capiere ſerenæ.
Georg. I. 424.

(B) 1. Horns of the moon obſcure—*Rain.*
2. When the moon is red—*Wind.*
3. On the fourth day of the new moon, if bright, with ſharp horns—*No winds nor rain till the month be finiſhed.*

gee, quadratures, and ſouthern luniſtice, are more favourable to good weather.

The changes produced by the influence of the lunar ſituations, ſeldom take place on the exact days on which theſe ſituations happen, but either precede or follow them; and Toaldo has found that, in the ſix winter months, the changes of weather commonly precede the lunar ſituations, whereas in the ſix ſummer months they more commonly follow them.

There are certain days before and after new and full moon, which deſerve particular attention in forming our judgments of the weather, eſpecially the octants or the fourth day before new and full moon, as at theſe times the weather is inclined to change, and it may be pretty certainly predicted, that a change will follow at the next lunar ſituation. Virgil has particularly noticed this fourth day as a ſure mark of the ſucceeding weather (c). If the weather continues unchanged on the fourth, fifth, and ſixth day of the moon, it proves that the lunar influence is at that time very weak, and we are to expect no change till the full moon, or perhaps till the next new moon.

Sig. Toaldo compared a diary which he had kept for many years of the ſtate of the barometer with the ten ſituations of the moon, and from the compariſon deduced the following concluſions, viz.

1. That at the time of the moon's apogee, the mercury riſes higher by the ſixth part of a line than at the perigee.

2. That at the time of the quadratures it is higher by the tenth of a line than at the time of the ſyzigies.

3. That it is higher by a fourth of a line at the ſouthern than at the northern luniſtice. This correſpondence of the lunar ſituations with the aſcent of the mercury in the barometer does not hold at the time of the moon's paſſage through her equinoctial points. The mercury is then higher, eſpecially when ſhe is paſſing in Libra; and as ſuch ſituations of the moon generally indicate bad weather, this circumſtance is not conformable to meteorological obſervations.

In this caſe Toaldo thinks that we muſt be guided, in our judgment of the weather, rather by the moon than by the barometer.

The caſe is ſimilar during the coincidence of the equinoctial points with the perigee, at which time the mercury is unuſually high; but this coincidence is a ſign of great irregularity.

According to Toaldo, the riſing and ſetting of the moon, as well as its ſuperior and inferior paſſage of the meridian, all which ſituations he calls the moon's angles, may ſerve for foretelling rain. The ſeaſons moſt expoſed to rain, are the riſing and ſetting of the moon; while its paſſage over the meridian is moſt favourable to good weather. It has ever been obſerved that during rainy days, the ſky always clears a little while the moon is paſſing the meridian. An exception to this rule muſt, however, be made when the moon's angle does not coincide with that of the ſun.

Bad years take place when the apſides of the moon fall in the four cardinal points of the zodiac. Their intervals, therefore, are as four to five, eight to nine, &c. or as the intervals of the paſſage of the apſides through the four cardinal points of the zodiac. Thus the year 1777 was, in general, a bad year; and in that year the apſides of the moon were in the equinoctial ſigns; and it is probable that the years in which the apſides fall in the ſigns Taurus, Leo, Virgo and Aquarius, will be good and moderate years, as the year 1776 really was; and in that year the apſides of the moon were in Taurus and Virgo.

Every 18th year muſt be ſimilar. We, however, cannot depend upon a return altogether the ſame, on account of the three different revolutions of the moon; and therefore it may happen, that the epoch of this extraordinary year may be retarded a year or perhaps two. Though approximations only are here given, this does not prevent their being uſeful to farmers, if they only pay attention to circumſtances. Beſides, various exceptions muſt be made for different parts of the earth; and it is difficult to determine theſe before-hand, as what regards this ſyſtem is applicable to the whole globe; but when the reſult of the ſyſtem has been improved by local obſervations, the conjectures for each country will be attended with more certainty.

The 54th year muſt have a greater ſimilarity to the firſt than to all the reſt; becauſe, at this period, the ſituations of the moon, in regard to the ſun and the earth, are again found in the ſame points.

The quantity of the rain which falls in nine ſucceſſive years, is almoſt equal to that which falls in the next following nine. But this is not the caſe when we compare in like manner the quantity of rain which falls in ſix, eight, or ten years*.

* See *Phil. Mag.* vol. iii.

The obſervations of M. Lamarck, though they confirm the opinion of the moon's general influence on the atmoſphere, do not agree with thoſe of Toaldo, as to the ſituations of that luminary which correſpond to the changes of the weather. He could not find that agreement between the ſyzigies and quadratures of the moon and a change of weather, which has been ſo much dwelt on by Toaldo; but he is of opinion, that we are to conſider the *declination* of the moon as the principal cauſe of her influence on the atmoſphere.

Lalande had conceived the idea that when the moon entered the northern hemiſphere, or had *north declination*, the weather was moſt likely to be cold and dry, and that when ſhe paſſed to the ſouth of the equator, it was likely to be rainy. The obſervations of Lamarck, however, tend to eſtabliſh the contrary opinion.

Lamarck conſiders the two following principles as eſtabliſhed by his obſervations; viz.

1. *That it is in the elevation of the moon above, and her depreſſion below, the equator that we are to ſearch for thoſe regularly varied effects which ſhe produces on our atmoſphere.*

2. *That the determinable circumſtances, which con-*

(c) Luna revertentes cum primum colligit ignes,
Si nigrum obſcuro comprenderit aëra cornu;
Maximus agricolis pelagoque parabitur imber.
At, ſi virgineum ſuffuderit ore ruborem,
Ventus erit; vento ſemper rubet aurea Phœbe.
Sin ortu in quarto (namque is certiſſimus auctor)
Pura, neque obtuſis per coelum cornibus ibit;
Totus et ille dies, et qui naſcentur ab illo
Exactum ad menſem, pluvia ventiſque carebunt.

See Note (B *Georg.* I. 427.

ſpire to increaſe or diminiſh the moon's influence in her different declinations, are her apogees and perigees, her conjunctions with and oppoſitions to the ſun; and laſtly, the ſolar ſolſtices and equinoxes.

Conſidering that every lunar month, or every revolution of the moon in the zodiac, may be divided into two diſtinct portions, each containing about fourteen days, and each giving occaſion to a particular atmoſpheric conſtitution, we may aſſume theſe as two circumſtances of importance in meteorology, and we may call one the *boreal* or *northern* conſtitution, viz. that in which the moon paſſes through the ſix northern ſigns of the zodiac, and the other, the *auſtral* or *ſouthern* conſtitution, viz. that in which ſhe traverſes the ſix ſouthern ſigns.

Lamarck is convinced by obſervation, that in theſe climates, during a *boreal conſtitution*, there chiefly prevail ſoutherly, ſouth-weſterly, and weſterly winds, though ſometimes, in the ſummer, the winds paſs to the ſouth-eaſt. In general, during this conſtitution, the barometer exhibits only moderate elevations of the mercury; moſt commonly the ſeaſon is rainy or moiſt, and the air loaded with clouds. And, laſtly, it is particularly during this conſtitution that we obſerve the effects of ſtorms and tempeſts, when the cauſes which occaſion them become active.

On the contrary, during an auſtral conſtitution, the winds which chiefly predominate blow from the north and north-weſt, and in the ſummer north-eaſt, and even eaſterly winds. In general during this conſtitution, the barometer exhibits conſiderable elevations in the column of mercury, at leaſt if the wind is not very ſtrong; the weather is then moſt uſually clear, cold and dry, and in the ſummer it is ſeldom (we might almoſt ſay never) during this conſtitution that ſtorms are formed.

Theſe atmoſpheric conſtitutions are not, however, ſo permanently characteriſed as to render it eaſy to diſtinguiſh them at all times by the ſtate of the atmoſphere. The atmoſpheric air is a moveable fluid, and ſo eaſily diſplaced, that it is not ſurpriſing that in the temperate zones, where the influence of the heavenly bodies acts leſs ſtrongly than between the tropics, from various cauſes, that counteract very often the regular influence of the moon, and tend to maſk and even change its effects.

The perturbations which theſe variable cauſes produce on the regular effects of the influence of the moon on the atmoſphere, occaſion in fact many variations in the two atmoſpheric conſtitutions which we have been deſcribing; and this is doubtleſs the reaſon why they have been hitherto diſregarded. M. Lamarck poſitively aſſerts, that theſe perturbations, though frequent, and ſometimes very conſiderable, do not prevent the character of each of theſe conſtitutions from being remarked in the greateſt number of caſes.

The probability that he finds, according to his obſervations, is eſtimated at five out of eight; that is to ſay, out of 48 atmoſpheric conſtitutions comprehended in the lunar year, he eſtimates there will be found at leaſt 30 agreeing with the principles pointed out in his memoir; and he adds, that among the diſturbing cauſes which modify the before-mentioned effects, ſeveral may be foreſeen, and perhaps even appreciated as to their quantity of effect.

He conſiders what is here pointed out as a fact; as an order of things which any one may prove by obſervation *.

Lamarck has alſo endeavoured to aſcertain what truth there may be in the periodical return of the variations of the atmoſphere at the end of nineteen years; and he has found, by comparing meteorological obſervations, that this return is far from being ſo correct as is generally believed.

Aſtronomers alſo know well, that the cycle of nineteen years is not exact within an hour and a half; an error which amounts to a whole day in the courſe of 308 years †.

M. Cotte has alſo beſtowed much attention on this ſubject of the moon's influence; but appears to think that our obſervations are not ſufficiently numerous or accurate, to deduce any thing like a correct theory, and he is not diſpoſed to go ſo far as M. Lamarck.

M. Cotte agrees in general with Mr Luke Howard's obſervations on the moon's influence. (See METEOROLOGY). He noted, during the ſpace of 34 years and five months, (from the 1ſt of January 1768, to the 22d of May 1802), the aſcending and deſcending direction of the barometer in each of the ſyzigies and quarters of the moon which have occurred through that period of time. He ſtates the total ſum of the elevations and depreſſions of the mercury at each of the phaſes as follows.

For 34½ Years.	New moon.	1ſt Quar.	Full Moen.	2d Quar.
Sum of elevations	218	296	199	290 times.
——-depreſſions	281	229	279	106
Differences	63	67	80	84

Theſe reſults, of nearly 35 years obſervations, confirm, as will be ſeen, the concluſions drawn by Mr Howard, both from his obſervations for one year at Plaiſtow, and thoſe made for 10 years in the Royal Society's apartments.

It is to be remarked, 1ſt, That the four numbers which expreſs the differences between the elevations and depreſſions are nearly in an exact proportion, ſince 63 : 67 :: 80 : $85\frac{5}{63}$.

2dly, That the two latter phaſes, viz. the full moon and laſt quarter, have more effect than the two firſt.

3dly, He examined what phaſes of the moon correſponded to the greateſt and leaſt height of the mercury for each month during ten years, and obtained the following reſults.

For 10 Years.	New Moon.	1ſt Quar.	Full Moon.	2d Quar.
Greateſt elevation occurred at	26	40	26	28 times.
Greateſt depreſſion occurred at	30	34	29	27
Differences	4	6	3	1

The ſcience may be therefore ſaid to have advanced one ſtep farther towards perfection on this occaſion; and it is to be hoped that, by redoubling our diligence in multiplying obſervations, and combining them in various ways to obtain their reſults, its progreſs may be ſtill accelerated. The uſeful purpoſes which may be thereby anſwered in philoſophy, agriculture, and medicine, may be properly urged to obſervers as the means of

---

* See *Jour. de Phyſ.* vol. iii. and *Nichol. Jour.* 4to, vol. iv.

† *Phil. Mag.* vol. v.

of ſupporting their ardour, and indemnifying them for thoſe ſarcaſms and reflections which even ſome learned men have been pleaſed to beſtow upon obſervations of this ſort, together with their authors *.

MOON-Eyes, among horſes, when the weakneſs of the eye increaſes or decreaſes according to the courſe of the moon; ſo that in the wane of the moon his eyes are muddy and troubled, and at new moon they clear up. This obſervation is probably inaccurate.

MOON-ſtone, or *Adularia*. See ADULARIA, MINERALOGY *Index*.

MOON-Wort. See LUNARIA, BOTANY *Index*.

MOOR, in country affairs, denotes a tract of land, uſually overrun with heath.

MOOR-Cock, or *Gor-Cock*. See TETRAO, ORNITHOLOGY *Index*.

MOOR Land, or *moory ſoil*, in *Agriculture*, is a black, light, and ſoft earth, very looſe, and without any admixture of ſtones; and with very little clay or ſand.

MOORE, or MORE, EDWARD, an ingenious writer, was bred a linen-draper, but quitted buſineſs to join the retinue of the Muſes; and he certainly had a very happy and pleaſing talent for poetry. In his Trial of Selim the Perſian, he complimented Lord Lyttleton in an elegant kind of panegyric, couched under the appearance of accuſation: and his Fables for the Female Sex, for eaſy verſification, poignant ſatire, and ſtriking morals, approach nearer to the manner of Gay than any other of the numerous imitations of that author. He wrote alſo three dramatic pieces; The Gameſter, a tragedy; The Foundling, and Gil Blas, comedies. The ſucceſs of theſe was not ſuch as they merited, the firſt of them having met with a cold reception, for no other apparent reaſon but becauſe it too nearly touched a favourite and faſhionable vice; and the ſecond having been condemned for its ſuppoſed reſemblance to Sir Richard Steele's Conſcious Lovers, but to which good judges have been inclined to give it greatly the preference. Mr Moore married a lady of the name of *Hamilton*, daughter to Mr Hamilton table-decker to the princeſſes, who had herſelf a very poetical turn, and has been ſaid to have aſſiſted him in the writing of his tragedy. One ſpecimen of her poetry, however, was handed about before their marriage, and has ſince appeared in print in different collections of ſongs, particularly in one called the *Goldfinch*. It was addreſſed to a daughter of the famous Stephen Duck; and begins with the following ſtanza:

> Would you think it, my Duck? (for the fault I
> muſt own),
> Your Jenny at laſt is quite covetous grown:
> Though millions if Fortune ſhould laviſhly pour,
> I ſtill would be wretched if I had not MORE.

And after half a dozen ſtanzas more, in which, with great ingenuity and delicacy, and yet in a manner that expreſſes a great affection, ſhe has quibbled on our author's name, ſhe concludes with the following lines:

> You may wonder, my girl, who this dear one can be?
> Whoſe merit can boaſt ſuch a conqueſt as me:
> But you ſhan't know his name, tho' I told you be-
> fore,
> It begins with an M, but I dare not ſay MORE.

In the year 1753, Mr Moore commenced a weekly miſcellaneous paper, entitled, *The World, by Adam Fitz-Adam*, in which undertaking he was aſſiſted by Lord Cheſterfield with ſome Eſſays. This paper was collected into volumes, and Mr Moore died ſoon after.

MOORING, the act of confining and ſecuring a ſhip in a particular ſtation, by chains or cables, which are either faſtened to the adjacent ſhore, or to anchors in the bottom.

A ſhip may be either moored by the head, or by the head and ſtern; that is to ſay, ſhe may be ſecured by anchors before her, without any behind; or ſhe may have anchors out, both before and behind her; or her cables may be attached to poſts, rings, or moorings, which anſwer the ſame purpoſe.

When a ſhip is moored by the head with her own anchors, they are diſpoſed according to the circumſtances of the place where ſhe lies and the time ſhe is to continue therein. Thus, wherever the tide ebbs and flows, it is uſual to carry one anchor out towards the flood, and another towards the ebb, particularly where there is little room to range about; and the anchors are laid in the ſame manner, if the veſſel is moored head and ſtern in the ſame place. The ſituation of the anchors, in a road or bay, is uſually oppoſed to the reigning winds, or thoſe which are moſt dangerous; ſo that the ſhip rides therein with the effort of both her cables. Thus if ſhe rides in a bay, or road, which is expoſed to a northerly wind and heavy ſea from the ſame quarter, the anchors paſſing from the oppoſite bows ought to lie eaſt and weſt from each other: hence both the cables will retain the ſhip in her ſtation with equal effort againſt the action of the wind and ſea.

MOORINGS, in ſea language, are uſually an aſſemblage of anchors, chains, and bridles, laid athwart the bottom of a river or haven, to ride the ſhipping contained therein. The anchors employed on this occaſion have rarely more than one fluke, which is ſunk in the water near low-water mark. Two anchors being fixed in this manner on the oppoſite ſide of the river, are furniſhed with a chain extending acroſs from one to the other. In the middle of the chain is a large ſquare link, whoſe lower end terminates in a ſwivel, which turns round in the chain as about an axis, whenever the ſhip veers about with the change of the tide. To this ſwivel link are attached the bridles, which are ſhort pieces of cable, well ſerved, whoſe upper ends are drawn into the ſhip at the mooring ports, and afterwards faſtened to the maſts or cable bolts. A great number of moorings of this ſort are fixed in the harbours adjacent to the king's dock-yards, as Deptford, Chatham, Portſmouth, Plymouth, &c.

MOORLANDS, a tract ſo called, in the north part of Staffordſhire, where the land riſes gradually into ſmall hills, which run through the midſt of England in one continued ridge, riſing higher and higher to Scotland, and ſending forth many rivers. The ſoil here is ſo foul and cold, that the ſnows lie almoſt all the year on the tops of the hills; and it is withal very rugged and barren: it, however, yields plenty of coal, lead, copper, rance-marble, and millſtones; and ſome of the limeſtone hills bear ſuch a ſweet though ſhort graſs, as is very grateful to the oxen, of which here is

---

* Phil. Mag. vol. iii.

a very good breed. It is obſerved here, that the weſt wind always brings rain, and the eaſt and ſouth fair weather; that though this tract is full of bogs, it is as healthy as any other part of the county; and that it produces the ſame plants as the Peak of Derby.

MOORS. See Morocco.

Moors, in the Iſle of Man, thoſe who ſummon the courts for the ſeveral ſheadings; ſuch as the lords bailiffs. Every moor has the like office with our bailiff of the hundred.

MOOSE, or Elk. See Cervus, Mammalia *Index*.

MOOT, a difficult caſe argued by the young barriſters and ſtudents at the inns of court, by way of exerciſe, the better to qualify them for practice, and to defend the cauſes of their clients. This, which is called *mooting*, is the chief exerciſe of the inns of court. Particular times are appointed for the arguing moot caſes: the place where this exerciſe is performed was anciently called *moot-hall;* and there is a bailiff, or ſurveyor of the moots, annually choſen by the bench to appoint the moot men for the inns of chancery, and to keep an account of the performance of exerciſes. The word is formed either from the Saxon *metan*, *gemetan*, "meeting"; or from the French *mot*, "word."

MOPSUS, in fabulous hiſtory, a celebrated prophet, ſon of Manto and Apollo, during the Trojan war. He was conſulted by Amphimachus, king of Colophon, who wiſhed to know what ſucceſs would attend his arms in a war which he was going to undertake. He predicted the greateſt calamities; but Calchas, who had been a ſoothſayer of the Greeks during the Trojan war, promiſed the greateſt ſucceſſes. Amphimachus followed the opinion of Calchas; but the prediction of Mopſus was fully verified. This had ſuch an effect upon Calchas, that he died ſoon after. His death is attributed by ſome to another mortification of the ſame nature. The two ſoothſayers, jealous of each other's fame, came to a trial of their ſkill in divination. Calchas firſt aſked his antagoniſt, how many figs a neighbouring tree bore? 10,000 except one, replied Mopſus, and one ſingle veſſel can contain them all. The figs were gathered, and his conjectures were true. Mopſus now, to try his adverſary, aſked him how many young ones a certain pregnant ſow would bring forth? Calchas confeſſed his ignorance; and Mopſus immediately ſaid that the ſow would bring forth on the morrow ten young ones, of which only one ſhould be a male, all black, and that the females ſhould all be known by their white ſtreaks. The morrow proved the veracity of his prediction; and Calchas died by the exceſs of grief which his defeat produced. Mopſus after death was ranked among the gods, and had an oracle at Malia, celebrated for the true and deciſive anſwers which it gave.—Another *Mopſus*, ſon of Ampyx and Chloris, born at Titareſſa in Theſſaly. He was the prophet and ſoothſayer of the Argonauts, and died at his return from Colchis by the bite of a ſerpent in Libya. Jaſon erected him a monument on the ſea ſhore, where afterwards the Africans built him a temple, where he gave oracles. He has often been confounded with the ſon of Manto, as their profeſſions and their names were alike.

MORÆA, a genus of plants belonging to the triandria claſs; and in the natural method ranking under the 6th order, *Enſatæ*. See Botany *Index*.

MORAI, is the name given at Otaheite in the South ſea to the burying grounds, which are alſo places of worſhip. This is a pile of ſtone raiſed pyramidically upon an oblong baſe or ſquare 267 feet long and 87 wide. On each ſide is a flight of ſteps; thoſe at the ſides being broader than thoſe at the ends; ſo that it terminated not in a ſquare of the ſame figure with the baſe, but in a ridge like the roof of a houſe. There were 11 of theſe ſteps to one of theſe morais, each of which was 4 feet high, ſo that the height of the pile was 44 feet; each ſtep was formed of one courſe of white coral ſtone, which was neatly ſquared and poliſhed; the reſt of the maſs (for there was no hollow within) conſiſted of round pebbles, which, from the regularity of their figure, ſeemed to have been wrought. The foundation was of rock ſtones, which were alſo ſquared. In the middle of the top ſtood an image of a bird carved in wood, and near it lay the broken one of a fiſh carved in ſtone. The whole of this pyramid made part of one ſide of a ſpacious area or ſquare 360 feet by 354, which was walled in with ſtone, and paved with flat ſtones in its whole extent. About 100 yards to the weſt of this building was another paved area or court, in which were ſeveral ſmall ſtages raiſed on wooden pillars about ſeven feet high, which are called by the Indians *ewattas*, and ſeem to be a kind of altars, as upon theſe are placed proviſions of all kinds, as offerings to their gods. On ſome of them were ſeen whole hogs, and on others the ſkulls of above 50, beſides the ſkulls of many dogs. The principal object of ambition among the natives is to have a magnificent morai. The male deities (for they have them of both ſexes) are worſhipped by the men, and the female by the women; and each have morais, to which the other ſex is not admitted, though they have alſo morais common to both.

MORAL PHILOSOPHY, or MORALS.

MORAL PHILOSOPHY is, "The ſcience of MANNERS or DUTY; which it traces from man's nature and condition, and ſhows to terminate in his happineſs." In other words, it is, "The knowledge of our DUTY and FELICITY;" or, "The art of being VIRTUOUS and HAPPY."

It is denominated an *art*, as it contains a ſyſtem of rules for becoming virtuous and happy. Whoever practiſes theſe rules, attains an habitual power or facility of becoming virtuous and happy. It is likewiſe called a *ſcience*, as it deduces thoſe rules from the principles and connexions of our nature, and proves that the obſervance of them is productive of our happineſs.

It is an art, and a ſcience of the higheſt dignity, importance, and uſe. Its object is man's duty, or his conduct

duct in the ſeveral moral capacities and connexions which he ſuſtains. Its office is to direct that conduct; to ſhow whence our obligations ariſe, and where they terminate. Its uſe, or end, is the attainment of happineſs; and the means it employs are rules for the right conduct of our moral powers.

Moral Philoſophy has this in common with Natural Philoſophy, that it appeals to nature or fact; depends on obſervation; and builds its reaſonings on plain uncontroverted experiments, or upon the fulleſt induction of particulars of which the ſubject will admit. We muſt obſerve, in both theſe ſciences, how nature is affected, and what her conduct is in ſuch and ſuch circumſtances: Or, in other words, we muſt collect the appearances of nature in any given inſtance; trace theſe to ſome general principles or laws of operation; and then apply theſe principles or laws to the explaining of other phenomena.

Therefore Moral Philoſophy inquires, not how man might have been, but how he is, conſtituted: not into what principles or diſpoſitions his actions may be artfully reſolved, but from what principles and diſpoſitions they actually flow: not what he may, by education, habit, or foreign influence, come to be or do, but what, by his nature, or original conſtituent principles, he is formed to be and do. We diſcover the office, uſe, or deſtination of any work, whether natural or artificial, by obſerving its ſtructure, the parts of which it conſiſts, their connexion or joint action. It is thus we underſtand the office and uſe of a watch, a plant, an eye, or hand. It is the ſame with a living creature of the rational or brute kind. Therefore, to determine the office, duty, or deſtination of man; or, in other words, what his buſineſs is, or what conduct he is obliged to purſue; we muſt inſpect his conſtitution, take every part to pieces, examine their mutual relations one to the other, and the common effort or tendency of the whole.

It has not been thus, however, that the ſcience has always been taught. The earlieſt moraliſts did not erect ſyſtems upon a juſt analyſis of the powers of the human mind; nor have all thoſe who thought ſuch a foundation neceſſary to be laid, deduced their theories from the very ſame principles. As moral truths are not capable of rigid demonſtration, it appears to us, that we cannot more properly introduce the ſyſtem which we have adopted, than by giving our readers a ſhort view of the moſt celebrated ſyſtems that have been maintained by others. They will thus have an opportunity of judging for themſelves of the reſpective merits of the different theories, and of adopting that which ſhall appear to them to place practical virtue on the firmeſt baſis.

HISTORY of the Science of MORALS.

1 Various opinions concerning the criterion of virtue, &c.

Whilſt there has been a remarkable agreement among the writers on morality, as to the particular actions which are virtuous and thoſe which are vicious; and whilſt they have uniformly taught, that it is our duty and our intereſt to perform the one and to avoid the other; they have yet differed exceedingly concerning the *teſt* or *criterion* of virtue, as well as concerning the *principle* or *motive* by which men are induced to purſue it. One cauſe of this difference in opinion reſpecting matters of ſuch univerſal importance, may perhaps be traced to the miſtakes into which philoſophers are apt to fall concerning the original ſtate of man.

2 Probable cauſe of this variety.

It is very generally taken for granted, that the firſt men were ſavages of the loweſt rank, and that the race gradually civilized itſelf during the courſe of many ſucceeding ages. Without mutual intercourſe, the progreſs of civilization could never have commenced; and as the practice of juſtice is abſolutely neceſſary to every ſpecies of friendly intercourſe, thoſe original ſavages, it is ſuppoſed, muſt have been juſt in their dealings, and juſt upon ſome principle which has its foundation in human nature. But to develope the principle by which ſavages are influenced in their conduct, no tedious or intricate proceſs of reaſoning can be neceſſary. It muſt have a place in every mind, and be inſtantaneous in all its deciſions. Hence it has been ſuppoſed, that the principle to which modern philoſophers have given the name of the *moral ſenſe*, is inſtinctive; that it is the ſole judge of virtue and vice; and that its admonitions have ſuch authority, as to enforce obedience without regard to the conſequences of any action.

Other philoſophers, who deny that the moral ſenſe is inſtinctive, and who yet ſuppoſe that the original ſtate of man was ſavage, are forced to pile hypotheſis upon hypotheſis, each unnatural in itſelf, and all contradictory to one another, in order to account for the commencement of civilization and the formation of ſociety. It has been ſuppoſed, that the deſire of ſelf-preſervation and the love of power are the governing principles in human nature; that in the ſavage ſtate every man had a right to every thing which he could ſeize by fraud or force; that all had an innate propenſity to invade each other's property; and that hence war, rapine, and bloodſhed, prevailed univerſally, till the ſavages diſcovered the expediency of uniting under ſome form of government for their mutual protection.

But before the original ſtate of man had been made the baſis of ſuch oppoſite theories as theſe, it would ſurely have been proper to inquire upon what grounds that ſtate has been ſuppoſed to be ſavage. To us theſe grounds appear to be nothing better than mere imaginations; the dreams of poets, and of ſuch philoſophers as bend facts to their own ſyſtems. In the authentic *hiſtory* of our ſpecies, there is no evidence, indeed there can be no evidence, that the firſt men were ſavages; and every thing which we know of human nature leads us to believe, that had they been ſo, the race could never have been civilized but by the miraculous interpoſition of ſome ſuperior being. The only record of the earlieſt ages of the world to which the ſmalleſt credit is due, repreſents all the nations of the earth as having ſprung from one pair, and that pair as having been inſtructed in their duty by their beneficent Creator. If this be the fact, and no conſiſtent theiſt can controvert it, the precepts of morality would be originally conveyed from one generation to another; not in a ſyſtematical or ſcientific form, but as the laws of the Univerſal Sovereign, whoſe authority demanded implicit obedience. Accordingly we find, that the firſt teachers of morals were men of ſuperior rank as well as of eminent talents, who formed collections of maxims derived from their anceſtors, "with the

3 Modes of communicating inſtruction by the earlieſt moraliſts.

view

view of perfecting ſubordination *, poliſhing manners, and educating youth. Such were the proverbs of Solomon, the Words of Agur, and the Wiſdom of the ſon of Sirach." Theſe inſtructors did not analyze the human mind into its various faculties, and build a ſyſtem of morals either upon a particular inſtinct pointing to the ſupreme good, or upon the fitneſs of things diſcovered by reaſon. Short iſolated ſentences were the mode in which they conveyed their precepts; which they prefaced by obſerving, that "the fear of the Lord is the beginning of knowledge;" and enforced by the aſſurance, that "length of days, and long life, and peace, ſhould they add to thoſe who obeyed them." The ſayings of the celebrated wiſe men of Greece were collections of apophthegms, made in the ſame manner, and delivered with ſimilar views. Thales and Pythagoras †, who founded the one the Ionic and the other the Italic ſchool, made collections of precepts for the conduct as well of a ſtate as of private life. "Neither the crimes nor the thoughts of bad men (ſaid Thales) are concealed from the gods. The only method of being juſt, is to avoid doing that which we blame in others." Of Pythagoras it is related by Porphyry and Laertius, that from Samos he repaired to Delos, and after preſenting an offering of cakes to Apollo, there received, or pretended to receive moral dogmas from the prieſteſs; which he afterwards delivered to his diſciples under the character of divine precepts. Amongſt theſe were the following: That, "next to gods and demons, the higheſt reverence is due to parents and legiſlators; and that the laws and cuſtoms of our country are to be religiouſly obſerved."

* *Bruce's Elements of the Science of Ethics.*

† *Bruce's Elements,* and *Enfield's Hiſtory of Philoſophy.*

To theſe maxims or apophthegms, which, for the ſake of delighting the ear and aiding the memory, were ſometimes delivered in verſe, ſucceeded, as has been ſuppoſed, the mode of inſtruction by fable or allegory. But the truth ſeems to be, that this method of communicating moral and political wiſdom was as ancient as the other; for we have a beautiful ſpecimen of it in the ninth chapter of the book which relates the tranſactions of the Judges of Iſrael. The fables of Eſop, too, which were written at a very early period, remain laſting modes of this ſpecies of art among the Greeks.

When the inſtructors of mankind had proceeded thus far as to give an artificial form to their precepts, they ſoon advanced a ſtep farther, and reduced their obſervations into claſſes or predicaments. Pythagoras, who viſited Egypt, has been ſuppoſed to have learned from its prieſts the method of arranging the virtues into diſtinct claſſes. But it is the opinion of an excellent writer ‡, founded on the previous aſpects of ethics, and on the comprehenſive talents of the Samian philoſopher, that the honour of the invention ought to be aſcribed to himſelf. Be this as it may, it was obſerved by the inventor, that "all the maxims of morality might be referred to the duties which men owe to themſelves, and the duties which they owe to each other." Hence the four cardinal virtues of the ancients, PRUDENCE, TEMPERANCE, FORTITUDE, and JUSTICE; of which the firſt three refer to the individual, and the fourth to ſociety.

‡ Mr *Bruce.*

4
The moral principles of Socrates.

Hitherto leſſons in morality had not taken a ſyſtematic form; but they were gradually approaching to it. Socrates was perhaps the firſt Pagan philoſopher who eſtabliſhed all his precepts on one ſure and ſteady baſis. In his lectures and diſcourſes, he ſeems to have had one great object in view ‡, to connect the moral maxims which were fitted to regulate the conduct of mankind, with ſublime conceptions reſpecting the character and government of a ſupreme Being. The firſt principles of virtuous conduct which are common to all mankind, are according to this excellent moraliſt, laws of God: and the concluſive argument by which he ſupports this opinion is, that no man departs from theſe principles with impunity. "It is frequently poſſible (ſays he) for men to ſcreen themſelves from the penalty of human laws, but no man can be unjuſt or ungrateful without ſuffering for his crime; hence I conclude, that theſe laws muſt have proceeded from a more excellent legiſlator than man." From this it would appear, that in the opinion of Socrates, conſcience, or the moral ſenſe, approving of any action, is the criterion by which it is known to be virtuous, and the will of God that which obliges men to perform it.

‡ *Bruce's Elements* and *Enfield's Hiſtory, &c.*

5
Origin of the Greek ſects.

Socrates himſelf left no writings behind him, nor, as far as we know, offered any regular and complete theory of ethics. His diſciples, however, who were numerous and diſtinguiſhed, became the founders of the celebrated Greek ſects. Among them the firſt great queſtion was, "what are the foundations of virtue?" and the ſecond, "what are the diſtinctions betwixt good and evil, happineſs and miſery?" The anſwers given to theſe important queſtions divided the philoſophers and their diſciples into diſtinct orders.

6
Theories of Plato,

In anſwer to the former queſtion, Plato taught * that "virtue is to be purſued for its own ſake; and that being a divine attainment, it cannot be taught, but is the gift of God." This ſeems to differ in nothing, but the name, from the doctrine of thoſe moderns who place the ſole foundation of virtue in the approbation of the moral ſenſe. The founder of the academy indeed has no ſuch phraſe as *moral ſenſe* in any of his writings with which we are acquainted; but if virtue cannot be taught, and if it is to be purſued for its own ſake, it muſt in itſelf be *good,* and the object of ſome feeling, whether called *ſenſe, inſtinct,* or *paſſion.* His ſolution of the ſecond queſtion agitated among the ſects is not indeed very conſiſtent with this neceſſary inference from his anſwer to the firſt; but for his inconſiſtencies we are not accountable. "Our higheſt good (he ſays) conſiſts in the contemplation and knowledge of the firſt good, which is mind or God; and all thoſe things which are called *good* by men, are in reality ſuch only ſo far as they are derived from the firſt and higheſt good. The only power in human nature which can acquire a reſemblance to the ſupreme good, is reaſon; and this reſemblance conſiſts in prudence, juſtice, ſanctity, and temperance."

* *Enfield.*

7
of Ariſtotle,

Ariſtotle, the founder of the Peripatetic ſchool, was the pupil of Plato; but of the two great moral queſtions he gives ſolutions ſomewhat different from thoſe of his maſter. "Virtue (according to him ‡) is either theoretical or practical. Theoretical virtue conſiſts in the due exerciſe of the underſtanding; practical, in the purſuit of what is *right* and *good.* Practical virtue is acquired by habit and exerciſe." This theory ſeems to differ little from that adopted by Cudworth, Clarke, and Price, which ſhall be conſidered afterwards.

‡ *Enfield.*

With reſpect to happineſs or good, the doctrine of Ariſtotle is very rational. "Pleaſures (he ſays) are eſſentially different in kind. Diſgraceful pleaſures are wholly unworthy of the name. The pureſt and nobleſt pleaſure is that which a good man derives from virtuous actions. Happineſs, which conſiſts in a conduct conformable to virtue, is either contemplative or active. Contemplative happineſs, which conſiſts in the purſuit of knowledge and wiſdom, is ſuperior to active happineſs, becauſe the underſtanding is the higher part of human nature, and the objects on which it is employed are of the nobleſt kind. The happineſs which ariſes from external poſſeſſions is inferior to that which ariſes from virtuous actions; but both are neceſſary to produce perfect felicity."

8
the
ics,
Enfield.

The Stoics, another celebrated ſect of Greek philoſophers, maintained *, that "nature impels every man to purſue whatever appears to him to be good." According to them, "ſelf-preſervation and defence is the firſt law of animated nature. All animals neceſſarily derive pleaſure from thoſe things which are ſuited to them; but the firſt object of purſuit is, not pleaſure, but conformity to nature. Every one, therefore, who has a right diſcernment of what is good, will be chiefly concerned to conform to nature in all his actions and purſuits. This is the origin of moral obligation." With reſpect to happineſs or good, the Stoical doctrine was altogether extravagant: They taught, that "all external things are indifferent, and cannot affect the happineſs of man; that pain which does not belong to the mind, is no evil; and that a wiſe man will be happy in the midſt of torture, becauſe virtue itſelf is happineſs (A)."

As the Stoics held that there is but one ſubſtance, partly active and partly paſſive, in the univerſe (ſee METAPHYSICS, N° 261, 262), and as they called the active principle *God*, their doctrine, which makes virtue conſiſt in a conformity to *nature*, bears no ſmall reſemblance to that of thoſe moderns who reſt moral obligation on the *Divine will*. It was therefore on better grounds than has been ſometimes ſuppoſed, that Warburton, when characterizing the founders of the three principal ſects in Greece, repreſented † *Plato*, as the patron of the *moral ſenſe*; *Ariſtotle* of the *eſſential differences*; and *Zeno*, of *arbitrary will*. Theſe principles, when ſeparated from each other, and treated in the manner of the ancients, may not each be able to bear the ſuperſtructure which was raiſed upon it; but the principles of moſt of the other ſects were much leſs pure, and infinitely more dangerous.

† *iv, Leg.*
Moſes.

ternal
immu-
le Mo-
ity.
‡

9
Ariſtip-
, Demo-
tus, and
tagoras;

Cudworth ‡, whoſe teſtimony when relating the doctrines of antiquity is entitled to the fulleſt credit, affirms, that Ariſtippus the founder of the Cyrenaic ſchool, Democritus, and Protagoras, with their followers among the atomiſts, taught, that "the diſtinction between virtue and vice is merely arbitrary; that nothing is juſt or unjuſt, ſacred or profane, but as it is agreeable or contrary to eſtabliſhed laws and cuſtoms; that what is juſt to-day, human authority may make unjuſt to-morrow; and that preſent pleaſure is the ſovereign good of man."

10
and of Epicurus.

With theſe impieties, the moral doctrines of Epicurus have very unjuſtly been confounded. The phyſical and metaphyſical ſyſtems of that philoſopher are indeed ſtrange compoſitions of ingenuity and abſurdity, truth and falſehood; and the moral precepts of many of his followers were in the higheſt degree licentious and impure. But his own life was exemplary; and his ethical ſyſtem, if candidly interpreted, is much more rational than that of the Stoics; though it muſt be confeſſed, that no ſect produced men of more determined virtue than the ſchool of Zeno. According to Epicurus *, "the end of living, or the ultimate good which is to be ſought for its own ſake, is happineſs. The happineſs which belongs to man, is that ſtate in which he enjoys as many of the good things, and ſuffers as few of the evils incident to human nature as poſſible; paſſing his days in a ſmooth courſe of tranquillity. Pleaſure is in its own nature good, as pain is in its nature evil. The one is therefore to be purſued, and the other to be avoided, for its own ſake. Pleaſure and pain are not only good and evil in themſelves, but they are the meaſures of what is good or evil in every object of deſire and averſion; for the ultimate reaſon why we purſue one thing and avoid another is, becauſe we expect pleaſure from the former, and apprehend pain from the latter.—That pleaſure, however, which prevents the enjoyment of a greater pleaſure, or produces a greater pain, is to be ſhunned; and that pain which either removes a greater pain, or procures a greater pleaſure, is to be endured."

* *Enfield's Hiſtory.*

Upon theſe ſelf-evident maxims, Epicurus builds his ſyſtem of ethics; and proves, with great force of argument, "that a ſteady courſe of virtue produces the greateſt quantity of happineſs of which human nature is capable." Without a *prudent* care of the body, and a ſteady government of the mind, to guard the one from diſeaſes and the other from the clouds of prejudice, happineſs is unattainable. By *temperance* we enjoy pleaſure, without ſuffering any conſequent inconvenience. *Sobriety* enables us to content ourſelves with ſimple and frugal fare. *Gentleneſs*, as oppoſed to an iraſcible temper, greatly contributes to the tranquillity and happineſs of life, by preſerving the mind from perturbation, and arming it againſt the aſſaults of calumny and malice. *Fortitude* enables us to bear thoſe pains which prudence cannot ſhun, and baniſhes fear from the mind; and the practice of *juſtice* is abſolutely neceſſary to the exiſtence of ſociety, and by conſequence to the happineſs of every individual." Theſe reaſonings come home to every man's boſom; and had not this philoſopher, by denying the providence, if not the being, of God, moſt unhappily excluded from his ſyſtem the very poſſibility of a future ſtate of retribution, his moral philoſophy would have been the moſt rational, and of courſe the moſt uſeful, of any that

---

(A) Since this ſhort hiſtory was written, a very pleaſing view of Stoiciſm has been given to the public in Ferguſon's Principles of Moral and Political Science; a work which the ſtudent of ethics will do well to conſult. Perhaps the amiable author may unintentionally have ſoftened the auſtere dogmas of the Porch, by transfuſing into them ſomething of the mild ſpirit of the goſpel; but, if ſo, he has much improved the ſyſtem of Zeno.

that was taught in the ſchools of Greece. This enormous defect, however, laid it open to the groſſeſt corruptions; and by his followers it was in fact corrupted ſo as to countenance the moſt impure and criminal pleaſures of ſenſe.

11
The eclectic philoſophers of Alexandria.

Theſe ſeveral ſyſtems of ethics continued to be cultivated with more or leſs purity through all the revolutions of the Grecian ſtates, and they were adopted by the Romans after Greece itſelf became a province of the empire. They had been introduced into Egypt during the reigns of the Ptolemies, and were taught with much celebrity in the ſchools of Alexandria.—The philoſophy which was moſt cultivated in thoſe ſchools was that of Plato; but from a deſire of uniformity which took poſſeſſion of the Alexandrian Platoniſts, many of the dogmas of Ariſtotle and Zeno, as well as the extravagant fictions of the eaſt, were incorporated with the principles of the old academy.—The patrons of this heterogeneous maſs have been called *eclectic* philoſophers, becauſe they profeſſed to ſelect from each ſyſtem thoſe doctrines which were rational and important, and to reject every thing which was falſe or futile; but they added nothing to the purity of Plato's ethics, and they increaſed the obſcurity and myſticiſm of his phyſics and metaphyſics.

12
Extinction and revival of moral ſcience in Europe.

After the ſubverſion of the Roman empire, every ſpecies of philoſophy, if ſyllogiſtic wrangling deſerve not that name, was baniſhed for ages from the ſchools of Europe; and ethics, properly ſo called, gave place to eccleſiaſtical caſuiſtry, and to the ſtudy of the civil and canon law. When the Greeks, whom the fury and fanaticiſm of Mahomet II. had driven from Conſtantinople, introduced into Italy the knowledge of their own language, the cabinets of ancient philoſophy were again unlocked; the ſyſtems of the different ſects were adopted with the utmoſt avidity; and, without accurate inveſtigation of their reſpective merits, men became Platoniſts, Peripatetics, or Stoics, as fancy or caprice prompted them to chooſe their leaders. The κυτος εφη of Ariſtotle, in particular, had not leſs authority over his modern admirers than it had of old in the Lyceum at Athens. At length the ſpirit of Luther and the genius of Bacon broke theſe fetters, and taught men to think for themſelves as well in ſcience as in religion. In phyſics, the effects produced by the writings of Bacon were great and rapid; for in phyſics the ancient theories were totally and radically wrong.—With reſpect to morals, however, the caſe was different. Each of the celebrated ſchools of antiquity was in poſſeſſion of much moral truth, blended indeed with error: and long after the Stagyrite and his rivals had loſt all influence in phyſical ſcience, philoſophers of eminence followed them implicitly in the ſcience of ethics.

13
Theories of Hobbes,

At this day, indeed, there is hardly a theory of morals at all diſtinguiſhed, to which ſomething very ſimilar may not be found in the writings of the ancients.—Hobbes adopted the principles of Democritus and Protagoras, and taught expreſsly that "there is no criterion of juſtice or injuſtice, good or evil, beſides the laws of each ſtate; and that it is abſurd to inquire at any perſon except the eſtabliſhed interpreters of the law, whether an action be right or wrong, good or evil (B)." Theſe impious abſurdities have been often confuted. Cudworth, who compoſed his *True Intellectual Syſtem of the Univerſe*, in order to trace the metaphyſical atheiſm of Hobbes to its ſource, and to expoſe it to the public in all its weakneſs, undertook likewiſe to overthrow his ethical ſyſtem, in a treatiſe, entitled *Of Eternal and Immutable Morality*. That work was left unfiniſhed; but the theory of its great author was adopted, illuſtrated, and very ably ſupported, by the doctors Clarke and Price.

14
of Cudworth, Clarke, and Price,

According to theſe three admirable ſcholars, "we feel ourſelves irreſiſtibly determined to approve ſome actions, and to diſapprove others. Some actions we cannot but conceive of as *right*, and others as *wrong*; and of all actions we are led to form ſome idea, as either *fit* to be performed or *unfit*, or as neither fit nor unfit to be performed, i. e. as *indifferent*. The power within us which thus perceives and determines, they declare to be the *underſtanding*; and they add, that it perceives or determines immediately or by intuition, becauſe *right* and *wrong* denote *ſimple ideas*. As there are ſome propoſitions, which when attended to neceſſarily determine all minds to *believe* them, ſo are there ſome actions whoſe natures are ſuch, that when obſerved, all rational beings immediately and neceſſarily *approve* them. He that can impartially attend, it is ſaid, to the nature of his own perceptions, and determine that when he conceives gratitude or beneficence to be *right*, he perceives nothing *true* of them, or *underſtands* nothing, but only *ſuffers* from a ſenſe, has a turn of mind which appears unaccountable: for the more we examine, the more indiſputable it will appear to us, that we expreſs *neceſſary* truth, when we ſay of ſome actions that they are right, and of others that they are wrong." It is added, that "we cannot perceive an action to be right without *approving* it, or *approve* it without being conſcious of ſome degree of *ſatisfaction* and complacency; that we cannot perceive an action to be wrong without *diſapproving* it, or *diſapprove* it without being *diſpleaſed* with it; and that the *firſt* muſt be liked, the *laſt* diſliked; the *firſt* loved, the *laſt* hated." By the patrons of this ſyſtem, *obligation* to action, and *rightneſs* of action, are held to be coincident or identical. "Virtue, they affirm, has a real, full, obligatory power, antecedently to all laws, and independently of all will; for obligation is involved in the very nature of it. To affirm that the performance of that which to omit would be wrong is not obligatory, unleſs conducive to private good, or enjoined by a ſuperior power, is a manifeſt contradiction *."

Few men have deſerved better of letters and philoſophy than Cudworth, Clarke, and Price; and yet their theory of morals appears to us to be contradictory and unintelligible. It is certainly romantic, and founded upon principles which, if they be denied, no man

---

* *Price's Review*, and *Clarke on the Attributes*.

(B) Doctrinas de juſto et injuſto, bono et malo, præter leges in unaquaque civitate conſtitutas, authenticas eſſe nullus: et utrum aliqua actio juſta vel injuſta, bona vel mala futura ſit, à nemine inquirendum eſſe, præterquam ab illis, quibus legum ſuarum interpretationem civitas demandaverit. *De Cive*, p. 343.

man by argument can be compelled to grant. There is, ſay they, an abſolute right and wrong, fitneſs and unfitneſs, in actions; but if ſo, the actions which are *right* and *fit* muſt be right and fit for ſomething, becauſe fitneſs, which reſpects no end, is wholly inconceivable. To ſay that any particular action is *fit*, and yet fit for *no particular purpoſe*, is juſt as abſurd as to ſay that the angles at the baſe of an iſoſceles triangle are *equal*, but neither to *one another*, nor to *any other angles*; and we may with no leſs propriety talk of the relation of equality attaching to a particular angle, and to nothing elſe with which the angle is equal, than of the *abſolute* fitneſs or rightneſs of any action or courſe of actions. If it be ſaid that ſuch actions are fit and right, becauſe they tend to promote the harmony of the world and the happineſs of men, this may be granted; but it overturns the intellectual theory from its very foundation. Actions which are fit and right only for their conſequences, are approved and liked for the ſake of thoſe conſequences; and the happineſs of men, among whom the virtuous perſon himſelf is certainly to be included, is the motive or ultimate obligation to their performance.

Similar to this theory, and liable to the ſame objections, is that which reſolves moral approbation into a ſenſe of propriety: for if actions be approved becauſe they are proper, it muſt be becauſe they are proper for ſome *end* or *purpoſe*, propriety in the abſtract being a word without meaning.

15 Of Lord Shafteſbury, Hutcheſon, &c.

Many philoſophers, feeling the force of theſe and of ſimilar objections to the intellectual theory of Cudworth, Clarke, and Price, as well as to a ſenſe of *propriety* in the abſtract, have had recourſe to another hypotheſis, apparently better founded. Obſerving that all mankind decide on the morality of characters and actions inſtantaneouſly, without weighing their conſequences in the balance of reaſon, they ſuppoſe that ſuch deciſions are made by an *inſtinct* of our common nature, implanted in the human breaſt by the hand that formed it. To this inſtinct ſome of them give the name of *conſcience*, and others that of *moral ſenſe*, in contradiction to *external ſenſe* the other great and univerſal inlet of human knowledge. By this *moral ſenſe* we intuitively diſcover an eſſential difference in the *quality* of all thoughts and actions, and a general diſtinction of them into *good* and *evil*, juſt as by the *tongue* and *palate* we diſcover an eſſential difference in the *taſte* of all objects, and a general diſtinction of them into *pleaſant* and *unpleaſant*. The ableſt advocates for this inſtinctive ſyſtem agree, that the moral ſenſe is the immediate and involuntary criterion of only a few general truths, which in their joint operation upon the mind, lay the baſis of moral obligation. Others have carried it to what we think a very dangerous extreme; as by affirming that we cannot prove, in regard to our moral feelings, that they are conformable to any extrinſic and eternal relations of things, they ſeem to wiſh that reaſon were baniſhed from the ſcience of ethics. Were this true, it would in many caſes be impoſſible to diſtinguiſh the prejudices of early education from the pure dictates of original inſtinct, and the moſt pernicious conduct might be ſanctified with the approbation of what would be deemed the ultimate teſt of virtue and vice.

To remedy the defects of the intellectual and inſtinctive theories of morality, Mr Hume blended them together; and, upon the broader baſis of reaſon and internal ſenſe co-operating with each other, he reared a ſyſtem which, though different from thoſe of all his predeceſſors, he rendered plauſible, and ſupported with his uſual ingenuity.

16 Of Mr Hume.

According to him, *ſentiment* and *reaſon* concur in almoſt all moral determinations; and he proves, that for this purpoſe, "there is implanted in the human breaſt a diſintereſted principle of *benevolence* or *ſympathy* which makes men take pleaſure in each other's happineſs. The merit or demerit of actions conſiſts wholly in their utility or natural tendency to add to the ſum of human happineſs; and the ſame he holds to be true of qualities whether bodily or mental. This utility or natural tendency it is the office of reaſon to diſcover; for that faculty alone can trace relations and conſequences. Such qualities or actions as reaſon diſcovers to be uſeful, either to the individual or ſociety, the inſtinctive principle of benevolence makes us inſtantly approve, and this approbation conſtitutes their morality. Thus temperance, fortitude, courage, induſtry, &c. reaſon diſcovers to be uſeful to him who poſſeſſes them; and upon this diſcovery they are approved of by the ſentiment of ſympathy. They are therefore moral qualities and the ſources of the *private* virtues. In like manner, generoſity, cheerfulneſs of temper, mercy, and juſtice, are diſcovered to be uſeful to ſociety, and are accompanied with the approbation of that ſentiment of ſympathy which makes every man feel a ſatisfaction in the felicity of all other men. They therefore conſtitute the *ſocial* virtues. Of every quality and every action, the merit or demerit, and of conſequence the degree of approbation or diſapprobation which is beſtowed upon it, is in exact proportion to its utility and the circumſtances of the caſe in which it occurs. The ſocial virtues are therefore greater than thoſe which are private, and one ſocial virtue is greater than another; but every quality and every action which is uſeful, either to ſociety or to the individual, is more or leſs virtuous, provided the good of the individual be conſidered as ſubordinate to the good of the public."

This theory is ingenious; and in placing the merit of actions in their utility, it furniſhes a criterion of virtue which can be employed by reaſon; but it ſeems not to be wholly free from error, and it is obviouſly defective. By pretending that the ſame ſentiment of approbation is given to uſeful actions voluntarily performed and to uſeful qualities which are merely conſtitutional, Mr Hume confounds the merit of virtuous habits with the value of natural talents. Yet every man's conſciouſneſs will ſurely tell him, that the feeling or ſentiment which attaches to deeds of juſtice, clemency, and beneficence, is very different from that which attaches to beauty of form, ſtrength of body, vigour of mind, and mere extent of capacity. All theſe actions and qualities are uſeful; but when we approve of the former, beſides attending to their utility, we conſider them as in the man's power, and attribute the merit of them immediately to himſelf. When we approve, or rather admire, the latter on account of their utility, we know them to be not in the man's power, and we attribute the merit of them immediately to the Author of nature.

But the defects of this theory are in practice more pernicious than its errors. The author well obſerves that the end of all moral ſpeculations is to teach us our duty, and by proper repreſentations of the deformity of vice and beauty of virtue, to beget correſpondent habits, and engage us to avoid the one and embrace the other; but the theory under review holds out no motive ſufficient in all caſes for this purpoſe.

It is indeed true, as Mr Hume affirms, that the virtues which are immediately uſeful or agreeable to the perſon poſſeſſed of them, are deſirable in a view to ſelf-intereſt, and that a regard to ſelf-intereſt ought to engage us in the purſuit. It is likewiſe true, that the virtues which are *uſeful* and *agreeable* to others, are generally more deſirable than the contrary qualities; for as by the conſtitution of our nature no enjoyment is ſincere without ſome reference to company and ſociety; ſo no ſociety can be agreeable, or even tolerable, where a man feels his preſence unwelcome, and diſcovers all around him ſymptoms of diſguſt and averſion. Theſe conſiderations he deems ſufficient to enforce the duties of humanity, clemency, and beneficence; but he ſtates a caſe himſelf in which they would certainly fail to make a man abſtain from his neighbour's property. The greater part of property he conſiders, and rightly conſiders, as having its foundation in human laws, which are ſo calculated as to preſerve the peace and promote the general good of the ſociety, at the unavoidable expence ſometimes of the individual. Now, in particular incidents, a ſenſible knave, by ſecretly purloining from the hoards of a worthleſs miſer, might make himſelf comfortable and independent for life, without cauſing any breach in the ſocial union, and even without hurting a ſingle individual. What then ſhould hinder him from acting thus? His ſelf-intereſt would be promoted; and if he poſſeſſed a generous ſpirit, he might gratify his ſentiment of benevolence or ſympathy by doing good with his money to the poor, which the miſer never did. For enforcing the uniform practice of juſtice in ſuch caſes as this, Mr Hume's theory of morals contains no adequate motive; but a very ſufficient one is held out by the ſyſtem which we are now to conſider.

17
A ſyſtem of ethics built upon religion.

That ſyſtem, which ſeems to have been unknown to the ancients, is built upon religion, of which indeed it conſtitutes a very eſſential part; and thoſe by whom it has been taught, maintain that no other foundation is ſufficient to bear a regular ſuperſtructure of practical ethics. The philoſophers of this ſchool (D) define virtue to be "the doing good to mankind, in obedience to the will of God, and for the ſake of everlaſting happineſs:" So that with them "the good of mankind" is the *ſubject*, "the will of God" the *criterion* or *rule*, and "everlaſting happineſs" the *motive*, of human virtue. The moral ſenſe, ſuppoſing it real, they conſider as a very inadequate rule of conduct, as being in many caſes difficult to be diſtinguiſhed from prejudice; and many of them confidently deny its exiſtence. The other rules, ſuch as the *fitneſs of things*, abſtract *right*, the *truth of things*, the *law of reaſon*, &c. they conſider either as unintelligible, or as relative to ſome end by which the rules muſt themſelves be tried. The two great queſtions, which in the ſyſtem of theſe religious philoſophers demand ſolution, are: 1*ſt*, By what means ſhall a man in every caſe diſcover preciſely what is the will of God? and, 2*dly*, What evidence have we that there will be a future ſtate of retribution and of everlaſting happineſs?

Of theſe two queſtions, the latter belongs wholly to religion; and to ſolve it they call in the aid of revelation, as well as of that which is called the religion of nature. The former queſtion is in the province of morality; and to find anſwers to it which will apply to every caſe, is the whole buſineſs of their ſyſtem.

The will of God reſpecting human conduct may be diſcovered by reaſoning *à priori* from his exiſtence and attributes, or *à poſteriori* from the tendency of his works. Being himſelf independent and all perfect, it is inconceivable that his view in creating the world could be any thing elſe than to communicate ſome portion of his own felicity. (See Metaphysics, N° 312). This concluſion is agreeable to what we perceive of his works, in which there are a thouſand contrivances, all tending to give happineſs to man, and to all animated nature; and of not one of which the natural tendency is to inflict pain, or prove ultimately injurious. Mankind are linked together by various ties, and made to depend in a great meaſure upon each other's conduct. That conduct, therefore, which is naturally productive of the greateſt ſum of human happineſs, muſt be agreeable to the will of God; or, in other words, virtuous conduct. That, of which the natural tendency is the reverſe, muſt be vicious; and that conduct, if there be any ſuch, which tends to produce neither happineſs nor miſery, muſt be indifferent, i. e. neither morally good nor morally evil. It is to be obſerved, however, that as, previous to their own obedience or diſobedience, all men ſtand in the ſame relation to their Creator, it muſt be his will that an equal portion of the happineſs of which human nature is capable be communicated to all by whom that nature is ſhared. Whence it follows, that only ſuch conduct as, if univerſally purſued by all men in the ſame ſtation and circumſtances, would be productive of the greateſt ſum of human happineſs on the whole, can be agreeable to the will of the Creator; and that, in judging of the morality of actions, we are not to regard their immediate conſequences in a particular caſe, but their natural and ultimate tendency if performed in all caſes.

This is a criterion of virtue which differs widely from the local or occaſional utility ſet up by Mr Hume: for the particular conſequences of an action and its general tendency may often be at variance, ſo that what might in certain circumſtances be immediately uſeful, would yet be highly criminal and ultimately pernicious. The general tendency of actions, too, may be always known, and known with the utmoſt certainty: the whole of their particular conſequences can never be diſcovered. One thing, however, is evident, that if all men in their reſpective ſtations would regulate their conduct by the natural tendency

---

(D) Gastrell, Cumberland, Puffendorff, Norris, Berkeley, Gay, Law, Rutherforth, Soame Jenyns, Dr Johnson, Mr Paley, and Mr Gisborne, &c.

dency of every action, the *particular* and *general* conſequences of their conduct would be the ſame, and the greateſt happineſs would reſult from it of which human nature is in this world capable. And therefore, ſince it is only through the perverſeneſs of ſome perſon or perſons concerned, that the *particular conſequences* of any action, of which the *natural tendency* is to produce *miſery*, can ever bring *happineſs* to a ſingle individual; it can no more be the will of God that we make theſe *occaſional* and *diſtorted* conſequences the rule of our conduct, than it can be his will that the *vices* of other men ſhould be the baſis of our *virtues*. According to this ſcheme of morals, which reſts all obligation on private happineſs, the whole difference between an act of *prudence* and an act of *duty*, is this: That in the former caſe we conſider only what we ſhall gain or loſe in this world; in the latter, what we ſhall gain or loſe in the world to come.

Although the patrons of this theory queſtion the reality of the moral ſenſe as an inſtinct, they allow that a ſentiment of approbation or diſapprobation of actions, according as they are virtuous or vicious, is generated by the aſſociating principle (ſee INSTINCT, and METAPHYSICS, N°97.); and that this ſentiment, though factitious, operates inſtantaneouſly as if it were inſtinctive. They inſiſt that our earlieſt actions are the reſult of imitation; that when we firſt begin to trace conſequences, education and the deſire of immediate enjoyment are our only guides; that as our mind expands and our knowledge increaſes, the hopes and fears of futurity become the *motives*, and the will of God the *rule* of our conduct; and that long practice in virtue, upon theſe principles, produces habits by which we go on with ſatisfaction in the ſame courſe, without looking forward, on every *particular* occaſion, to the ultimate conſequences and firſt motives of our actions. Thus do habits of juſtice, benevolence, clemency, and moral approbation, ſpring through a proper courſe of diſcipline, out of the ſelfiſh principle; and when theſe habits are completely formed and deeply rooted, man has attained the utmoſt perfection of which he is capable in this ſtate of probation, and is fitted for another of retribution and happineſs.

19 Defects and excellency of the ſyſtem.

That theſe philoſophers have not a juſt view of human nature, when they deny that there are any innate principles of benevolence in man, we ſhall endeavour to ſhow when we lay the foundation of that theory which we think deſerves to be preferred to all others; but we fully agree with a candid and able writer*, who ſeems to conſider them as under the ſame miſtake, "that their theory of morals has no tendency to weaken the foundations of virtue; and that by the account which it gives of the riſe of the ſocial affections, it obviates many of the arguments which had formerly been urged againſt the ſelfiſh ſyſtem." Nay, we ſcruple not to confeſs, that the mode of inveſtigation which it employs in *all caſes* to diſcover the will of God, may in *ſome caſes* be neceſſary in any ſyſtem which does not baniſh the uſe of reaſon from the ſcience of ethics. On this account, as well as out of reſpect to the firſt moraliſt † of the age, who affirms, that "it muſt be embraced by all who are willing to know why they act, or why they forbear, to give any reaſon of their conduct to themſelves or to others," we ſhall apply it to one of thoſe caſes of ſocial duty which Mr Hume's principle of utility could not reſolve. Such an example will enable the meaneſt of our readers to decide between the merits of it and of the theory which we ſhall adopt; or, as we rather hope, it will ſhow them that the two theories lead to the ſame practical concluſions.

Having thus given our readers a ſhort view of the moſt celebrated ſyſtems of ethics which have prevailed from the earlieſt ages of the world to the preſent day, we now proceed, agreeably to our definition of the ſcience, to trace man's duty from his nature and connexions, and to ſhow that the ſteady practice of virtue muſt terminate in his ultimate happineſs.

PART I.

CHAP. I. *Of* MAN *and his* CONNEXIONS.

20 Man's infant ſtate.

MAN is born a weak, helpleſs, delicate creature, unprovided with food, clothing, and whatever elſe is neceſſary for ſubſiſtence or defence. And yet, expoſed as the infant is to numberleſs wants and dangers, he is utterly incapable of ſupplying the *former*, or ſecuring himſelf againſt the *latter*. But, though thus feeble and expoſed, he finds immediate and ſure reſources in the *affection* and *care* of his parents, who refuſe no labours, and forego no dangers, to nurſe and rear up the tender babe. By theſe powerful inſtincts, as by ſome mighty chain, does nature link the *parent* to the *child*, and form the ſtrongeſt *moral connexion* on his part, before the child has the leaſt apprehenſion of it. *Hunger* and *thirſt*, with all the ſenſations that accompany or are connected with them, explain themſelves by a language ſtrongly expreſſive, and irreſiſtibly moving. As the ſeveral ſenſes bring in notices and informations of ſurrounding objects, we may perceive in the young ſpectator early ſigns of a growing *wonder* and *admiration*. Bright objects and ſtriking ſounds are beheld and heard with a ſort of commotion and ſurpriſe. But, without reſting on any, he eagerly paſſes on from object to object, ſtill pleaſed with whatever is neweſt. Thus the *love* of *novelty* is formed, and the paſſion of *wonder* kept awake. By degrees he becomes acquainted with the moſt familiar objects, his parents, his brethren, and thoſe of the family who are moſt converſant with him. He contracts a *fondneſs* for them, is uneaſy when they are gone, and charmed to ſee them again. Theſe feelings become the foundation of a *moral attachment* on his ſide; and by this reciprocal ſympathy he forms the domeſtic alliance with his parents, brethren, and other members of the family. Hence he becomes intereſted in their concerns; and feels *joy* or *grief*, *hope* or *fear*, on their account, as well as his own. As his affections now point beyond himſelf to others, he is denominated a *good* or *ill* creature, as he ſtands *well* or *ill affected* to them. Theſe, then, are the firſt links of the

---

* *Stuart's Elements of the Philoſophy of the Human Mind.*

† *Johnſon.*

moral chain; the early rudiments, or outlines, of his character; his firſt rude eſſays towards agency, freedom, manhood.

21 His childhood. When he begins to make excurſions from the nurſery, and extends his acquaintance abroad, he forms a little circle of companions, engages with them in play, or in queſt of adventures; and leads, or is led by them, as his genius is more or leſs aſpiring. Though this is properly the ſeaſon in which *appetite* and *paſſion* have the *aſcendant*, yet his *imagination* and *intellectual* powers open apace; and as the various images of things paſs before the mental eye, he forms variety of taſtes; reliſhes ſome things, and diſlikes others, as his parents, companions, and a thouſand other circumſtances, lead him to combine agreeable or diſagreeable ſets of ideas, or repreſent to him objects in alluring or odious lights.

As his views are enlarged, his *active* and *ſocial* powers expand themſelves in proportion; the *love of action*, of *imitation*, and of *praiſe*, *emulation*, *curioſity*, *docility*, *a paſſion for command*, and *fondneſs of change*.—His paſſions are quick, variable, and pliant to every impreſſion; his attachments and diſguſts quickly ſucceed each other. He compares things, diſtinguiſhes actions, judges of characters, and loves or hates them, as they appear well or ill affected to himſelf, or to thoſe he holds dear. Meanwhile he ſoon grows ſenſible of the conſequences of his own actions, as they attract applauſe, or bring contempt: he triumphs in the former; and is aſhamed of the latter, wants to hide them, and bluſhes when they are diſcovered. By means of theſe powers he becomes a fit ſubject of culture, the moral tie is drawn cloſer, he feels that he is accountable for his conduct to others as well as to himſelf, and thus is gradually ripening for ſociety and action.

22 His youth. As man advances from *childhood* to *youth*, his paſſions as well as perceptions take a more extenſive range. New ſenſes of pleaſure invite him to new purſuits; he grows ſenſible to the attractions of beauty, feels a peculiar ſympathy with the ſex, and forms a more tender kind of attachment than he has yet experienced. This becomes the cement of a *new moral relation*, and gives a ſofter turn to his paſſions and behaviour. In this turbulent period he enters more deeply into a *reliſh of friendſhip*, *company*, *exerciſes*, and *diverſions;* the *love of truth*, of *imitation*, and of *deſign*, grows upon him; and as his connexions ſpread among his neighbours, fellow citizens, and countrymen, his *thirſt of praiſe*, *emulation*, and *ſocial affections* grow more intenſe and active. Meanwhile, it is impoſſible for him to have lived thus long without having become ſenſible of thoſe more auguſt ſignatures of order, wiſdom, and goodneſs, which are ſtamped on the viſible creation; and of thoſe ſtrong ſuggeſtions within himſelf of a parent mind, the ſource of all intelligence and beauty; an object as well as ſource of that activity, and thoſe aſpirations which ſometimes rouſe his inmoſt frame, and carry him out of himſelf to an almighty and all-governing power: Hence ariſe thoſe ſentiments of *reverence*, and thoſe affections of *gratitude*, *reſignation*, and *love*, which link the ſoul with the Author of Nature, and form that moſt ſublime and godlike of all connexions.

23 His manhood. Man having now reached his prime, either new paſſions ſucceed, or the old ſet are wound up to a higher pitch. For, growing more ſenſible of his connexions with the public, and that particular community to which he more immediately belongs; and taking withal a larger proſpect of human life, and its various wants and enjoyments; he forms more intimate friendſhip, graſps at power, courts honour, lays down cooler plans of intereſt, and becomes more attentive to the concerns of ſociety: he enters into family connexions, and indulges thoſe charities which ariſe from thence. The *reigning* paſſions of this period powerfully prompt him to provide for the decays of life: and in it *compaſſion* and *gratitude* exert their influence in urging the *man*, now in full vigour, to requite the affection and care of his parents, by ſupplying their wants and alleviating their infirmities.

24 Old age. At length human life verges downwards; and *old age* creeps on apace, with its *anxiety*, *love of eaſe*, *intereſtedneſs*, *fearfulneſs*, *foreſight*, and *love of offſpring*.—The experience of the aged is formed to direct, and their coolneſs to temper, the heat of youth: the former teaches them to look back on paſt follies; and the latter to look forward into the conſequences of things, and provide againſt the worſt. Thus every age has its peculiar genius and ſet of paſſions correſponding to that period, and moſt conducive to the proſperity of the reſt. And thus are the *wants* of one period ſupplied by the *capacities* of another, and the *weakneſſes* of one age tally to the *paſſions* of another.

25 Paſſions of every age. Beſides theſe, there are other paſſions and affections of a leſs *ambulatory* nature, not peculiar to one period, but belonging to every age, and acting more or leſs in every breaſt throughout life. Such are *ſelf-love*, *benevolence*, *love of life*, *honour*, *ſhame*, *hope*, *fear*, *deſire*, *averſion*, *joy*, *ſorrow*, *anger*, and the like. The two firſt are affections of a cooler ſtrain; one pointing to the good of the individual, the other to that of the ſpecies: *joy* and *ſorrow*, *hope* and *fear*, ſeem to be only modifications, or different exertions, of the ſame *original* affections of *love* and *hatred*, *deſire* and *averſion*, ariſing from the different circumſtances or poſition of the object deſired or abhorred, as it is preſent or abſent. From theſe likewiſe ariſe other *ſecondary* or *occaſional* paſſions, which depend, as to their exiſtence and ſeveral degrees, upon the original affections being gratified or diſappointed; as *anger*, *complacence*, *confidence*, *jealouſy*, *love*, *hatred*, *dejection*, *exultation*, *contentment*, *diſguſt*, which do not form *leading* paſſions, but rather hold of them.

26 Their joint effects. By theſe ſimple but powerful ſprings, whether *periodical* or *fixed*, the life of man, weak and indigent as he is, is preſerved and ſecured, and the creature is prompted to a conſtant round of action, even to ſupply his own numerous and ever-returning *wants*, and to guard againſt the various *dangers* and *evils* to which he is obnoxious. By theſe links men are connected with each other, formed into families, drawn into particular communities, and all united as by a common league into one ſyſtem or body, whoſe members feel and ſympathiſe one with another. By this admirable adjuſtment of the conſtitution of *man* to his *ſtate*, and the gradual evolution of his powers, order is maintained, ſociety upheld, and human life filled with that variety of paſſion and action which at once enliven and diverſify it.

27 The directing power. This is a ſhort ſketch of the *principal movements* of the

f Man
nd his
Connexions.

the human mind. Yet theſe movements are not the whole of man; they impel to action, but do not direct it: they need a *regulator* to guide their motions, to meaſure and apply their forces; and accordingly they have one that naturally *ſuperintends* and *directs* their action. We are conſcious of a principle within us, which examines, compares, and weighs things; notes the differences, obſerves the forces, and foreſees the conſequences, of affections and actions. By this power we look back on paſt times, and forward into futurity, gather experiences, eſtimate the real and comparative value of objects, lay out ſchemes, contrive means to execute them, and ſettle the whole order and economy of life. This power we commonly diſtinguiſh by the name of *reaſon* or *reflection*, the buſineſs of which is not to ſuggeſt any original notices or ſenſations, but to canvaſs, range, and make deductions from them.

28
The judging or approving powers.

We are intimately conſcious of another principle within us, which approves of certain *ſentiments*, *paſſions*, and *actions*, and diſapproves of their contraries. In conſequence of the deciſions of this inward judge, we denominate ſome actions and principles of conduct *right*, *honeſt*, *good*; and others *wrong*, *diſhoneſt*, *ill*. The former excite our *eſteem*, *moral complacence*, and *affection*, immediately and originally of themſelves, without regard to their conſequences, and whether they affect our intereſt or not. The latter do as naturally and neceſſarily call forth our *contempt*, *ſcorn*, and *averſion*. That power by which we perceive this difference in affections and actions, and feel a conſequent reliſh or diſlike, is commonly called *conſcience* or the *moral ſenſe*.

That there is ſuch a power as this in the mind of every man of ſound underſtanding, is a fact which cannot be controverted; but whether it be an inſtinctive power, or the reſult of early and deep-rooted aſſociations, has been long and ably debated. The queſtion is of importance in the ſcience of human nature, as well as in aſcertaining the ſtandard of practical virtue; but to us it appears that the contending parties have carried their reſpective opinions to dangerous extremes.

29
n attempt
prove
at we
ave from
ature no
ch
owers.

When it is affirmed, as it ſometimes has been, that reaſon has nothing to do in ethical ſcience, but that in every poſſible ſituation our duty is pointed out and the performance of it enforced by mere ſentiment, the conſequence ſeems to be, that virtue and vice are nothing permanent in themſelves, but change their nature according to local circumſtances. Certain it is, that ſentiment has in ſimilar ſituations approved of very different practices in different ages and different nations. At preſent this ſentiment in Europe approves of the univerſal practice of juſtice, and of parents protecting their children, whether well or ill formed, whether ſtrong or weak: but in Sparta we know that theft, if dexterouſly practiſed, was approved, and not unfrequently rewarded; and that the expoſition of lame and deformed children was not only permitted, but abſolutely enjoined. There is nothing which our conſcience or moral ſenſe condemns with greater ſeverity, or views as a crime of a deeper dye, than children's unkind treatment of their aged parents; yet there are ſavages, among whom inſtincts of all kinds ought to prevail in greater purity than in civilized nations, whoſe moral ſenſe permits them to put their aged and decrepid parents to death. If this ſenſe be inſtinctive, and the ſole judge of right and wrong, how comes it to decide ſo differently on the ſame line of conduct in different ages and diſtant countries? The inſtincts of brutes, in ſimilar circumſtances, prompt uniformly to ſimilar actions in every age and in every region where the ſpecies is found; and the external ſenſes of man afford in all nations the ſame unvaried evidence concerning their reſpective objects. To theſe obſervations we may add, that inſtincts muſt be calculated for the ſtate of nature, whatever that ſtate may be, and therefore cannot be ſuppoſed capable of directing our ſteps through all the labyrinths of poliſhed ſociety, in which duties are to be performed that in a ſtate of nature would never have been thought of.

Of Man
and his
Connexions.

But though for theſe reaſons it is apparent that mere ſentiment, whether called conſcience or the moral ſenſe, would *alone* be a very unſafe guide to virtue in every individual caſe that may occur, we think that thoſe who reſolve all ſuch ſentiment into habit and the effect of education, without giving any part of it to nature, advance an opinion which is equally ill-founded and not leſs dangerous. There are, indeed, men who affirm that all benevolence is hypocriſy, friendſhip a cheat, public ſpirit a farce, fidelity a ſnare to procure truſt and confidence; and that while all of us at bottom purſue only our private intereſt, we wear thoſe fair diſguiſes, in order to put thoſe off their guard with whom we have to deal, and to expoſe them the more to our wiles and machinations. Others again, too virtuous to accuſe themſelves and all mankind of direct knavery, yet inſiſt, that whatever affection one may feel, or imagine he feels, for others, no paſſion is or can be diſintereſted; that the moſt generous friendſhip, however ſincere, is only a modification of ſelf-love; and that even unknown to ourſelves we ſeek only our own gratification, while we appear the moſt deeply engaged in ſchemes for the liberty and happineſs of mankind.

30
Examined, and ſhown.

Surely the mildeſt of theſe repreſentations is an exaggerated picture of the ſelfiſhneſs of man. Self-love is indeed a very powerful as well as an eſſential principle in human nature; but that we have likewiſe an inſtinctive principle of benevolence, which, without any particular regard to our own intereſt, makes us feel pleaſure in the happineſs of other men, is a fact which we think admits of very complete proof. For, as Mr Hume well argues, "when a man grieves for a friend, who could be of no ſervice to him, but on the contrary ſtood in need of his conſtant patronage and protection, how is it poſſible to ſuppoſe that ſuch paſſionate tenderneſs ariſes from ſelf-intereſt, which has no foundation in nature? What intereſt (aſks the ſame deep thinker) can a fond mother have in view, who loſes her health by her aſſiduous attendance on her ſick child, and afterwards languiſhes and dies of grief when freed by its death from the ſlavery of attendance?—Have we no satisfaction (continues he) in one man's company above another's, and no deſire of the welfare of our friend, even though abſence or death ſhould prevent us from all participation in it? Or what is it commonly that gives us any participation in it, even while alive and preſent, but our affection and regard to him?" Nor is it to contemporaries and individuals alone,

alone, that, independent of all intereſt, we feel a benevolent attachment. We conſtantly beſtow praiſe on actions calculated to promote the good of mankind, though performed in ages very diſtant and in countries moſt remote; and he who was the author of ſuch actions is the object of our eſteem and affection. There is not perhaps a man alive, however ſelfiſh in his diſpoſition, who does not applaud the ſentiment of that emperor, who, recollecting at ſupper that he had done nothing in that day for any one, exclaimed with regret, that the day had been loſt! yet the utmoſt ſubtility of imagination can diſcover no appearance of intereſt that *we* can have in the generoſity of *Titus*, or find any connexion of our preſent happineſs with a character removed ſo far from us both in time and in place. But, as Mr Hume juſtly obſerves, if we even feign a character conſiſting of all the moſt generous and beneficent qualities, and give inſtances in which theſe diſplay themſelves, after an eminent and moſt extraordinary manner, for the good of mankind, we ſhall inſtantly engage the eſteem and approbation of all our audience, who will never ſo much as inquire in what age or country the accompliſhed perſon lived.

Theſe are facts which cannot be controverted; and they are wholly unaccountable, if there be not in human nature an inſtinctive ſentiment of benevolence or ſympathy which feels a diſintereſted pleaſure in the happineſs of mankind. But an end in which we feel pleaſure we are naturally prompted to purſue; and therefore the ſame ſentiment impels every man, with greater or leſs force, to promote the happineſs of other men, which by means of it becomes in reality his own good, and is afterwards purſued from the combined motives of benevolence and ſelf-enjoyment. For in obeying this ſentiment we all feel an inward *complacency*, *ſelf-approbation*, or conſciouſneſs of *worth* or *merit;* and in diſobeying it, which cannot be done but with reluctance, we feel *remorſe*, or a conſciouſneſs of *unworthineſs* or *demerit*. It appears, however, from hiſtory, that the ſentiment, as it is inſtinctive, points only to the good of mankind, without informing us how that good is to be promoted. The means proper for this purpoſe muſt be diſcovered by reaſon; and when they are brought into view, this *ſentiment*, *conſcience*, or *moral ſenſe*, inſtantly ſhows us that it is our duty to purſue them.

31 to originate in the objector's miſtaking the extent of thoſe powers;

Hence we ſee how different lines of conduct may in ſimilar circumſtances be approved of as virtuous in different nations. When the Spartan expoſed his ſickly and deformed child, and when the ſavage put his aged parents to death, neither of them erred from want of ſentiment, or from having ſentiments originally different from ours. Their errors reſulted from a defect in reaſoning. They both imagined that they were obeying the law of benevolence by preventing miſery: for a weak and deformed perſon was very ill qualified to exiſt with any degree of comfort under the military conſtitution of Sparta, where all were ſoldiers, and under the neceſſity of enduring the greateſt hardſhips; and in a ſtate where the people have no fixed habitations, and where the chaſe ſupplies even the neceſſaries of life, an aged and infirm perſon is in danger of periſhing through hunger, by one of the cruelleſt and moſt lingering of deaths. The theft allowed in Sparta, if theft it may be called, was a ſtill leſs deviation from the inſtinctive law of benevolence. Boys were taught to ſlip as cunningly as they could into the gardens and public halls, in order to ſteal away herbs or meat; and if they were caught in the fact, they were puniſhed for their want of dexterity. This kind of theft, ſince it was authorized by the law and the conſent of the citizens, was no robbery; and the intention of the legiſlator in allowing it, was to inſpire the Spartan youth, who were all deſigned for war, with the greater boldneſs, ſubtlety, and addreſs; to inure them betimes to the life of a ſoldier; and to teach them to ſhift for themſelves, and to live upon little. That the Spartan legiſlator did wrong in giving his countrymen a conſtitution, of which ſucceſsful war was the ultimate object; and that ſavages, rather than kill their aged parents, or ſuffer them to die of hunger, ought to cultivate the ground, and abandon the chaſe; is readily granted: but the faults of the one as well as of the other aroſe not from any improper deciſion of the moral ſenſe, but from a defect in their reaſoning powers, which were not able to eſtimate the advantages and diſadvantages of different modes of life. In moral deciſions, therefore, conſcience and reaſon are aiding to each other. The former principle, when ſeparated from the latter, is defective, enjoining only the good of mankind, but unable to point out the means by which it can be moſt effectually promoted; and the latter principle, when ſeparated from the former, only directs a man to do what is moſt prudent, but cannot give him a conception of duty.

32 which are different in nature and kind from the paſſions and affections.

Theſe two powers of *reaſon* and *conſcience* are evidently principles different in *nature* and *kind* from the paſſions and affections. For the paſſions are mere *force* or *power*, *blind impulſes*, acting violently and without choice, and ultimately tending each to their reſpective objects, without regard to the intereſt of the others, or of the whole ſyſtem. Whereas the *directing* and *judging* powers diſtinguiſh and aſcertain the different forces, mutual proportions and relations, which the paſſions bear to each other, and to the whole; recognize their ſeveral degrees of merit, and judge of the whole temper and conduct, as they reſpect either the individual or the ſpecies; and are capable of directing or reſtraining the blind impulſes of paſſion in a due conſiſtency one with the other, and a regular ſubordination to the whole ſyſtem.

33 Diviſion of the paſſions.

This is ſome account of the *conſtituent principles* of our nature, which, according to their different mixtures, degrees, and proportions, mould our character and ſway our conduct in life. In reviewing that large train of affections which fill up the different ſtages of human life, we perceive this obvious diſtinction among them; that ſome of them reſpect the *good* of the *individual*, and others carry us beyond ourſelves to the *good* of the *ſpecies* or *kind*. The former have therefore been called *private*, and the latter *public* affections. Of the firſt ſort are *love of life*, of *pleaſure*, of *power*, and the like. Of the laſt are *compaſſion*, *gratitude*, *friendſhip*, *natural affection*, and the like. Of the *private* paſſions (D), ſome reſpect merely the *ſecurity* and *defence*, of the creature, ſuch as *reſentment* and *fear;* whereas others

---

(D) Here we uſe paſſions and affections without diſtinction. Their difference will be marked afterwards.

others aim at ſome *poſitive* advantage or good, as *wealth, eaſe, fame.* The former ſort, therefore, becauſe of this difference of objects, may be termed *defenſive* paſſions. Theſe anſwer to our *dangers*, and prompt us to avoid them if we can, or boldly to encounter them when we cannot.

34 fenſive ſions.

35 vate or petitive ſions.

The other claſs of *private* paſſions, which purſue *private poſitive* good, may be called *appetitive.* However, we ſhall ſtill retain the name of *private* in contradiſtinction to the *defenſive* paſſions. Man has a great variety of wants to ſupply, and is capable of many enjoyments, according to the ſeveral periods of his life, and the different ſituations in which he is placed. To theſe therefore a ſuitable train of *private paſſions* correſpond, which engage him in the purſuit of whatever is neceſſary for his ſubſiſtence or welfare.

36 blic paſ-

Our *public* or *ſocial* affections are adapted to the ſeveral *ſocial connexions* and *relations* which we bear to others, by making us ſenſible of their dangers, and intereſting us in their wants, and ſo prompting us to ſecure them againſt one and ſupply the other.

This is the firſt ſtep then to diſcover the *duty* and *deſtination* of man, the having analyzed the principles of which he is compoſed. It is neceſſary, in the next place, to conſider in what *order, proportion,* and *meaſure,* of thoſe inward principles, *virtue,* or a ſound moral temper and right conduct, conſiſts; that we may diſcover whence *moral obligation* ariſes.

Chap. II. *Of* Duty, *or* Moral Obligation.

37 e mea- e of wers.

It is by the end or deſign of any power or movement that we muſt direct its motions, and eſtimate the degree of force neceſſary to its juſt action. If it want the force requiſite for the obtaining its end, we reckon it defective; if it has too much, ſo as to be carried beyond it, we ſay it is overcharged; and in either caſe it is imperfect and ill contrived. If it has juſt enough to reach the ſcope, we eſteem it right and as it ſhould be. Let us apply this reaſoning to the paſſions.

38 eaſure of e defen- e paſ- ns.

The *defence* and *ſecurity* of the individual being the *aim* of the *defenſive paſſions*, that *ſecurity* and *defence* muſt be the *meaſure* of their *ſtrength* or *indulgence.* If they are ſo *weak* as to prove inſufficient for that end, or if they *carry us beyond it*, i. e. raiſe unneceſſary commotions, or continue longer than is needful, they are unfit to anſwer their original deſign, and therefore are in an unſound and unnatural ſtate. The exerciſe of *fear* or of *reſentment* has nothing deſirable in it, nor can we give way to either without painful ſenſations. Without a certain degree of them, we are naked and expoſed. With too high a proportion of them, we are miſerable, and often injurious to others. Thus *cowardice* or *timidity*, which is the exceſs of fear, inſtead of ſaving us in danger, gives it too formidable an appearance, makes us incapable of attending to the beſt means of preſervation, and diſarms us of *courage*, our natural armour. *Fool-hardineſs*, which is the want of a due meaſure of *fear*, leads us heedleſsly into danger, and lulls us into a pernicious ſecurity. *Revenge*, i. e. *exceſſive reſentment*, by the violence of its commotion, robs us of that *preſence of mind* which is often the beſt guard againſt injury, and inclines us to purſue the aggreſſor with more ſeverity than ſelf-defence requires. *Puſillanimity*, or the want of a juſt indignation againſt wrong, leaves us quite unguarded, and tends to ſink the mind into a paſſive enervated tameneſs. Therefore, "to keep the defenſive paſſions duly proportioned to our dangers, is their natural pitch and tenor."

39 Meaſure of the private paſſions.

The *private* paſſions lead us to purſue ſome *poſitive* ſpecies of *private* good: that *good* therefore which is the object and end of each muſt be the meaſure of their reſpective force, and direct their operation. If they are too *weak* or *ſluggiſh* to engage us in the purſuit of their ſeveral objects, they are evidently *deficient;* but if they defeat their end by their *impetuoſity*, then are they ſtrained beyond the juſt tone of nature. Thus *vanity*, or an *exceſſive paſſion for applauſe*, betrays into ſuch meanneſſes and little arts of popularity, as make us forfeit the honour we ſo anxiouſly court. On the other hand, *a total indifference about the eſteem of mankind*, removes a ſtrong guard and ſpur to virtue, and lays the mind open to the moſt abandoned proſecutions. Therefore, "to keep our private paſſions and deſires proportioned to our *wants*, is the juſt meaſure and pitch of this claſs of affections."

40 Comparative force.

The *defenſive* and *private* paſſions do all agree in general, in their tendency or conduciveneſs to the intereſt or good of the individual. Therefore, when there is a colliſion of intereſt, as may ſometimes happen, that *aggregate of good* or *happineſs*, which is compoſed of the particular goods to which they reſpectively tend, muſt be the common ſtandard by which their *comparative degrees* of ſtrength are to be meaſured: that is to ſay, if any of them, in the degree in which they prevail, are incompatible with the greateſt aggregate of good or moſt extenſive intereſt of the individual, then are they unequal and diſproportionate. For in judging of a particular *ſyſtem* or *conſtitution* of powers, we call that the *ſupreme* or *principal* end, in which the aims of the ſeveral parts or powers coincide, and to which they are ſubordinate; and reckon them in due proportion to each other, and right with regard to the whole, when they maintain that ſubordination of ſubſerviency. Therefore, "to proportion our defenſive and private paſſions in ſuch meaſure to our dangers and wants as beſt to ſecure the individual, and obtain the greateſt aggregate of private good or happineſs, is their juſt balance or comparative ſtandard in caſe of competition."

41 Meaſure of the public affections.

In like manner as the *public* or *ſocial* affections point at the good of others, that *good* muſt be the meaſure of their force. When a particular *ſocial* affection, as *gratitude* or *friendſhip*, which belongs to a particular *ſocial connexion*, viz. that of a *benefactor*, or of a *friend*, is too feeble to make us act the *grateful* or *friendly* part, that affection, being inſufficient to anſwer its end, is *defective* and *unſound.* If on the other hand, a particular paſſion of this claſs counteract or defeat the intereſt it is deſigned to promote, by its violence or diſproportion, then is that paſſion *exceſſive* and *irregular.* Thus *natural affection*, if it degenerates into a *paſſionate* fondneſs, not only hinders the parents from judging coolly of the intereſt of their offspring, but often leads them into a moſt partial and pernicious indulgence.

42 Colliſion of ſocial affections.

As every kind affection points at the good of its particular object, it is poſſible there may ſometimes be a colliſion of intereſts or goods. Thus the regard due to a *friend* may interfere with that which we owe to a *community*. In ſuch a competition of intereſts, it is evident that the *greateſt* is to be choſen; and that is the greateſt intereſt which contains the greateſt ſum or aggregate of public good, greateſt in *quantity* as well as *duration*. This then is the *common ſtandard* by which the reſpective forces and ſubordinations of the ſocial affections muſt be adjuſted. *Therefore* we conclude that "this claſs of affections are ſound and regular when they prompt us to purſue the *intereſt* of *individuals* in an entire conſiſtency with the *public good*;" or in other words, "when they are duly proportioned to the *dangers* and *wants* of others, and to the various *relations* in which we ſtand to *individuals* or to *ſociety*."

Thus we have found, by an induction of particulars, the *natural pitch* or *tenor* of the *different orders of affection*, conſidered apart by themſelves. Now, as the *virtue* or *perfection* of every creature lies in following its nature, or acting ſuitably to the juſt proportion and harmony of its ſeveral powers; therefore, "the VIRTUE of a creature endowed with ſuch affections as *man* muſt conſiſt in obſerving or acting agreeably to their *natural pitch and tenor*."

43
Balance of affection.

But as there are no independent affections in the fabric of the mind, no paſſion that ſtands by itſelf, without ſome relation to the reſt, we cannot pronounce of any one, conſidered APART, that it is either *too ſtrong* or *too weak*. Its ſtrength and juſt proportion muſt be meaſured not only by its ſubſerviency to its own immediate end, but by the reſpect it bears to the whole ſyſtem of affections. Therefore we ſay a paſſion is *too ſtrong*, not only when it defeats its own end, but when it impairs the force of other paſſions, which are equally neceſſary to form a *temper of mind* ſuited to a certain *economy* or *ſtate*; and too weak, not merely on account of its inſufficiency to anſwer its end, but becauſe it cannot ſuſtain its *part* or *office* in the balance of the whole ſyſtem. Thus the *love of life* may be *too ſtrong* when it takes from the *regard* due to one's country, and will not allow one bravely to encounter dangers, or even death, on its account. Again, The *love of fame* may be *too weak* when it throws down the fences which render virtue more ſecure, or weakens the incentives which make it more active and public ſpirited.

44
Limits of private affections.

If it be aſked. "How far may the affections towards private good or happineſs be indulged?" One limit was before fixed for the particular indulgence of each, viz. their ſubordination to the common aggregate of good to the private ſyſtem. In theſe therefore a due regard is always ſuppoſed to be had to *health*, *reputation*, *fortune*, the *freedom of action*, the *unimpaired exerciſe of reaſon*, the *calm enjoyment of one's ſelf*, which are all private goods. Another limit now reſults from the balance of affection juſt named, viz. "The ſecurity and happineſs of others;" or, to expreſs it more generally, "a *private* affection may be ſafely indulged, when, by that indulgence, we do not violate the obligations which reſult from our higher relations or public connexions." A juſt reſpect therefore being had to theſe boundaries which nature has fixed in the breaſt of every man, what ſhould limit our purſuits of private happineſs? Is nature ſullen and penurious? or, does the God of nature envy the happineſs of his offſpring?

45
Colliſion of intereſts.

Whether there is ever a real colliſion of intereſts between the *public* and *private* ſyſtem of affections, or the ends which each claſs has in view, will be afterwards conſidered; but where there is no colliſion, there is little or no danger of carrying either, but eſpecially the *public* affections, to exceſs, provided both kinds are kept ſubordinate to a diſcreet and cool *ſelf-love*, and to a calm and univerſal *benevolence*, which principles ſtand as guards at the head of each ſyſtem.

46
Reſult.

This then is the conduct of the paſſions, conſidered as *particular* and *ſeparate* forces, carrying us out to their reſpective ends; and this is their balance or economy, conſidered as *compound* powers, or powers mutually related, acting in conjunction towards a *common* end, and conſequently as forming a *ſyſtem* or *whole*.

47
Subordination of powers.

Now, whatever adjuſts or maintains this *balance*, whatever in the human conſtitution is formed for *directing* the paſſions ſo as to keep them from defeating their own end or interfering with each other, muſt be a principle of a *ſuperior* nature to them, and *ought* to direct their meaſures and govern their proportions. But it was found that *reaſon* or reflection is ſuch a principle, which points out the tendency of our paſſions, weighs their influence upon private and public happineſs, and ſhows the beſt means of attaining either. It having been likewiſe found that there is another directing or controlling principle, which we call CONSCIENCE or the MORAL SENSE, which, by a native kind of authority, judges of affections and actions, pronouncing ſome *juſt* and *good*, and others *unjuſt* and *ill*; it follows, that the paſſions, which are mere impulſe or blind forces, are principles inferior and ſubordinate to this *judging* faculty. Therefore, if we would follow the order of nature, i. e. obſerve the mutual reſpects and the ſubordination which the different parts of the human conſtitution bear one to another, the paſſions ought to be ſubjected to the direction and authority of the *leading* or *controlling* principles.

48
In what it conſiſts.

We conclude, therefore, from this *induction*, that the *conſtitution* or *juſt economy* of *human nature* conſiſts in a regular *ſubordination* of the *paſſions* and *affections* to the *authority* of *conſcience* and the *direction* of *reaſon*.

49
Economy of nature or right temper.

That *ſubordination* is *regular*, when the proportion formerly mentioned is maintained; that is to ſay, "when the *defenſive* paſſions are kept proportioned to our *dangers*; when the *private* paſſions are proportioned to our *wants*; and when the *public* affections are adapted to our *public connexions*, and proportioned to the wants and dangers of others."

50
Human virtue and perfection,

But the *natural ſtate*, or the *ſound* and *vigorous conſtitution* of any creature, or the *juſt economy* of its powers, we call its *health* and *perfection*; and the acting agreeably to theſe, its *virtue* or *goodneſs*. Therefore, "the *health* and *perfection* of man muſt lie in the aforeſaid *ſupremacy* of *conſcience* and *reaſon*, and in the *ſubordination* of the paſſions to their *authority* and *direction*. And his *virtue* or *goodneſs* muſt conſiſt in acting agreeably to that *order* or *economy*."

51
how conformable to reaſon.

That ſuch an ornament of the mind, and ſuch a conduct of its powers and paſſions, will ſtand the teſt of *reaſon*, cannot admit of any diſpute. For, upon a fair

fair examination into the conſequences of things, or the relations and aptitudes of *means* to *ends*, *reaſon* evidently demonſtrates, and *experience* confirms it, that, “ to have our *defenſive paſſions* duly proportioned to our *dangers*, is the ſureſt way to avoid or get clear of them, and obtain the ſecurity we ſeek after.—To proportion our *private paſſions* to our *wants*, is the beſt means to ſupply them ;—and, to adapt our *public affections* to our *ſocial relations*, and the *good* of others, is the moſt effectual method of fulfilling the *one*, and procuring the *other*.” In this ſenſe, therefore, *virtue* may be ſaid to be a “ *conduct* conformable to *reaſon*,” as reaſon diſcovers an apparent *aptitude*, in ſuch an *order* and *economy* of powers and paſſions, to anſwer the end for which they are *naturally* formed.

52
nnexion
ween af-
tions and
ds, not
idea of
ral obli-
tion.

If the idea of *moral obligation* is to be deduced merely from this *aptitude* or *connexion* between certain paſſions, or a certain order and balance of paſſions, and certain ends obtained or to be obtained by them, then is *reaſon* or *reflection*, which perceives that aptitude or connexion, the proper judge of *moral obligation ;* and on this ſuppoſition it may be defined, as hath been done by ſome, the connexion between the *affection* and the *end*, or, which is the ſame thing, between the *action* and the *motive ;* for the *end* is the *motive* or the *final cauſe*, and the *affection* is the *action*, or its immediate natural cauſe. A man, from mere ſelf-love, may be induced to fulfil that obligation which is founded on the connexion between the *defenſive* paſſions and their *ends*, or the *private* paſſions and their *ends ;* becauſe in that caſe his own intereſt will prompt him to indulge them in the due proportion required. But if he has no affections which point beyond himſelf, no principle but *ſelf-love*, or ſome ſubtle modification of it, what ſhall intereſt him in the happineſs of others, where there is no connexion between it and his own ? or what ſenſe can he have of *moral obligation* to promote it ? Upon this ſcheme, therefore, without public or ſocial affection, there could be no *motive*, and conſequently no moral obligation, to a beneficent diſintereſted conduct.

But if the mere connexion between certain paſſions, or a certain order of paſſions, and certain ends, is what conſtitutes or gives us the idea of *moral obligation*, then why may not the appoſiteneſs of any temper or conduct, nay, of any piece of machinery, to obtain its end, form an equally ſtrict *moral obligation ?* for the connexion and aptitude are as ſtrong and invariable in the latter inſtances as in the former. But as this is confounding the moſt obvious differences of things, we muſt trace the idea of *moral obligation* to another and a more natural ſource.

53
ea of it
m expe-
nce.

Let us appeal, therefore, to our inmoſt ſenſe and experience, “ how we ſtand affected to thoſe different ſets of paſſions, in the juſt meaſure and balance of which we found a right temper to conſiſt.” For this is entirely a matter of experience, in which we muſt examine, as in any other natural inquiry, “ what are the genuine feelings and operations of nature, and what affections or ſymptoms of them appear in the given inſtance.”

54
hy the
fenſive
ſſions ap-
oved.

The defenſive paſſions, as *anger* and *fear*, give us rather pain than pleaſure, yet we cannot help feeling them when provoked by injury, or expoſed to harm. We account the creature imperfect that wants them, becauſe they are neceſſary to his defence. Nay, we ſhould in ſome meaſure condemn ourſelves, did we want the neceſſary degree of *reſentment* and *caution.* But if our *reſentment* exceeds the wrong received, or our *caution* the evil dreaded, we then blame ourſelves for having overacted our part. Therefore, while we are in danger, to be totally deſtitute of them, we reckon a *blameable defect*, and to feel them in a juſt, i. e. neceſſary meaſure, we *approve*, as ſuited to the nature and condition of ſuch a creature as man. But our ſecurity obtained, to continue to indulge them, we not only *diſapprove* as *hurtful*, but *condemn* as *unmanly*, *unbecoming* and *mean-ſpirited :* Nor will ſuch a conduct afford any ſelf-approving joy when we coolly reflect upon it.

55
Why the private.

With regard to the *private* paſſions, ſuch as *love of life*, *pleaſure*, *eaſe*, and the like, as theſe aim at private good, and are neceſſary to the perfection and happineſs of the individual, we ſhould reckon any creature *defective*, and even *blameable*, that was deſtitute of them. Thus, we condemn the man who imprudently ruins his fortune, impairs his health, or expoſes his life ; we not only pity him as an unfortunate creature, but feel a kind of *moral indignation* and contempt of him, for having made himſelf ſuch. On the other hand, though a diſcreet ſelf-regard does not attract our eſteem and veneration, yet we approve of it in ſome degree, in a higher and different degree from what we would regard a well-contrived machine, as neceſſary to conſtitute a finiſhed creature, nay, to complete the virtuous character, as exactly ſuited to our preſent indigent ſtate. There are ſome paſſions reſpecting private good, towards which we feel higher degrees of approbation, as the *love of knowledge*, of *action*, of *honour*, and the like. We eſteem them as marks of an ingenious mind ; and cannot help thinking the character in which they are wanting remarkably ſtupid, and in ſome degree *immoral.*

56
Why the public.

With regard to the ſocial affections, as *compaſſion*, *natural affection*, *friendſhip*, *benevolence*, and the like, we approve, admire, and love them in ourſelves, and, in all in whom we diſcover them, with an eſteem and approbation, if not different in kind, yet ſurely far ſuperior in degree, to what we feel towards the other paſſions. Theſe we reckon neceſſary, juſt, and excellently fitted to our ſtructure and ſtate ; and the creature which wants them we call defective, ill-conſtituted, a kind of abortion. But the *public* affections we eſteem as ſelf-worthy, originally and eternally amiable.

57
Diſtinction between vehement and calm affections.

But among the *ſocial* affections we make an obvious and conſtant diſtinction, viz. between thoſe particular paſſions which urge us with a ſudden violence, and uneaſy kind of ſenſation, to purſue the good of their reſpective objects, as *pity*, *natural affection*, and the like ; and thoſe calm diſpaſſionate affections and deſires which prompt us more ſteadily and uniformly to promote the happineſs of others. The former we generally call *paſſions*, to diſtinguiſh them from the other ſort, which go more commonly by the name of *affections*, or *calm deſires*. The firſt kind we approve indeed, and delight in ; but we feel ſtill higher degrees of approbation and moral complacence towards the *laſt*, and towards all limitation of the particular inſtincts, by the principle of *univerſal benevolence*. The more objects the calm affections take in, and the worthier theſe are, their dignity riſes in proportion, and with this our approbation keeps an exact pace. A character, on the other hand, which is quite diveſted of theſe public affections, which feels no love for the ſpecies, but inſtead of it entertains malice, rancour, and ill will, we reckon totally immoral and unnatural.

Such then are the ſentiments and diſpoſitions we feel when theſe ſeveral orders of affections paſs before the mental eye.

Therefore, "that ſtate in which we feel ourſelves moved, in the manner above deſcribed, towards thoſe affections and paſſions, as they come under the mind's review, and in which we are, inſtantaneouſly and independently of our choice or volition, prompted to a *correſpondent* conduct, we call a ſtate of *moral obligation*." Let us ſuppoſe, for inſtance, a parent, a friend, a benefactor, reduced to a condition of the utmoſt indigence and diſtreſs, and that it is in our power to give them immediate relief. To what conduct are we *obliged?* what *duty* does nature dictate and require in ſuch a caſe? Attend to nature, and nature will tell, with a voice irreſiſtibly audible and commanding to the *human heart*, with an authority which no man can ſilence without being ſelf-condemned, and which no man can elude but at his peril, "that immediate relief *ought* to be given." Again, Let a friend, a neighbour, or even a ſtranger, have lodged a *depoſite* in our hands, and after ſome time reclaim it; no ſooner do theſe ideas of the confidence repoſed in us, and of property not *transferred*, but *depoſited*, occur, than we immediately and unavoidably feel and recognize the *obligation* to reſtore it. In both theſe caſes we ſhould condemn and even loathe ourſelves if we acted otherwiſe, as having done, or omitted doing, what we *ought* not, as having acted beneath the dignity of our nature;—contrary to our moſt intimate ſenſe of *right* and *wrong*:—we ſhould accuſe ourſelves as guilty of ingratitude, injuſtice, and inhumanity,—and be conſcious of deſerving the cenſure, and therefore dread the reſentment, of all rational beings.—But in complying with the *obligation*, we feel joy and ſelf-approbation,—are conſcious of an inviolable harmony between our nature and duty, and think ourſelves entitled to the applauſe of every impartial ſpectator of our conduct.

58 Moral obligation.

To *deſcribe*, therefore, what we cannot perhaps *define*, a ſtate of *moral obligation* is "that ſtate in which a creature, endued with ſuch ſenſes, powers, and affections as man, would condemn himſelf, and think he deſerved the condemnation of all others, ſhould he refuſe to fulfil it; but would approve himſelf, and expect the approbation of all others, upon complying with it."

59 Moral agent.

And we call him a MORAL AGENT, who is in ſuch a *ſtate*, or is ſubject to *moral obligation*. Therefore, as man's *ſtructure* and *connexions* often ſubject him to ſuch a ſtate of *moral obligation*, we conclude that *he* is a *moral agent*. But as man may ſometimes act without *knowing* what he does, as in caſes of *frenzy* or *diſeaſe*, or in many *natural functions*; or, knowing what he does, he may act without *choice* or *affection*, as in caſes of *neceſſity* or *compulſion*; therefore, to denominate an action *moral*, i. e. *approveable*, or *blameable*, it muſt be done *knowingly* and *willingly*, or *from affection* and *choice*.

60 Moral action good and bad.

"A *morally good action*, then, is to fulfil a *moral obligation* knowingly and willingly." And a *morally bad action*, or an *immoral action*, is, "to violate a *moral obligation* knowingly and willingly."

61 Moral character and temper good and bad.

As not an *action*, but a *ſeries of actions*, conſtitute a *character*; as not an *affection*, but a *ſeries of affections*, conſtitute a *temper*; and as we denominate things by the groſs, *à fortiori*, or by the qualities which chiefly prevail in them; therefore we call that a "*morally good character*, in which a *ſeries of morally good actions* prevail;" and that a "*morally good temper*, in which a *ſeries of morally good affections* have the aſcendant." A bad character and bad temper are the reverſe. But where the above-mentioned *order* or *proportion* of paſſions is maintained, there a *ſeries* of *morally good affections and actions* will prevail. *Therefore*, "to maintain that order and proportion, is to have a *morally good temper and character*." But a "morally good temper and character is *moral rectitude*, *integrity*, *virtue*, or the *completion of duty*."

62 How we come by the idea of moral obligation.

If it be aſked, after all, "how we come by the idea "of *moral obligation* or *duty?*" we may anſwer, That we come by it in the ſame way as by our other *original* and *primary* perceptions. We receive them all from nature, or the great Author of nature. For this idea of *moral obligation* is not a creature of the mind, or dependent on any previous act of volition; but ariſes on certain occaſions, or when certain other ideas are preſented to the mind, as neceſſarily, inſtantaneouſly, and unavoidably, as *pain* does upon too near an approach to the fire, or *pleaſure* from the fruition of any good. It does not, for inſtance, depend on our choice, whether we ſhall feel the *obligation* to ſuccour a diſtreſſed parent, or to reſtore a depoſite intruſted to us when it is recalled. We cannot call this a *compound idea* made up of one or more ſimple ideas. We may indeed, nay we muſt, have ſome ideas antecedent to it, e. g. that of a parent in diſtreſs—of a child—able to relieve—of the relation of one to the other—of a truſt—of right, &c. But none of theſe ideas conſtitute the perception of *obligation*. This is an idea quite diſtinct from, and ſomething ſuperadded to, the ideas of the correlatives, or the relation ſubſiſting between them. Theſe indeed, by a law of our nature, are the occaſion of ſuggeſting it; but they are as totally different from it as colours are from ſounds. By ſenſe of reflection we perceive the correlatives; our memory recals the favours or depoſite we received; the various circumſtances of the caſe are matters of fact or experience; but ſome delicate inward *organ* or *power*, or call it what we pleaſe, does, by a certain inſtantaneous ſympathy, antecedent to the cool deductions of reaſon, and independent of previous inſtruction, or volition, *perceive the moral harmony*, the *living*, *irreſiſtible charms of moral obligation*, which immediately intereſts the correſpondent paſſions, and prompts us to fulfil its lawful dictates.

63 The uſe of reaſon in moral caſes.

We need not apprehend any danger from the quickneſs of its deciſions, nor be frightened becauſe it looks like *inſtinct*, and has been called ſo. Would we approve one for deliberating long, or reaſoning the matter much at leiſure, whether he ſhould relieve a diſtreſſed parent, feed a ſtarving neighbour, or reſtore the truſt committed to him? ſhould we not ſuſpect the reaſoner of knavery, or of very weak affections to virtue? We employ *reaſon*, and worthily employ it, in examining the condition, relations, and other circumſtances of the agent or patient, or of thoſe with whom

Percep- on and ection.

whom either of them are connected, or, in other words, the *ſtate of the caſe*: and in complicated caſes, where the circumſtances are many, it may require no ſmall attention to find the true ſtate of the caſe; but when the relations of the agent or patient, and the circumſtances of the action are obvious, or come out ſuch after a fair trial, we ſhould ſcarcely approve him who demurs on the obligation to that conduct which the caſe ſuggeſts.

64 aſure the of obli- ion.

From what has been ſaid, it is evident, that it is not the pleaſure or agreeable ſenſations, which accompany the exerciſe of the ſeveral affections, nor thoſe conſequent to the actions, that conſtitute *moral obligation*, or excite in us the idea of it. That pleaſure is poſterior to the idea of obligation; and frequently we are obliged, and acknowledge ourſelves under an obligation, to ſuch affections and actions as are attended with pain; as in the trials of virtue, where we are obliged to ſacrifice private to public good, or a preſent pleaſure to a future intereſt. We have pleaſure in ſerving an aged parent, but it is neither the perception nor proſpect of that pleaſure which gives us the idea of obligation to that conduct.

CHAP. III. *The* FINAL *Cauſes of our moral Faculties of* PERCEPTION *and* AFFECTION.

65 e ſurvey poſed.

WE have now taken a *general* proſpect of MAN and of his *moral powers* and *connexions*, and on theſe erected a ſcheme of *duty*, or *moral obligation*, which ſeems to be confirmed by *experience*, conſonant to *reaſon*, and approved by his moſt inward and moſt ſacred *ſenſes*. It may be proper, in the next place, to take a more particular view of the *final cauſes* of thoſe delicate *ſprings* by which he is *impelled* to action, and of thoſe *clogs* by which he is reſtrained from it. By this detail we ſhall be able to judge of their aptitude to anſwer their end, in a creature endued with his *capacities*, ſubject to his *wants*, expoſed to his *dangers*, and ſuſceptible of his *enjoyments*; and from thence we ſhall be in a condition to pronounce concerning the *end* of his *whole ſtructure*, its *harmony* with its *ſtate*, and conſequently its ſubſerviency to anſwer the great and benevolent intentions of its Author.

66 ward atomy of ſyſtem the nd.

The ſupreme Being has ſeen fit to blend in the whole of things a prodigious variety of diſcordant and contrary principles, *light* and *darkneſs*, *pleaſure* and *pain*, *good* and *evil*. There are multifarious natures, *higher* and *lower*, and many intermediate ones between the wide-diſtant extremes. Theſe are differently ſituated, variouſly adjuſted, and ſubjected to each other, and all of them ſubordinate to the order and perfection of the whole. We may ſuppoſe *man* placed as in a centre amidſt thoſe innumerable orders of beings, by his *outward* frame drawing to the *material* ſyſtem, and by his *inward* connected with the INTELLECTUAL or *moral*, and of courſe affected by the laws which govern both, or affected by that good and that ill which reſult from thoſe laws. In this infinite variety of *relations* with which he is ſurrounded, and of *contingencies* to which he is liable, he feels ſtrong attractions to the *good*, and violent repulſions or averſions to the *ill*. But as good and ill are often blended, and wonderfully complicated one with the other; as they ſometimes immediately produce and run up into each other, and at other times lie at great diſtances, yet by means of intervening links introduce one another; and as theſe effects are often brought about in conſequence of hidden relations and general laws, of the energy of which he is an incompetent judge; it is eaſy for him to miſtake *good* for *evil*, and *evil* for *good*, and conſequently he may be frequently attracted by ſuch things as are deſtructive or repel ſuch as are ſalutary. Thus, by the tender and complicated frame of his body, he is ſubjected to a great variety of ills, to *ſickneſs*, *cold*, *heat*, *fatigue*, and innumerable *wants*. Yet his knowledge is ſo narrow withal, and his reaſon ſo weak, that in many caſes he cannot judge, in the way of inveſtigation or reaſoning, of the connexions of thoſe effects with their reſpective cauſes, or of the various latent energies of natural things. He is therefore informed of this connexion by the experience of certain *ſenſes* or *organs of perception*, which by a mechanical inſtantaneous motion, feel the *good* and the *ill*, receiving pleaſure from *one*, and pain from the *other*. By theſe, without any reaſoning, he is taught to attract or chooſe what tends to his welfare, and to repel and avoid what tends to his ruin. Thus, by his ſenſes of *taſte* and *ſmell*, or by the *pleaſure* he receives from certain kinds of food, he is admoniſhed which agree with his conſtitution; and by an oppoſite ſenſe of *pain* he is informed which ſort diſagree, or are deſtructive of it; but is not by means of this inſtructed in the inward natures and conſtitutions of things.

Of Perception and Affection.

67 Uſe of appetites and paſſions.

Some of thoſe ſenſes are armed with ſtrong degrees of *uneaſineſs* or *pain*, in order to urge him to ſeek after ſuch objects as are ſuited to them. And theſe reſpect his more immediate and preſſing *wants*; as the ſenſe of *hunger*, *thirſt*, *cold*, and the like; which, by their painful importunities, compel him to provide *food*, *drink*, *raiment*, *ſhelter*. Thoſe inſtincts by which we are thus prompted with ſome kind of commotion or violence to attract and purſue *good*, or to repel and avoid *ill*, we call *appetites* and *paſſions*. By our ſenſes then we are informed of what is *good* or *ill* to the *private ſyſtem*, or the *individual*; and by our *private appetites* and *paſſions* we are impelled to one, and reſtrained from the other.

68 Man's outward ſtate.

In conſequence of this machinery, and the great train of wants to which our nature ſubjects us, we are engaged in a continued ſeries of occupations, which often require much application of thought, or great bodily labour, or both. The neceſſaries of life, food, clothes, ſhelter, and the like, muſt be provided; conveniencies muſt be acquired to render life ſtill more eaſy and comfortable. In order to obtain theſe, arts, induſtry, manufactures, and trade are neceſſary. And to ſecure to us the peaceable enjoyment of their fruits, civil government, policy, and laws, muſt be contrived, and the various buſineſs of public life carried on: thus, while man is concerned and buſied in making proviſion, or obtaining ſecurity for himſelf, he is by degrees engaged in connexions with a family, friends, neighbours, a community, or a commonwealth. Hence ariſe new wants, new intereſts, new cares, and new employments. The paſſions of one man interfere with thoſe of another. Intereſts are oppoſed. Competitions ariſe, contrary courſes are taken. Diſappointments happen, diſtinctions are made, and parties formed. This opens a vaſt ſcene of diſtraction and embarraſſment, and introduces a mighty train of good and ill, both public and private. Yet amidſt all this confuſion and hurry, plans of action muſt be laid, conſequences foreſeen or guarded againſt, inconveniences provided for; and frequently particular reſolutions muſt be taken, and ſchemes executed, without reaſoning or delay.

69 Proviſions for it.

Now what proviſion has the Author of our nature made for this neceſſitous condition? how has he fitted the actor, man, for playing his part in this perplexed and buſy ſcene?

70 By public ſenſes and paſſions.

Our ſupreme Parent, watchful for the whole, has not left himſelf without a witneſs here neither, and hath made nothing imperfect, but all things are double one againſt the other. He has not left man to be informed, only by the cool notices of reaſon, of the *good* or *ill*, the *happineſs* or *miſery* of his fellow creatures.—He has made him ſenſible of their good and happineſs, but eſpecially of their ill and miſery, by an immediate ſympathy, or quick *feeling* of *pleaſure* and of *pain*.

71 Pity.

The latter we call PITY or COMPASSION. For the former, though every one, who is not quite diveſted of humanity, feels it in ſome degree, we have not got a name, unleſs we call it CONGRATULATION or *joyful* SYMPATHY, or that *good humour* which ariſes on ſeeing others pleaſed or happy. Both theſe feelings have been called in general the PUBLIC or COMMON SENSE, κοινη μνημοσυνη, by which we feel for others, and are intereſted in their concerns as really, though perhaps leſs ſenſibly, than in our own.

72 Congratulation.

73 Reſentment.

When we ſee our fellow creatures unhappy through the fault or injury of others, we feel *reſentment* or *indignation* againſt the *unjuſt* cauſers of that miſery.—If we are conſcious that it has happened through our fault or *injurious* conduct, we feel *ſhame*; and both theſe claſſes of *ſenſes* and *paſſions*, regarding *miſery* and *wrong*, are armed with ſuch ſharp ſenſations of *pain*, as not only prove a powerful guard and ſecurity to the *ſpecies*, or *public ſyſtem*, againſt thoſe ills it may, but ſerve alſo to leſſen or remove thoſe ills it does, ſuffer. Compaſſion draws us out of ourſelves to bear a part of the misfortunes of others, powerfully ſolicits us in their favour, melts us at the ſight of their diſtreſs, and makes us in ſome degree unhappy till they are relieved from it. It is peculiarly well adapted to the condition of human life, becauſe it is much more and oftener in our power to do miſchief than good, and to prevent or leſſen miſery than to communicate poſitive happineſs; and therefore it is an admirable reſtraint upon the more *ſelfiſh* paſſions, or thoſe violent impulſes that carry us to the hurt of others.

74 Public affections.

There are other particular *inſtincts* or *paſſions* which intereſt us in the concerns of others, even while we are moſt buſy about our own, and which are ſtrongly attractive of *good*, and repulſive of *ill* to them. Such are *natural affection*, *friendſhip*, *love*, *gratitude*, *deſire of fame*, *love of ſociety*, of *one's country*, and others that might be named. Now as the *private* appetites and paſſions were found to be armed with ſtrong ſenſations of deſire and uneaſineſs, to prompt man the more effectually to ſuſtain labours, and to encounter dangers in purſuit of thoſe goods that are neceſſary to the preſervation and welfare of the individual, and to avoid thoſe ills which tend to his deſtruction; in like manner it was neceſſary, that this *other* claſs of deſires and affections ſhould be prompted with as quick ſenſations of pain, not only to counteract the ſtrength of their antagoniſts, but to engage us in a virtuous activity for our relations, families, friends, neighbours, country. Indeed our *ſenſe* of *right* and *wrong* will admoniſh us that it is our *duty*, and *reaſon* and *experience* farther aſſure us that it is both our *intereſt* and beſt *ſecurity*, to promote the happineſs of others; but that *ſenſe*, that *reaſon*, and that *experience*, would frequently prove but weak and ineffectual prompters to ſuch a conduct, eſpecially in caſes of danger and hardſhip, and amidſt all the importunities of nature, and that conſtant hurry in which the *private* paſſions involve us, without the aid of thoſe particular *kind* affections which mark out to us particular ſpheres of duty, and with an agreeable violence engage and fix us down to them.

75 Contraſt or balance of paſſions.

It is evident, therefore, that thoſe two claſſes of affection, the *private* and *public*, are ſet one againſt the other, and deſigned to controul and limit each other's influence, and thereby to produce a juſt balance in the whole *. In general, the violent ſenſations of pain and uneaſineſs which accompany hunger, thirſt, and the other private appetites, or too great fatigue of mind as well as of body, prevent the individual from running to great exceſſes in the exerciſe of the higher functions of the mind, as too intenſe thought in the ſearch of truth, violent application to buſineſs of any kind, and different degrees of romantic heroiſm. On the other hand, the finer ſenſes of *perception*, and thoſe *generous deſires* and *affections* which are connected with them, the *love of action*, of *imitation*, of *truth*, *honour*, *public virtue*, and the like, are wiſely placed in the oppoſite ſcale, in order to prevent us from ſinking into the dregs of the *animal* life, and debaſing the dignity of man below the condition of brutes. So that, by the mutual reaction of thoſe oppoſite powers, the bad effects are prevented that would naturally reſult from their acting ſingly and apart, and the good effects are produced which each are ſeverally formed to produce.

76 Contraſt or balance of public and private paſſions.

The ſame wholeſome oppoſition appears likewiſe in the particular counter-workings of the *private* and *public* affections one againſt the other. Thus *compaſſion* is adapted to counterpoiſe the *love of eaſe*, of *pleaſure*, and of *life*, and to diſarm or to ſet bounds to *reſentment*; and *reſentment* of injury done to ourſelves, or to our friends who are dearer than ourſelves, prevents an effeminate *compaſſion* or *conſternation*, and gives us a noble contempt of labour, pain, and death. *Natural affection*, *friendſhip*, *love of one's country*, nay *zeal* for any particular virtue, are frequently more than a match for the whole train of *ſelfiſh* paſſions. —On the other hand, without that intimate over-ruling paſſion of *ſelf-love*, and thoſe private deſires which are connected with it, the *ſocial* and *tender inſtincts* of the human heart would degenerate into the wildeſt dotage, the moſt torturing anxiety, and down-right frenzy.

77 Contraſts among thoſe of the ſame claſſes.

But not only are the different orders or claſſes of affection checks one upon another, but paſſions of the ſame claſſes are mutual clogs. Thus, how many are withheld from the violent outrages of *reſentment* by *fear!* and how eaſily is *fear* controlled in its turn, while mighty wrongs awaken a mighty *reſentment!*

The

---

* Vid. *Hutcheſon's Conduct of the Paſſions*, Treat. I. §. 2.

The *private* paſſions often interfere, and therefore moderate the violence of each other; and a calm *ſelf-love* is placed at their head, to direct, influence, and controul their particular attractions and repulſions. The *public* affections likewiſe reſtrain one another; and all of them are put under the controul of a calm diſpaſſionate *benevolence*, which ought in like manner to direct and limit their particular motions. Thus moſt part, if not all the paſſions, have a twofold aſpect, and ſerve a twofold end. In *one* view they may be conſidered as *powers*, impelling mankind to a certain courſe, with a *force* proportioned to the *apprehended moment* of the good they aim at. In *another* view they appear as *weights*, balancing the action of the *powers*, and controlling the violence of their impulſes. By means of theſe *powers* and *weights* a natural *poiſe* is ſettled in the human breaſt by its all-wiſe Author, by which the creature is kept tolerably ſteady and regular in his courſe, amidſt that variety of ſtages through which he muſt paſs.

78 Particular perceptions or inſtincts of approbation.

But this is not all the proviſion which God has made for the hurry and perplexity of the ſcene in which man is deſtined to act. Amidſt thoſe infinite attractions and repulſions towards private and public good and ill, mankind either cannot often foreſee the *conſequences* or *tendencies* of all their actions towards one or other of theſe, eſpecially where thoſe tendencies are intricate and point different ways, or thoſe conſequences remote and complicated; or though, by careful and cool inquiry, and a due improvement of their rational powers, they might find them out, yet, diſtracted as they are with buſineſs, amuſed with trifles, diſſipated by pleaſure, and diſturbed by paſſion, they either have or can find no leiſure to attend to thoſe conſequences, or to examine how far this or that conduct is productive of private or public good on the whole. Therefore, were it left entirely to the ſlow and ſober deductions of reaſon to trace thoſe tendencies, and make out thoſe conſequences, it is evident, that in many particular inſtances the buſineſs of life muſt ſtand ſtill, and many important occaſions of action be loſt, or perhaps the groſſeſt blunders be committed. On this account, the Deity, beſides that general approbation which we beſtow on every degree of *kind* affection, has moreover implanted in man many particular *perceptions* or *determinations* to approve of certain *qualities* or *actions*, which, in effect, tend to the advantage of ſociety, and are connected with private good, though he does not always ſee that tendency, nor mind that connexion. And theſe *perceptions* or *determinations* do, without reaſoning, point out, and, antecedent to views of intereſt, prompt to a conduct beneficial to the *public*, and uſeful to the *private* ſyſtem. Such is that *ſenſe of candour and veracity*, that *abhorrence of fraud and falſehood*, that *ſenſe of fidelity*, *juſtice*, *gratitude*, *greatneſs of mind*, *fortitude*, *clemency*, *decorum*, and that *diſapprobation of knavery*, *injuſtice*, *ingratitude*, *meanneſs of ſpirit*, *cowardice*, *cruelty*, and *indecorum*, which are natural to the human mind. The *former* of thoſe diſpoſitions, and the actions flowing from them, are approved, and thoſe of the latter kind diſapproved by us, even abſtracted from the view of their tendency or conduciveneſs to the happineſs or miſery of others, or of ourſelves. In one we diſcern a *beauty*, a *ſuperior excellency*, a congruity to the *dignity* of man; in the other a *deformity*, a *littleneſs*, a *debaſement*, of human nature.

79 Others of an inferior order.

There are other principles alſo connected with the good of ſociety, or the happineſs and perfection of the individual, though that connexion is not immediately apparent, which we behold with real complacency and approbation, though perhaps inferior in degree, if not in kind, ſuch as *gravity*, *modeſty*, *ſimplicity of deportment*, *temperance*, *prudent economy*; and we feel ſome degree of contempt and diſlike where they are wanting, or where the oppoſite qualities prevail. Theſe and the like *perceptions* or *feelings* are either different *modifications* of the *moral ſenſe*, or *ſubordinate* to it, and plainly ſerve the ſame important purpoſe, being expeditious *monitors*, in the ſeveral emergencies of a various and diſtracted life, of what is *right*, what is *wrong*, what is to be *purſued*, and what *avoided*; and, by the pleaſant or painful conſequences which attends them, exerting their influence as powerful *prompters* to a ſuitable conduct.

80 Their general tendencies.

From a ſlight inſpection of the above-named principles, it is evident they all carry a friendly aſpect to *ſociety* and the *individual*, and have a more immediate or a more remote tendency to promote the *perfection* or *good* of both. This tendency cannot be always foreſeen, and would be often miſtaken or ſeldom attended to by a weak, buſy, ſhort-ſighted creature like man, both raſh and variable in his opinions, a dupe to his own paſſions, or to the deſigns of others, liable to ſickneſs, to want, and to error. Principles, therefore, which are ſo nearly linked with *private ſecurity* and *public good*, by directing him, without operoſe reaſoning, where to find the *one*, and how to promote the *other*; and, by prompting him to a conduct conducive to both, are admirably adapted to the exigencies of his preſent ſtate, and wiſely calculated to obtain the ends of univerſal benevolence.

81 Paſſions fitted to a ſtate of trial.

It were eaſy, by conſidering the ſubject in another light, to ſhow, in a curious detail of particulars, how wonderfully the inſide of man, or that aſtoniſhing train of *moral powers* and *affections* with which he is endued, is fitted to the ſeveral ſtages of that *progreſſive* and *probationary* ſtate through which he is deſtined to paſs. As our faculties are narrow and limited, and riſe from very ſmall and imperfect beginnings, they muſt be improved by exerciſe, by attention, and repeated trials. And this holds true not only of our *intellectual* but of our *moral* and *active* powers. The former are liable to errors in ſpeculation, the latter to blunders in practice, and both often terminate in miſfortunes and pains. And thoſe errors and blunders are generally owing to our paſſions, or to our too forward and warm *admiration* of thoſe partial *goods* they naturally purſue, or to our fear of thoſe partial *ills* they naturally repel. Thoſe miſfortunes, therefore, lead us back to conſider where our miſconduct lay, and whence our errors flowed; and conſequently are ſalutary pieces of trial, which tend to enlarge our views, to *correct* and *refine* our paſſions, and conſequently improve both our *intellectual* and *moral* powers. Our paſſions then are the rude materials of our virtue, which Heaven has given us to work up, to refine and poliſh into a harmonious and divine piece of workmanſhip. They furniſh out the whole machinery, the calms and ſtorms, the lights and ſhades of human life. They ſhow mankind in every attitude and variety of character, and give *virtue* both its ſtruggles and its triumphs. To conduct them well in every ſtate, is merit; to abuſe or miſapply them, is demerit.

82 To a progreſſive ſtate.

The different ſets of *ſenſes*, *powers*, and *paſſions*, which unfold themſelves in thoſe ſucceſſive ſtages, are both neceſſary and adapted to that *riſing* and *progreſſive* ſtate. Enlarging views and growing connexions require new paſſions and new habits; and thus the mind, by theſe continually expanding and finding a progreſſive exerciſe, riſes to higher improvements, and puſhes forward to maturity and perfection.

83 Harmony of our ſtructure and ſtate.

In this beautiful economy and harmony of our ſtructure, both outward and inward, with that ſtate, we may at once diſcern the great lines of our duty traced out in the faireſt and brighteſt characters, and contemplate with admiration a more auguſt and marvellous ſcene of divine wiſdom and goodneſs laid in the human breaſt, than we ſhall perhaps find in the whole compaſs of nature.

84 In what economy virtue conſiſts.

From this detail it appears, that man, by his original frame, is made for a *temperate*, *compaſſionate*, *benevolent*, *active*, and *progreſſive* ſtate. He is ſtrongly *attractive* of the *good*, and *repulſive* of the *ills* which befal others as well as himſelf. He feels the higheſt *approbation* and *moral complacence* in thoſe affections, and in thoſe actions, which immediately and directly reſpect the *good* of others, and the higheſt *diſapprobation* and *abhorrence* of the contrary. Beſides theſe, he has many particular *perceptions* or *inſtincts* of *approbation*, which, though perhaps not of the ſame kind with the others, yet are accompanied with correſpondent degrees of affection, proportioned to their reſpective tendencies to the *public good*. *Therefore*, by acting agreeably to theſe principles, *man* acts agreeably to his ſtructure, and fulfils the benevolent intentions of its Author. But we call a thing *good* when it anſwers its *end*, and a creature *good*, when he acts in a *conformity* to his *conſtitution*. Conſequently, *man* muſt be denominated *good* or *virtuous* when he acts ſuitably to the *principles* and *deſtination* of his nature.

PART II.

CHAP. I. *The principal Diſtinctions of* DUTY *or* VIRTUE.

WE have now conſidered the *conſtitution* and *connexions* of *man*, and on thoſe erected a general ſyſtem of *duty* or *moral obligation*, conſonant to *reaſon*, approved by his moſt ſacred and intimate *ſenſe*, ſuitable to his *mixed condition*, and confirmed by the *experience* of mankind. We have alſo traced the *final cauſes* of his *moral faculties* and *affections* to thoſe noble purpoſes they anſwer, with regard both to the *private* and the *public ſyſtem*.

85 General diviſion of duty.

From this induction it is evident, that there is one order or claſs of duties which *man* owes to *himſelf*: another to *ſociety*: and a third to *God*.

86 Duty to one's ſelf.

The duties he owes to *himſelf* are founded chiefly on the *defenſive* and *private* paſſions, which prompt him to purſue whatever tends to *private good* or *happineſs*, and to avoid or ward off whatever tends to *private ill* or *miſery*. Among the various goods which allure and ſolicit him, and the various ills which attack or threaten him, "to be intelligent and accurate in ſelecting *one*, and rejecting the *other*, or in preferring the moſt *excellent goods*, and avoiding the moſt *terrible ills*, when there is a competition among either, and to be diſcreet in uſing the beſt means to attain the *goods* and avoid the *ills*, is what we call *prudence*." This, in our *inward* frame, correſponds to *ſagacity*, or *quickneſs of ſenſe*, in our *outward*.—"To proportion our *defenſive paſſions* to our *dangers*, we call *fortitude*; which always implies "a juſt mixture of calm reſentment or animoſity, and well-governed caution." And this *firmneſs of mind* anſwers to the *ſtrength* and *muſcling* of the *body*. And "duly to adjuſt our *private paſſions* to our wants, or to the reſpective moment of the good we affect or purſue, we call *temperance*; which does therefore always imply, in this large ſenſe of the word, "a juſt balance or command of the paſſions."

87 Duties to ſociety.

The *ſecond claſs* of *duties* ariſes from the *public* or *ſocial affections*, "the juſt harmony or proportion of which to the *dangers* and *wants* of others, and to the ſeveral *relations* we bear, commonly goes by the name of *juſtice*." This includes the whole of our duty to *ſociety*, to our *parents*, and the *general polity* of *nature*; particularly *gratitude*, *friendſhip*, *ſincerity*, *natural affection*, *benevolence*, and the other *ſocial virtues*: This, being the *nobleſt temper*, and *faireſt complexion* of the ſoul, correſponds to the *beauty* and *fine proportion* of the perſon. The virtues comprehended under the former claſs, eſpecially *prudence* and *fortitude*, may likewiſe be transferred to this; and according to the various circumſtances in which they are placed, and the more confined or more extenſive ſphere in which they operate, may be denominated *private*, *economical*, or *civil prudence*, *fortitude*, &c. Theſe direct our conduct with regard to the *wants* and *dangers* of thoſe leſſer or greater circles with which they are connected.

88 Duties to God.

The *third* claſs of duties reſpects the DEITY, and ariſes from the *public affections*, and the ſeveral glorious *relations*, which he ſuſtains to us as our *Creator*, *Benefactor*, *Lawgiver*, *Judge*, &c.

89 Method.

We chooſe to conſider this *ſet* of duties in the laſt place; becauſe, though *prior* in dignity and excellency, they ſeem to be *laſt* in order of time, as thinking it the moſt ſimple and eaſy method to follow the gradual progreſs of nature, as it takes its riſe from individuals, and ſpreads through the ſocial ſyſtem, and ſtill aſcends upwards, till at length it ſtretches to its almighty Parent and Head, and ſo terminates in thoſe duties which are *higheſt* and *beſt*.

90 Piety.

The duties reſulting from theſe *relations* are, *reverence*, *gratitude*, *love*, *reſignation*, *dependence*, *obedience*, *worſhip*, *praiſe*: which, according to the model of our finite capacities, muſt maintain ſome ſort of proportion to the grandeur and perfection of the object whom we venerate, love, and obey. "This *proportion* or *harmony* is expreſſed by the general name of *piety* or *devotion*," f Man's duty to imſelf. *devotion*," which is always ſtronger or weaker according to the greater or leſs apprehended excellency of its object. This ſublime principle of virtue is the enlivening ſoul which animates the *moral ſyſtem*, and that cement which binds and ſuſtains the other duties which *man* owes to *himſelf* or to *ſociety*.

91 nſcience. This then is the general temper and conſtitution of virtue, and theſe are the principal lines or diviſions of duty. To thoſe good diſpoſitions which reſpect the ſeveral objects of our duty, and to all actions which flow from ſuch diſpoſitions, the mind gives its ſanction or teſtimony. And this ſanction or judgment concerning the moral quality, or the goodneſs of actions or diſpoſitions, moraliſts call *conſcience*. When it judges of an action that is to be performed, it is called an *antecedent conſcience*; and when it paſſes ſentence on an action which is performed, it is called a *ſubſequent conſcience*. The tendency of an action to produce happineſs, or its external conformity to a law, is termed its *material* goodneſs. But the good diſpoſitions from which an action proceeds, or its conformity to law in every reſpect, conſtitutes its *formal* goodneſs.

92 diviſions. When the mind is ignorant or uncertain about the moment of an action or its tendency to private or public good; or when there are ſeveral circumſtances in the caſe, ſome of which, being doubtful, render the mind dubious concerning the morality of the action; that is called a *doubtful* or *ſcrupulous conſcience*; if it miſtakes concerning theſe, it is called an *erroneous conſcience*. If the *error* or *ignorance* is *involuntary* or *invincible*, the action proceeding from that *error*, or from that *ignorance*, is reckoned *innocent*, or not imputable. If the error or ignorance is *ſupine* or *affected*, i. e. the effect of negligence, or of affectation and wilful inadvertence, the conduct flowing from ſuch error, or ſuch ignorance, is *criminal* and *imputable*.—Not to follow one's conſcience, though erroneous and ill-informed, is *criminal*, as it is the guide of life; and to counteract it, ſhows a depraved and incorrigible ſpirit. Yet to follow an erroneous conſcience is likewiſe criminal, if that error which miſled the conſcience was the effect of inattention, or any criminal paſſion *.

93 ow conence is be recied. If it be aſked, "How an erroneous conſcience ſhall be rectified, ſince it is ſuppoſed to be the only guide of life, and judge of morals? we anſwer, In the very ſame way that we would rectify reaſon if at any time it ſhould judge wrong, as it often does, viz. by giving it proper and ſufficient materials for judging right, i. e. by inquiring into the whole ſtate of the caſe, the relations, connexions, and ſeveral obligations of the actor, the conſequences and other circumſtances of the action, or the ſurpluſage of private or public good which reſults, or is likely to reſult, from the action or from the omiſſion of it. If thoſe circumſtances are fairly and fully ſtated, the conſcience will be juſt and impartial in its deciſion; for, by a neceſſary law of our nature, it approves and is well affected to the *moral form*; and if it ſeems to approve of *vice* or *immorality*, it is always under the notion or maſk of ſome *virtue*. So that, ſtrictly ſpeaking, it is not conſcience which errs; for its ſentence is always conformable to the view of the caſe which lies before it; and is *juſt*, upon the ſuppoſition that the caſe is truly ſuch as it is repreſented to it. All the fault is to be imputed to the agent, who neglects to be better informed, or who, through weakneſs or wickedneſs, haſtens to paſs ſentence from an imperfect evidence.

* Hutchſ. or. Inſt. b. ii. c. 3.

CHAP. II. *Of Man's Duty to* HIMSELF. *Of the Nature of* GOOD, *and the Chief* GOOD.

94 Diviſions of good. EVERY creature, by the conſtitution of his nature, is determined to love himſelf; to purſue whatever tends to his preſervation and happineſs, and to avoid whatever tends to his hurt and miſery. Being endued with ſenſe and perception, he muſt neceſſarily receive *pleaſure* from ſome objects, and *pain* from others. Thoſe objects which give pleaſure are called *good*; and thoſe which give pain, *evil*. To the former he feels that attraction or motion we call *deſire* or *love*; to the latter, that impulſe we call *averſion* or *hatred*.—To objects which ſuggeſt neither pleaſure nor pain, and are apprehended of no uſe to procure one or ward off the other, we feel neither *deſire* nor *averſion*; and ſuch objects are called *indifferent*. Thoſe objects which do not of themſelves produce pleaſure or pain, but are the *means* of procuring either, we call *uſeful* or *noxious*. Towards them we are affected in a ſubordinate manner, or with an *indirect* and *reflective* rather than a *direct* and *immediate* affection. All the original and particular affections of our nature lead us out to and ultimately reſt in the firſt kind of objects, viz. thoſe which give immediate pleaſure, and which we therefore call *good directly ſo*. The calm affection of *ſelf-love* alone is converſant about ſuch objects as are only *conſequentially good*, or merely uſeful to ourſelves.

95 Moral good. But, beſides thoſe ſorts of objects which we call *good*, merely and ſolely as they give pleaſure, or are means of procuring it, there is a higher and nobler ſpecies of good, towards which we feel that peculiar movement we call *approbatian* or *moral complacency*; and which we *therefore* denominate *moral good*. Such are our affections, and the conſequent actions to them. The perception of this is, as has been already obſerved, quite diſtinct in kind from the perception of other ſpecies; and though it may be connected with *pleaſure* or *advantage* by the benevolent conſtitution of nature, yet it conſtitutes a *good* independent of that pleaſure and that advantage, and far ſuperior not in degree only but in dignity to both. The *other*, viz. the *natural good*, conſiſts in obtaining thoſe pleaſures which are adapted to the peculiar ſenſes and paſſions ſuſceptible of them, and is as various as are thoſe ſenſes and paſſions. This, *viz.* the *moral*, good, lies in the right conduct of the ſeveral ſenſes and paſſions, or their juſt proportion and accommodation to their reſpective objects and relations, and this is of a more ſimple and invariable kind.

96 Human happineſs. By our ſeveral ſenſes we are capable of a great variety of pleaſing ſenſations. Theſe conſtitute diſtinct ends or objects ultimately purſuable for their own ſake. To theſe ends, or ultimate objects, correſpond peculiar appetites or affections, which prompt the mind to purſue them. When theſe ends are attained, there it reſts, and looks no farther. Whatever therefore is purſuable, not on its own account, but as ſubſervient or neceſſary to the attainment of ſomething elſe that is intrinſically valuable for its own ſake, be that value ever ſo great or ever ſo ſmall, we call a *mean*,

mean, and not an *end*. So that *ends* and *means* conſtitute the *materials* or the very *eſſence* of our *happineſs*. Conſequently happineſs, *i. e. human* happineſs, cannot be one ſimple uniform thing in creatures conſtituted as we are, with ſuch various ſenſes of pleaſure, or ſuch different capacities of enjoyment. Now the ſame principle, or law of our nature, which determines us to purſue any one end or ſpecies of good, prompts us to purſue every other end or ſpecies of good of which we are ſuſceptible, or to which our Maker has adapted an original propenſion. But amidſt the great multiplicity of *ends* or *goods* which form the various ingredients of our happineſs, we perceive an evident *gradation* or *ſubordination* ſuited to that gradation of *ſenſes*, *powers*, and *paſſions*, which prevails in our mixed and various conſtitution, and to that aſcending ſeries of connexions which open upon us in the different ſtages of our progreſſive ſtate.

97 Gradation of goods.

Thus the goods of the *body*, or of the *external ſenſes*, ſeem to hold the loweſt rank in this gradation or ſcale of goods. Theſe we have in common with the brutes; and though many men are brutiſh enough to purſue the goods of the body with a more than brutal fury, yet, when at any time they come in competition with goods of an higher order, the unanimous verdict of mankind, by giving the laſt the preference, condemns the firſt to the meaneſt place. Goods conſiſting in exterior ſocial connexions, as *fame*, *fortune*, *power*, *civil authority*, ſeem to ſucceed next, and are chiefly valuable as the means of procuring *natural* or *moral* good, but principally the latter. Goods of the *intellect* are ſtill ſuperior, as *taſte*, *knowledge*, *memory*, *judgment*, &c. The higheſt are moral goods of the mind, directly and ultimately regarding ourſelves, as *command of the appetites* and *paſſions*, *prudence*, *fortitude*, *benevolence*, &c. Theſe are the great objects of our purſuit, and the principal ingredients of our happineſs. Let us conſider each of them as they riſe one above the other in this natural ſeries or ſcale, and touch briefly on our obligations to purſue them.

98 Goods of the body.

Thoſe of the body are *health*, *ſtrength*, *agility*, *hardineſs*, and *patience of change*, *neatneſs*, and *decency*.

99 Good health;

Good health, and a regular eaſy flow of ſpirits, are in themſelves ſweet natural enjoyments, a great fund of pleaſure, and indeed the proper ſeaſoning which gives a flavour and poignancy to every other pleaſure. The want of health unfits us for moſt duties of life, and is eſpecially an enemy to the ſocial and humane affections, as it generally renders the unhappy ſufferer peeviſh and ſullen, diſguſted at the allotments of Providence, and conſequently apt to entertain ſuſpicious and gloomy ſentiments of its Author. It obſtructs the free exerciſe and full improvement of our reaſon, makes us a burden to our friends, and uſeleſs to ſociety. Whereas the uninterrupted enjoyment of good health is a conſtant ſource of good humour, and good humour is a great friend to openneſs and benignity of heart, enables us to encounter the various ills and diſappointments of life with more courage, or to ſuſtain them with more patience; and, in ſhort, conduces much, if we are otherwiſe duly qualified, to our acting our part in every exigency of life with more firmneſs, conſiſtency, and dignity. Therefore it imports us much to preſerve and improve a habit or enjoyment, without which every other external entertainment is taſteleſs, and moſt other advantages of little avail.— 100 How preſerved. And this is beſt done by a ſtrict temperance in diet and regimen, by regular exerciſe, and by keeping the mind ſerene and unruffled by violent paſſions, and unſubdued by intenſe and conſtant labours, which greatly impair and gradually deſtroy the ſtrongeſt conſtitutions.

101 Strength, agility, &c.

Strength, *agility*, *hardineſs*, and *patience of change*, ſuppoſe health, and are unattainable without it; but they imply ſomething more, and are neceſſary to guard it, to give us the perfect uſe of life and limbs, and to ſecure us againſt many otherwiſe unavoidable ills.—The exerciſe of the neceſſary manual, and of moſt of the elegant arts of life, depends on ſtrength and agility of body; perſonal dangers, private and public dangers, the demands of our friends, our families, and country, require them; they are neceſſary in war, and ornamental in peace; fit for the employment of a country and a town life, and they exalt the entertainments and diverſions of both. 102 How attained. They are chiefly obtained by moderate and regular exerciſe.

103 Patience of change;

Few are ſo much raiſed above want and dependence, or ſo exempted from buſineſs and care, as not to be often expoſed to inequalities and changes of diet, exerciſe, air, climate, and other irregularities. Now, what can be ſo effectual to ſecure one againſt the miſchiefs ariſing from ſuch unavoidable alterations, as hardineſs, and a certain verſatility of conſtitution which can bear extraordinary labours, and ſubmit to great changes, without any ſenſible uneaſineſs or bad conſequences. 104 How attained. This is beſt attained, not by an over great delicacy and minute attention to forms, or by an invariable regularity in diet, hours, and way of living, but rather by a bold and diſcreet latitude of regimen. Beſides, deviations from eſtabliſhed rules and forms of living, if kept within the bounds of ſobriety and reaſon, are friendly to thought and original ſentiments, animate the dull ſcene of ordinary life and buſineſs, and agreeably ſtir the paſſions, which ſtagnate or breed ill humour in the calms of life.

105 Neatneſs, decency, &c.

Neatneſs, *cleanlineſs*, and *decency*, to which we may add *dignity* of *countenance* and *demeanour*, ſeem to have ſomething refined and moral in them: at leaſt we generally eſteem them indications of an orderly, genteel, and well governed mind, conſcious of an inward worth, or the reſpect due to one's nature. Whereas *naſtineſs*, *ſlovenlineſs*, *awkwardneſs*, and *indecency*, are ſhrewd ſymptoms of ſomething mean, careleſs, and deficient, and betray a mind untaught, illiberal, unconſcious of what is due to one's ſelf or to others. How much cleanlineſs conduces to health, needs hardly to be mentioned; and how neceſſary it is to maintain one's character and rank in life, and to render us agreeable to others as well as to ourſelves, is as evident.—There are certain motions, airs and geſtures, which become the human countenance and form, in which we perceive a *comelineſs*, *openneſs*, *ſimplicity*, *gracefulneſs*; and there are others, which to our ſenſe of decorum appear *uncomely*, *affected*, *diſingenuous*, and *awkward*, quite unſuitable to the native dignity of our face and form. The *firſt* are in themſelves the moſt eaſy, natural and commodious, give one boldneſs and preſence of mind, a modeſt aſſurance, an addreſs both awful and alluring; they beſpeak candour and greatneſs

neſs of mind, raiſe the moſt agreeable prejudices in one's favour, render ſociety engaging, command reſpect, and often love, and give weight and authority both in converſation and buſineſs; in fine, they are the colouring of virtue, which ſhow it to the greateſt advantage in whomſoever it is; and not only imitate, but in ſome meaſure ſupply it where it is wanting. Whereas the laſt, *viz. rudeneſs*, *affectation*, *indecorum*, and the like, have all the contrary effects; they are burdenſome to one's ſelf, a diſhonour to our nature, and a nuiſance in ſociety.

106 Hw attned.

The former qualities or goods are beſt attained by a liberal education, by preſerving a juſt ſenſe of the dignity of our nature, by keeping the beſt and politeſt company, but, above all, by acquiring thoſe virtuous and ennobling habits of mind which are decency in perfection, which will give an air of unaffected grandeur, and ſpread a luſtre truly engaging over the whole form and deportment.

107 Gods of eterior ſocl connectns.

We are next to conſider thoſe goods which conſiſt in exterior ſocial connexions, as *fame*, *fortune*, *civil authority*, *power*.

108 Eme.

The firſt has a twofold aſpect, as a good pleaſant in itſelf, or gratifying to an original paſſion, and then as expedient or uſeful towards a farther end. Honour from the wiſe and good, on the account of a virtuous conduct, is regaling to a good man; for then his heart re-echoes to the grateful ſound. There are few quite indifferent even to the commendation of the vulgar. Though we cannot approve that conduct which proceeds entirely from this principle, and not from good affection or love of the conduct itſelf, yet, as it is often a guard and additional motive to virtue in creatures imperfect as we are, and often diſtracted by interfering paſſions, it might be dangerous to ſuppreſs it altogether, however wiſe it may be to reſtrain it within due bounds, and however laudable to uſe it only as a ſcaffolding to our virtue, which may be taken down when that glorious ſtructure is finiſhed, but hardly till then. To purſue fame for itſelf, is innocent; to regard it only as an auxiliary to virtue, is noble; to ſeek it chiefly as an engine of public uſefulneſs is ſtill more noble, and highly praiſe-worthy. For though the opinion and breath of men are tranſient and fading things, often obtained without merit, and loſt without cauſe; yet as our buſineſs is with men, and as our capacity of ſerving them is generally increaſed in proportion to their eſteem of us, therefore ſound and well eſtabliſhed *moral* applauſe may and will be modeſtly, not oſtentatiouſly, ſought after by the *good*; not indeed as a ſolitary refined ſort of luxury, but as a public and proper inſtrument to ſerve and bleſs mankind. At the ſame time they will learn to deſpiſe that reputation which is founded on rank, fortune, and any other circumſtances or accompliſhments that are foreign to real merit, or to uſeful ſervices done to others, and think that praiſe of little avail which is purchaſed without deſert, and beſtowed without judgment.

109 Ftune, Prer, &c.

Fortune, *power*, and *civil authority*, or whatever is called influence and weight among mankind, are *goods* of the *ſecond* diviſion, that is, valuable and purſuable only as they are *uſeful*, or as means to a farther end, viz. procuring or preſerving the immediate objects of enjoyment or happineſs to ourſelves or others. Therefore to love ſuch goods on their own account, and to purſue them as ends, not the means of enjoyment, muſt be highly prepoſterous and abſurd. There can be no meaſure, no limit, to ſuch purſuit; all muſt be whim, caprice, extravagance. Accordingly, ſuch appetites, unlike all the *natural* ones, are increaſed by poſſeſſion, and whetted by enjoyment. They are always precarious, and never without fears, becauſe the objects lie without one's ſelf; they are ſeldom without ſorrow and vexation, becauſe no acceſſion of wealth or power can ſatisfy them.

110 How far purſuable.

But if thoſe goods are conſidered only as the materials or means of private or public happineſs, then the ſame obligations which bind us to purſue the latter, bind us likewiſe to purſue the former. We may, and no doubt we ought, to ſeek ſuch a meaſure of wealth as is neceſſary to ſupply all our real wants, to raiſe us above ſervile dependence, and provide us with ſuch conveniences as are ſuited to our rank and condition in life. To be regardleſs of this meaſure of wealth, is to expoſe ourſelves to all the temptations of poverty and corruption: to forfeit our natural independency and freedom; to degrade, and conſequently to render the rank we hold, and the character we ſuſtain in ſociety, uſeleſs, if not contemptible. When theſe important ends are ſecured, we ought not to murmur or repine that we poſſeſs no more; yet we are not ſecluded by any obligation, moral or divine, from ſeeking more, in order to give us that happieſt and moſt godlike of all powers, the *power* of *doing good*. A ſupine indolence in this reſpect is both abſurd and criminal; *abſurd*, as it robs us of an inexhauſted fund of the moſt refined and durable enjoyments; and *criminal*, as it renders us ſo far uſeleſs to the ſociety to which we belong.

111 Avarice.

"That purſuit of wealth which goes beyond the former end, viz. the obtaining the neceſſaries, or ſuch conveniencies of life, as, in the eſtimation of reaſon, not of vanity or paſſion, are ſuited to our rank and condition, and yet is not directed to the latter, viz. the doing good, is what we call *avarice*." And "that purſuit of *power*, which after ſecuring one's ſelf, i. e. having attained the proper independence and liberty of a rational ſocial creature, is not directed to the good of others, is what we call *ambition*, or the *luſt of power*."

112 Ambition.

To what extent the ſtrict meaſures of virtue will allow us to purſue either wealth or power, and civil authority, is not perhaps poſſible preciſely to determine. That muſt be left to prudence, and the peculiar character, condition, and other circumſtances of each man. Only thus far a limit may be ſet, that the purſuit of either muſt encroach upon no other duty or obligation which we owe to ourſelves, to ſociety, or to its parent and head. The ſame reaſoning is to be applied to *power* as to *wealth*. It is only valuable as an inſtrument of our own ſecurity, and of the free enjoyment of thoſe original goods it may, and often does, adminiſter to us, and as an engine of more extenſive happineſs to our friends, our country, and mankind.

113 How fame and power are attained.

Now the beſt, and indeed the only way to obtain a ſolid and laſting fame, is an uniform inflexible courſe of virtue, the employing one's ability and wealth in ſupplying the wants, and uſing one's power in promoting or ſecuring the happineſs, the rights and liberties of mankind, joined to an univerſal affability and politeneſs of manners. And ſurely one will not miſtake the matter much, who thinks the ſame courſe conducive to the acquiring greater acceſſions both of wealth and power; eſpecially if he adds to thoſe qualifications a vigorous induſtry, a conſtant attention to the characters and wants of men, to the conjunctures of times, and continually varying genius of affairs; and a ſteady intrepid honeſty, that will neither yield to the allurements, nor be overawed with the terrors, of that corrupt and corrupting ſcene in which we live. We have ſometimes heard indeed of other ways and means, as fraud, diſſimulation, ſervility, and proſtitution, and the like ignoble arts, by which the men of the world (as they are called, ſhrewd politicians, and men of addreſs!) amaſs wealth, and procure power; but as we want rather to form a man of virtue, an honeſt, contented, happy man, we leave to the men of the world their own ways, and permit them, unenvied and unimitated by us, to reap the fruit of their doings.

114 Goods of the intellect.

The next ſpecies of objects in the ſcale of good, are the goods of the *intellect*, as *knowledge*, *memory*, *judgement*, *taſte*, *ſagacity*, *docility*, and whatever elſe we call intellectual virtues. Let us conſider them a little, and the means as well as obligations to improve them.

115 Their moment.

As *man* is a *rational* creature, capable of knowing the differences of things and actions;—as he not only ſees and feels what is preſent, but remembers what is paſt, and often foreſees what is future;—as he advances from ſmall beginnings by ſlow degrees, and with much labour and difficulty, to knowledge and experience;—as his opinions ſway his paſſions,—as his paſſions influence his conduct,—and as his conduct draws conſequences after it, which extend not only to the preſent but to the future time, and therefore is the principal ſource of his happineſs or miſery; it is evident, that he is formed for intellectual improvements, and that it muſt be of the utmoſt conſequence for him to improve and cultivate his intellectual powers, on which theſe opinions, thoſe paſſions, and that conduct depend *.

116 The pleaſures they give.

117 Knowledge and taſte;

But beſides the future conſequences and moment of improving our intellectual powers, their immediate exerciſe on their proper objects yields the moſt rational and refined pleaſures. Knowledge, and a right taſte in the arts of *imitation* and *deſign*, as *poetry*, *painting*, *ſculpture*, *muſic*, *architecture*, afford not only an innocent, but a moſt ſenſible and ſublime entertainment. By theſe the underſtanding is inſtructed in ancient and modern life, the hiſtory of men and things, the energies and effects of the paſſions, the conſequences of virtue and vice; by theſe the imagination is at once entertained and nouriſhed with the beauties of nature and art, lighted up and ſpread out with the novelty, grandeur, and harmony of the univerſe; and, in fine, the paſſions are agreeably rouſed, and ſuitably engaged, by the greateſt and moſt intereſting objects that can fill the human mind. He who has a taſte formed to thoſe ingenious delights, and plenty of materials to gratify it, can never want the moſt agreeable exerciſe and entertainment, nor once have reaſon to make that faſhionable complaint of the tediouſneſs of time. Nor can he want a proper ſubject for the diſcipline and improvement of his heart. For, being daily converſant with *beauty*, *order*, and *deſign*, in inferior ſubjects, he bids fair for growing in due time an admirer of what is fair and well-proportioned in the conduct of life and the order of ſociety, which is only order and deſign exerted in their higheſt ſubject. He will learn to transfer the numbers of poetry to the harmony of the mind and of well-governed paſſions; and, from admiring the virtues of others in moral paintings, come to approve and imitate them himſelf. Therefore, to cultivate a *true* and *correct taſte* muſt be both our intereſt and our duty, when the circumſtances of our ſtation give leiſure and opportunity for it, and when the doing it is not inconſiſtent with our higher obligations or engagements to ſociety and mankind.

118 How attained.

It is beſt attained by reading the beſt books, where *good ſenſe* has more the aſcendant than *learning*, and which pertain more to *practice* than to *ſpeculation*; by ſtudying the beſt models, i. e. thoſe which profeſs to imitate nature moſt, and approach the neareſt to it, and by converſing with men of the moſt refined taſte, and the greateſt experience in life.

119 Other intellectual goods,

As to the other intellectual goods, what a fund of entertainment muſt it be to inveſtigate the truth and various relations of things, to trace the operations of nature to general laws, to explain by theſe its manifold phenomena, to underſtand that order by which the univerſe is upheld, and that economy by which it is governed! to be acquainted with the human mind, the connexions, ſubordinations, and uſes of its powers, and to mark their energy in life! how agreeable to the ingenious inquirer, to obſerve the manifold relations and combinations of individual minds in ſociety, to diſcern the cauſes why they flouriſh or decay, and from thence to aſcend, through the vaſt ſcale of beings, to that general Mind which preſides over all; and operates unſeen in every ſyſtem and in every age, through the whole compaſs and progreſſion of nature! Devoted to ſuch entertainments as theſe, the contemplative have abandoned every other pleaſure, retired from the body, ſo to ſpeak, and ſequeſtered themſelves from ſocial intercourſe: for theſe, the *buſy* have often preferred to the hurry and din of life the calm retreats of contemplation; for theſe, when once they came to taſte them, even the *gay* and *voluptuous* have thrown up the lawleſs purſuits of ſenſe and appetite, and acknowledged theſe mental enjoyments to be the moſt *refined*, and indeed the *only* luxury. Beſides, by a juſt and large knowledge of nature, we recognize the perfections of its Author; and thus piety, and all thoſe pious affections which depend on juſt ſentiments of his character, are awakened and confirmed; and a thouſand ſuperſtitious fears, that ariſe from partial views of his nature and works, will of courſe be excluded. An extenſive proſpect of human life, and of the periods and revolutions of human things, will conduce much to the giving a certain greatneſs of mind, and a noble contempt to thoſe little competitions about power, honour, and wealth, which diſturb and divide the bulk of mankind; and promote a calm endurance of thoſe inconveniencies and ills that are the common appendages of humanity. Add to all, that a juſt knowledge of human nature, and of thoſe hinges upon which the buſineſs and fortunes of men turn, will prevent our thinking either too highly or too meanly of our fellow creatures, give no ſmall ſcope to the exerciſe of friendſhip, confidence, and good will, and at the ſame time brace the mind with a proper caution and diſtruſt (thoſe nerves of prudence), and give a greater maſtery in the conduct of private as well as public life. Therefore, by cultivating our intellectual abilities, we ſhall beſt

---

* *Philoſ. Sinic. Confuc.* lib. i. § 3, 4, &c.

beſt promote and ſecure our intereſt, and be qualified for acting our part in ſociety with more honour to ourſelves, as well as advantage to mankind. Conſequently, to improve them to the utmoſt of our power is our duty; they are talents committed to us by the Almighty Head of ſociety, and we are accountable to him for the uſe of them.

120 w at-ned.

The intellectual virtues are beſt improved by accurate and impartial obſervation, extenſive reading, and unconfined converſe with men of all characters, eſpecially with thoſe who to private ſtudy, have joined the wideſt acquaintance with the world, and greateſt practice in affairs; but, above all, by being much in the world, and having large dealings with mankind. Such opportunities contribute much to diveſt one of prejudices and a ſervile attachment to crude ſyſtems, to open one's views, and to give that experience on which the moſt uſeful becauſe the moſt practical knowledge is built, and from which the ſureſt maxims for the conduct of life are deduced.

121 oral ods.

The higheſt goods which enter into the compoſition of human happineſs are *moral* goods of the mind, directly and ultimately regarding ourſelves; as *command of the appetites and paſſions*, *prudence and caution*, *magnanimity*, *fortitude*, *humility*, *love of virtue*, *love of God*, *reſignation*, and the like. Theſe ſublime goods are goods by way of eminence, goods recommended and enforced by the moſt intimate and awful ſenſe and conſciouſneſs of our nature; goods that conſtitute the quinteſſence, the very temper of happineſs, and form that complexion of ſoul which renders us approveable and lovely in the ſight of God; goods, in fine, which are the elements of all our future perfection and felicity.

122 heir mo-nt.

Moſt of the other goods we have conſidered depend partly on ourſelves, and partly on accidents which we can neither foreſee nor prevent, and reſult from cauſes which we cannot influence or alter. They are ſuch goods as we may poſſeſs to-day and loſe to-morrow, and which require a felicity of conſtitution and talents to attain them in full vigour and perfection, and a felicity of conjunctures to ſecure the poſſeſſion of them. Therefore, did our happineſs depend altogether or chiefly on ſuch tranſitory and precarious poſſeſſions, it were itſelf moſt precarious, and the higheſt folly to be anxious about it. But though creatures, conſtituted as we are, cannot be indifferent about ſuch goods, and muſt ſuffer in ſome degree, and conſequently have our happineſs incomplete without them, yet they weigh but little in the ſcale when compared with moral goods. By the benevolent conſtitution of our nature, theſe are placed within the ſphere of our activity, ſo that no man can be deſtitute of them unleſs he is firſt wanting to himſelf. Some of the wiſeſt and beſt of mankind have wanted moſt of the former goods, and all the external kind, and felt moſt of the oppoſite ills, ſuch at leaſt as ariſe from without; yet by poſſeſſing the latter, viz. the moral goods, have declared they were happy; and to the conviction of the moſt impartial obſervers have appeared happy. The worſt of men have been ſurrounded with every outward good and advantage of fortune, and have poſſeſſed great parts; yet for want of moral rectitude, have been, and have confeſſed themſelves, notoriouſly and exquiſitely miſerable. The exerciſe of virtue has ſupported its votaries, and made them exult in the midſt of tortures almoſt intolerable; nay, how often has ſome falſe form or ſhadow of it ſuſtained even the greateſt (E) villains and bigots under the ſame preſſures! But no external goods, no goods of fortune, have been able to alleviate the agonies or expel the fears of a guilty mind, conſcious of the deſerved hatred and reproach of mankind, and the juſt diſpleaſure of Almighty God.

123 The mixed condition of human life requires particular virtues.

As the preſent condition of human life is wonderfully chequered with good and ill, and as no height of ſtation, no affluence of fortune, can abſolutely enſure the good, or ſecure againſt the ill, it is evident that a great part of the comfort and ſerenity of life muſt lie in having our minds duly affected with regard to both, i. e. rightly attempered to the loſs of one and the ſufferance of the other. For it is certain that outward calamities derive their chief malignity and preſſure from the inward diſpoſitions with which we receive them. By managing theſe right, we may greatly abate that malignity and preſſure, and conſequently diminiſh the number, and weaken the force, of the ills of life, if we ſhould not have it in our power to obtain a large ſhare of its goods. There are particularly three virtues which go to the forming this right temper towards ill, and which are of ſingular efficacy, if not totally to remove, yet wonderfully to alleviate, the calamities of life. Theſe are *fortitude* or *patience*, *humility*, and *reſignation*.

124 Fortitude.

Fortitude is that calm and ſteady habit of mind which either moderates our fears, and enables us bravely to encounter the proſpect of ill, or renders the mind ſerene and invincible under its immediate preſſure. It lies equally diſtant from raſhneſs and cowardice: and though it does not hinder us from feeling, yet prevents our complaining or ſhrinking under the ſtroke. It always includes a generous contempt of, or at leaſt a noble ſuperiority to, thoſe precarious goods of which we can enſure neither the poſſeſſion nor continuance. The man therefore who poſſeſſes this virtue in this ample ſenſe of it, ſtands upon an eminence, and ſees human things below him; the tempeſt indeed may reach him, but he ſtands ſecure and collected againſt it upon the baſis of conſcious virtue, which the ſevereſt ſtorms can ſeldom ſhake, and never overthrow.

125 Humility.

Humility is another virtue of high rank and dignity, though often miſtaken by proud mortals for meanneſs and puſillanimity. It is oppoſed to *pride*, which commonly includes in it a falſe or overrated eſtimation of our own merit, an aſcription of it to ourſelves as its only and original cauſe, an undue compariſon of ourſelves with others, and in conſequence of that ſuppoſed ſuperiority, an arrogant preference of ourſelves, and a ſupercilious contempt of them. *Humility*, on the other hand, ſeems to denote that modeſt and ingenuous temper of mind, which ariſes from a juſt and equal eſtimate

---

(E) As Ravaillac, who aſſaſſinated Henry IV. of France; and Balthaſar Geraerd, who murdered William I. prince of Orange.

eſtimate of our own advantages compared with thoſe of others, and from a ſenſe of our deriving all originally from the Author of our being. Its ordinary attendants are mildneſs, a gentle forbearance, and an eaſy unaſſuming humanity with regard to the imperfections and faults of others; virtues rare indeed, but of the faireſt complexion, the proper offspring of ſo lovely a parent, the beſt ornaments of ſuch imperfect creatures as we are, precious in the ſight of God, and which ſweetly allure the hearts of men.

126 Reſignation. *Reſignation* is that mild and heroic temper of mind which ariſes from a ſenſe of an infinitely wiſe and good providence, and enables one to acquieſce with a cordial affection in its juſt appointments. This virtue has ſomething very particular in its nature, and ſublime in its efficacy. For it teaches us to bear ill, not only with patience, and as being unavoidable, but it transforms, as it were, ill into good, by leading us to conſider it, and every event that has the leaſt appearance of ill, as a divine diſpenſation, a wiſe and benevolent temperament of things, ſubſervient to univerſal good, and of courſe including that of every individual, eſpecially of ſuch as calmly ſtoop to it. In this light, the adminiſtration itſelf, nay every act of it, becomes an object of affection, the evil diſappears, or is converted into a balm which both heals and nouriſheth the mind. For though the firſt unexpected acceſs of ill may ſurpriſe the ſoul into grief, yet that grief, when the mind calmly reviews its object, changes into contentment, and is by degrees exalted into veneration and a divine compoſure. Our private will is loſt in that of the Almighty, and our ſecurity againſt every real ill reſts on the ſame bottom as the throne of him who lives and reigns for ever.

127 Chief good, *objective* and *formal*. Before we finiſh this ſection, it may be fit to obſerve, that as the Deity is the ſupreme and inexhauſted ſource of good, on whom the happineſs of the whole creation depends; as he is the higheſt object in nature, and the only object who is fully proportioned to the intellectual and moral powers of the mind, in whom they ultimately reſt, and find their moſt perfect exerciſe and completion; he is therefore termed the *Chief good of man*, objectively conſidered. And *virtue*, or the proportioned and vigorous exerciſe of the ſeveral powers and affections on their reſpective objects, as above deſcribed, is, in the ſchools, termed the *chief good*, formally conſidered, or its formal idea, being the inward temper and native conſtitution of human happineſs.

From the detail we have gone through, the following corollaries may be deduced.

128 Corollaries. 1. It is evident, that the happineſs of ſuch a *progreſſive* creature as man can never be at a ſtand, or continue a fixed invariable thing. His finite nature, let it riſe ever ſo high, admits ſtill higher degrees of improvement and perfection. And his progreſſion in improvement or virtue always makes way for a progreſſion in happineſs. So that no poſſible point can be aſſigned in any period of his exiſtence in which he is perfectly happy, that is, ſo happy as to exclude higher degrees of happineſs. All his perfection is only comparative. 2. It appears that many things muſt conſpire to complete the happineſs of ſo *various* a creature as man, ſubject to ſo many wants, and ſuſceptible of ſuch different pleaſures. 3. As his capacities of pleaſure cannot be all gratified at the ſame time, and muſt often interfere with each other in ſuch a precarious and fleeting ſtate as human life, or be frequently diſappointed, perfect happineſs, i. e. the undiſturbed enjoyment of the ſeveral pleaſures of which we are capable, is unattainable in our preſent ſtate. 4. That ſtate is moſt to be ſought after, in which the feweſt competitions and diſappointments can happen, which leaſt of all impairs any ſenſe of pleaſure, and opens an inexhauſted ſource of the moſt refined and laſting enjoyments. 5. That ſtate which is attended with all thoſe advantages, is a ſtate or courſe of virtue. 6. *Therefore*, a ſtate of *virtue*, in which the moral goods of the mind are attained, is the *happieſt ſtate*.

Chap. III. *Duties of* Society.

Sect. I. *Filial and Fraternal Duty.*

As we have followed the order of nature in tracing the hiſtory of man, and thoſe duties which he owes to himſelf, it ſeems reaſonable to take the ſame method with thoſe he owes to ſociety, which conſtitute the *ſecond* claſs of his *obligations*.

129 Connexion of parents. His parents are among the earlieſt objects of his attention; he becomes ſooneſt acquainted with them, repoſes a peculiar confidence in them, and ſeems to regard them with a fond affection, the early prognoſtics of his future *piety* and *gratitude*. Thus does nature dictate the firſt lines of filial duty, even before a juſt ſenſe of the connexion is formed. But when the child is grown up, and has attained to ſuch a degree of underſtanding, as to comprehend the *moral tie*, and be ſenſible of the obligations he is under to his parents; when he looks back on their tender and diſintereſted affection, their inceſſant cares and labours in nurſing, educating, and providing for him, during that ſtate in which he had neither prudence nor ſtrength to care and provide for himſelf, he muſt be conſcious that he owes to them theſe peculiar duties.

130 Duties to parents. 1. To reverence and honour them, as the inſtruments of nature in introducing him to life, and to that ſtate of comfort and happineſs which he enjoys; and therefore to eſteem and imitate their good qualities, to alleviate and bear with, and ſpread, as much as poſſible, a decent veil over their faults and weakneſſes.

2. To be highly grateful to them, for thoſe favours which it can hardly ever be in his power fully to repay; to ſhow this gratitude by a ſtrict attention to their wants, and a ſolicitous care to ſupply them; by a ſubmiſſive deference to their authority and advice, eſpecially by paying great regard to it in the choice of a wife, and of an occupation; by yielding to, rather than peeviſhly contending with, their humours, as remembering how oft they have been perſecuted by his; and, in fine, by ſoothing their cares, lightening their ſorrows, ſupporting the infirmities of age, and making the remainder of their life as comfortable and joyful as poſſible.

131 Duties to brethren and ſiſters. As his brethren and ſiſters are the next with whom the creature forms a *ſocial* and *moral* connexion, to them he owes a *fraternal* regard; and with them ought he to enter into a ſtrict league of friendſhip, mutual ſympathy, advice, aſſiſtance, and a generous intercourſe of kind offices, remembering their relation to

to common parents, and that brotherhood of nature which unites them into a cloſer community of intereſt and affection.

Sect. II. *Concerning Marriage.*

132 Cnnexion wh the oter ſex.

When man arrives to a certain age, he becomes ſenſible of a peculiar ſympathy and tenderneſs towards the other ſex; the charms of beauty engage his attention, and call forth new and ſofter diſpoſitions than he has yet felt. The many amiable qualities exhibited by a fair outſide, or by the mild allurement of female manners, or which the prejudiced ſpectator without much reaſoning ſuppoſes thoſe to include, with ſeveral other circumſtances both natural and accidental, point his view and affection to a particular object, and of courſe contract that general rambling regard, which was loſt and uſeleſs among the undiſtinguiſhed crowd, into a peculiar and permanent attachment to one woman, which ordinarily terminates in the moſt important, venerable, and delightful connection in life.

133 Te gunds of tis connxion.

The ſtate of the brute creation is very different from that of human creatures. The former are clothed and generally armed by their ſtructure, eaſily find what is neceſſary to their ſubſiſtence, and ſoon attain their vigour and maturity; ſo that they need the care and aid of their parents but for a ſhort while; and therefore we ſee that nature has aſſigned to them vagrant and tranſient amours. The connexion being purely *natural*, and merely for propagating and rearing their offspring, no ſooner is that end anſwered, than the connexion diſſolves of courſe. But the human race are of a more tender and defenceleſs conſtitution; their infancy and non-age continue longer; they advance ſlowly to ſtrength of body and maturity of reaſon; they need conſtant attention, and a long ſeries of cares and labours, to train them up to decency, virtue, and the various arts of life. Nature has therefore, provided them with the moſt affectionate and anxious tutors, to aid their weakneſs, to ſupply their wants, and to accompliſh them in thoſe neceſſary arts, even their own parents, on whom ſhe has devolved this mighty charge, rendered agreeable by the moſt alluring and powerful of all ties, parental affection. But unleſs both concur in this grateful taſk, and continue their joint labours, till they have reared up and planted out their young colony, it muſt become a prey to every rude invader, and the purpoſe of nature in the original union of the human pair be defeated. Therefore our ſtructure as well as condition is an evident indication, that the human ſexes are deſtined for a more intimate, for a moral and laſting union. It appears likewiſe, that the principal end of marriage is not to propagate and nurſe up an offspring, but to educate and form minds for the great duties and extenſive deſtinations of life. Society muſt be ſupplied from this original nurſery with uſeful members, and its faireſt ornaments and ſupports.

134 oral ends mar-ge.

The mind is apt to be diſſipated in its views and acts of friendſhip and humanity; unleſs the *former* be directed to a particular object, and the *latter* employed in a particular province. When men once indulge in this diſſipation, there is no ſtopping their career; they grow inſenſible to moral attractions; and, by obſtructing or impairing the decent and regular exerciſe of the tender and generous feelings of the human heart, they in time become unqualified for, or averſe to, the forming a moral union of ſouls, which is the cement of ſociety, and the ſource of the pureſt domeſtic joys. Whereas a rational, undepraved *love*, and its fair companion, *marriage*, collect a man's views, guide his heart to its proper object, and, by confining his affection to that object, do really enlarge its influence and uſe. Beſides, it is but too evident from the conduct of mankind, that the common ties of humanity are too feeble to engage and intereſt the paſſions of the generality in the affairs of ſociety. The connexions of neighbourhood, acquaintance, and general intercourſe, are too wide a field of action for many, and thoſe of a *public* or *community* are ſo for more; and in which they *either care not or know not how* to exert themſelves. Therefore nature, ever wiſe and benevolent, by implanting that ſtrong ſympathy which reigns between the individuals of each ſex, and by urging them to form a particular moral connexion, the ſpring of many domeſtic endearments, has meaſured out to each pair a particular *ſphere of action*, proportioned to their views, and adapted to their reſpective capacities. Beſides, by intereſting them deeply in the concerns of their own little circle, ſhe has connected them more cloſely with ſociety, which is compoſed of particular families, and bound them down to their good behaviour in that particular community to which they belong. This *moral connexion* is *marriage*, and this *ſphere of action* is a *family*.

135 Duties of marriage.

Of the *conjugal* alliance the following are the *natural laws*. Firſt, Mutual fidelity to the marriage bed. Diſloyalty defeats the very end of marriage; diſſolves the natural cement of the relation; weakens the moral tie, the chief ſtrength of which lies in the reciprocation of affection; and by making the offspring uncertain, diminiſhes the care and attachment neceſſary to their education.

2. A conſpiration of counſels and endeavours to promote the common intereſt of the family, and to educate their common offspring. In order to obſerve theſe laws, it is neceſſary to cultivate, both before and during the married ſtate, the ſtricteſt decency and chaſtity of manners, and a juſt ſenſe of what becomes their reſpective characters.

3. The union muſt be inviolable, and for life. The nature of friendſhip, and particularly of this ſpecies of it, the education of their offspring, and the order of ſociety and of ſucceſſions, which would otherwiſe be extremely perplexed, do all ſeem to require it. To preſerve this union, and render the matrimonial ſtate more harmonious and comfortable, a mutual eſteem and tenderneſs, a mutual deference and forbearance, a communication of advice, and aſſiſtance and authority, are abſolutely neceſſary. If either party keep within their proper departments, there need be no diſputes about power or ſuperiority, and there will be none. They have no *oppoſite* no *ſeparate* intereſts, and therefore there can be no juſt ground for oppoſition of conduct.

136 Polygamy.

From this detail, and the preſent ſtate of things, in which there is pretty near a parity of numbers of both ſexes, it is evident that *polygamy* is an *unnatural* ſtate; and though it ſhould be granted to be more fruitful

of

of children, which however it is not found to be, yet it is by no means ſo fit for rearing minds, which ſeems to be as much, if not more, the intention of nature than the propagation of bodies.

SECT. III. *Of Parental Duty.*

137 Connexion of parents and children.

The connexion of parents with their children is a natural conſequence of the matrimonial connexion; and the duties which they owe them reſult as naturally from that connexion. The feeble ſtate of children, ſubject to ſo many wants and dangers, requires their inceſſant care and attention; their ignorant and uncultivated minds demand their continual inſtruction and culture. Had human creatures come into the world with the full ſtrength of *men*, and the weakneſs of reaſon and vehemence of paſſions which prevail in *children*, they would have been too ſtrong or too ſtubborn to have ſubmitted to the government and inſtruction of their parents. But as they were deſigned for a progreſſion in knowledge and virtue, it was proper that the growth of their bodies ſhould keep pace with that of their minds, leſt the purpoſes of that progreſſion ſhould have been defeated. Among other admirable purpoſes which this gradual expanſion of their outward as well as inward ſtructure ſerves, this is one, that it affords ample ſcope to the exerciſe of many tender and generous affections, which fill up the domeſtic life with a beautiful variety of duties and enjoyments; and are of courſe a noble diſcipline for the heart, and a hardy kind of education for the more honourable and important duties of *public* life.

138 The authority founded on that connexion.

The above-mentioned weak and ignorant ſtate of children ſeems plainly to inveſt their parents with ſuch authority and power as is neceſſary to their ſupport, protection, and education; but that authority and power can be conſtrued to extend no farther than is neceſſary to anſwer thoſe ends, and to laſt no longer than that weakneſs and ignorance continue; wherefore, the foundation or reaſon of the authority and power ceaſing, they ceaſe of courſe. Whatever power or authority then it may be neceſſary or lawful for parents to exerciſe during the non-age of their children, to aſſume or uſurp the ſame when they have attained the maturity or full exerciſe of their ſtrength and reaſon would be tyrannical and unjuſt. From hence it is evident, that parents have no right to puniſh the perſons of their children more ſeverely than the nature of their wardſhip requires, much leſs to invade their lives, to encroach upon their liberty, or transfer them as their property to any maſter whatſoever.

139 Duties of parents.

The firſt claſs of duties which parents owe their children reſpect their natural life; and theſe comprehend protection, nurture, proviſion, introducing them into the world in a manner ſuitable to their rank and fortune, and the like.

140 Education.

The ſecond order of duties regards the *intellectual* and *moral* life of their children, or their education in ſuch arts and accompliſhments as are neceſſary to qualify them for performing the duties they owe to themſelves and to others. As this was found to be the principal deſign of the matrimonial alliance, ſo the fulfilling that deſign is the moſt important and dignified of all the parental duties. In order therefore to fit the child for acting his part wiſely and worthily as a *man*, as a *citizen*, and a *creature of God*, both parents ought to combine their joint wiſdom, authority, and power, and each apart to employ thoſe talents which are the peculiar excellency and ornament of their reſpective ſex. The father ought to *lay out* and *ſuperintend* their education, the mother to execute and manage the detail of which ſhe is capable. The *former* ſhould direct the manly exertion of the intellectual and moral powers of his child. His imagination, and the manner of thoſe exertions, are the peculiar province of the *latter*. The *former* ſhould adviſe, protect, command, and, by his experience, maſculine vigour, and that ſuperior authority which is commonly aſcribed to his ſex, brace and ſtrengthen his pupil for *active* life, for gravity, integrity, and firmneſs in ſuffering. The buſineſs of the *latter* is to bend and ſoften her *male* pupil, by the charms of her converſation, and the ſoftneſs and decency of her manners, for *ſocial* life, for politeneſs of taſte, and the elegant decorums and enjoyments of humanity; and to improve and refine the tenderneſs and modeſty of her *female* pupil, and form her to all thoſe mild domeſtic virtues which are the peculiar characteriſtics and ornaments of her ſex: To conduct the opening minds of their ſweet charge through the ſeveral periods of their progreſs, to aſſiſt them in each period, in throwing out the latent ſeeds of reaſon and ingenuity, and in gaining freſh acceſſions of light and virtue; and at length, with all theſe advantages, to produce the young adventurers upon the great theatre of human life, to play their ſeveral parts in the ſight of their friends, of ſociety, and mankind.

SECT. IV. *Herile and Servile Duty.*

141 The ground of this connexion.

In the natural courſe of human affairs, it muſt neceſſarily happen that ſome of mankind will live in plenty and opulence, and others be reduced to a ſtate of indigence and poverty. The former need the labours of the latter, and the latter proviſion and ſupport of the former. This mutual neceſſity is the foundation of that connexion, whether we call it *moral* or *civil*, which ſubſiſts between maſters and ſervants. He who feeds another has a right to ſome equivalent, the labour of him whom he maintains, and the fruits of it. 142 The conditions of ſervice. And he who labours for another has a right to expect that he ſhould ſupport him. But as the labours of a man of ordinary ſtrength are certainly of greater value than mere food and clothing; becauſe they would actually produce more, even the maintenance of a family, were the labourer to employ them in his own behalf; therefore he has an undoubted right to rate and diſpoſe of his ſervice for certain wages above mere maintenance; and if he has incautiouſly diſpoſed of it for the latter only, yet the contract being of the *onerous* kind, he may equitably claim a ſupply of that deficiency. If the ſervice be ſpecified, the ſervant is bound to that only; if not, then he is to be conſtrued as bound only to ſuch ſervices as are conſiſtent with the laws of juſtice and humanity. By the voluntary ſervitude to which he ſubjects himſelf, he forfeits no rights but ſuch as are neceſſarily included in that ſervitude, and is obnoxious to no puniſhment but ſuch as a voluntary failure in the ſervice may be ſuppoſed reaſonably to require. *The offſpring of ſuch ſervants* have a right to uties of Society. that liberty which neither they nor their parents have forfeited.

143 he caſe of eat offen- rs. As to thoſe who, becauſe of ſome heinous offence, or for ſome notorious damage, for which they cannot otherwiſe compenſate, are condemned to perpetual ſervice, they do not, on that account, forfeit all the rights of men; but thoſe, the loſs of which is neceſſary to ſecure ſociety againſt the like offences for the future, or to repair the damage they have done.

144 he caſe of ptives. With regard to captives taken in war, it is barbarous and inhuman to make perpetual ſlaves of them, unleſs ſome peculiar and aggravated circumſtances of guilt have attended their hoſtility. The bulk of the ſubjects of any government engaged in war may be fairly eſteemed innocent enemies; and therefore they have a right to that clemency which is conſiſtent with the common ſafety of mankind, and the particular ſecurity of that ſociety againſt which they are engaged. Though ordinary captives have a grant of their lives, yet to pay their liberty as an equivalent is much too high a price. There are other ways of acknowledging or returning the favour, than by ſurrendering what is far dearer than life itſelf *. To thoſe who, under pretext of the neceſſities of commerce, drive the unnatural trade of bargaining for human fleſh, and conſigning their innocent but unfortunate fellow creatures to eternal ſervitude and miſery, we may addreſs the words of a fine writer; "Let avarice defend it as it will, there is an honeſt reluctance in humanity againſt buying and ſelling, and regarding thoſe of our own ſpecies as our wealth and poſſeſſions."

Sect. V. *Social Duties of the private Kind.*

Hitherto we have conſidered only the *domeſtic economical* duties, becauſe theſe are firſt in the progreſs of nature. But as man paſſes beyond the little circle of a family, he forms connexions with relations, friends, neighbours, and others; from whence reſults a new train of duties of the more private ſocial kind, as "friendſhip, chaſtity, courteſy, good neighbourhood, charity, forgiveneſs, hoſpitality."

145 an's aptide for ſoety. Man is admirably formed for particular ſocial attachments and duties. There is a peculiar and ſtrong propenſity in his nature to be affected with the ſentiments and diſpoſitions of others. Men, like certain muſical inſtruments, are ſet to each other, ſo that the vibrations or notes excited in one raiſe correſpondent notes and vibrations in the others. The impulſes of *pleaſure* or *pain*, *joy* or *ſorrow*, made on one mind, are by an inſtantaneous ſympathy of nature communicated in ſome degree to all; eſpecially when hearts are (as a humane writer expreſſes it) in *uniſon* of kindneſs; the joy that vibrates in one communicates to the other alſo. We may add, that though joy thus imparted ſwells the harmony, yet grief vibrated to the heart of a friend, and rebounding from thence in ſympathetic notes, melts as it were, and almoſt dies away. All the paſſions, but eſpecially thoſe of the ſocial kind, are contagious; and when the paſſions of one man mingle with thoſe of another, they increaſe and multiply prodigiouſly. There is a moſt moving eloquence in the human countenance, air, voice, and geſture, wonderfully expreſſive of the moſt latent feelings and paſſions of the ſoul, which darts them like a ſubtle flame into the hearts of others, and raiſes correſpondent feelings there: friendſhip, love, good humour, joy, ſpread through every feature, and particularly ſhoot from the eyes their ſofter and fiercer fires with an irreſiſtible energy. And in like manner the oppoſite paſſions of hatred, enmity, ill humour, melancholy, diffuſe a ſullen and ſaddening air over the face, and, flaſhing from eye to eye, kindle a train of ſimilar paſſions. By theſe, and other admirable pieces of machinery, men are formed for ſociety and the delightful interchange of friendly ſentiments and duties, to increaſe the happineſs of others by participation, and their own by rebound; and to diminiſh, by dividing, the common ſtock of their miſery.

Duties of Society.

146 Duties ariſing from private relation. The firſt emanations of the *ſocial* principle beyond the bounds of a family lead us to form a nearer conjunction of friendſhip or good will with thoſe who are anywiſe connected with us by *blood* or *domeſtic alliance*. To them our affection does commonly exert itſelf in a greater or leſs degree, according to the nearneſs or diſtance of the relation. And this proportion is admirably ſuited to the extent of our powers and the indigence of our ſtate; for it is only within thoſe leſſer circles of conſanguinity or alliance that the generality of mankind are able to diſplay their abilities or benevolence, and conſequently to uphold their connexion with ſociety, and ſubſerviency to a public intereſt. Therefore it is our duty to regard theſe cloſer connexions as the next department to that of a family, in which nature has marked out for us a ſphere of activity and uſefulneſs; and to cultivate the kind affections which are the cement of theſe endearing alliances.

147 Ingredients of friendſhip. Frequently the view of diſtinguiſhing moral qualities in ſome of our acquaintance may give birth to that more noble connexion we call FRIENDSHIP, which is far ſuperior to the alliances of conſanguinity. For theſe are of a ſuperficial, and often of a tranſitory nature, of which as they hold more of *inſtinct* than of *reaſon*, we cannot give ſuch a rational account. But *friendſhip* derives all its ſtrength and beauty, and the only exiſtence which is durable, from the qualities of the heart, or from virtuous and lovely diſpoſitions. Or, ſhould theſe be wanting, they or ſome ſhadow of them muſt be ſuppoſed preſent.—Therefore *friendſhip* may be deſcribed to be, "The union of two ſouls by means of *virtue*, the common object and cement of their mutual affection." Without virtue, or the ſuppoſition of it, friendſhip is only a *mercenary* league, an alliance of intereſt, which muſt diſſolve of courſe when that intereſt decays or ſubſiſts no longer. It is not ſo much any particular paſſion, as a compoſition of ſome of the nobleſt feelings and paſſions of the mind. *Good ſenſe*, a *juſt taſte* and *love of virtue*, a *thorough candour and benignity of heart*, or what we uſually call a *good temper*, and a generous ſympathy of ſentiments and affections, are the neceſſary ingredients of this virtuous connection. When it is grafted on eſteem, ſtrengthened by habit, and mellowed by time, it yields infinite pleaſure, ever new and ever growing; is a noble ſupport amidſt the various trials and viciſſitudes of life, and a high ſeaſoning to moſt of our other enjoyments.—To form and cultivate virtuous friendſhip, muſt be very improving to the temper, as its principal *object* is *virtue*, ſet off with all the allurement of countenance, air,

---

* Hutcheſ. Mor. Inſt. hil. lib. iii. 3.

air, and manners, ſhining forth in the native graces of manly honeſt ſentiments and affections, and rendered *viſible* as it were to the friendly ſpectator in a conduct unaffectedly great and good; and as its principal exerciſes are the very energies of virtue, or its effect and emanations. So that wherever this amiable attachment prevails, it will exalt our admiration and attachment to virtue, and unleſs impeded in its courſe by unnatural prejudices, run out into a friendſhip to the human race. For as no one can merit, and none ought to uſurp, the ſacred name of friend, who hates mankind; ſo whoever truly loves *them*, poſſeſſes the moſt eſſential quality of a true friend.

148 Its duties.

The duties of friendſhip are a mutual eſteem of each other, unbribed by intereſt, and independent of it; a generous confidence, as far diſtant from ſuſpicion as from reſerve; an inviolable harmony of ſentiments and diſpoſitions, of deſigns and intereſts; a fidelity unſhaken by the changes of fortune; a conſtancy unalterable by diſtance of time or place; a reſignation of one's perſonal intereſt to thoſe of one's friend, and a reciprocal, unenvious, unreſerved exchange of kind offices.—But, amidſt all the exertions of this moral connection, humane and generous as it is, we muſt remember that it operates within a narrow ſphere, and its immediate operations reſpect only the individual; and therefore its particular impulſes muſt ſtill be ſubordinate to a more public intereſt, or be always directed and controlled by the more extenſive connexions of our nature.

149 Love and chaſtity.

When our friendſhip terminates on any of the other ſex, in whom beauty or agreeableneſs of perſon and external gracefulneſs of manners conſpire to expreſs and heighten the moral charm of a tender honeſt heart, and ſweet, ingenuous, modeſt temper, lighted up by good ſenſe; it generally grows into a more ſoft and endearing attachment. When this attachment is improved by a growing acquaintance with the worth of its object, is conducted by diſcretion, and iſſues at length, as it ought to do, in the moral connexion formerly mentioned *, it becomes the ſource of many amiable duties, of a communication of paſſions and intereſts, of the moſt refined decencies, and of a thouſand nameleſs deep-felt joys of reciprocal tenderneſs and love, flowing from every look, word, and action. Here friendſhip acts with double energy, and the *natural* conſpires with the *moral* charms to ſtrengthen and ſecure the love of virtue. As the delicate nature of female honour and decorum, and the inexpreſſible grace of a chaſte and modeſt behaviour are the ſureſt and indeed the only means of kindling at firſt, and ever after of keeping alive, this tender and elegant flame, and of accompliſhing the excellent ends deſigned by it; to attempt by fraud to violate one, or, under pretence of paſſion, to ſully and corrupt the other, and, by ſo doing, to expoſe the too often credulous and unguarded object, with a wanton cruelty, to the hatred of her own ſex and the ſcorn of ours, and to the loweſt infamy of both, is a conduct not only baſe and criminal, but inconſiſtent with that truly rational and refined enjoyment, the ſpirit and quinteſſence of which are derived from the baſhful and ſacred charms of virtue kept untainted, and therefore ever alluring to the lover's heart.

* See Sect. ii. of this chapter.

150 Courteſy, good neighbourhood, &c.

Courteſy, *good neighbourhood*, *affability*, and the like duties, which are founded on our private ſocial connexions, are no leſs neceſſary and obligatory to creatures united to ſociety, and ſupporting and ſupported by each other in a chain of mutual want and dependence. They do not conſiſt in a ſmooth addreſs, an artificial or obſequious air, fawning adulations or a polite ſervility of manners; but in a juſt and modeſt ſenſe of our own dignity and that of others, and of the reverence due to mankind, eſpecially to thoſe who hold the higher links of the ſocial chain; in a diſcreet and manly accommodation of ourſelves to the foibles and humours of others; in a ſtrict obſervance of the rules of decorum and civility; but, above all, in a frank obliging carriage, and generous interchange of good deeds rather than words. Such a conduct is of great uſe and advantage, as it is an excellent ſecurity againſt injury, and the beſt claim and recommendation to the eſteem, civility, and univerſal reſpect of mankind. This inferior order of virtues unites the particular members of ſociety more cloſely, and forms the leſſer pillars of the civil fabric; which, in many inſtances, ſupply the unavoidable defects of laws, and maintain the harmony and decorum of ſocial intercourſe, where the more important and eſſential lines of virtue are wanting.

151 Charity, forgiveneſs.

Charity and *forgiveneſs* are truly amiable and uſeful duties of the ſocial kind. There is a twofold diſtinction of rights commonly taken notice of by moral writers, viz. *perfect* and *imperfect*. To fulfil the former, is neceſſary to the being and ſupport of ſociety; to fulfil the latter, is a duty equally ſacred and obligatory, and tends to the improvement and proſperity of ſociety; but as the violation of them is not equally prejudicial to the public good, the fulfilling them is not ſubjected to the cognizance of law, but left to the candour, humanity, and gratitude of individuals. And by this means ample ſcope is given to exerciſe all the generoſity, and diſplay the genuine merit and luſtre, of virtue. Thus the wants and misfortunes of others call for our charitable aſſiſtance and ſeaſonable ſupplies. And the good man, unconſtrained by law, and uncontrolled by human authority, will cheerfully acknowledge and generouſly ſatiſfy this mournful and moving claim; a claim ſupported by the ſanction of heaven, of whoſe bounties he is honoured to be the grateful truſtee. If his own *perfect* rights are invaded by the injuſtice of others, he will not therefore reject their *imperfect* right to pity and forgiveneſs, unleſs his grant of theſe ſhould be inconſiſtent with the more extenſive rights of ſociety, or the public good. In that caſe he will have recourſe to public juſtice and the laws, and even then he will proſecute the injury with no unneceſſary ſeverity, but rather with mildneſs and humanity. When the injury is merely perſonal, and of ſuch a nature as to admit of alleviations, and the forgiveneſs of which would be attended with no worſe conſequences, eſpecially of a public kind, the good man will generouſly forgive his offending brother. And it is his duty to do ſo, and not to take private revenge, or retaliate evil for evil. For though reſentment of injury is a natural paſſion, and implanted, as was obſerved † above, for wiſe and good ends; yet, conſidering the manifold partialities which moſt men have for themſelves, was every one to act as judge in

† See Part I. chap. ii. and iv.

in his own cauſe, and to execute the ſentence dictated by his own reſentment, it is but too evident that mankind would paſs all bounds in their fury, and the laſt ſufferer be provoked in his turn to make full repriſals. So that evil, thus encountering with evil, would produce one continued ſeries of violence and miſery, and render ſociety intolerable, if not impracticable. Therefore, where the ſecurity of the individual, or the good of the public, does not require a proportionable retaliation, it is agreeable to the general law of benevolence, and to the particular end of the paſſion (which is to prevent injury and the miſery occaſioned by it), to forgive perſonal injuries, or not to return evil for evil. This duty is one of the noble refinements which *Chriſtianity* has made upon the general maxims and practice of mankind, and enforced, with a peculiar ſtrength and beauty, by ſanctions no leſs alluring than awful. And indeed the practice of it is generally its own reward; by expelling from the mind the moſt dreadful intruders upon its repoſe, thoſe rancorous paſſions which are begot and nurſed by reſentment, and by diſarming and even ſubduing every enemy one has, except ſuch as have nothing left of men but the outward form.

152 oſpitali-

The moſt enlarged and humane connexion of the private kind ſeems to be the hoſpitable alliance, from which flow the amiable and diſintereſted duties we owe to ſtrangers. If the exerciſe of paſſions of the moſt private and inſtinctive kind is beheld with moral approbation and delight, how lovely and venerable muſt thoſe appear which reſult from a calm philanthropy, are founded in the common rights and connexions of ſociety, and embrace men, not of a particular ſect, party, or nation, but all in general without diſtinction, and without any of the little partialities of ſelf-love.

SECT. VI. *Social Duties of the* COMMERCIAL *Kind.*

153 mmer- al duties.

The next order of connexions are thoſe which ariſe from the wants and weakneſs of mankind, and from the various circumſtances in which their different ſituations place them. Theſe we may call *commercial* connections, and the duties which reſult from them *commercial* duties, as *juſtice*, *fair-dealing*, *ſincerity*, *fidelity to compacts*, and the like.

154 heir foun- tion.

Though nature is perfect in all her works, yet ſhe has obſerved a manifeſt and eminent diſtinction among them. To all ſuch as lie beyond the reach of human ſkill and power, and are properly of her own department, ſhe has given the finiſhing hand. Theſe man may deſign after and imitate, but he can never rival them, nor add to their beauty or perfection. Such are the forms and ſtructure of vegetables, animals, and many of their productions, as the honey comb, the ſpider's web, and the like. There are others of her works which ſhe has of deſign left unfiniſhed, as it were, in order to exerciſe the ingenuity and power of man. She has preſented to him a rich profuſion of materials of every kind for his conveniency and uſe; but they are rude and unpoliſhed, or not to be come at without art and labour. Theſe therefore he muſt apply, in order to adapt them to his uſe, and to enjoy them in perfection. Thus nature hath given him an infinite variety of herbs, grains, foſſils, minerals, woods, water, earth, air, and a thouſand other crude materials, to ſupply his numerous wants. But he muſt ſow, plant, dig, refine, poliſh, build, and, in ſhort, manufacture the various produce of nature, in order to obtain even the neceſſaries, and much more the conveniences and elegancies of life. Theſe then are the price of his labour and induſtry, and, without that, nature will ſell him nothing. But as the wants of mankind are many, and the ſingle ſtrength of individuals ſmall, they could hardly find the neceſſaries, and much leſs the conveniences of life, without uniting their ingenuity and ſtrength in acquiring theſe, and without a mutual intercourſe of good offices. Some men are better formed for ſome kinds of ingenuity and labour, and others for other kinds; and different ſoils and climates are enriched with different productions; ſo that men, by exchanging the produce of their reſpective labours, and ſupplying the wants of one country with the ſuperfluities of another, do in effect diminiſh the labours of each, and increaſe the abundance of all. This is the foundation of all commerce, or exchange of commodities and goods, one with another; in order to facilitate which, men have contrived different ſpecies of coin, or money, as a common ſtandard by which to eſtimate the comparative values of their reſpective goods. But to render commerce ſure and effectual, *juſtice*, *fair-dealing*, *ſincerity*, and *fidelity to compacts*, are abſolutely neceſſary.

155 Juſtice;

Juſtice or *fair-dealing*, or, in other words, a diſpoſition to treat others as we would be treated by them, is a virtue of the firſt importance, and inſeparable from the virtuous character. It is the cement of ſociety, or that pervading ſpirit which connects its members, inſpires its various relations, and maintains the order and ſubordination of each part of the whole. Without it, ſociety would become a den of thieves and banditti, hating and hated, devouring and devoured, by one another.

And here it may be proper to take a view of Mr Hume's ſuppoſed caſe of the ſenſible knave and the worthleſs miſer (N° 16), and conſider what would be the duty of the former according to the theory of thoſe moraliſts who hold the *will of God* to be the *criterion* or *rule*, and *everlaſting happineſs* the *motive* of human virtue.

156 univerſally a duty on the principles of thoſe who hold the will of God to be the criterion of virtue.

It has been already obſerved, and the truth of the obſervation cannot be controverted, that, by ſecretly purloining from the coffers of a miſer, part of that gold which there lies uſeleſs, a man might in particular circumſtances promote the good of ſociety, without doing any injury to a ſingle individual: and it was hence inferred, that, in ſuch circumſtances, it would be no duty to abſtain from theft, were *local utility* ariſing from *particular conſequences* the real criterion or ſtandard of juſtice. Very different, however, is the concluſion which muſt be drawn by thoſe who conſider the natural tendency of actions, if univerſally performed, as the criterion of their merit or demerit, in the ſight of God. Such philoſophers attend, not to the particular conſequences of a ſingle action in any given caſe, but to the general conſequences of the principle from which it flows, if that principle were univerſally adopted. You cannot (ſay they) permit one action and forbid another, without ſhowing a difference between them. The ſame ſort of actions, therefore, muſt be generally permitted or generally forbidden. But were every man allowed to aſcertain for himſelf the circumſtances in which the good of ſociety would be promoted, by ſecretly abſtracting the ſuperfluous wealth of a worthleſs miſer, it is plain that no property could be ſecure; that all incitements to induſtry would be at once removed; and that, whatever might be the *immediate* conſequences of any *particular theft*, the *general* and *neceſſary* conſequences of the *principle* by which it was authorized muſt ſoon prove fatal. Were one man to purloin part of the riches of a real miſer, and to conſider his conduct as vindicated by his intention to employ thoſe riches in acts of generoſity, another might by the ſame ſort of caſuiſtry think himſelf authorized to appropriate to himſelf part of his wealth; and thus theft would ſpread through all orders of men, till ſociety were diſſolved into ſeparate, hoſtile, and ſavage families, mutually dreading and ſhunning each other. The general conſequences, therefore, of encroaching upon private property tend evidently and violently to univerſal miſery.

On the other hand, indeed, the particular and immediate conſequences of that principle which conſiders every man's property as ſacred, may in ſome caſes, ſuch as that ſuppoſed, be in a ſmall degree injurious to a few families in the neighbourhood of the miſer and the knave. But that injury can never be of long duration; and it is infinitely more than counterbalanced by the general good conſequences of the principle from which it accidentally reſults; for theſe conſequences extend to all nations and to all ages. Without a ſacred regard to property, there could neither be arts nor induſtry nor confidence among men, and happineſs would be for ever baniſhed from this world. But the communication of happineſs being the end which God had in view when he created the world, and all men ſtanding in the ſame relation to him, it is impoſſible to ſuppoſe that he does not approve, and will not ultimately reward, thoſe voluntary actions of which the natural tendency is to increaſe the ſum of human happineſs; or that he does not diſapprove, and will not ultimately puniſh, thoſe which naturally tend to aggravate human miſery. The concluſion is, that a ſtrict adherence to the principle of juſtice is univerſally, and in all poſſible circumſtances, a duty from which we cannot deviate without offending our Creator, and ultimately bringing miſery upon ourſelves.

157 Sincerity. *Sincerity*, or *veracity*, in our words and actions, is another virtue or duty of great importance to ſociety, being one of the great bands of mutual intercourſe, and the foundation of mutual truſt. Without it, ſociety would be the dominion of miſtruſt, jealouſy, and fraud, and converſation a traffic of lies and diſſimulation. It includes in it a conformity of our words with our ſentiments, a correſpondence between our actions and diſpoſitions, a ſtrict regard to truth, and an irreconcilable abhorrence of falſehood. It does not indeed require, that we expoſe our ſentiments indiſcreetly, or tell all the truth in every caſe; but certainly it does not and cannot admit the leaſt violation of truth or contradiction to our ſentiments. For if theſe bounds are once paſſed, no poſſible limit can be aſſigned where the violation ſhall ſtop, and no pretence of private or public good can poſſibly counterbalance the ill conſequences of ſuch a violation.

158 Fidelity to promiſes, compacts, &c. *Fidelity to promiſes*, *compacts*, and *engagements*, is likewiſe a duty of ſuch importance to the ſecurity of commerce and interchange of benevolence among mankind, that ſociety would ſoon grow intolerable without the ſtrict obſervance of it. Hobbes, and others who follow the ſame track, have taken a wonderful deal of pains to puzzle this ſubject, and to make all the virtues of this ſort merely *artificial*, and not at all *obligatory*, antecedent to human conventions. No doubt compacts ſuppoſe people who make them; and promiſes perſons to whom they are made; and therefore both ſuppoſe ſome ſociety, more or leſs, between thoſe who enter into theſe mutual engagements. But is not a compact or promiſe binding, till men have agreed that they ſhall be binding? or are they only binding, becauſe it is our intereſt to be bound by them, or to fulfil them? Do not we highly approve the man who fulfils them, even though they ſhould prove to be againſt his intereſt? and do not we condemn him as a knave who violates them on that account? A promiſe is a voluntary declaration by words, or by an action equally ſignificant, of our reſolution to do ſomething in behalf of another, or for his ſervice. When it is made, the perſon who makes it is by all ſuppoſed under an obligation to perform it. And he to whom it is made may demand the performance as his right. That perception of *obligation* is a ſimple idea, and is on the ſame footing as our other moral perceptions, which may be deſcribed by inſtances, but cannot be defined. Whether we have a perception of ſuch obligation quite diſtinct from the intereſt, either public or private, that may accompany the fulfilment of it, muſt be referred to the conſcience of every individual. And whether the mere ſenſe of that obligation, apart from its concomitants, is not a ſufficient inducement or motive to keep one's promiſe, without having recourſe to any ſelfiſh principle of our nature, muſt be likewiſe appealed to the conſcience of every honeſt man.

159 Shown to be duties independent of the authority of the moral ſenſe. It may, however, be not improper to remark, that in this, as in all other inſtances, our chief good is combined with our duty. "Men act from expectation. Expectation is in moſt caſes determined by the aſſurances and engagements which we receive from others. If no dependence could be placed upon theſe aſſurances, it would be impoſſible to know what judgement to form of many future events, or how to regulate our conduct with reſpect to them. Confidence, therefore, in promiſes, is eſſential to the intercourſe of human life, becauſe without it, the greateſt part of our conduct would proceed upon chance. But there could be no confidence in promiſes, if men were not obliged to perform them. Thoſe, therefore, who allow not to the perceptions of the moral ſenſe all that authority which we attribute to them, muſt ſtill admit the obligation to perform promiſes; becauſe ſuch performance may be ſhown to be agreeable to the will of God, in the very ſame manner in which, upon their principles, we have ſhown the uniform practice of juſtice to be ſo.

160 What thoſe duties require. *Fair dealing* and *fidelity* to *compacts* require that we take no advantage of the ignorance, paſſion, or incapacity of others, from whatever cauſe that incapacity ariſes;

ariſes;—that we be explicit and candid in making bargains, juſt and faithful in fulfilling our part of them. And if the other party violates his engagements, redreſs is to be ſought from the laws, or from thoſe who are intruſted with the execution of them. In fine, the *commercial* virtues and duties require that we not only do not invade, but maintain the rights of others;—that we be fair and impartial in transferring, bartering, or exchanging property, whether in goods or ſervice; and be inviolably faithful to our word and our engagements, where the matter of them is not criminal, and where they are not extorted by force. See PROMISE.

SECT. VII. *Social Duties of the* POLITICAL *Kind.*

We are now arrived at the laſt and higheſt order of duties reſpecting ſociety, which reſult from the exerciſe of the moſt generous and heroic affections, and are founded on our moſt enlarged connexions.

161 litical connec- ns.

The ſocial principle in man is of ſuch an expanſive nature, that it cannot be confined within the circuit of a family, of friends, or a neighbourhood; it ſpreads into wider ſyſtems, and draws men into larger confederacies, communities, and commonwealths. It is in thoſe only that the higher powers of our nature attain the higheſt improvement and perfection of which they are capable. Theſe principles hardly find objects in the ſolitary ſtate of nature. *There* the principle of action riſes no higher at fartheſt than *natural affection* towards one's offspring. There perſonal or family wants entirely engroſs the creature's attention and labour, and allow no leiſure, or if they did, no exerciſe for views and affections of a more enlarged kind. In *ſolitude* all are employed in the ſame way, in providing for the *animal* life. And even after their utmoſt labour and care, ſingle and unaided by the induſtry of others, they find but a ſorry ſupply of their wants, and a feeble precarious ſecurity againſt dangers from wild beaſts; from inclement ſkies and ſeaſons; from the miſtakes or petulant paſſions of their fellow creatures; from their preference of themſelves to their neighbours; and from all the little exorbitancies of ſelf-love. But in *ſociety*, the mutual aids which men give and receive ſhorten the labours of each, and the combined ſtrength and reaſon of individuals give ſecurity and protection to the whole body. There is both a variety and ſubordination of genius among mankind. Some are formed to lead and direct others, to contrive plans of happineſs for individuals and of government for communities, to take in a public intereſt, invent laws and arts, and ſuperintend their execution, and, in ſhort, to refine and civilize human life. Others, who have no ſuch good heads, may have as honeſt hearts, a truly public ſpirit, love of liberty, hatred of corruption and tyranny, a generous ſubmiſſion to laws, order, and public inſtitutions, and an extenſive philanthropy. And others, who have none of thoſe capacities either of heart or head, may be well formed for manual exerciſe and bodily labour. The former of theſe principles have no ſcope in ſolitude, where a man's thoughts and concerns do all either centre in himſelf or extend no farther than a family; into which little circle all the duty and virtue of the ſolitary mortal is crowded. But ſociety finds proper objects and exerciſes for every genius, and the nobleſt objects and exerciſes for the nobleſt geniuſes, and for the higheſt principles in the human conſtitution; particularly for that warmeſt and moſt divine paſſion which God hath kindled in our boſoms, the inclination of doing good, and reverencing our nature; which may find here both employment and the moſt exquiſite ſatiſfaction. In ſociety, a man has not only more leiſure, but better opportunities, of applying his talents with much greater perfection and ſucceſs, eſpecially as he is furniſhed with the joint advice and aſſiſtance of his fellow creatures, who are now more cloſely united one with the other, and ſuſtain a common relation to the ſame moral ſyſtem or community. This then is an object proportioned to his moſt enlarged ſocial affections; and in ſerving it he finds ſcope for the exerciſe and refinement of his higheſt intellectual and moral powers. *Therefore ſociety*, or *a ſtate of civil government*, reſts on theſe two principal pillars, "That in it we find ſecurity againſt thoſe evils which are unavoidable in ſolitude,—and obtain thoſe goods, ſome of which cannot be obtained at all, and others not ſo well, in that ſtate where men depend ſolely on their individual ſagacity and induſtry."

From this ſhort detail it appears, that *man* is a *ſocial* creature, and formed for a *ſocial* ſtate; and that *ſociety*, being adapted to the higher principles and deſtinations of his nature, muſt of neceſſity be his *natural* ſtate.

162 Political duties.

The duties ſuited to that ſtate, and reſulting from thoſe principles and deſtinations, or, in other words, from our ſocial paſſions and ſocial connexions, or relation to a public ſyſtem, are, *love of our country, reſignation and obedience to the laws, public ſpirit, love of liberty, ſacrifice of life and all to the public, and the like.*

163 Love of one's country.

Love of our country, is one of the nobleſt paſſions that can warm and animate the human breaſt. It includes all the limited and particular affections to our parents, friends, neighbours, fellow citizens, countrymen. It ought to direct and limit their more confined and partial actions within their proper and natural bounds, and never let them encroach on thoſe ſacred and firſt regards we owe to the great public to which we belong. Were we ſolitary creatures, detached from the reſt of mankind, and without any capacity of comprehending a *public intereſt*, or without affections leading us to deſire and purſue it, it would not be our duty to mind it, nor criminal to neglect it. But as we are PARTS of the *public ſyſtem*, and are not only capable of taking in large views of its intereſts, but by the ſtrongeſt affections connected with it, and prompted to take a ſhare of its concerns, we are under the moſt ſacred ties to proſecute its ſecurity and welfare with the utmoſt ardour, eſpecially in times of public trial. This *love of our country* does not import an attachment to any particular ſoil, climate, or ſpot of earth, where perhaps we firſt drew our breath, though thoſe *natural* ideas are often aſſociated with the *moral* ones, and, like external ſigns or ſymbols, help to aſcertain and bind them; but it imports an affection to that *moral ſyſtem*, or *community*, which is governed by the ſame laws and magiſtrates, and whoſe ſeveral parts are variouſly connected one with the other, and all

all united upon the bottom of a common intereſt. Perhaps indeed every member of the community cannot comprehend ſo large an object, eſpecially if it extends through large provinces, and over vaſt tracts of land; and ſtill leſs can he form ſuch an idea, if there is no *public*, i. e. if all are ſubject to the caprice and unlimited will of one man; but the preference the generality ſhow to their native country, the concern and longing after it which they expreſs when they have been long abſent from it; the labours they undertake and ſufferings they endure to ſave or ſerve it, and the peculiar attachment they have to their countrymen, evidently demonſtrate that the paſſion is *natural*, and never fails to exert itſelf when it is fairly diſengaged from foreign clogs, and is directed to its proper object. Wherever it prevails in its genuine vigour and extent, it ſwallows up all ſordid and ſelfiſh regards; it conquers the love of *eaſe*, *power*, *pleaſure*, and *wealth;* nay, when the amiable partialities of *friendſhip*, *gratitude*, *private affection*, or *regards to a family*, come in competition with it, it will teach us bravely to ſacrifice all, in order to maintain the rights, and *promote* or *defend* the honour and happineſs, of our country.

164 Reſignation and obedience to the laws, &c.

Reſignation and *obedience to the laws* and *orders* of the ſociety to which we belong, are *political* duties neceſſary to its very being and ſecurity, without which it muſt ſoon degenerate into a ſtate of licentiouſneſs and anarchy. The welfare, nay, the nature of civil ſociety, requires, that there ſhould be a ſubordination of orders, or diverſity of ranks and conditions in it;—that certain men, or orders of men, be appointed to ſuperintend and manage ſuch affairs as concern the public ſafety and happineſs;—that all have their particular provinces aſſigned them; that ſuch a ſubordination be ſettled among them as none of them may interfere with another; and finally, that certain *rules* or *common meaſures of action* be agreed on, by which each is to diſcharge his reſpective duty to govern or be governed, and all may concur in ſecuring the order, and promoting the felicity, of the whole political body. Thoſe *rules of action* are the *laws* of the community; and thoſe different *orders* are the ſeveral officers or magiſtrates appointed by the public to explain them, and ſuperintend or aſſiſt in their execution. In conſequence of this ſettlement of things, it is the duty of each individual to obey the laws enacted; to ſubmit to the executors of them with all due deference and homage, according to their reſpective ranks and dignity, as to the keepers of the public peace, and the guardians of public liberty; to maintain his own rank, and perform the functions of his own ſtation, with diligence, fidelity, and incorruption. The ſuperiority of the *higher* orders, or the authority with which the ſtate has inveſted them, entitle them, eſpecially if they employ their authority well, to the obedience and ſubmiſſion of the *lower*, and to a proportionable honour and reſpect from all. The ſubordination of the lower ranks claims protection, defence, and ſecurity from the higher. And the laws, being ſuperior to all, require the obedience and ſubmiſſion of all, being the laſt reſort, beyond which there is no deciſion or appeal.

16 Foundation of public ſpirit, love of liberty, &c.

Public ſpirit, *heroic zeal*, *love of liberty*, and the other *political* duties, do, above all others, recommend thoſe who practiſe them to the admiration and homage of mankind; becauſe, as they are the offspring of the nobleſt minds, ſo *are they* the parents of the greateſt bleſſing to ſociety. Yet, exalted as they are, it is only in equal and free governments where they can be exerciſed and have their due effect; for there only does a true *public ſpirit* prevail, and there only is the *public good* made the ſtandard of the civil conſtitution. As the end of ſociety is the *common intereſt* and *welfare* of the people aſſociated, this end muſt of neceſſity be the *ſupreme law*, or *common ſtandard*, by which the particular rules of action of the ſeveral members of the ſociety towards each other are to be regulated. But a *common intereſt* can be no other than that which is the reſult of the *common reaſon* or *common feelings* of all. Private men, or a particular order of men, have intereſts and feelings peculiar to themſelves, and of which they may be good judges; but theſe may be ſeparate from, and often contrary to, the intereſts and feelings of the reſt of the ſociety; and therefore they can have no right to make, and much leſs to impoſe, laws on their fellow citizens, inconſiſtent with, and oppoſite to, thoſe intereſts and thoſe feelings. Therefore, a *ſociety*, *a government*, or *real public*, truly worthy the name, and not a confederacy of banditti, a clan of lawleſs ſavages, or a band of ſlaves under the whip of a maſter, muſt be ſuch a one as conſiſts of freemen, chooſing or conſenting to laws themſelves; or, ſince it often happens that they cannot aſſemble and act in a *collective body*, delegating a ſufficient number of *repreſentatives*, i. e. ſuch a number as ſhall moſt fully comprehend, and moſt equally repreſent, their *common feelings* and *common intereſts*, to digeſt and vote laws for the conduct and controul of the whole body, the moſt agreeable to thoſe common feelings and common intereſts.

166 Political duties of every citizen.

A ſociety thus conſtituted by *common reaſon*, and formed on the plan of a *common intereſt*, becomes immediately an object of public attention, public veneration, public obedience, a public and inviolable attachment, which ought neither to be ſeduced by bribes, nor awed by terrors; an object, in fine, of all thoſe extenſive and important duties which ariſe from ſo glorious a confederacy. To watch over ſuch a ſyſtem; to contribute all he can to promote its good by his reaſon, his ingenuity, his ſtrength, and every other ability, whether natural or acquired; to reſiſt, and, to the utmoſt of his power, defeat every encroachment upon it, whether carried on by a ſecret corruption or open violence; and to ſacrifice his eaſe, his wealth, his power, nay life itſelf, and, what is dearer, ſtill, his family and friends, to defend or ſave it, is the duty, the honour, the intereſt, and the happineſs of every citizen; it will make him venerable and beloved while he lives, be lamented and honoured if he falls in ſo glorious a cauſe, and tranſmit his name with immortal renown to the lateſt poſterity.

167 Of the people.

As the PEOPLE are the fountain of power and authority, the original ſeat of majeſty, the authors of laws, and the creators of officers to execute them; if they ſhall find the power they have conferred abuſed by their truſtees, their majeſty violated by tyranny or by uſurpation, their authority proſtituted to ſupport violence or ſcreen corruption, the laws grown pernicious through accidents unforeſeen or unavoidable, or rendered ty to od

rendered ineffectual through the infidelity and corruption of the executors of them; then it is their right, and what is their right is their duty, to reſume that delegated power, and call their truſtees to an account; to reſiſt the uſurpation, and extirpate the tyranny; to reſtore their ſullied majeſty and proſtituted authority; to ſuſpend, alter, or abrogate thoſe laws, and puniſh their unfaithful and corrupt officers. Nor is it the duty only of the united body; but every member of it ought, according to his reſpective rank, power, and weight in the community, to concur in advancing and ſupporting theſe glorious deſigns.

Reſiſtance, therefore, being undoubtedly lawful in extraordinary emergencies, the queſtion, among good reaſoners, can only be with regard to the degree of neceſſity which can juſtify reſiſtance, and render it expedient or commendable. And here we muſt acknowledge, that, with Mr Hume *, "we ſhall always incline to their ſide that draw the bond of allegiance very cloſe, and who conſider an infringement of it as the laſt refuge in deſperate caſes, when the public is in the higheſt danger from violence and tyranny. For beſides the miſchiefs of a civil war, which commonly attends inſurrection, it is certain, that where a diſpoſition to rebellion appears among any people, it is one chief cauſe of tyranny in the rulers, and forces them into many violent meaſures, which, had every one been inclined to ſubmiſſion and obedience, they would never have embraced. Thus the *tyrannicide*, or aſſaſſination approved of by ancient maxims, inſtead of keeping tyrants and uſurpers in awe, made them ten times more fierce and unrelenting; and is now juſtly aboliſhed on that account by the laws of nations, and univerſally condemned, as a baſe and treacherous method of bringing to juſtice thoſe diſturbers of ſociety."

* ſſays, vo i.

CHAP. IV. *Duty to* GOD.

168 ine nex-

OF all the *relations* which the human mind ſuſtains, that which ſubſiſts between the *Creator* and his *creatures*, the ſupreme *Lawgiver* and his *ſubjects*, is the higheſt and the beſt. This relation ariſes from the *nature* of a *creature* in general, and the *conſtitution* of the *human mind* in particular; the nobleſt powers and affections of which point to an *univerſal* Mind, and would be imperfect and abortive without ſuch a direction. How lame then muſt that ſyſtem of morals be, which leaves a *Deity* out of the queſtion! How diſconſolate, and how deſtitute of its firmeſt ſupport!

169 ſtence God.

It does not appear, from any true hiſtory or experience of the mind's progreſs, that any man, by any formal deduction of his diſcurſive power, ever reaſoned himſelf into the belief of a God. Whether ſuch a belief is only ſome *natural anticipation* of ſoul, or is derived from father to ſon, and from one man to another, in the way of *tradition*, or is ſuggeſted to us in conſequence of an *immutable law of our nature*, on beholding the auguſt aſpect and beautiful order of the univerſe, we will not pretend to determine. What ſeems moſt agreeable to experience is, that a *ſenſe* of its *beauty* and *grandeur*, and the *admirable fitneſs* of one thing to another in its vaſt apparatus, leads the mind *neceſſarily* and *unavoidably* to a perception of a *deſign*, or of a *deſigning cauſe*, the origin of all, by a progreſs as ſimple and natural as that by which a *beautiful picture* or a *fine building* ſuggeſts to us the idea of an *excellent artiſt*. For it ſeems to hold univerſally true, that wherever we diſcern a *tendency* or *co-operation of things towards a certain end*, or producing a common effect, there, by a neceſſary *law of aſſociation*, we apprehend *deſign*, a *deſigning energy* or *cauſe*. No matter whether the objects are *natural* or *artificial*, ſtill that ſuggeſtion is unavoidable, and the *connexion* between the *effect* and its *adequate cauſe* obtrudes itſelf on the mind, and it requires no nice ſearch or elaborate deduction of reaſon to trace or prove that connexion. We are particularly ſatisfied of its truth in the ſubject before us by a kind of direct intuition; and we do not ſeem to attend to the maxim we learn in ſchools, "That there cannot be an *infinite ſeries* of *cauſes* and *effects* producing and produced by one another." That maxim is familiar only to metaphyſicians; but all men of ſound underſtanding are led to believe the exiſtence of a God. We are conſcious of our *exiſtence*, of *thought*, *ſentiment*, and *paſſion*, and ſenſible withal that theſe came not of ourſelves; therefore we immediately recognize a *parent mind*, an *original intelligence*, from whom we borrowed thoſe little portions of thought and activity. And while we not only feel *kind* affections in ourſelves, and diſcover them in others, but likewiſe behold round us ſuch a number and variety of creatures, endued with natures nicely adjuſted to their ſeveral ſtations and economies, ſupporting and ſupported by each other, and all ſuſtained by a *common order* of things, and ſharing different degrees of happineſs according to their reſpective capacities, we are naturally and neceſſarily led up to the Father of ſuch a numerous offspring, the fountain of ſuch wide-ſpread happineſs. As we conceive this Being before all, above all, and greater than all, we naturally, and without reaſoning, aſcribe to him every kind of perfection, wiſdom, power, and goodneſs without bounds, exiſting through all time, and pervading all ſpace. We apply to him thoſe glorious epithets of our *Creator*, *Preſerver*, *Benefactor*, the *ſupreme Lord* and *Lawgiver* of the whole ſociety of rational and intelligent creatures. Not only the imperfections and wants of our being and condition, but ſome of the nobleſt inſtincts and affections of our minds, connect us with this great and univerſal nature. The mind, in its progreſs from object to object, from one character and proſpect of beauty to another, finds ſome blemiſh or deficiency in each, and ſoon exhauſts or grows weary and diſſatisfied with its ſubject; it ſees no character of excellency among men equal to that pitch of eſteem which it is capable of exerting; no object within the compaſs of human things adequate to the ſtrength of its affection: nor can it ſtay anywhere in this ſelf-expanſive progreſs, or find repoſe after its higheſt flights, till it arrives at a Being of unbounded greatneſs and worth, on whom it may employ its ſublimeſt powers without exhauſting the ſubject, and give ſcope to the utmoſt force and fulneſs of its love without ſatiety or diſguſt. So that the nature of this Being correſponds to the nature of man; nor can his intelligent and moral powers obtain their entire end, but on the ſuppoſition of ſuch a Being, and without a real ſympathy and communication with him. The native propenſity of the mind to reverence whatever is *great* and *wonderful* in nature, finds a proper object of homage in him who ſpread out the heavens and

Duty to God.

170 His relation to the human mind.

and the earth, and who ſuſtains and governs the whole of things. The *admiration* of beauty, the *love* of order, and the *complacency* we feel in goodneſs, muſt riſe to the higheſt pitch, and attain the full vigour and joy of their operations, when they unite in him who is the ſum and ſource of all perfection.

171 Immorality of impiety.

It is evident from the ſlighteſt ſurvey of morals, that how punctual ſoever one may be in performing the duties which reſult from our relations to mankind, yet to be quite deficient in performing thoſe which ariſe from our *relation* to the *Almighty*, muſt argue a ſtrange perverſion of *reaſon* or depravity of *heart*. If imperfect degrees of worth attract our veneration, and if the want of it would imply an inſenſibility, or, which is worſe, an averſion to merit, what lameneſs of affection or immorality of character muſt it be to be unaffected with, and much more to be ill-affected to, a Being of ſuperlative worth! To love ſociety, or particular members of it, and yet to have no ſenſe of our connexion with its Head, no affection to our common Parent and Benefactor; to be concerned about the approbation or cenſure of our fellow creatures, and yet to feel nothing of this kind towards him who ſees and weighs our actions with unerring wiſdom and juſtice, and can fully reward or puniſh them, betrays equal madneſs and partiality of mind. It is plain, therefore, beyond all doubt, that ſome regards are due to the great Father of all, in whom every lovely and adorable quality combines to inſpire veneration and homage.

172 Right opinions of God.

As it has been obſerved already, that our *affections* depend on our *opinions* of their objects, and generally keep pace with them, it muſt be of the higheſt importance, and ſeems to be among the firſt duties we owe to the Author of our being, "to form the leaſt imperfect, ſince we cannot form perfect, conceptions of his *character* and *adminiſtration*." For ſuch *conceptions*, thoroughly imbibed, will render our *religion* rational, and our *diſpoſitions* refined. If our *opinions* are diminutive and diſtorted, our religion will be ſuperſtitious, and our temper abject. Thus, if we aſcribe to the Deity that falſe majeſty which conſiſts in the unbenevolent and ſullen exerciſe of mere *will* or *power*, or ſuppoſe him to delight in the proſtrations of ſervile fear, or as ſervile praiſe, he will be worſhipped with mean adulation and a profuſion of compliments. Farther, If he be looked upon as a ſtern and implacable Being, delighting in vengeance, he will be adored with pompous offerings, ſacrifices, or whatever elſe may be thought proper to ſoothe and mollify him. But if we believe *perfect goodneſs* to be the character of the ſupreme Being, and that he loves thoſe moſt who reſemble him moſt, the worſhip paid him will be rational and ſublime, and his worſhippers will ſeek to pleaſe him by imitating that goodneſs which they adore.

173 Rational faith.

The foundation then of all true religion is a *rational faith*. And of a rational faith theſe ſeem to be the chief articles, to believe, "that an infinite all-perfect Mind exiſts, who has no oppoſite nor any ſeparate intereſt from that of his creatures: that he ſuperintends and governs all creatures, and things;—that his goodneſs extends to all his creatures, in different degrees indeed, according to their reſpective natures, but without any partiality or envy:—that he does every thing for the beſt, or in a ſubſerviency to the perfection and happineſs of the whole; particularly that he directs and governs the affairs of men, inſpects their actions, diſtinguiſhes the *good* from the *bad*, loves and befriends the former, is diſpleaſed with and pities the latter in *this* world, and will according to their reſpective deſerts reward one and puniſh the other in the next;—that, in fine, he is always carrying on a ſcheme of virtue and happineſs through an unlimited duration; and is ever guiding the univerſe, through its ſucceſſive ſtages and periods, to higher degrees of perfection and felicity." This is true *Theiſm*, the glorious ſcheme of divine faith; a ſcheme exhibited in all the works of God, and executed through his whole adminiſtration.

174 Morality of theiſm.

This faith, well founded and deeply felt, is nearly connected with a *true moral taſte*, and hath a powerful efficacy on the temper and manners of the theiſt. He who admires goodneſs in others, and delights in the practice of it, muſt be conſcious of a reigning order within, a rectitude and candour of heart, which diſpoſes him to entertain favourable apprehenſions of men, and, from an impartial ſurvey of things, to preſume that *good order* and *good meaning* prevail in the univerſe; and if good meaning and good order, then an *ordering*, an *intending mind*, who is no enemy, no tyrant to his creatures, but a *friend*, a *benefactor*, an *indulgent ſovereign*.

175 Immorality of atheiſm.

On the other hand, a bad man, having nothing goodly or generous *to contemplate within*, no right intentions, nor honeſty of heart, ſuſpects every perſon and every thing; and, beholding nature through the gloom of a ſelfiſh and guilty mind, is either averſe to the belief of a reigning order, or, if he cannot ſuppreſs the unconquerable anticipations of a governing mind, he is prone to tarniſh the beauty of nature, and to impute malevolence, or blindneſs and impotence at leaſt, to the Sovereign Ruler. He turns the univerſe into a forlorn and horrid waſte, and transfers his own character to the Deity, by aſcribing to him that uncommunicative grandeur, that arbitrary or revengeful ſpirit, which he affects or admires in himſelf. As ſuch a temper of mind naturally leads to *atheiſm*, or to a *ſuperſtition* fully as bad; therefore, as far as that temper depends on the unhappy creature on whom it prevails, the propenſity to atheiſm or ſuperſtition conſequent thereto muſt be *immoral*. Farther, If it be true that the belief or ſenſe of a Deity is natural to the mind, and the evidence of his exiſtence reflected from his works ſo full as to ſtrike even the moſt ſuperficial obſerver with conviction, then the ſupplanting or corrupting that ſenſe, or the want of due attention to that evidence, and, in conſequence of both, a ſupine ignorance or affected unbelief of a Deity, muſt argue a bad temper or an immoral turn of mind. In the caſe of invincible ignorance, or a very bad education, though nothing can be concluded directly againſt the character; yet whenever ill paſſions and habits pervert the judgment, and by perverting the judgment terminate in atheiſm, then the caſe becomes plainly criminal.

176 The connection of theiſm and virtue.

But let caſuiſts determine this as they will, a true faith in the divine character and adminiſtration is generally the conſequence of a virtuous ſtate of mind. The man who is truly and habitually good, feels the *love of order*, of *beauty*, and *goodneſs*, in the ſtrongeſt degree; and therefore cannot be inſenſible to thoſe emanations of them which appear in all the works of God, nor help loving their ſupreme ſource and model. He cannot but think, that he who has poured ſuch beauty and goodneſs over all his works, muſt himſelf delight in beauty and goodneſs, and what he delights in muſt be both amiable and happy. Some indeed there are, and it is pity there ſhould be any ſuch, who, through the unhappy influence of a wrong education, have entertained dark and unfriendly thoughts of the Deity and his adminiſtration, though otherwiſe of a virtuous temper themſelves. However, it muſt be acknowledged, that ſuch ſentiments have, for the moſt part, a bad effect on the temper; and when they have not, it is becauſe the undepraved affections of an honeſt *heart* are more powerful in their operation than the ſpeculative opinions of an ill-informed *head*.

177 Duties of gratitude, love, &c.

But wherever right conceptions of the Deity and his providence prevail, when he is conſidered as the inexhauſted ſource of light, and love, and joy, as acting in the joint character of a *Father* and *Governor*, imparting an endleſs variety of capacities to his creatures, and ſupplying them with every thing neceſſary to their full completion and happineſs; what veneration and gratitude muſt ſuch conceptions, thoroughly believed, excite in the mind? How natural and delightful muſt it be to one whoſe heart is open to the perception of truth, and of every thing *fair*, *great*, and *wonderful* in nature, to contemplate and adore him who is the firſt *fair*, the firſt *great*, and firſt *wonderful*; in whom *wiſdom*, *power*, and *goodneſs*, dwell vitally, eſſentially, originally, and act in perfect concert? What *grandeur* is here to fill the moſt enlarged capacity, what *beauty* to engage the moſt ardent love, what a maſs of *wonders* in ſuch exuberance of perfection to aſtoniſh and delight the human mind through an unfailing duration!

178 Other affections.

If the *Deity* is conſidered as our ſupreme *Guardian* and *Benefactor*, as the *Father of Mercies*, who loves his creatures with infinite tenderneſs, and in a particular manner all good men, nay all who delight in goodneſs, even in its moſt imperfect degrees; what reſignation, what dependence, what generous confidence, what hope in God and his all-wiſe providence, muſt ariſe in the ſoul that is poſſeſſed of ſuch amiable views of him! All thoſe exerciſes of piety, and above all a ſuperlative eſteem and love, are directed to God as to their *natural*, their *ultimate*, and indeed their only *adequate* object; and though the immenſe obligations we have received from him may excite in us more lively feelings of divine goodneſs than a general and abſtracted contemplation of it, yet the affections of *gratitude* and *love* are of themſelves of the generous diſintereſted kind, not the reſult of ſelf-intereſt, or views of reward. A perfect character, in which we always ſuppoſe infinite goodneſs, guided by unerring wiſdom, and ſupported by almighty power, is the proper object of perfect love; which, as ſuch, we are forcibly drawn to purſue and to aſpire after. In the contemplation of the divine nature and attributes, we find at laſt what the ancient philoſophers ſought in vain, the SUPREME AND SOVEREIGN GOOD; from which all other goods ariſe, and in which they are all contained. The Deity therefore challenges our ſupreme and ſovereign love, a ſentiment which, whoſoever indulges, muſt be confirmed in the love of virtue, in a deſire to imitate its all perfect pattern, and in a cheerful ſecurity that all his great concerns, thoſe of his friends and of the univerſe, ſhall be abſolutely ſafe under the conduct of unerring wiſdom and unbounded goodneſs. It is in his care and providence alone that the good man, who is anxious for the happineſs of all, finds perfect ſerenity; a ſerenity neither ruffled by partial ill nor ſoured by private diſappointment.

179 Repentance, &c.

When we conſider the unſtained purity and abſolute perfection of the *divine* nature, and reflect withal on the imperfection and various blemiſhes of our own, we muſt ſink, or be convinced we ought to ſink, into the deepeſt humility and proſtration of ſoul before him who is ſo wonderfully great and holy. When, further, we call to mind what low and languid feelings we have of the divine preſence and majeſty, what inſenſibility of his fatherly and univerſal goodneſs, nay, what ungrateful returns we have made to it, how far we come ſhort of the perfection of his law and the dignity of our own nature, how much we have indulged the ſelfiſh paſſions, and how little we have cheriſhed the benevolent ones; we muſt be conſcious that it is our duty to repent of a temper and conduct ſo unworthy our nature and unbecoming our obligations to its Author, and to reſolve and endeavour to act a wiſer and better part for the future.

180 Hopes of pardon.

Nevertheleſs, from the character which his works exhibit of him, from thoſe delays or alleviations of puniſhment which offenders often experience, and from the merciful tenor of his adminiſtration in many other inſtances, the ſincere penitent may entertain good hopes that his Parent and Judge will not be ſtrict to mark iniquity, but will be propitious and favourable to him, if he honeſtly endeavours to avoid his former practices, and ſubdue his former habits, and to live in a greater conformity to the divine will for the future. If any doubts or fears ſhould ſtill remain, how far it may be conſiſtent with the rectitude and equity of the divine government to let his iniquities paſs unpuniſhed, yet he cannot think it unſuitable to his paternal clemency and wiſdom to contrive a method of retrieving the penitent offender, that ſhall unite and reconcile the majeſty and mercy of his government. If reaſon cannot of itſelf ſuggeſt ſuch a ſcheme, it gives at leaſt ſome ground to expect it. But though *natural religion* cannot let in moral light and aſſurance on ſo intereſting a ſubject, yet it will teach the humble theiſt to wait with great ſubmiſſion for any farther intimations it may pleaſe the ſupreme Governor to give of his will; to examine with candour and impartiality whatever evidence ſhall be propoſed to him of a *divine revelation*, whether that evidence is *natural* or *ſupernatural*; to embrace it with veneration and cheerfulneſs, if the evidence is clear and convincing; and, finally, if it bring to light any *new relations* or *connexions*, *natural religion* will perſuade its ſincere votary faithfully to comply with the *obligations*, and perform the *duties* which reſult from thoſe relations and connexions. This is *theiſm*, *piety*, the *completion of morality*!

181 Worſhip, praiſe, thankſgiving.

We muſt farther obſerve, that all thoſe affections which we ſuppoſed to regard the Deity as their *immediate* and *primary* object, are vital energies of the ſoul, and conſequently exert themſelves into act, and, like all other energies, gain ſtrength or greater activity by that exertion. It is therefore our *duty* as well as higheſt *intereſt*, often at ſtated times, and by decent and ſolemn

lemn acts, to contemplate and adore the great Original of our exiſtence, the Parent of all beauty and of all good; to expreſs our veneration and love by an awful and devout recognition of his perfections; and to evidence our gratitude by celebrating his goodneſs, and thankfully acknowledging all his benefits. It is likewiſe our duty, by proper exerciſes of ſorrow and humiliation, to confeſs our ingratitude and folly; to ſignify our dependence on God, and our confidence in his goodneſs, by imploring his bleſſing and gracious concurrence in aſſiſting the weakneſs and curing the corruptions of our nature; and, finally, to teſtify our ſenſe of his authority, and our faith in his government, by devoting ourſelves to do his will, and reſigning ourſelves to his diſpoſal. Theſe duties are not therefore obligatory, becauſe the Deity needs or can be profited by them; but as they are apparently *decent* and *moral*, ſuitable to the relations he ſuſtains of our *Creator*, *Benefactor*, *Lawgiver*, and *Judge;* expreſſive of our ſtate and obligations; and improving to our tempers, by making us more rational, ſocial, god-like, and conſequently more happy.

182 External worſhip. We have now conſidered INTERNAL piety, or the *worſhip of the mind*, that which is in ſpirit and in truth; we ſhall conclude the ſection with a ſhort account of that which is EXTERNAL. *External* worſhip is founded on the ſame principles as *internal*, and of as ſtrict moral obligation. It is either *private* or *public*. *Devotion* that is *inward*, or *purely intellectual*, is too ſpiritual and abſtracted an operation for the bulk of mankind. The operations of their minds, ſuch eſpecially as are employed on the moſt ſublime, immaterial objects, muſt be aſſiſted by their outward organs, or by ſome help from the imagination; otherwiſe they will ſoon be diſſipated by ſenſible impreſſions, or grow tireſome if too long continued. Ideas are ſuch fleeting things, that they muſt be fixed; and ſo ſubtle, that they muſt be expreſſed and delineated, as it were, by ſenſible marks and images; otherwiſe we cannot attend to them, nor be much affected by them. *Therefore, verbal adoration, prayer, praiſe, thankſgiving*, and *confeſſion*, are admirable aids to *inward* devotion, fix our attention, compoſe and enliven our thoughts, impreſs us more deeply with a ſenſe of the awful preſence in which we are, and, by a natural and mechanical ſort of influence, tend to heighten thoſe devout feelings and affections which we ought to entertain, and after this manner reduce into formal and explicit act.

183 Public worſhip. This holds true in a higher degree in the caſe of *public* worſhip, where the preſence of our fellow-creatures, and the powerful contagion of the *ſocial* affections, conſpire to kindle and ſpread the devout flame with greater warmth and energy. To conclude: As *God* is the *parent* and *head* of the *ſocial ſyſtem*, as he has formed us for a *ſocial ſtate*, as by *one* we find the beſt ſecurity againſt the ills of life, and in the *other* enjoy its greateſt comforts, and as, by means of *both*, our nature attains its higheſt improvement and perfection; and moreover, as there are *public bleſſings* and *crimes* in which we all ſhare in ſome degree, and *public wants* and *dangers* to which all are expoſed—it is therefore evident, that the various and ſolemn offices of *public religion* are duties of indiſpenſable moral obligation, among the beſt cements of ſociety, the firmeſt prop of government, and the faireſt ornament of both.

PART III.

CHAP. I. *Of* PRACTICAL ETHICS, *or the* CULTURE *of the* MIND.

184 Dignity and importance of the ſubject. WE have now gone through a particular detail of the ſeveral duties we owe to OURSELVES, to SOCIETY, and to GOD. In conſidering the *firſt order* of duties, we juſt touched on the methods of acquiring the different kinds of goods which we are led by nature to purſue; only we left the conſideration of the method of acquiring the *moral* goods of the mind to a chapter by itſelf, becauſe of its ſingular importance. This chapter then will contain a brief enumeration of the arts of acquiring *virtuous habits*, and of eradicating *vicious ones*, as far as is conſiſtent with the brevity of ſuch a work: a ſubject of the utmoſt difficulty as well as importance in morals; to which, nevertheleſs, the leaſt attention has been generally given by *moral* writers. This will properly follow a detail of duty, as it will direct us to ſuch *means* or *helps* as are moſt neceſſary and conducive to the practice of it.

185 Senſible ideas and ſenſible taſte. In the firſt part of this inquiry we traced the order in which the paſſions ſhoot up in the different periods of human life. That order is not accidental or dependent on the caprice of men, or the influence of cuſtom and education, but ariſes from the original conſtitution and laws of our nature; of which this is one, viz. "That ſenſible objects make the firſt and ſtrongeſt impreſſions on the mind." Theſe, by means of our outward organs, being conveyed to the mind, become objects of its attention, on which it reflects when the outward objects are no longer preſent, or, in other words, when the impreſſions upon the outward organs ceaſe. Theſe objects of the mind's reflection are called *ideas* or *notions*. Towards theſe, by another law of our nature, we are not altogether indifferent; but correſpondent movements of *deſire* or *averſion*, *love* or *hatred*, ariſe, according as the objects which they denote made an agreeable or diſagreeable impreſſion on our organs. Thoſe *ideas* and *affections* which we experience in the *firſt* period of life, we refer to the *body*, or to *ſenſe;* and the *taſte*, which is formed towards them, we call a *ſenſible*, or a merely *natural taſte;* and the objects correſponding to them we in general call *good* or *pleaſant*.

186 Ideas of beauty and a fine taſte. But as the mind moves forward in its courſe, it extends its views, and receives a new and more *complex* ſet of ideas, in which it obſerves *uniformity*, *variety*, *ſimilitude*, *ſymmetry of parts*, *reference to an end*, *novelty*, *grandeur*. Theſe compoſe a vaſt train and diverſity of *imagery*, which the mind compounds, divides, and moulds into a thouſand forms, in the abſence of thoſe objects which firſt introduced it. And this more complicated imagery ſuggeſts a new train of *deſires* and *affections*,

affections, full as ſprightly and engaging as any which have yet appeared. This whole claſs of *perceptions* or *impreſſions* is referred to the *imagination*, and forms a higher taſte than the *ſenſible*, and which has an immediate and mighty influence on the *finer* paſſions of our nature, and is commonly termed a *fine taſte*.

The objects which correſpond to this taſte we uſe to call *beautiful*, *great*, *harmonious*, or *wonderful*, or in general by the name of *beauty*.

187 Mral ideas an a mo- rataſte.

The mind, ſtill puſhing onwards and increaſing its ſtock of ideas, aſcends from thoſe to a higher ſpecies of objects, viz. the *order* and *mutual relations* of *minds* to each other, their reciprocal *affections*, *characters*, *actions*, and various *aſpects*. In theſe it diſcovers a *beauty*, a *grandeur*, a *decorum*, more intereſting and alluring than in any of the former kinds. Theſe objects, or the notions of them, paſſing in review before the mind, do, by a neceſſary law of our nature, call forth another and nobler ſet of affections, as *admiration*, *eſteem*, *love*, *honour*, *gratitude*, *benevolence*, and others of the like tribe. This claſs of *perfections*, and their correſpondent *affections*, we refer, becauſe of their objects (*manners*), to a *moral* ſenſe, and call the *taſte* or *temper* they excite, *moral*. And the objects which are agreeable to this *taſte* or *temper* we denominate by the general name of *moral beauty*, in order to diſtinguiſh it from the other, which is termed *natural*.

188 Sces of aciation.

Theſe different ſets of *ideas* or *notions* are the materials about which the mind employs itſelf, which it blends, ranges, and diverſifies ten thouſand different ways. It feels a ſtrong propenſion to connect and aſſociate thoſe ideas among which it obſerves any *ſimilitude* or any *aptitude*, whether *original* and *natural*, or *cuſtomary* and *artificial*, to ſuggeſt each other. See METAPHYSICS.

189 Ls of aciation.

But whatever the reaſons are, whether *ſimilitude*, *coexiſtence*, *cauſality*, or any other *aptitude* or *relation*, why any two or more ideas are connected by the mind at firſt, it is an eſtabliſhed law of our nature, "that when two or more ideas have often ſtarted in company, they form ſo ſtrong an union, that it is very difficult ever after to ſeparate them." Thus the *lover* cannot ſeparate the idea of *merit* from his *miſtreſs*; the *courtier* that of *dignity* from his *title* or *ribbon*; the *miſer* that of *happineſs* from his *bags*. It is theſe aſſociations of *worth* or *happineſs* with any of the different ſets of *objects* or *images* before ſpecified that form our *taſte* or *complex idea* of *good*. By another law of our nature, "our *affections* follow and are governed by this *taſte*. And to theſe *affections* our *character* and *conduct* are ſimilar and proportioned on the general tenor of which our *happineſs* principally depends."

190 Lding paons fol- lc taſte.

As all our *leading* paſſions then depend on the direction which our *taſte* takes, and as it is always of the ſame ſtrain with our *leading* aſſociations, it is worth while to inquire a little more particularly how theſe are formed, in order to detect the ſecret ſources from whence our paſſions derive their principal ſtrength, their various riſes and falls. For this will give us the true key to their management, and let us into the right method of correcting the *bad* and improving the *good*.

191 Te impor- tce and uof the igina- ti.

No kind of objects make ſo powerful an impreſſion on us as thoſe which are immediately impreſſed on our *ſenſes*, or ſtrongly painted on our *imaginations*. Whatever is purely *intellectual*, as abſtracted or ſcientific truths, the ſubtle relations and differences of things, has a fainter ſort of exiſtence in the mind; and though it may exerciſe and whet the *memory*, the *judgment*, or the *reaſoning power*, gives hardly any impulſe at all to the *active* powers, the *paſſions*, which are the main ſprings of motion. On the other hand, were the mind entirely under the direction of *ſenſe*, and impreſſible only by ſuch objects as are preſent, and ſtrike ſome of the outward organs, we ſhould then be preciſely in the ſtate of the brute creation, and be governed ſolely by *inſtinct* or *appetite*, and have no power to controul whatever impreſſions are made upon us: Nature has therefore endued us with a *middle faculty*, wonderfully adapted to our *mixed* ſtate, which holds partly of *ſenſe* and partly of *reaſon*, being ſtrongly allied to the *former*, and the common receptacle in which all the notices that come from that quarter are treaſured up; and yet greatly ſubſervient and miniſterial to the *latter*, by giving a body, a coherence, and beauty to its conceptions. This *middle* faculty is called the *imagination*, one of the moſt buſy and fruitful powers of the mind. Into this common ſtorehouſe are likewiſe carried all thoſe *moral forms* which are derived from our *moral faculties* of perception; and there they often undergo new changes and appearances, by being mixed and wrought up with the ideas and forms of *ſenſible* or *natural* things. By this coalition of imagery, *natural beauty* is dignified and heightened by *moral qualities* and *perfections*, and *moral qualities* are at once exhibited and ſet off by *natural beauty*. The *ſenſible* beauty, or good, is refined from its droſs by partaking of the *moral*; and the *moral* receives a ſtamp, a viſible character and currency, from the *ſenſible*.

192 Its energy in various inſtances in heighten- ing ſenſible pleaſures;

As we are firſt of all accuſtomed to *ſenſible* impreſſions and *ſenſible* enjoyments, we contract early a *ſenſual* reliſh or *love of pleaſure*, in the lower ſenſe of the word. In order, however, to juſtify this reliſh, the mind, as it becomes open to *higher* perceptions of *beauty* and *good*, borrows from thence a noble ſet of *images*, as *fine taſte*, *generoſity*, *ſocial affections*, *friendſhip*, *good fellowſhip*, and the like; and, by dreſſing out the old purſuits with theſe new ornaments, gives them an additional dignity and luſtre. By theſe ways the *deſire of a table*, *love of finery*, *intrigue* and *pleaſure*, are vaſtly increaſed beyond their natural pitch, having an impulſe combined of the force of the *natural* appetites, and of the ſuperadded ſtrength of thoſe *paſſions* which tend to the *moral ſpecies*.

193 in height- ening the pleaſures of beauty, harmony, &c.

When the mind becomes more ſenſible to thoſe objects or appearances in which it perceives *beauty*, *uniformity*, *grandeur*, and *harmony*, as fine clothes, elegant furniture, plate, pictures, gardens, houſes, equipage, the beauty of animals, and particularly the attractions of the ſex; to theſe objects the mind is led by *nature* or taught by *cuſtom*, the *opinion* and example of others, to annex certain ideas of *moral character*, *dignity*, *decorum*, *honour*, *liberality*, *tenderneſs*, and *active* or *ſocial enjoyment*. The conſequence of this aſſociation is, that the objects to which theſe are annexed muſt riſe in their value, and be purſued with proportionable ardour. The *enjoyment* of them is often attended with *pleaſure*; and the mere *poſſeſſion* of them, where that is wanting, frequently draws reſpect from one's fellow-creatures: This *reſpect* is, by many, thought equivalent to the pleaſure of *enjoyment*. Hence it it happens that the idea of *happineſs* is connected with the mere *poſſeſſion*, which is therefore eagerly ſought after without any regard to the *generous uſe* or *honourable enjoyment*. Thus the paſſion, reſting on the *means*, not the end, i. e. loſing ſight of its *natural* object, becomes wild and extravagant.

194 in raiſing the value of external ſymbols, &c.

In fine, any *object*, or *external denomination*, a *ſtaff*, a *garter*, a *cup*, a *crown*, *a title*, may become a *moral* badge or emblem of *merit*, *magnificence*, or *honour*, according as theſe have been found or thought, by the poſſeſſors or admirers of them, to accompany them; yet, by the deception formerly mentioned, the *merit* or the *conduct* which entitled, or ſhould entitle to thoſe marks of diſtinction, ſhall be forgot or neglected, and the *badges* themſelves be paſſionately affected or purſued, as including every excellency. If theſe are attained by any means, all the concomitants which *nature*, *cuſtom*, or *accidents* have joined to them, will be ſuppoſed to follow of courſe. Thus, *moral ends* with which the unhappy admirer is apt to colour over his paſſion and views will, in his opinion, juſtify the moſt *immoral means*, as *proſtitution*, *adulation*, *fraud*, *treachery*, and every ſpecies of *knavery*, whether more open or more diſguiſed.

195 in heightening the value of wealth, power, &c.

When men are once engaged in *active* life, and find that *wealth* and *power*, generally called INTEREST, are the great avenues to every kind of enjoyment, they are apt to throw in many engaging *moral forms* to the object of their purſuit, in order to juſtify their paſſion, and varniſh over the meaſures they take to gratify it, as *independency on the vices* or *paſſions* of others, *proviſion* and *ſecurity to themſelves* and *friends*, *prudent economy* or *well-placed charity*, *ſocial communication*, *ſuperiority to their enemies*, who are all villains, *honourable ſervice*, and many other ingredients of *merit*. To attain ſuch capacities of *uſefulneſs* or *enjoyment*, what arts, nay what meanneſſes, can be thought blameable by thoſe cool purſuers of intereſt?—Nor have they whom the gay world is pleaſed to indulge with the title of *men of pleaſure*, their imaginations leſs pregnant with *moral images*, with which they never fail to ennoble, or, if they cannot do that, to palliate their groſs purſuits. Thus *admiration of wit*, of *ſentiments* and *merit*, *friendſhip*, *love*, *generous ſympathy*, *mutual confidence*, *giving* and *receiving pleaſure*, are the ordinary ingredients with which they ſeaſon their gallantry and pleaſurable entertainments; and by which they impoſe on themſelves, and endeavour to impoſe on others, that *their amours* are the joint iſſue of good ſenſe and virtue.

196 Its influence on all the paſſions.

Theſe *aſſociations*, variouſly combined and proportioned by the *imagination*, form the chief *private* paſſions, which govern the lives of the generality, as the *love of action*, of *pleaſure*, *power*, *wealth*, and *fame*; they influence the *defenſive*, and affect the *public paſſions*, and raiſe *joy* or *ſorrow* as they are gratified or diſappointed. So that in effect theſe aſſociations of *good* and *evil*, *beauty* and *deformity*, and the paſſions they raiſe, are the main *hinges of life* and *manners*, and the great *ſources* of our *happineſs* or *miſery*. It is evident, therefore, that the whole of *moral culture* muſt depend on giving a right direction to the *leading paſſions*, and duly proportioning them to the *value* of the *objects* or *goods* purſued, under what name ſoever they may appear.

197 Moral culture, by correcting our taſte or imaginations;

Now, in order to give them this *right direction* and *due proportion*, it appears from the foregoing detail, that thoſe *aſſociations* of ideas, upon which the paſſions depend, muſt be *duly* regulated; that is to ſay, as an exorbitant paſſion for *wealth*, *pleaſure*, or *power*, flows from an *aſſociation* or *opinion*, that more *beauty* and *good*, whether *natural* or *moral*, enters into the enjoyment or poſſeſſion of them, that really belongs to either; *therefore*, in reſtoring thoſe paſſions to their juſt proportion, we muſt begin with correcting the *opinion*, or breaking the *falſe aſſociation*, or, in other words, we muſt decompound the *complex phantom* of *happineſs* or *good*, which we fondly admire; diſunite thoſe ideas that have no natural alliance; and ſeparate the *original* idea of *wealth*, *power*, or *pleaſure*, from the foreign mixtures incorporated with it, which enhance its value, or give it its chief power to enchant and ſeduce the mind. For inſtance, let it be conſidered how poor and inconſiderable a thing *wealth* is, if it be disjoined from *real uſe*, or from ideas of *capacity* in the poſſeſſor to *do good*, from *independence*, *generoſity*, *proviſion for a family* or *friends*, and *ſocial communication* with others. By this *ſtandard* let its true value be fixed; let its miſapplication, or unbenevolent enjoyment, be accounted ſordid and infamous; and nothing worthy or eſtimable be aſcribed to the *mere poſſeſſion* of it, which is not borrowed from its *generous uſe*.

198 by ſelf-denial, and a counter-proceſs;

If that *complex* form of *good* which is called *pleaſure* engage us, let it be analyzed into its conſtituent principles, or thoſe allurements it draws from the *heart* and *imagination*, in order to heighten the low part of the indulgence; let the *ſeparate* and *comparative* moment of each be diſtinctly aſcertained and deduced from that groſs part, and this remainder of the accumulated enjoyment will dwindle down into a poor, inſipid, tranſitory thing. In proportion as the *opinion* of the *good* purſued abates, the *admiration* muſt decay, and the *paſſions* loſe ſtrength of courſe. One effectual way to lower the *opinion*, and conſequently to weaken the habit founded upon it, is to practiſe leſſer pieces of ſelf-denial, or to abſtain, to a certain pitch, from the purſuit or enjoyment of the favourite object; and, that this may be the more eaſily accompliſhed, one muſt avoid thoſe occaſions, that company, thoſe places, and the other circumſtances, that inflamed *one* and endeared the *other*. And, as a *counter-proceſs*, let *higher* or even *different* enjoyments be brought in view, other paſſions played upon the former, different places frequented, other exerciſes tried, company kept with perſons of a different or more correct way of thinking both in *natural* and *moral* ſubjects.

199 by a ſound and natural education.

As much depends on our ſetting out well in life, let the *youthful* fancy, which is apt to be very florid and luxuriant, be early accuſtomed by *inſtruction*, *example*, and ſignificant *moral exerciſes*, nay, by looks, geſtures, and every other teſtimony of juſt approbation or blame, to annex ideas of *merit*, *honour*, and *happineſs*, not to *birth*, *dreſs*, *rank*, *beauty*, *fortune*, *power*, *popularity*, and the like *outward* things, but to *moral* and *truly virtuous qualities*, and to thoſe *enjoyments* which ſpring from a well-informed judgment and a regular conduct of the affections, eſpecially thoſe of the *ſocial* and *diſintereſted* kind. Such dignified forms of *beauty* and *good*, often ſuggeſted, and, by moving pictures and examples warmly recommended to the *imagination*, enforced by the authority of conſcience, and demonſtrated by reaſon to be the ılture of e Mind.

the ſureſt means of enjoyment, and the only independent, undeprivable, and durable goods, will be the beſt counterbalance to meaner paſſions, and the firmeſt foundation and ſecurity of virtue.

200 rightly ſtlying man na- e; It is of great importance to the forming a *juſt taſte*, or pure and large conceptions of happineſs, to ſtudy and underſtand *human nature* well, to remember what a complicated ſyſtem it is, particularly to have deeply imprinted on our mind that GRADATION of *ſenſes*, *faculties*, and *powers of enjoyment* formerly mentioned, and the *ſubordination of goods* reſulting from thence, which nature points out, and the experience of mankind confirms. Who, when they think ſeriouſly, and are not under the immediate influence of ſome violent prejudice or paſſion, prefer not the pleaſures of *action*, *contemplation*, *ſociety*, and moſt *exerciſes* and *joys* of the *moral* kind, as *friendſhip*, *natural affection*, and the like, to all *ſenſual* gratifications whatſoever? Where the different ſpecies of pleaſure are blended into *one complex form*, let them be accurately diſtinguiſhed, and be referred each to its proper *faculty* and *ſenſe*, and examined apart what they have peculiar, what common with others, and what foreign and adventitious.

201 compar- the ment al abate- nts of erent ds; Let *wealth*, *grandeur*, *luxury*, *love*, *fame*, and the like, be tried by this teſt, and their true alloy will be found out. Let it be further conſidered, whether the mind may not be eaſy and enjoy itſelf greatly, though it want many of thoſe elegancies and ſuperfluities of life which ſome poſſeſs, or that load of wealth and power which others eagerly purſue, and under which they groan. Let the difficulty of attaining, the precariouſneſs of poſſeſſing, and the many abatements in enjoying overgrown wealth and envied greatneſs, of which the weary poſſeſſors ſo frequently complain, as the hurry of buſineſs, the burden of company, of paying attendance to the *few*, and giving it to *many*, the cares of keeping, the fears of loſing, and the deſires of increaſing what they have, and the other troubles which accompany this pitiful drudgery and pompous ſervitude; let theſe and the like circumſtances be often conſidered, that are conducive to the removing or leſſening the *opinion* of ſuch goods, and the attendant *paſſion* or *ſet* of *paſſions* will decay of courſe.

202 obſerv- our own t and racter, Let the peculiar bent of our nature and character be obſerved, whether we are moſt inclined to form aſſociations and reliſh objects of the *ſenſible*, *intellectual*, or *moral* kind. Let that which has the aſcendant be particularly watched; let it be directed to right objects, be improved by proportioned exerciſes, and guarded by proper checks from an oppoſite quarter. Thus the *ſenſible* turn may be exalted by the *intellectual*, and a taſte for the beauty of the *fine arts*, and both may be made ſubſervient to convey and rivet ſentiments highly *moral* and *public ſpirited*. This inward ſurvey muſt extend to the *ſtrength* and *weakneſſes* of one's *nature*, one's *conditions*, *connexions*, *habitudes*, *fortunes*, *ſtudies*, *acquaintance*, and the other circumſtances of one's life, from which every man will form the juſteſt eſtimate of his own diſpoſitions and character, and the beſt rules for correcting and improving them. And in order to do this with more advantage, let thoſe *times* or *critical ſeaſons* be watched when the mind is beſt diſpoſed towards a change; and let them be improved by rigorous *reſolutions*, *promiſes*, or whatever elſe will engage the mind to perſevere in virtue. Let the *conduct*, in fine, be often reviewed, and the *cauſes* of its *corruption* or *improvement* be carefully obſerved.

Culture of the Mind.

203 by frequent moral exerciſes; It will greatly conduce to refine the *moral taſte* and ſtrengthen the *virtuous temper*, to accuſtom the mind to the frequent exerciſe of *moral ſentiments* and *determinations*, by reading *hiſtory*, *poetry*, particularly of the *picture ſque* and *dramatic* kind, the ſtudy of the *fine arts*; by converſing with the moſt eminent for good ſenſe and virtue; but above all, by frequent and repeated acts of *humanity*, *compaſſion*, *friendſhip*, *politeneſs*, and *hoſpitality*. It is exerciſe that gives health and ſtrength. He that reaſons moſt frequently becomes the wiſeſt, and moſt enjoys the pleaſures of wiſdom. He who is moſt often affected by objects of compaſſion in poetry, hiſtory, or real life, will have his ſoul moſt open to pity, and its delightful pains and duties. So he alſo who practiſes moſt diligently the offices of kindneſs and charity, will by it cultivate that diſpoſition from whence all his pretenſions to perſonal merit muſt ariſe, his preſent and his future happineſs.

204 by an honeſt employment; An uſeful and honourable employment in life will adminiſter a thouſand opportunities of this kind, and greatly ſtrengthen a ſenſe of virtue and good affections, which muſt be nouriſhed by light training, as well as our underſtandings. For ſuch an employment, by enlarging one's experience, giving a habit of attention and caution, or obliging one, from neceſſity or intereſt, to keep a guard over the paſſions, and ſtudy the outward decencies and appearances of virtue, will by degrees produce good habit, and at length inſinuate the love of virtue and honeſty for its own ſake.

205 by viewing men and manners in a fair light; It is a great inducement to the exerciſe of benevolence to view *human nature* in a favourable light, to obſerve the characters and circumſtances of mankind on the *faireſt* ſides, to put the beſt conſtructions on their actions they will bear, and to conſider them as the reſult of *partial* and *miſtaken* rather than *ill* affections, or, at worſt, as the exceſſes of a pardonable ſelf-love, ſeldom or never the effect of pure malice.

206 by conſideration and pious exerciſes; Above all, the *nature* and *conſequences* of *virtue* and *vice*, their conſequences being the law of our nature and will of heaven; the light in which they appear to our ſupreme *Parent* and *Lawgiver*, and the reception they will meet with from him, muſt be often attended to. The exerciſes of *piety*, as *adoration* and *praiſe* of the *divine* excellency, *invocation* of and *dependence* on his aid, *confeſſion*, *thankſgiving*, and *reſignation*, are habitually to be indulged, and frequently performed, not only as *medicinal*, but highly *improving* to the temper.

207 by juſt views of human life, and its connection with a future. To conclude: It will be of admirable efficacy towards eradicating *bad* habits, and implanting *good* ones, frequently to contemplate *human life* as the great *nurſery* of our *future* and *immortal exiſtence*, as that *ſtate* of *probation* in which we are to be *educated* for a *divine life*; to remember, that our *virtues* or *vices* will be *immortal* as ourſelves, and influence our *future* as well as our *preſent* happineſs—and therefore, that every diſpoſition and action is to be regarded as pointing beyond the *preſent* to an *immortal* duration.—An habitual attention to this wide and important *connexion* will give a vaſt compaſs and dignity to our ſentiments and actions, a noble

ble ſuperiority to the pleaſures and pains of life, and a generous ambition to make our *virtue* as *immortal as* our *being*.

CHAP. II. *Motives to* VIRTUE *from Perſonal* HAPPINESS.

208 Motives from perſonal happineſs.

WE have already conſidered our *obligations* to the practice of *virtue*, ariſing from the *conſtitution* of our nature, by which we are led to *approve* a certain *order* and *economy* of *affections*, and a certain *courſe of action* correſpondent to it *. But, beſides this, there are ſeveral motives which ſtrengthen and ſecure virtue, though not themſelves of a *moral* kind. Theſe are, its *tendency to perſonal happineſs* and the *contrary tendency of vice*. "Perſonal happineſs ariſes either from the ſtate of a man's own mind, or from the ſtate and diſpoſition of external cauſes towards him."

209 Happineſs of virtue from within.

We ſhall firſt examine the "tendency of virtue to happineſs with reſpect to the ſtate of a man's own mind." This is a point of the utmoſt conſequence in morals, becauſe, unleſs we can convince ourſelves, or ſhow to others, that, by doing our *duty*, or fulfilling our *moral obligations*, we conſult the greateſt ſatisfaction of our own mind, or our higheſt intereſt on the whole, it will raiſe ſtrong and often unſurmountable prejudices againſt the practice of virtue, eſpecially whenever there ariſe any appearances of *oppoſition* between our *duty* and our *ſatisfaction* or *intereſt*. To creatures ſo deſirous of happineſs, and averſe to miſery, as we are, and often ſo oddly ſituated amidſt contending paſſions and intereſts, it is neceſſary that virtue appear not only an *honourable* but a *pleaſing* and *beneficent* form. And in order to juſtify our choice to ourſelves as well as before others, we muſt ourſelves feel and be able to avow in the face of the whole world, that her ways are ways of pleaſantneſs, and her paths the paths of peace. This will ſhow, beyond all contradiction, that we not only approve, but can give a ſufficient reaſon for what we do.

210 Influence of vice on the temper of the mind.

Let any man in a cool hour, when he is diſengaged from buſineſs, and undiſturbed by paſſion (as ſuch cool hours will ſometimes happen), ſit down, and ſeriouſly reflect with himſelf what ſtate or temper of mind he would chooſe to feel and indulge, in order to be eaſy and to enjoy himſelf. Would he chooſe, for that purpoſe, to be in a conſtant diſſipation and hurry of thought; to be diſturbed in the exerciſe of his reaſon; to have various and often interfering phantoms of good playing before his imagination, ſoliciting and diſtracting him by turns, now ſoothing him with amuſing hopes, then torturing him with anxious fears; and to approve this minute what he ſhall condemn the next? Would he chooſe to have a ſtrong and painful ſenſe of every petty injury; quick apprehenſions of every impending evil; inceſſant and inſatiable deſires of power, wealth, honour, pleaſure; an irreconcilable antipathy againſt all competitors and rivals; inſolent and tyrannical diſpoſitions to all below him; fawning, and at the ſame time envious, diſpoſitions to all above him; with dark ſuſpicions and jealouſies of every mortal? Would he chooſe neither to love nor be beloved of any; to have no friend in whom to confide, or with whom to interchange his ſentiments or deſigns; no favourite, on whom to beſtow his kindneſs, or vent his paſſions; in fine, to be conſcious of no merit with mankind, no eſteem from any creature, no good affection to his Maker, no concern for, nor hopes of, his approbation; but, inſtead of all theſe, to hate, and know that he is hated, to condemn, and know that he is condemned by all; by the good, becauſe he is ſo unlike; and by the bad becauſe he is ſo like themſelves; to hate or to dread the very Being that made him; and, in ſhort, to have his breaſt the ſeat of pride and paſſion, petulance and revenge, deep melancholy, cool malignity, and all the other furies that ever poſſeſſed and tortured mankind?—Would our calm inquirer after happineſs pitch on ſuch a ſtate, and ſuch a temper of mind, as the moſt likely means to put him in poſſeſſion of his deſired eaſe and ſelf-enjoyment?

211 Influence of virtue on the temper.

Or would he rather chooſe a ſerene and eaſy flow of thought; a reaſon clear and compoſed; a judgment unbiaſſed by prejudice, and undiſtracted by paſſion; a ſober and well-governed fancy, which preſents the images of things true, and unmixed with deluſive and unnatural charms, and therefore adminiſters no improper or dangerous fuel to the paſſions, but leaves the mind free to chooſe or reject, as becomes a reaſonable creature; a ſweet and ſedate temper, not eaſily ruffled by hopes or fears, prone neither to ſuſpicion nor revenge, apt to view men and things in the faireſt lights, and to bend gently to the humours of others rather than obſtinately to contend with them? Would he chooſe ſuch moderation and continence of mind, as neither to be ambitious of *power*, fond of *honours*, covetous of *wealth*, nor a ſlave to *pleaſure*; a mind of courſe neither elated with ſucceſs, nor dejected with diſappointment; ſuch a modeſt and noble ſpirit as ſupports power without inſolence, wears honour without pride, uſes wealth without profuſion or parſimony; and rejoices more in giving than in receiving pleaſure; ſuch fortitude and equanimity as riſes above misfortunes, or turns them into bleſſings; ſuch integrity and greatneſs of mind, as neither flatters the vices, nor triumphs over the follies of men; as equally ſpurns ſervitude and tyranny, and will neither engage in low deſigns, nor abet them in others? Would he chooſe, in fine, ſuch mildneſs and benignity of heart as takes part in all the joys, and refuſes none of the ſorrows, of others; ſtands well affected to all mankind; is conſcious of meriting the eſteem of all, and of being beloved by the beſt; a mind which delights in doing good without any ſhow, and yet arrogates nothing on that account; rejoices in loving and being beloved by its Maker, acts ever under his eye, reſigns itſelf to his providence, and triumphs in his approbation? Which of theſe diſpoſitions would be his choice in order to be contented, ſerene, and happy? The *former* temper is VICE, the *latter* VIRTUE. Where *one* prevails, there MISERY prevails, and by the generality is acknowledged to prevail. Where the *other* reigns, there HAPPINESS reigns, and by the confeſſion of mankind is acknowledged to reign. The *perfection* of either temper is *miſery* or *happineſs in perfection*.—THEREFORE, every *approach* to *either extreme* is an *approach to miſery* or to *happineſs*; i. e. every *degree* of *vice* or *virtue* is accompanied with a *proportionable degree* of *miſery* or *happineſs*.

212 The alleviations of his ills.

The principal alleviations of a virtuous man's calamities are theſe:—That though ſome of them may have

---

* Vide Part I. chap. i. ii. &c.

Mtives to
irtue.

have been the effect of his imprudence or weakneſs, yet few of them are ſharpened by a ſenſe of guilt, and none of them by a conſciouſneſs of wickedneſs, which ſurely is their keeneſt ſting;—that they are common to him with the beſt of men;—that they ſeldom or never attack him quite unprepared, but rather guarded with a conſciouſneſs of his own ſincerity and virtue, with a faith and truſt in Providence, and a firm reſignation to its perfect orders;—that they may be improved as means of correction, or materials to give ſcope and ſtability to his virtues;—and, to name no more, they are conſiderably leſſened, and often ſweetened to him, by the general ſympathy of the wiſe and good.

213
enjoy-
nts.

His enjoyments are more numerous, or, if leſs numerous, yet more intenſe than thoſe of the bad man: for he ſhares in the joys of others by rebound; and every increaſe of *general* or *particular* happineſs is a real addition to his own. It is true, his friendly *ſympathy* with others ſubjects him to ſome pains which the hard-hearted wretch does not feel; yet to give a looſe to it, is a kind of agreeable diſcharge. It is ſuch a ſorrow as he loves to indulge; a ſort of pleaſing anguiſh that ſweetly melts the mind, and terminates in a ſelf-approving joy. Though the good man may want means to execute, or be diſappointed in the ſucceſs of, his benevolent purpoſes; yet, as was formerly † obſerved, he is ſtill conſcious of good affection, and that conſciouſneſs is an enjoyment of a more delightful ſavour than the greateſt triumphs of ſucceſsful vice. If the *ambitious*, *covetous*, or *voluptuous*, are diſappointed, their paſſions recoil upon them with a fury proportioned to their opinion of the value of what they purſue, and their hope of ſucceſs; while they have nothing within to balance the diſappointment, unleſs it is an uſeleſs fund of pride, which, however, *frequently* turns mere accidents into mortifying affronts, and exalts grief into rage and frenzy. Whereas the meek, humble, and benevolent temper, is its own reward, is ſatisfied from within; and, as it magnifies greatly the pleaſure of ſucceſs, ſo it wonderfully alleviates, and in a manner annihilates, all pain for the want of it.

214
rom me-
ited eſ-
eem and
ympathy.

As the good man is conſcious of loving and wiſhing well to all mankind, he muſt be ſenſible of his deſerving the eſteem and good-will of all; and this ſuppoſed reciprocation of ſocial feelings is, by the very frame of our nature, made a ſource of very intenſe and enlivening joys. By this ſympathy of affections and intereſts, he feels himſelf intimately united with the human race; and, being ſenſibly *alive* over the whole ſyſtem, his heart receives and becomes reſponſive to every touch given to any part. So that, as an eminent *philoſopher* * finely expreſſes it, he gathers contentment and delight from the pleaſed and happy ſtates of thoſe around him, from accounts and relations of ſuch happineſs, from the very countenances, geſtures, voices, and ſounds, even of creatures foreign to our kind, whoſe ſigns of joy and contentment he can any way diſcern.

215
Do not interfere with other joys.

Nor do thoſe generous affections ſtop any other natural ſource of joy whatever, or deaden his ſenſe of any innocent gratification. They rather keep the ſeveral *ſenſes* and *powers of enjoyment* open and diſengaged, intenſe and uncorrupted by riot or abuſe; as is evident to any one who conſiders the diſſipated, unfeeling ſtate of men of *pleaſure*, *ambition*, or *intereſt*, and compares it with the ſerene and gentle ſtate of a mind at peace with itſelf, and friendly to all mankind, unruffled by any violent emotion, and ſenſible to every good-natured and alluring joy.

From Happineſs.

216
The miſery of exceſs in the private paſſions.

It were eaſy, by going through the different ſets of affections mentioned formerly †, to ſhow, that it is only by maintaining the proportion ſettled there, that the mind arrives at true repoſe and ſatisfaction. If *fear* exceeds that proportion, it ſinks into melancholy and dejection. If *anger* paſſes juſt bounds, it ferments into rage and revenge, or ſubſides into a ſullen corroding gloom, which embitters every good, and renders one exquiſitely ſenſible to every ill. The *private* paſſions, the *love of honour* eſpecially, whoſe impulſes are more generous, as its effects are more diffuſive, are inſtruments of private pleaſure; but if they are diſproportioned to our *wants*, or to the *value* of their ſeveral objects, or to the *balance* of other paſſions equally neceſſary and more amiable, they become inſtruments of intenſe pain and miſery. For, being now deſtitute of that counterpoiſe which held them at a due pitch, they grow turbulent, peeviſh, and revengeful, the cauſe of conſtant reſtleſſneſs and torment, ſometimes flying out into a wild delirious joy, at other times ſettling in a deep ſplenetic grief. The concert between reaſon and paſſion is then broke: all is diſſonance and diſtraction within. The mind is out of frame, and feels an agony proportioned to the violence of the reigning paſſion.

217
In the public affection.

The caſe is much the ſame, or rather worſe, when any of the particular *kind* affections are out of their natural order and proportion; as happens in the caſe of *effeminate pity*, *exorbitant love*, *parental dotage*, or any *party paſſion*, where the juſt regards to ſociety are ſupplanted. The more *ſocial* and *diſintereſted* the paſſion is, it breaks out into the wilder exceſſes, and makes the more dreadful havock both within and abroad; as is but too apparent in thoſe caſes where a falſe ſpecies of *religion*, *honour*, *zeal*, or *party-rage*, has ſeized on the natural enthuſiaſm of the mind, and worked it up to madneſs. It breaks through all ties *natural* and *civil*, diſregards the moſt ſacred and ſolemn obligations, ſilences every other affection whether *public* or *private*, and transforms the moſt gentle natures into the moſt ſavage and inhuman.

218
Happineſs of well proportioned paſſions.

Whereas, the man who keeps the *balance* of *affection* even, is eaſy and ſerene in his motions; mild, and yet affectionate; uniform and conſiſtent with himſelf: is not liable to diſagreeable colliſions of intereſts and paſſions; gives always place to the moſt friendly and humane affections, and never to diſpoſitions or acts of reſentment, but on high occaſions, when the *ſecurity* of the *private*, or *welfare* of the *public* ſyſtem, or the *great intereſts* of mankind, neceſſarily require a noble indignation; and even then he obſerves a juſt meaſure in wrath; and laſt of all, he proportions every paſſion to the value of the object he affects, or to the importance of the end he purſues.

219
Sum of the argument.

To ſum up this part of the argument, the *honeſt* and *good* man has eminently the advantage of the *knaviſh* and *ſelfiſh* wretch in every reſpect. The pleaſures which the *laſt* enjoys flow chiefly from external advantages and gratifications; are ſuperficial and tranſitory; daſhed with long intervals of ſatiety, and frequent

ee Part II.
ap. ii.

* Vide Shafteſb. Inq. into Virtue, Book II.

† See Part I. chap. i. ii.

quent returns of remorſe and fear; dependent on favourable accidents and conjunctures; and ſubjected to the humours of men. But the *good* man is ſatisfied from himſelf; his principal poſſeſſions lie within, and therefore beyond the reach of the caprice of men or fortune; his enjoyments are exquiſite and permanent; accompanied with no inward checks to damp them, and always with ideas of dignity and ſelf-approbation; may be taſted at any time, and in any place. The gratifications of *vice* are turbulent and unnatural, generally ariſing from the relief of paſſions in themſelves intolerable, and iſſuing in tormenting reflection; often irritated by diſappointment, always inflamed by enjoyment, and yet ever cloyed with repetition. The pleaſures of *virtue* are calm and natural; flowing from the exerciſe of kind affections, or delightful reflections in conſequence of them; not only agreeable in the proſpect, but in the preſent feeling; they never ſatiate nor loſe their reliſh; nay, rather the admiration of virtue grows ſtronger every day; and not only is the deſire but the enjoyment heightened by every new gratification; and, unlike to moſt others, it is increaſed, not diminiſhed, by ſympathy and communication.—In fine, the ſatisfactions of *virtue* may be purchaſed without a bribe, and poſſeſſed in the humbleſt as well as the moſt triumphant fortune; they can bear the ſtricteſt review, do not change with circumſtances, nor grow old with time. Force cannot rob, nor fraud cheat us of them; and, to crown all, inſtead of abating, they enhance every other pleaſure.

220 External effects of virtue. But the happy conſequences of *virtue* are ſeen not only in the internal enjoyments it affords a man, but "in the favourable diſpoſition of external cauſes towards him, to which it contributes."

221 On the body. As *virtue* gives the ſober poſſeſſion of one's ſelf, and the command of one's paſſions, the conſequence muſt be heart's eaſe, and a fine natural flow of ſpirits, which conduce more than any thing elſe to health and long life. Violent paſſions, and the exceſſes they occaſion, gradually impair and wear down the machine. But the calm placid ſtate of a temperate mind, and the healthful exerciſes in which *virtue* engages her faithful votaries, preſerve the natural functions in full vigour and harmony, and exhilarate the ſpirits, which are the chief inſtruments of action.

222 On one's fortune, intereſt, &c. It may by ſome be thought odd to aſſert, that *virtue* is no enemy to a man's *fortune* in the preſent ſtate of things.—But if by *fortune* be meant a moderate or competent ſhare of *wealth*, *power*, or *credit*, not overgrown degrees of them; what ſhould hinder the virtuous man from obtaining that? He cannot cringe or fawn, it is true, but he can be civil and obliging as well as the knave; and ſurely his civility is more alluring, becauſe it has more manlineſs and grace in it than the mean adulation of the other: he cannot cheat or undermine; but he may be cautious, provident, watchful of occaſions, and equally prompt with the rogue in improving them: he ſcorns to proſtitute himſelf as a pander to the paſſions, or as a tool to the vices, of mankind; but he may have as ſound an underſtanding and as good capacities for promoting their real intereſts as the veriest court ſlave: and then he is more faithful and true to thoſe who employ him. In the common courſe of buſineſs, he has the ſame chances with the knave of acquiring a fortune, and riſing in the world. He may have equal abilities, equal induſtry, equal attention to buſineſs; and in other reſpects he has greatly the advantage of him. People love better to deal with him; they can truſt him more; they know he will not impoſe on them, nor take advantage of them, and can depend more on his word than on the oath or ſtrongeſt ſecurities of others. Whereas what is commonly called *cunning*, which is the *offspring of ignorance*, and conſtant *companion* of *knavery*, is not only a mean-ſpirited, but a very ſhort-ſighted talent, and a fundamental obſtacle in the road of buſineſs. It may indeed procure immediate and petty gains; but it is attended with dreadful abatements, which do more than overbalance them, both as it ſinks a man's credit when diſcovered, and cramps that largeneſs of mind which extends to the remoteſt as well as the neareſt intereſt, and takes in the moſt durable equally with the moſt tranſient gains. It is therefore eaſy to ſee how much a man's *credit* and *reputation*, and conſequently his ſucceſs, depend on his honeſty and virtue.

223 On one's peace and ſecurity. With regard to *ſecurity* and *peace* with his neighbours, it may be thought, perhaps, that the man of a quiet forgiving temper, and a flowing benevolence and courteſy, is much expoſed to injury and affronts from every proud or peeviſh mortal, who has the power or will to do miſchief. If we ſuppoſe, indeed, this *quietneſs* and *gentleneſs* of nature accompanied with *cowardice* and *puſillanimity*, this may often be the caſe; but in reality the good man is bold as a lion, and ſo much the bolder for being the calmer. Such a perſon will hardly be a butt to mankind. The ill natured will be afraid to provoke him, and the good natured will not incline to do it. Beſides, *true virtue*, which is conducted by reaſon, and exerted gracefully and without parade, is a moſt inſinuating and commanding thing; if it cannot diſarm malice and reſentment at once, it will wear them out by degrees, and ſubdue them at length. How many have, by favours and prudently yielding, triumphed over an enemy, who would have been inflamed into tenfold rage by the fierceſt oppoſition! In fine, *goodneſs* is the moſt univerſally popular thing that can be.

224 On one's family. To conclude; the good man may have ſome enemies, but he will have more friends; and, having given ſo many marks of private friendſhip or public virtue, he can hardly be deſtitute of a patron to protect, or a ſanctuary to entertain him, or to protect or entertain his children when he is gone. Though he ſhould have little elſe to leave them, he bequeaths them the faireſt, and generally the moſt unenvied, inheritance of a *good name*, which, like good ſeed ſown in the field of futurity, will often raiſe up unſolicited friends, and yield a benevolent harveſt of unexpected charities. But ſhould the fragrance of the parent's virtue prove offenſive to a perverſe or envious age, or even draw perſecution on the friendleſs orphans, there is *one* in heaven who will be more than a father to them, and recompenſe their parent's virtues by ſhowering down bleſſings on them.

CHAP. III. *Motives to* VIRTUE *from the* BEING *and* PROVIDENCE *of* GOD.

225 Two external motives to virtue. BESIDES the intereſting motive mentioned in the laſt Chapter, there are two great motives of *virtue*,

Mives to irtue. ſtrictly connected with *human life*, and reſulting from the very *conſtitution* of the *human mind*. The firſt is the BEING and PROVIDENCE of GOD; the ſecond is the IMMORTALITY of the SOUL, with *future rewards* and *puniſhments*.

226 Thir im- poance. It appears from Chap. IV. of Part II. that *man*, by the *conſtitution* of his nature, is deſigned to be a RELIGIOUS CREATURE. He is intimately connected with the *Deity*, and neceſſarily dependent on him. From that *connexion* and neceſſary *dependence* reſult various *obligations* and *duties*, without fulfilling which, ſome of his ſublimeſt powers and affections would be incomplete and abortive. If he be likewiſe an IMMORTAL creature, and if his *preſent conduct* ſhall affect his *future happineſs* in *another* ſtate as well as in the *preſent*, it is evident that we take only a *partial view* of the *creature*, if we leave out this important property of his nature; and make a *partial eſtimate of human life*, if we ſtrike out of the account, or overlook, that part of his duration which runs out into eternity.

227 Py, It is evident from the above-mentioned Chapter, that "to have a reſpect to the *Deity* in our temper and conduct, to *venerate* and *love* his *character*, to *adore* his *goodneſs*, to *depend upon* and *reſign* ourſelves to his *providence*, to *ſeek* his *approbation*, and *act* under a *ſenſe* of his *authority*, is a *fundamental part* of *moral virtue*, and the *completion* of the *higheſt deſtination* of *our nature*."

228 a pport to ue; But as *piety* is an eſſential part of virtue, ſo likewiſe it is a *great ſupport* and *enforcement* to the practice of it. To contemplate and admire a Being of ſuch tranſcendent dignity and perfection as GOD, muſt naturally and neceſſarily open and enlarge the mind, give a freedom and ampleneſs to its powers, and a grandeur and elevation to its aims. For, as an excellent *divine* obſerves, "the greatneſs of an object, and the excellency of the act of any AGENT about a tranſcendent object, doth mightily tend to the enlargement and improvement of his faculties." Little objects, mean company, mean cares, and mean buſineſs, cramp the mind, contract its views, and give it a creeping air and deportment. But when it ſoars above mortal cares and mortal purſuits into the regions of divinity, and converſes with the greateſt and beſt of Beings, it ſpreads itſelf into a wider compaſs, takes higher flights in reaſon and goodneſs, becomes godlike in its air and manners. *Virtue* is, if one may ſay ſo, both the *effect* and *cauſe* of largeneſs of mind. It requires that one think freely, and act nobly. Now what can conduce more to freedom of thought and dignity of action, than to conceive worthily of GOD, to reverence and adore his unrivalled excellency, to imitate and tranſcribe that excellency into our own nature, to remember our relation to him, and that we are the images and repreſentatives of his glory to the reſt of the creation? Such feelings and exerciſes muſt and will make us ſcorn all actions that are baſe, unhandſome, or unworthy our ſtate; and the relation we ſtand in to GOD will irradiate the mind with the light of wiſdom, and ennoble it with the liberty and dominion of virtue.

229 uard d en- cement virtue. The influence and efficacy of *religion* may be conſidered in another light. We all know that the preſence of a friend, a neighbour, or any number of ſpectators, but eſpecially an auguſt aſſembly of them, uſes to be a conſiderable check upon the conduct of one who is not loſt to all ſenſe of honour and ſhame, and contributes to reſtrain many irregular ſallies of paſſion. In the ſame manner we may imagine, that the awe of ſome ſuperior mind, who is ſuppoſed privy to our ſecret conduct, and armed with full power to reward or puniſh it, will impoſe a reſtraint on us in ſuch actions as fall not under the controul or animadverſon of others. If we go ſtill higher, and ſuppoſe our inmoſt thoughts and darkeſt deſigns, as well as our moſt ſecret actions, to lie open to the notice of the ſupreme and univerſal Mind, who is both the *ſpectator* and *judge* of human actions, it is evident that the belief of ſo auguſt a preſence, and ſuch awful inſpection, muſt carry a reſtraint and weight with it proportioned to the ſtrength of that belief, and be an additional motive to the practice of many duties which would not have been performed without it.

From the Immortality of the Soul.

230 Exerciſes of piety improving to virtue. It may be obſerved farther, that "to live under an habitual ſenſe of the *Deity* and his great *adminiſtration*, is to be converſant with *wiſdom*, *order*, and *beauty*, in the higheſt ſubjects, and to receive the delightful reflexions and benign feelings which theſe excite while they irradiate upon him from every ſcene of nature and providence." How improving muſt ſuch views be to the mind, in dilating and exalting it above thoſe puny intereſts and competitions which agitate and inflame the bulk of mankind againſt each other!

CHAP. IV. *Motive to* VIRTUE *from the* IMMORTALITY *of the* SOUL, *&c.*

231 Metaphyſical arguments for its immortality. THE other motive mentioned was the *immortality* of the ſoul, with *future rewards* and *puniſhments*. The *metaphyſical* proofs of the ſoul's immortality are commonly drawn from—its *ſimple*, *uncompounded*, and *indiviſible* nature; from whence it is concluded, that it cannot be corrupted or extinguiſhed by a diſſolution or deſtruction of its parts:—from its having a *beginning* of *motion* within itſelf; whence it is inferred, that it cannot diſcontinue and loſe its motion:—from the different properties of *matter* and *mind*, the *ſluggiſhneſs* and *inactivity* of the *one*, and the immenſe *activity* of the *other*; its prodigious flight of *thought* and *imagination*; its *penetration*, *memory*, *foreſight*, and *anticipations* of *futurity*; from whence it is concluded, that a being of ſo divine a nature cannot be extinguiſhed. But as theſe metaphyſical proofs depend on intricate reaſonings concerning the *nature*, *properties*, and *diſtinctions* of *body* and *mind*, with which we are not very well acquainted, they are not obvious to ordinary underſtandings, and are ſeldom ſo convincing even to thoſe of higher reach, as not to leave ſome doubts behind them. Therefore perhaps it is not ſo ſafe to reſt the proof of ſuch an important article on what many may call the ſubtilities of ſchool learning. Thoſe proofs which are brought from *analogy*, from the *moral conſtitution* and *phenomena* of the *human mind*, the *moral attributes* of God, and the *preſent courſe of things*, and which therefore are called the *moral* arguments, are the plaineſt and generally the moſt ſatisfying. We ſhall ſelect only one or two from the reſt.

232 Moral proof from analogy. In tracing the *nature* and *deſtination* of any being, we form the ſureſt judgment from his *powers* of *action*, and the ſcope and *limits* of theſe, compared with his *ſtate*,

ſtate, or with that *field* in which they are exerciſed. If this being paſſes through different ſtates, or fields of action, and we find a *ſucceſſion* of powers adapted to the different periods of his progreſs, we conclude that he was deſtined for thoſe ſucceſſive ſtates, and reckon his nature *progreſſive*. If, beſides the immediate ſet of powers which fit him for action in his preſent ſtate, we obſerve another ſet which appear ſuperfluous if he were to be confined to it, and which point to another or higher one, we naturally conclude, that he is not deſigned to remain in his preſent ſtate, but to advance to that for which thoſe ſupernumerary powers are adapted. Thus we argue, that the *inſect*, which has wings forming or formed, and all the apparatus proper for flight, is not deſtined always to creep on the ground, or to continue in the torpid ſtate of adhering to a wall, but is deſigned in its ſeaſon to take its flight in air. Without this farther deſtination, the admirable mechaniſm of wings and the other apparatus would be uſeleſs and abſurd. The ſame kind of reaſoning may be applied to man, while he lives only a ſort of *vegetative* life in the womb. He is furniſhed even there with a beautiful apparatus of organs, eyes, ears, and other delicate ſenſes, which receive nouriſhment indeed, but are in a manner folded up, and have no proper exerciſe or uſe in their preſent confinement *. Let us ſuppoſe ſome intelligent ſpectator, who never had any connexion with man, nor the leaſt acquaintance with human affairs, to ſee this odd phenomenon, a creature formed after ſuch a manner, and placed in a ſituation apparently unſuitable to ſuch various machinery: muſt he not be ſtrangely puzzled about the uſe of his complicated ſtructure, and reckon ſuch a profuſion of art and admirable workmanſhip loſt on the ſubject; or reaſon by way of anticipation, that a creature endued with ſuch various yet unexerted capacities, was deſtined for a more enlarged ſphere of action, in which thoſe latent capacities ſhall have full play? the vaſt variety and yet beautiful ſymmetry and proportions of the ſeveral parts and organs with which the creature is endued, and their apt coheſion with, and dependence on, the curious receptacle of their life and nouriſhment, would forbid his concluding the whole to be the birth of chance, or the bungling effort of an unſkilful artiſt; at leaſt would make him demur a while at ſo harſh a ſentence. But if, while he is in this ſtate of uncertainty, we ſuppoſe him to ſee the babe, after a few ſucceſsful ſtruggles, throwing off his fetters, breaking looſe from his little dark priſon, and emerging into open day, then unfolding his recluſe and dormant powers, breathing in air, gazing at light, admiring colours, ſounds, and all the *fair variety* of nature, immediately his doubts clear up, the propriety and excellency of the workmanſhip dawn upon him with full luſtre, and the whole myſtery of the firſt period is unravelled by the opening of this new ſcene. Though in this *ſecond* period the creature lives chiefly a kind of *animal life*, i. e. of *ſenſe* and *appetite*, yet by various trials and obſervations he gains experience, and by the gradual evolution of the powers of *imagination* he ripens apace for a *higher* life, for exerciſing the arts of *deſign* and *imitation*, and of thoſe in which ſtrength or dexterity are more requiſite than acuteneſs or reach of judgment. In the ſucceeding *rational* or *intellectual* period, his *underſtanding*, which formerly crept in a lower, mounts into a higher ſphere, canvaſſes the natures, judges of the relations of things, forms ſchemes, deduces conſequences from what is paſt, and from preſent as well as paſt collects future events. By this ſucceſſion of ſtates, and of correſpondent culture, he grows up at length into a *moral*, a *ſocial*, and a *political* creature. This is the laſt period at which we perceive him to arrive in this his mortal career. Each *period* is introductory to the next ſucceeding one; each *life* is a field of exerciſe and improvement for the next higher one; the life of the *fœtus* for that of the *infant*, the life of the *infant* for that of the *child*, and all the lower for the higheſt and beſt §.—But is this the laſt period of nature's progreſſion? Is this the utmoſt extent of her plot, where ſhe winds up the drama, and diſmiſſes the actor into eternal oblivion? Or does he appear to be inveſted with ſupernumerary powers, which have not full exerciſe and ſcope even in the laſt ſcene, and reach not that maturity or perfection of which they are capable; and therefore point to ſome higher ſcene where he is to ſuſtain another and more important character than he has yet ſuſtained? If any ſuch there are, may we not conclude by analogy, or in the ſame way of anticipation as before, that he is deſtined for that after part, and is to be produced upon a more auguſt and ſolemn ſtage, where his ſublimer powers ſhall have proportioned action, and his nature attain its completion.

233 Powers in man which point to an after-life. 234 Intellectual.

If we attend to that *curioſity*, or prodigious *thirſt* of *knowledge*, which is natural to the mind in every period of its progreſs, and conſider withal the endleſs round of buſineſs and care, and the various hardſhips to which the bulk of mankind are chained down; it is evident, that in this preſent ſtate it is impoſſible to expect the gratification of an appetite at once ſo inſatiable and ſo noble. Our *ſenſes*, the ordinary organs by which knowledge is let into the mind, are always imperfect, and often fallacious; the advantages of aſſiſting or correcting them are poſſeſſed by few; the difficulties of finding out truth amidſt the various and contradictory opinions, intereſts, and paſſions of mankind, are many; and the wants of the creature, and of thoſe with whom he is connected, numerous and urgent: ſo that it may be ſaid of moſt men, that their *intellectual* organs are as much ſhut up and ſecluded from proper nouriſhment and exerciſe in that little circle to which they are confined, as the bodily organs are in the womb. Nay, thoſe who to an aſpiring genius have added all the aſſiſtances of art, leiſure, and the moſt liberal education, what narrow proſpects can even they take of this unbounded ſcene of things from that little eminence on which they ſtand? and how eagerly do they ſtill graſp at new diſcoveries, without any ſatisfaction or limit to their ambition?

235 Moral powers.

But ſhould it be ſaid, that man is made for *action*, and not for *ſpeculation*, or fruitleſs ſearches after knowledge, we aſk, For what kind of action? Is it only for bodily exerciſes, or for *moral*, *political*, and *religious* ones? Of all theſe he is capable; yet, by the unavoidable circumſtances of his lot, he is tied down to the *former*, and has hardly any leiſure to think of the *latter*, or, if he has, wants the proper inſtruments of exerting them. The *love of virtue*, *of one's friends* and *country*, the *generous ſympathy with mankind*, and *heroic zeal of doing good*, which are all ſo *natural* to great and good

---

* *Vide* Ludov. Viv. *de Relig. Chriſt.* Lib. II. *de vita Uteri*, &c.

§ *See* Butler's *Analogy*, Part I.

good minds, and ſome traces of which are found in the loweſt, are ſeldom united with proportioned means or opportunities of exerciſing them: ſo that the *moral* ſpring, the noble energies and impulſes of the mind, can hardly find proper ſcope even in the moſt fortunate condition; but are much depreſſed in ſome, and almoſt entirely reſtrained in the generality, by the numerous clogs of an indigent, ſickly, or embarraſſed life. Were ſuch mighty powers, ſuch godlike affections, planted in the human breaſt to be folded up in the narrow womb of our preſent exiſtence, never to be produced into a more *perfect* life, nor to expatiate in the ample career of immortality?

236
U atisfied
d res of
e tence
a happi-
ne.

Let it be conſidered, at the ſame time, that no poſſeſſion, no enjoyment, within the round of mortal things, is commenſurate to the deſires, or adequate to the capacities, of the mind. The moſt exalted condition has its abatements; the happieſt conjuncture of fortune leaves many wiſhes behind; and, after the higheſt gratifications, the mind is carried forward in purſuit of new ones without end. Add to all, the fond *deſire* of *immortality*, the ſecret *dread* of *non-exiſtence*, and the high unremitting *pulſe* of the ſoul beating for *perfection*, joined to the improbability or the impoſſibility of attaining it *here;* and then judge whether this elaborate ſtructure, this magnificent apparatus of inward powers and organs, does not plainly point out an *hereafter, and intimate eternity to man?* Does nature give the finiſhing touches to the leſſer and ignoble inſtances of her ſkill, and raiſe every other creature to the maturity and perfection of his being; and ſhall ſhe leave her principal workmanſhip unfiniſhed? Does ſhe carry the *vegetative* and *animal* life in *man* to their full vigour and higheſt deſtination; and ſhall ſhe ſuffer his *intellectual*, his *moral*, his *divine* life, to fade away, and be for ever extinguiſhed? Would ſuch abortions in the *moral* world be congruous to that *perfection of wiſdom and goodneſs* which upholds and adorns the *natural?*

237
Terefore
m im-
rtal.

We muſt therefore conclude from this detail, that the *preſent ſtate*, even at its beſt, is only the WOMB of man's being, in which the nobleſt principles of his nature are in a manner fettered, or ſecluded from a correſpondent ſphere of action; and therefore deſtined for a future and unbounded ſtate, where they ſhall emancipate themſelves, and exert the fulneſs of their ſtrength. The moſt accompliſhed mortal, in this low and dark apartment of nature, is only the *rudiments* of what he ſhall be when he takes his ethereal flight, and puts on immortality. Without a reference to that ſtate, *man* were a mere abortion, a rude unfiniſhed embryo, a monſter in nature. But this being once ſuppoſed, he ſtill maintains his rank of the maſterpiece of the creation; his latent powers are all ſuitable to the *harmony* and *progreſſion* of nature; his noble aſpirations, and the pains of his diſſolution, are his efforts towards a *ſecond* birth, the pangs of his delivery into light, liberty, and perfection; and *death*, his diſcharge from gaol, his ſeparation from his fellow priſoners, and introduction into the aſſembly of thoſe heroic ſpirits who are gone before him, and of their great eternal Parent. The fetters of his mortal coil being looſened, and his priſon walls broke down, he will be bare and open on every ſide to the admiſſion of *truth* and *virtue*, and their fair attendant *happineſs;* every *vital* and *intellectual* ſpring will evolve itſelf with a divine elaſticity in the free air of heaven. He will not then peep at the univerſe and its glorious Author through a dark grate or a groſs medium, nor receive the reflections of his glory through the ſtrait openings of ſenſible organs: but will be *all eye, all ear, all ethereal and divine feeling* *. Let one part, however, of the analogy be attended to: That as in the womb we receive our original conſtitution, form, and the eſſential *ſtamina* of our being, which we carry along with us into the light, and which greatly affect the ſucceeding periods of our life; ſo our temper and condition in the *future* life will depend on the conduct we have obſerved, and the character we have formed, in the *preſent* life. We are *here* in *miniature* what we ſhall be at *full length hereafter.* The firſt *rude ſketch* or *outlines* of *reaſon* and *virtue* muſt be drawn at preſent, to be afterwards enlarged to the *ſtature* and *beauty* of angels.

From the Immortality of the Soul.

238
Immortality a guard and incentive to virtue.

This, if duly attended to, muſt prove not only a *guard*, but an admirable *incentive* to virtue. For he who faithfully and ardently follows the light of knowledge, and pants after higher improvements in virtue, will be wonderfully animated and inflamed in that purſuit by a full conviction that the ſcene does not cloſe with life—that his ſtruggles, ariſing from the weakneſs of nature and the ſtrength of habit, will be turned into triumphs—that his career in the track of wiſdom and goodneſs will be both ſwifter and ſmoother—and thoſe generous ardours with which he glows towards *heaven*, i. e. the *perfection* and *immortality of virtue*, will find their adequate object and exerciſe in a ſphere proportionably enlarged, incorruptible, immortal. On the other hand, what an inexpreſſible damp muſt it be to the good man, to dread the total extinction of that *light* and *virtue*, without which *life*, nay, *immortality* itſelf, were not worth a ſingle wiſh?

239
Proof from the inequality of preſent diſtributions.

Many writers draw their proofs of the immortality of the ſoul, and of a future ſtate of rewards and puniſhments, from the unequal diſtribution of theſe here. It cannot be diſſembled that wicked men often eſcape the *outward* puniſhment due to their crimes, and do not feel the *inward* in that meaſure their demerit ſeems to require, partly from the callouſneſs induced upon their nature by the habits of vice, and partly from the diſſipation of their minds abroad by pleaſure or buſineſs—and ſometimes good men do not reap all the natural and genuine fruits of their virtue, through the many unforeſeen or unavoidable calamities in which they are involved. To the ſmalleſt reflection, however, it is obvious, that the natural tendency of virtue is to produce happineſs; that if it were univerſally practiſed, it would, in fact, produce the greateſt ſum of happineſs of which human nature is capable; and that this tendency is defeated only by numerous individuals, who, forſaking the laws of virtue, injure and oppreſs thoſe who ſteadily adhere to them. But the natural tendency of virtue is the reſult of that conſtitution of things which was eſtabliſhed by God at the creation of the world. This being the caſe, we muſt either conclude, that there will be a future ſtate, in which all the moral obliquities of the preſent ſhall be made ſtraight; or elſe admit, that the deſigns of infinite wiſdom, goodneſs, and power, can be finally defeated by the perverſe conduct of human weakneſs.—But this laſt ſuppoſition is ſo extravagantly abſurd,

---

* *Vide* Religion of Nature, § 9.

Motives to Virtue.

that the reality of a future ſtate, the only other poſſible alternative, may be pronounced to have the evidence of perfect demonſtration.

240 Belief of immortality, &c. a great ſupport amidſt trials.

Virtue has preſent rewards, and *vice* preſent puniſhments annexed to it; ſuch rewards and puniſhments as make *virtue*, in moſt caſes that happen, far more eligible than *vice*: but, in the infinite variety of human contingencies, it may ſometimes fall out, that the inflexible practice of virtue ſhall deprive a man of conſiderable advantages to himſelf, his family, or friends, which he might gain by a well-timed piece of roguery; ſuppoſe by betraying his truſt, voting againſt his conſcience, ſelling his country, or any other crime where the ſecurity againſt diſcovery ſhall heighten the temptation. Or, it may happen, that a ſtrict adherence to his honour, to his religion, to the cauſe of liberty and virtue, ſhall expoſe him, or his family, to the loſs of every thing, nay, to poverty, ſlavery, death itſelf, or to torments far more intolerable. Now what ſhall ſecure a man's virtue in circumſtances of ſuch trial? What ſhall enforce the obligations of conſcience againſt the allurements of ſo many intereſts, the dread of ſo many and ſo terrible evils, and the almoſt unſurmountable averſion of human nature to exceſſive pain! The conflict is the greater, when the circumſtances of the crime are ſuch as eaſily admit a variety of alleviations from *neceſſity*, *natural affection*, *love to one's family* or *friends*, perhaps in indigence: theſe will give it even the air of virtue. Add to all, that the crime may be thought to have few bad conſequences,—may be eaſily concealed,—or imagined poſſible to be retrieved in a good meaſure by future good conduct. It is obvious to which ſide moſt men will lean in ſuch a caſe; and how much need there is of a balance in the oppoſite ſcale, from the conſideration of a *God*, of a *Providence*, and of an *immortal ſtate of retribution*, to keep the mind firm and uncorrupted in thoſe or like inſtances of ſingular trial or diſtreſs.

241 In the general courſe of life.

But without ſuppoſing ſuch peculiar inſtances, a ſenſe of a governing Mind, and a perſuaſion that virtue is not only befriended by him here, but will be crowned by him hereafter with rewards ſuitable to its nature, vaſt in themſelves, and immortal in their duration, muſt be not only a mighty ſupport and incentive to the practice of virtue, but a ſtrong barrier againſt vice. The thoughts of an Almighty Judge, and of an impartial future reckoning, are often alarming, inexpreſſibly ſo, even to the ſtouteſt offenders. On the other hand, how ſupporting muſt it be to the good man, to think that he acts under the eye of his friend, as well as judge! How improving, to conſider the *preſent ſtate* as connected with a *future* one, and every relation in which he ſtands as a *ſchool* of *diſcipline* for his *affections*; every *trial* as the *exerciſe* of ſome *virtue*; and the virtuous deeds which reſult from both, as introductory to higher ſcenes of *action* and *enjoyment*! Finally, How tranſporting is it to view *death* as his *diſcharge* from the *warfare* of *mortality*, and a triumphant *entry* into a ſtate of freedom, ſecurity, and perfection, in which knowledge and wiſdom ſhall break upon him from every quarter; where each faculty ſhall have its proper object: and his virtue, which was often damped or defeated here, ſhall be enthroned in undiſturbed and eternal empire?

From the Immortality of the Soul.

242 Advantages of the Chriſtian ſcheme, and its connexion with natural religion or morality.

On reviewing this ſhort *ſyſtem* of *morals*, and the *motives* which ſupport and enforce it, and comparing both with the CHRISTIAN *ſcheme*, what *light* and *vigour* do they borrow from thence! How clearly and fully does CHRISTIANITY lay open the *connexions* of our nature, both *material* and *immaterial*, and *future* as well as *preſent*! What an ample and beautiful detail does it preſent of the *duties* we owe to *God*, to *ſociety*, and *ourſelves*, promulgated in the moſt ſimple, intelligible, and popular manner; diveſted of every partiality of ſect or nation; and adapted to the general ſtate of mankind! With what bright and alluring *examples* does it illuſtrate and recommend the practice of thoſe duties: and with what mighty *ſanctions* does it enforce that practice! How ſtrongly does it deſcribe the *corruptions* of our nature; the *deviations* of our life from the *rule* of *duty*, and the *cauſes* of both! How marvellous and benevolent a plan of *redemption* does it unfold, by which thoſe corruptions may be remedied, and our *nature* reſtored from its *deviations* to tranſcendent heights of *virtue* and *piety*! Finally, What a fair and comprehenſive proſpect does it give us of the *adminiſtration* of *God*, of which it repreſents the *preſent ſtate* only as a *ſmall period*, and a *period* of *warfare* and *trial*! How ſolemn and unbounded are the ſcenes which it opens beyond it! the *reſurrection* of the *dead*, the *general judgment*, the *equal diſtribution* of *rewards* and *puniſhments* to the *good* and the *bad*; and the full *completion* of *divine wiſdom* and *goodneſs* in the *final eſtabliſhment* of *order*, *perfection*, and *happineſs*! How glorious then is that SCHEME of RELIGION, and how worthy of *affection* as well as of *admiration*, which, by making ſuch *diſcoveries*, and affording ſuch *aſſiſtances*, has diſcloſed the unfading fruits and triumphs of VIRTUE, and ſecured its intereſts beyond the power of TIME and CHANCE.

Moral ‖ Morass.

MORAL Senſe, that whereby we perceive what is good, virtuous, and beautiful, in actions, manners, and characters. See *MORAL Philoſophy*.

MORALITY. See *MORAL Philoſophy*.

MORANT-Point, the moſt eaſterly point or promontory of the iſland of Jamaica, in America. W. Long. 75. 56. N. Lat. 17. 56.

MORASS, a marſh, fen, or low moiſt ground, which receives the waters from above without having any deſcent to carry them off again. Somner derives the word from the Saxon *merſe*, "lake;" Salmaſius from *mare*, "a collection of waters;" others from the German *maraſt*, "a muddy place;" and others from *mareſc*, of *maricetum*, *à mariſcis*, i. e. ruſhes. See DRAINING, AGRICULTURE *Index*.

Moraſs, Morat.

In Scotland, Ireland, and the north of England, there is a particular kind of moraſſes called *moſſes*, or *peat-moſſes*, whence the country people dig their peat or turf for firing. See MOSS.

MORAT, or MURTEN, a conſiderable town of Switzerland,

Switzerland, capital of a bailiwick of the ſame name, belonging to the cantons of Bern and Friburg. It is ſeated on the lake Morat, on the road from Avenche to Bern, 10 miles weſt of Bern and 10 miles north-eaſt of Friburg. The lake is about ſix miles long and two broad, and the country about it pleaſant and well cultivated. The lakes of Morat and Neufchatel are parallel to each other, but the latter is more elevated, diſcharging itſelf by means of the river Broye into the lake of Neufchatel. According to M. de Luc, the former is 15 French feet above the level of Neufchatel lake; and both theſe lakes, as well as that of Bienne, ſeem formerly to have extended conſiderably beyond their preſent limits, and from the poſition of the country appear to have been once united. Formerly the large fiſh named *ſilurus glanis*, or the ſaluth, frequented theſe lakes, but has not been caught in them for a long time paſt. The environs of this town and lake were carefully examined by Mr Coxe, during his reſidence in Switzerland, who made ſeveral excurſions acroſs the lake to a ridge of hills ſituated betwixt it and Neufchatel. Here are many delightful proſpects; particularly one from the top of Mount Vuilly, which, he ſays, is perhaps the only central ſpot from which the eye can at once comprehend the vaſt amphitheatre formed on one ſide by the Jura ſtretching from the environs of Geneva as far as Baſle, and, on the other, by that ſtupendous chain of ſnowy Alps which extend from the frontiers of Italy to the confines of Germany, and is loſt at each extremity in the horizon. Morat is celebrated for the obſtinate defence it made againſt Charles the Bold, duke of Burgundy, and for the battle which afterwards followed on the 22d of June 1476, where the duke was defeated, and his army almoſt entirely deſtroyed *. Not far from the town, and adjoining to the high road, there ſtill remains a monument of this victory. It is a ſquare building, filled with the bones of Burgundian ſoldiers who were ſlain at the ſiege and in the battle; the number of which appears to have been very conſiderable. There are ſeveral inſcriptions in the Latin and German languages commemorating the victory.

MORATA, Olympia Fulvia, an Italian lady, diſtinguiſhed for her learning, was born at Ferrara, in 1526. Her father, after teaching the belles lettres in ſeveral cities of Italy, was made preceptor to the two young princes of Ferrara, the ſons of Alphonſus I. The uncommon abilities he diſcovered in his daughter determined him to give her all the advantages of education Meanwhile the princeſs of Ferrara ſtudying polite literature, it was judged expedient that ſhe ſhould have a companion in the ſame purſuit; and Morata being called, ſhe was heard by the aſtoniſhed courtiers to declaim in Latin, to ſpeak Greek, and to explain the paradoxes of Cicero. Her father dying, ſhe was obliged to return home to take upon her the management of family affairs, and the education of her brother and three ſiſters; both which ſhe executed with the greateſt diligence and ſucceſs. In the mean time Andrew Grunthler, a young German phyſician, had married her, and with him ſhe went to Germany, taking her brother along with her, whom ſhe inſtructed in the Latin and Greek tongues; and after ſtaying a ſhort time at Augſburg, went to Schweinfort in Franconia, where her huſband was born: but they had not been there long before that town was unhappily beſieged and burnt; however, eſcaping the flames, they fled in the utmoſt diſtreſs to Hammelburg. This place they were alſo obliged to quit, and were reduced to the laſt extremities, when the elector Palatine invited Grunthler to be profeſſor of phyſic at Heidelberg. He entered on his new office in 1554; but they no ſooner began to taſte the ſweets of repoſe, than a diſeaſe, occaſioned by the diſtreſſes and hardſhips they had ſuffered, ſeized upon Morata, who died in 1555, in the 29th year of her age; and her huſband and brother did not long ſurvive her. She compoſed ſeveral works, great part of which were burnt with the town of Schweinfort; the remainder, which conſiſt of orations, dialogues, letters, and tranſlations, were collected and publiſhed under the title of *Olympiæ Fulviæ Moratæ, fœminæ doctiſſimæ, et planè divinæ, opera omnia quæ hactenus inveniri potuerint; quibus Cœlii ſecundi curionis epiſtolæ ac orationes acceſſerunt.*

MORAVIA, a river of Turkey in Europe, which riſes in Bulgaria, runs north through Servia by Niſſa, and falls into the Danube at Semendria, to the eaſtward of Belgrade.

Moravia, a marquiſate of Germany, derives the name of *Mahern*, as it is called by the Germans, and of *Morawa*, as it is called by the natives, from the river of that name, which riſes in the mountains of the county of Glatz, and paſſes through the middle of it. It is bounded to the ſouth by Auſtria, to the north by Glatz and Sileſia, to the weſt by Bohemia, and to the eaſt by Sileſia and Hungary; being about 120 miles in length and 100 in breadth.

A great part of this country is overrun with woods and mountains, where the air is very cold, but much wholeſomer than in the low grounds, which are full of bogs and lakes. The mountains, in general, are barren; but the more champaign parts tolerably fertile, yielding corn, with plenty of hemp and flax, good ſaffron, and paſture. Nor is it altogether deſtitute of wine, red and white, fruits, and garden ſtuff. Moravia alſo abounds in horſes, black cattle, ſheep, and goats. In the woods and about the lakes there is plenty of wild fowl, game, veniſon, bees, honey, hares, foxes, wolves, beavers, &c. This country affords marble, alum, iron, ſulphur, ſaltpetre, and vitriol, with mineral waters, and warm ſprings; but ſalt is imported. Its rivers, of which the March, Morawa, or Morau, are the chief, abound with trout, crayfiſh, barbels, eels, perch, and many other ſorts of fiſh.

The language of the inhabitants is a dialect of the Sclavonic, differing little from the Bohemian; but the nobility and citizens ſpeak German and French.

Moravia was anciently inhabited by the Quadi, who were driven out by the Sclavi. Its kings, who were once powerful and independent, afterwards became dependent on, and tributary to, the German emperors and kings. At laſt, in the year 908, the Moravian kingdom was parcelled out among the Germans, Poles, and Hungarians. In 1086, that part of it properly called *Moravia* was declared a marquiſate by the German king Henry IV. and united with Bohemia, to whoſe dukes and kings it hath ever ſince been ſubject. Though it is not very populous, it contains about 42 greater or walled towns, 17 ſmaller or open towns, and 198 market towns, beſides villages, &c. The

---

* See Hiſ- ry of ance.

ſtates of the country conſiſt of the clergy, lords, knights, and burgeſſes; and the diets, when ſummoned by the regency, are held at Brunn. The marquiſate is ſtill governed by its own peculiar conſtitutions, under the *directorium in publicis et cameralibus*, and the ſupreme judicatory at Vienna. It is divided into ſix circles, each of which has its captain, and contributes to its ſovereign about one-third of what is exacted of Bohemia. Towards the expences of the military eſtabliſhment of the whole Auſtrian hereditary countries, its yearly quota is 1,856,490 florins. Seven regiments of foot, one of cuiraſſiers, and one of dragoons, are uſually quartered in it.

Chriſtianity was introduced into this country in the 9th century; and the inhabitants continued attached to the church of Rome till the 15th, when they eſpouſed the doctrine of John Huſs, and threw off Popery: but after the defeat of the elector Palatine, whom they had choſen king, as well as the Bohemians, the emperor Ferdinard II. re-eſtabliſhed Popery; though there are ſtill ſome Proteſtants in Moravia. The biſhop of Olmutz, who ſtands immediately under the pope, is at the head of the eccleſiaſtics in this country. The ſupreme eccleſiaſtical juriſdiction, under the biſhop, is veſted in a conſiſtory.

The commerce of this country is inconſiderable. Of what they have, Brunn enjoys the principal part. At Iglau and Trebitx are manufactures of cloth, paper, gunpowder, &c. There are alſo ſome iron works and glaſs houſes in the country.

The inhabitants of Moravia in general are openhearted, not eaſy to be provoked or pacified, obedient to their maſters, and true to their promiſes; but credulous of old prophecies, and much addicted to drinking, though neither ſuch ſots or bigots as they are repreſented by ſome geographers. The boors, indeed, upon the river Hank, are ſaid to be a thieviſh, unpoliſhed, brutal race. The ſciences now begin to lift up their heads a little among the Moravians, the univerſity of Olmutz having been put on a better footing; and a riding academy, with a learned ſociety, have been lately eſtabliſhed there.

MORAVIAN BRETHREN. See HERNHUTTERS, and UNITAS *Fratrum*.

MORAW, or MORAVA, a large river of Germany, which has its ſource on the confines of Bohemia and Sileſia. It traverſes the whole of Moravia, waters Olmutz and Hradiſch, and receiving the Taya from the confines of Lower Hungary and Upper Auſtria, ſeparates theſe two countries as far as the Danube, into which it falls.

MORBID, among phyſicians, ſignifies "diſeaſed or corrupt;" a term applied either to an unſound conſtitution, or to thoſe parts or humours that are affected by a diſeaſe.

MORBUS COMITIALIS, a name given to the epilepſy; becauſe if on any day when the people were aſſembled in *comitia* upon public buſineſs, any perſon ſuddenly ſeized with this diſorder ſhould fall down, the aſſembly was diſſolved, and the buſineſs of the *comitia*, however important, was ſuſpended. See COMITIA.

MORBUS Regius, the ſame with the JAUNDICE. See MEDICINE *Index*.

MORBUS, or *Diſeaſe*, in *Botany*. See VARIETAS.

MORDAUNT, CHARLES, earl of Peterborough, a celebrated commander both by ſea and land, was the ſon of John Lord Mordaunt Viſcount Avalon, and was born about the year 1658. In 1675 he ſucceeded his father in his honours and eſtate. While young he ſerved under the admirals Torrington and Narborough in the Mediterranean againſt the Algerines; and in 1680 embarked for Africa with the earl of Plymouth, and diſtinguiſhed himſelf at Tangier when it was beſieged by the Moors. In the reign of James II. he voted againſt the repeal of the teſt act; and diſliking the meaſures of the court, obtained leave to go to Holland to accept the command of a Dutch ſquadron in the Weſt Indies. He afterwards accompanied the prince of Orange into this kingdom; and upon his advancement to the throne, was ſworn of the privy-council, made one of the lords of the bedchamber to his majeſty, alſo firſt commiſſioner of the treaſury, and advanced to the dignity of earl of Monmouth. But in November 1690 he was diſmiſſed from his poſt in the treaſury. On the death of his uncle Henry earl of Peterborough in 1697, he ſucceeded to that title; and, upon the acceſſion of Queen Anne, was inveſted with the commiſſion of captain-general and governor of Jamaica. In 1705 he was ſworn of the privy-council; and the ſame year declared general and commander in chief of the forces ſent to Spain, and joint admiral of the fleet with Sir Cloudſley Shovel, of which the year following he had the ſole command. His taking Barcelona with a handful of men, and afterwards relieving it when greatly diſtreſſed by the enemy; his driving out of Spain the duke of Anjou, and the French army, which conſiſted of 25,000 men, though his own troops never amounted to 10,000; his gaining poſſeſſion of Catalonia, of the kingdoms of Valencia, Arragon, and the iſle of Majorca, with part of Murcia and Caſtile, and thereby giving the earl of Galway an opportunity of advancing to Madrid without a blow; are aſtoniſhing inſtances of his bravery and conduct. For theſe important ſervices his lordſhip was declared general in Spain by Charles III. afterwards emperor of Germany; and on his return to England he received the thanks of the houſe of lords. His lordſhip was afterwards employed in ſeveral embaſſies to foreign courts, inſtalled knight of the Garter, and made governor of Minorca. In the reign of George I. he was general of all the marine forces in Great Britain, in which poſt he was continued by King George II. He died in his paſſage to Liſbon, where he was going for the recovery of his health, in 1735. His lordſhip was diſtinguiſhed by various ſhining qualities: for, to the greateſt perſonal courage and reſolution, he added all the arts and addreſs of a general; a lively and penetrating genius; and a great extent of knowledge upon almoſt every ſubject of importance within the compaſs of ancient and modern literature; hence his familiar letters, inſerted among thoſe of his friend Mr Pope, are an ornament to that excellent collection.

MORDELLA, a genus of inſects of the coleoptera order. See ENTOMOLOGY *Index*.

MORE, SIR THOMAS, lord high chancellor of England, the ſon of Sir John More, knight, one of the judges of the King's Bench, was born in the year 1480, in in Milk-ſtreet London. He was firſt ſent to a ſchool at St Anthony's in Threadneedle ſtreet; and afterward introduced into the family of Cardinal Moreton, who in 1497 ſent him to Canterbury college in Oxford. During his reſidence at the univerſity he conſtantly attended the lectures of Linacre and Grocinus, on the Greek and Latin languages. Having in the ſpace of about two years made conſiderable proficiency in academical learning, he came to New Inn in London, in order to ſtudy the law; whence, after ſome time, he removed to Lincoln's Inn, of which his father was a member. Notwithſtanding his application to the law, however, being now about 20 years old, he was ſo bigotted to monkiſh diſcipline, that he wore a hair ſhirt next his ſkin, frequently faſted, and often ſlept on a bare plank. In the year 1503, being then a burgeſs in parliament, he diſtinguiſhed himſelf in the houſe, in oppoſition to the motion for granting a ſubſidy and three fifteenths for the marriage of Henry VII.'s eldeſt daughter, Margaret, to the king of Scotland. The motion was rejected; and the king was ſo highly offended at this oppoſition from a beardleſs boy, that he revenged himſelf on Mr More's father, by ſending him, on a frivolous pretence, to the Tower, and obliging him to pay 100l. for his liberty. Being now called to the bar, he was appointed law reader at Furnival's inn, which place he held about three years; but about this time he alſo read a public lecture in the church of St Lawrence, Old Jewry, upon St Auſtin's treatiſe *De Civitate Dei*, with great applauſe. He had indeed formed a deſign of becoming a Franciſcan friar, but was diſſuaded from it; and, by the advice of Dr Colet, married Jane, the eldeſt daughter of John Colt, Eſq. of Newhall in Eſſex. In 1508 he was appointed judge of the ſheriff's court in the city of London, was made a juſtice of the peace, and became very eminent at the bar. In 1516 he went to Flanders in the retinue of Biſhop Tonſtal, and Dr Knight, who were ſent by King Henry VIII. to renew the alliance with the archduke of Auſtria, afterwards Charles V. On his return, Cardinal Wolſey would have engaged Mr More in the ſervice of the crown, and offered him a penſion, which he refuſed. Nevertheleſs, it was not long before he accepted the place of maſter of the requeſts, was created a knight, admitted of the privy council, and in 1520 made treaſurer of the exchequer. About this time he built a houſe on the bank of the Thames, at Chelſea, and married a ſecond wife. This wife, whoſe name was *Middleton*, and a widow, was old, ill tempered, and covetous; nevertheleſs Eraſmus ſays, he was as fond of her as if ſhe were a young maid.

In the 14th year of Henry VIII. Sir Thomas More was made ſpeaker of the houſe of commons: in which capacity he had the reſolution to oppoſe the then powerful miniſter, Wolſey, in his demand of an oppreſſive ſubſidy; notwithſtanding which, it was not long before he was made chancellor of the duchy of Lancaſter, and was treated by the king with ſingular familiarity. The king having once dined with Sir Thomas at Chelſea, walked with him near an hour in the garden, with his arm round his neck. After he was gone, Mr Roper, Sir Thomas's ſon-in-law, obſerved how happy he was to be ſo familiarly treated by the king: to which Sir Thomas replied, "I thank our lord, ſon Roper, I find his grace my very good lord indeed, and believe he doth as ſingularly favour me as any ſubject within this realm: howbeit, I muſt tell thee, I have no cauſe to be proud thereof; for if my head would win him a caſtle in France, it would not fail to go off." From this anecdote it apears, that Sir Thomas knew his grace to be a villain.

In 1526 he was ſent with Cardinal Wolſey and others, on a joint embaſſy to France, and in 1529 with Biſhop Tonſtal to Cambray. The king, it ſeems, was ſo well ſatisfied with his ſervices on theſe occaſions, that in the following year, Wolſey being diſgraced, he made him chancellor; which ſeems the more extraordinary, when we are told that Sir Thomas had repeatedly declared his diſapprobation of the king's divorce, on which the great *defenſor fidei* was ſo poſitively bent. Having executed the office of chancellor about three years, with equal wiſdom and integrity, he reſigned the ſeals in 1533, probably to avoid the danger of his refuſing to confirm the king's divorce. He now retired to his houſe at Chelſea; diſmiſſed many of his ſervants; ſent his children with their reſpective families to their own houſes (for hitherto, he had, it ſeems, maintained all his children, with their families, in his own houſe, in the true ſtyle of an ancient patriarch; and ſpent his time in ſtudy and devotion: but the capricious tyrant would not ſuffer him to enjoy his tranquillity. Though now reduced to a private ſtation, and even to indigence, his opinion of the legality of the king's marriage with Anne Boleyn was deemed of ſo much importance, that various means were tried to procure his approbation; but all perſuaſion proving ineffectual, he was, with ſome others, attainted in the houſe of lords of miſpriſion of treaſon, for encouraging Elizabeth Barton, the nun of Kent, in her treaſonable practices. His innocence in this affair appeared ſo clearly, that they were obliged to ſtrike his name out of the bill. He was then accuſed of other crimes, but with the ſame effect; till, refuſing to take the oath enjoined by the act of ſupremacy, he was committed to the Tower, and, after 15 months impriſonment, was tried at the bar of the king's bench for high treaſon, in denying the king's ſupremacy. The proof reſted on the ſole evidence of Rich the ſolicitor general, whom Sir Thomas, in his defence, ſufficiently diſcredited; nevertheleſs the jury brought him in guilty, and he was condemned to ſuffer as a traitor. The merciful Harry, however, indulged him with ſimple decollation; and he was accordingly beheaded on Tower hill, on the 5th of July 1535. His body, which was firſt interred in the Tower, was begged by his daughter Margaret, and depoſited in the chancel of the church at Chelſea, where a monument, with an inſcription written by himſelf, had been ſome time before erected. This monument with the inſcription is ſtill to be ſeen in that church. The ſame daughter, Margaret, alſo procured his head after it had remained 14 days upon London bridge, and placed it in a vault belonging to the Roper family, under a chapel adjoining to St Dunſtan's church in Canterbury. Sir Thomas More was a man of ſome learning, and an upright judge; a very prieſt in religion, yet cheerful, and even affectedly witty (A). He wanted not ſagacity, where religion was out of the queſtion; but in that his faculties were ſo enveloped, as to render him a weak and credulous enthuſiaſt. He left one ſon and three daughters; of whom Margaret, the eldeſt, was very remarkable for her knowledge of the Greek and Latin languages. She married a Mr Roper of Wellhall in Kent, whoſe life of Sir Thomas More was publiſhed by Mr Hearne at Oxford in 1716. Mrs Roper died in 1544; and was buried in the vault of St Dunſtan's in Canterbury, with her father's head in her arms.

Sir Thomas was the author of various works, though his *Utopia* is the only performance that has ſurvived in the eſteem of the world; owing to the reſt being chiefly of a polemic nature: his anſwer to Luther has only gained him the credit of having the beſt knack of any man in Europe, at calling bad names in good Latin. His Engliſh works were collected and publiſhed by order of Queen Mary, in 1557; his Latin, at Baſil, in 1563, and at Louvain, in 1566.

MOREA, formerly called the *Peloponneſus*, is a peninſula to the ſouth of Greece, to which it is joined by the iſthmus of Corinth. Its form reſembles a mulberry leaf, and its name is derived from the great number of mulberry trees which it produces. It is about 180 miles in length, and 130 in breadth. The air is temperate, and the land fertile, except in the middle, where it is full of mountains, and is watered by a great number of rivers. It is divided into three provinces; Scania, Belvedera, and Brazzo-di-Maina. It was taken from the Turks by the Venetians in 1687; but they loſt it again in 1715. The ſangiac of the Morea reſides at Modon. See GREECE and PELOPONNESUS.

MOREL, the name of ſeveral celebrated printers to the kings of France, who, like the Stephens, were alſo men of great learning.

Frederic MOREL, who was interpreter in the Greek and Latin tongues, as well as printer to the king, was heir to Vaſcoſan, whoſe daughter he had married.—He was born in Champagne, and he died in an advanced age at Paris, 1583. His ſons and grandſons trode in his ſteps; they diſtinguiſhed themſelves in literature, and maintained alſo the reputation which he had acquired by printing. The edition of *St Gregory of Nyſſa*, by his ſon Claude Morel, is held in great eſtimation by the learned.

MOREL, *Frederic*, ſon of the preceding, and ſtill more celebrated than his father, was profeſſor and interpreter to the king, and printer in ordinary for the Hebrew, Greek, Latin, and French languages. He was ſo devoted to ſtudy, that when he was told his wife was at the point of death, he would not ſtir till he had finiſhed the ſentence which he had begun. Before it was finiſhed, he was informed that ſhe was actually dead: *I am ſorry for it* (replied he coldly), *ſhe was an excellent woman.* This printer acquired great reputation from the works which he publiſhed, which were very numerous and beautifully executed. From the manuſcripts in the king's library, he publiſhed ſeveral treatiſes of St Baſil, Theodoret, St Cyrille; and he accompanied them with a tranſlation. His edition of the works of Œcumenius and Aretas, in 2 vols. folio, is much eſteemed. In ſhort, after diſtinguiſhing himſelf by his knowledge in the languages, he died June 27. 1630, at the age of 78. His ſons and grandſons followed the ſame profeſſion.

MOREL, *William*, regius profeſſor of Greek, and director of the king's printing houſe at Paris, died 1564. He compoſed a *Dictionnaire Grec-Latin François*, which was publiſhed in quarto in 1622, and ſome other works which indicate very extenſive learning. His editions of the Greek authors are exceedingly beautiful. This great ſcholar, who was of a different family from the preceding, had a brother named John, who died in priſon (where he had been confined for hereſy) at the age of 20, and whoſe body was dug out of the grave, and burnt Feb. 27. 1559. They were of the pariſh of Tilleul, in the county of Mortein in Normandy.

MORENA, in *Ancient Geography*, a diſtrict or diviſion of Myſia, in the Hither Aſia. A part of which was occupied by Cleon, formerly at the head of a band of robbers, but afterwards prieſt of Jupiter Abrettenus, and enriched with poſſeſſions, firſt by Antony, and then by Cæſar.

MORESQUE, MORESK, or *Moriſko*, a kind of painting, carving, &c. done after the manner of the Moors; conſiſting of ſeveral groteſque pieces and compartiments promiſcuouſly intermingled, not containing any perfect figure of a man, or other animal, but a wild reſemblance of birds, beaſts, trees, &c. Theſe are alſo called *arabeſques*, and are particularly uſed in embroideries, damaſk work, &c.

MORESQUE Dances, vulgarly called *Morrice dances*, are thoſe altogether in imitation of the Moors, as ſarabands, chacons, &c. and are uſually performed with caſtanets, tambours, &c.

There are few country places in England where the morrice dance is not known. It was probably introduced about, or a little before, the reign of Henry VIII. and is a dance of young men in their ſhirts, with bells at their feet, and ribbands of various colours tied round their arms and flung acroſs their ſhoulders.

MORGAGNA. See FATA.

MORGAGNI, JOHN BAPTIST, doctor of medicine, firſt profeſſor of anatomy in the univerſity of Padua, and member of ſeveral of the moſt eminent ſocieties of learned men in Europe, was born in the year 1682, at Forli, a town in the diſtrict of *La Romagna* in Italy. His

---

(A) This laſt diſpoſition, we are told, he could not reſtrain even at his execution. The day being come, he aſcended the ſcaffold, which ſeemed ſo weak that it was ready to fall; whereupon, "I pray (ſaid he) ſee me ſafe up, and for my coming down let me ſhift for myſelf." His prayers being ended, he turned to the executioner, and with a cheerful countenance ſaid, "Pluck up thy ſpirits, man, and be not afraid to do thy office; my neck is very ſhort, take heed therefore thou ſtrike not awry for ſaving thy honeſty." Then laying his head upon the block, he bade him ſtay until he had put aſide his beard, ſaying, "That had never committed any treaſon."

of his *phyſician*, and that of *profeſſor royal of botany*, with a penſion of 200l. per annum. The *Præludium Botanicum*, which he publiſhed in 1669, procured him ſo much reputation, that the univerſity of Oxford invited him to the profeſſorſhip of botany in 1669; which he accepted, and acquitted himſelf in it with great ability. He died at London in 1683, aged 63. He publiſhed a ſecond and third part of his Hiſtory of Plants, in 2 vols. folio; with this title, *Plantarum Hiſtoria Oxonienſis Univerſalis*. The firſt part of this excellent work has not been printed; and it is not known what has become of it.

MORISONIA, a genus of plants belonging to the monadelphia claſs, and in the natural method ranking under the 25th order, *Putamineæ*. See BOTANY *Index*.

MORLACHIA, a mountainous country of Dalmatia. The inhabitants are called *Morlacks* or *Morlacchi;* they inhabit the pleaſant valleys of Koter, along the rivers Kerha, Cettina, Narenta, and among the inland mountains of Dalmatia. The inhabitants are by ſome ſaid to be of Walachian extraction, as is indicated by their name; Morlachia being a contraction of *Mauro Walachia*, that is, *Black Walachia:* and the Walachians are ſaid to be deſcendants of the ancient Roman colonies planted in theſe countries. This, however, is denied by the Abbé Fortis, who publiſhed a volume of travels into that country. He informs us, that the origin of the Morlacchi is involved in the darkneſs of barbarous ages, together with that of many other nations, reſembling them ſo much in cuſtoms and language, that they may be taken for one people, diſperſed in the vaſt tracts from the Adriatic ſea to the Frozen ocean.

With regard to the etymology of the name, the Abbé obſerves, that the Morlacchi generally call themſelves, in their own language, *Vlaſſi;* a national term, of which no veſtige is found in the records of Dalmatia till the 13th century. It ſignifies *powerful men*, or *men of authority;* and the denomination of *Moro Vlaſſi*, corruptly *Morlacchi*, as they are now called, may perhaps point out the original of the nation. This word may poſſibly ſignify the *conquerors that came from the ſea; moor*, in all the dialects of the Sclavonian language, ſignifying the *ſea*.

With regard to the character of theſe people, we are informed that they are much injured by their maritime neighbours. The inhabitants of the ſea coaſt of Dalmatia tell many frightful ſtories of their avarice and cruelty: but theſe, in our author's opinion, are all either of an ancient date, or if any have happened in latter times, they ought rather to be aſcribed to the corruption of a few individuals, than to the bad diſpoſition of the nation in general; and though thieviſh tricks are frequent among them, he informs us, that a ſtranger may travel ſecurely through their country, where he is faithfully eſcorted, and hoſpitably treated.

As to the Morlacchi themſelves, they are repreſented as open and ſincere to ſuch a degree, that they would be taken for ſimpletons in any other country; and by means of this quality they have been ſo often duped by the Italians, that *the faith of an Italian* and *the faith of a dog*, are ſynonymous among the Morlacchi. They are very hoſpitable to ſtrangers; and their hoſpitality is equally conſpicuous among the rich and poor. The rich prepares a roaſted lamb or ſheep, and the poor with equal cordiality offers whatever he has; nor is this generoſity confined to ſtrangers, but generally extends itſelf to all who are in want. When a Morlack is on a journey, and comes to lodge at a friend's houſe, the eldeſt daughter of the family, or the new married bride, if there happen to be one, receives and kiſſes him when he alights from his horſe or at the door of the houſe: but a foreigner is rarely favoured with theſe female civilities; on the contrary, the women, if they are young, hide themſelves, and keep out of his way.

The Morlacchi in general have little notion of domeſtic economy, and readily conſume in a week as much as would be ſufficient for ſeveral months, whenever any occaſion of merriment preſents itſelf. A marriage, the holiday of the ſaint protector of the family, the arrival of relations or friends, or any other joyful incident, conſumes of courſe all that there is to eat and to drink in the houſe. Yet the Morlack is a great economiſt in the uſe of his wearing apparel; for rather than ſpoil his new cap, he takes it off, let it rain ever ſo hard, and goes bareheaded in the ſtorm. In the ſame manner he treats his ſhoes, if the road is dirty and they are not very old. Nothing but an abſolute impoſſibility hinders a Morlack from being punctual; and if he cannot repay the money he borrowed at the appointed time, he carries a ſmall preſent to his creditor, and requeſts a longer term.

Friendſhip is laſting among the Morlacchi. They have even made it a kind of religious point, and tie the ſacred bond at the foot of the altar. The Sclavonian ritual contains a particular benediction for the ſolemn union of two male or two female friends in the preſence of the congregation. The male friends thus united are called *Pobratimi*, and the female *Poſeſtreme*, which means half-brothers and half-ſiſters. From thoſe conſecrated friendſhips among the Morlacchi and other nations of the ſame origin, it ſhould ſeem that the *ſworn brothers* aroſe; a denomination frequent enough among the common people of Italy and in many parts of Europe. The difference between theſe and the Pobratimi of Morlachia conſiſts not only in the want of the ritual ceremony, but in the deſign of the union itſelf. For, among the Morlacchi, the ſole view is reciprocal ſervice and advantage; but ſuch a brotherhood among the Italians is generally commenced by bad men, to enable them the more to hurt and diſturb ſociety.

But as the friendſhips of the Morlacchi are ſtrong and ſacred, ſo their quarrels are commonly unextinguiſhable. They paſs from father to ſon; and the mothers fail not to put their children in mind of their duty to revenge their father if he has had the misfortune to be killed, and to ſhow them often the bloody ſhirt and arms of the dead. And ſo deeply is revenge rooted in the minds of this nation, that all the miſſionaries in the world would not be able to eradicate it. A Morlack is naturally inclined to do good to his fellow creatures, and is full of gratitude for the ſmalleſt benefit; but implacable if injured or inſulted.

A Morlack who has killed another of a powerful family, is commonly obliged to ſave himſelf by flight; and

and to keep out of the way for ſeveral years. If during that time he has been fortunate enough to eſcape the ſearch of his purſuers, and has got a ſmall ſum of money, he endeavours to obtain pardon and peace; and, that he may treat about the conditions in perſon, he aſks and obtains a ſafe conduct, which is faithfully maintained, though only verbally granted. Then he finds mediators: and, on the appointed day, the relations of the two hoſtile families are aſſembled, and the criminal is introduced, dragging himſelf along on his hands and feet, the muſket, piſtol, or cutlaſs, with which he committed the murder, hung about his neck; and while he continues in that humble poſture, one or more of the relations recites a panegyric on the dead, which ſometimes rekindles the flames of revenge, and puts the poor proſtrate in no ſmall danger.

The Morlacks, whether they happen to be of the Roman or of the Greek church, have very ſingular ideas about religion: and the ignorance of their teachers daily augments this monſtrous evil. They are as firmly perſuaded of the reality of witches, fairies, enchantments, nocturnal apparitions, and ſortileges, as if they had ſeen a thouſand examples of them. Nor do they make the leaſt doubt about the exiſtence of vampires: and attribute to them, as in Tranſylvania, the ſucking the blood of infants. Therefore, when a man dies ſuſpected of becoming a vampire, or *vukodlak*, as they call it, they cut his hams, and prick his whole body with pins; pretending, that after this operation he cannot walk about. There are even inſtances of Morlacchi, who, imagining that they may poſſibly thirſt for children's blood after death, entreat their heirs, and ſometimes oblige them to promiſe, to treat them as vampires when they die.

A moſt perfect diſcord reigns in Morlachia, as it generally does in other parts, between the Latin and Greek communion, which their reſpective prieſts fail not to foment, and tell a thouſand little ſcandalous ſtories of each other. The churches of the Latins are poor, but not very dirty; thoſe of the Greeks are equally poor, and ſhamefully ill kept. Our author has ſeen the curate of a Morlack village ſitting on the ground in the churchyard, to hear the confeſſion of women on their knees by his ſide: a ſtrange poſture indeed! but a proof of the innocent manners of thoſe good people, who have the moſt profound veneration for their ſpiritual paſtors, and a total dependence upon them; who, on their part, frequently make uſe of a diſcipline rather military, and correct the bodies of their offending flock with the cudgel.

Innocence, and the natural liberty of paſtoral ages, are ſtill preſerved among the Morlacchi, or at leaſt many traces of them remain in the places fartheſt diſtant from our ſettlements. Pure cordiality of ſentiment is not there reſtrained by other regards, and diſplays itſelf without any diſtinction of circumſtances. A young handſome Morlack girl, who meets a man of her diſtrict on the road, kiſſes him affectionately, without the leaſt imputation of impropriety; and M. Fortis has ſeen all the women and girls, all the young men and old, kiſſing one another as they came into the churchyard on a holiday; ſo that they looked as if they all belonged to one family. He often obſerved the ſame thing on the road, and at the fairs in the maritime towns, where the Morlacchi came to ſell their commodities.

The dreſs of the unmarried women is the moſt complex and whimſical, in reſpect to the ornaments of the head; for when married they are not allowed to wear any thing elſe but a handkerchief, either white or coloured tied about it. The girls uſe a ſcarlet cap, to which they commonly hang a veil falling down on the ſhoulders, as a mark of their virginity. The better ſort adorn their caps with ſtrings of ſilver coins, among which are frequently ſeen very ancient and valuable ones; they have moreover ear rings of very curious work, and ſmall ſilver chains with the figures of half moons faſtened to the ends of them. But the poor are forced to content themſelves with plain caps; or if they have any ornaments, they conſiſt only of ſmall exotic ſhells, round glaſs beads, or bits of tin. The principal merit of theſe caps, which conſtitute the good taſte as well as vanity of the Morlack young ladies, is to attract and fix the eyes of all who are near them by the multitude of ornaments, and the noiſe they make on the leaſt motion of their heads.

Both old and young women wear about their necks large ſtrings of round glaſs beads, of various ſize and colour; and many rings of braſs, tin, or ſilver, on their fingers. Their bracelets are of leather covered with wrought tin or ſilver; and they embroider their ſtomachers, or adorn them with beads or ſhells. But the uſe of ſtays is unknown, nor do they put whalebone or iron in the ſtomacher. A broad woollen girdle ſurrounds their petticoat, which is commonly decked with ſhells, and of blue colour, and therefore called *modrina*. Their gown as well as petticoat, is of a kind of ſerge; and both reach near to the ancle: the gown is bordered with ſcarlet, and called *ſadak*. They uſe no modrina in ſummer, and only wear the ſadak without ſleeves over a linen petticoat or ſhift.—The girls always wear red ſtockings; and their ſhoes are like thoſe of the men, called *opanke*. The ſole is of undreſſed ox hide, and the upper part of ſheep's ſkin thongs knotted, which they call *apute*; and theſe they faſten above the ancles, ſomething like the ancient cothurnus. The unmarried women, even of the richeſt families, are not permitted to wear any other ſort of ſhoes; though after marriage, they may, if they will, lay aſide the opanke, and uſe the Turkiſh ſlippers. The girls keep their hair treſſed under their caps, but when married they let it fall diſhevelled on the breaſt; ſometimes they tie it under the chin; and always have medals, beads, or bored coins, in the Tartar or American mode twiſted amongſt it.

Nothing is more common among the Morlacchi than marriages concluded between the old people of the reſpective families, eſpecially when the parties live at a great diſtance, and neither ſee nor know each other; and the ordinary motive of theſe alliances is the ambition of being related to a numerous and powerful family, famous for having produced valiant men. A denial in ſuch caſes is very rare; nor does the father of the maid inquire much into the circumſtances of the family that aſks her. Sometimes a daughter of the maſter is given in marriage to the ſervant or tenant, as was uſual in patriarchal times; ſo little are the women regarded in this country. But on theſe occaſions, the Morlacchi girls enjoy the privilege of refuſal. For he

Morlacchi.

who acts by proxy, having obtained his ſuit, is obliged to go and bring the bridegroom: and, if on ſeeing each other, the young people are reciprocally content, the marriage is concluded, but not otherwiſe. In ſome parts it is the cuſtom for the bride to go to ſee the houſe and family of the propoſed huſband, before ſhe gives a definitive anſwer; and if the place or perſons are diſagreeable to her, ſhe is at liberty to annul the contract.

The bride is conducted to a church, veiled, and ſurrounded by the friends of the bridegroom, or *ſvati*, as they are called, on horſeback; and the ſacred ceremony is performed amidſt the noiſe of muſkets, piſtols, barbaric ſhouts and acclamations, which continue till ſhe return to her father's houſe or to that of her huſband, if not far off. The firſt day's entertainment is ſometimes made at the bride's houſe, but generally at the bridegroom's, whither the ſvati haſten immediately after the nuptial benediction; and at the ſame time three or four men run on foot to tell the good news; the firſt who gets to the houſe has a kind of a towel embroidered at the ends, as a premium. The domachin, or head of the houſe, comes out to meet his daughter-in-law; and a child is handed to her, before ſhe alights, to careſs it; and if there happen to be none in the houſe, the child is borrowed from one of the neighbours. When ſhe alights, ſhe kneels down, and kiſſes the threſhold.—Then the mother-in-law, or in her place ſome other female relation, preſents a corn ſieve, full of different kinds of grain, nuts, almonds, and other ſmall fruit, which the bride ſcatters upon the ſvati, by handfuls, behind her back. The bride does not ſit at the great table the firſt day, but has one apart for herſelf, the two diveri, and the ſtacheo. The bridegroom ſits at table with the ſvati; but in all that day, conſecrated to the matrimonial union, he muſt neither unlooſen nor cut any thing whatever. The knum carves his meat, and cuts his bread. It is the domachin's buſineſs to give the toaſts; and the ſtari-ſvat is the firſt who pledges him. Generally the bukkara, a very large wooden cup, goes round, firſt to the ſaint protector of the family; next to the proſperity of the holy faith; and ſometimes to a name the moſt ſublime and venerable. The moſt extravagant abundance reigns at theſe feaſts; and each of the ſvati contributes, by ſending a ſhare of proviſions. The dinner begins with fruit and cheeſe; and the ſoup comes laſt, juſt contrary to our cuſtom. All ſorts of domeſtic fowls, kid, lamb, and ſometimes veniſon, are heaped in prodigal quantities upon their tables.

Theſe nuptial feaſts, called *ſdrave* by the ancient Huns, are by the Morlacchi called *ſdravize*, from whence the Italian word *ſtravizzo* is undoubtedly derived. They continue three, ſix, eight, or more days, according to the ability or prodigal diſpoſition of the family where they are held. The new married wife gets no inconſiderable profit in theſe days of joy; and it uſually amounts to much more than all the portion ſhe brings with her, which often conſiſts of nothing but her own clothes and perhaps a cow; nay, it happens ſometimes that the parents, inſtead of giving money with their daughter, get ſomething from the bridegroom by way of price. The bride carries water every morning, to waſh the hands of her gueſts as long as the feaſting laſts; and each of them throws a ſmall piece of money into the baſon after performing that function, which is a very rare one among them, excepting on ſuch occaſions.

Morlacchi, Mornay.

The Morlacchi paſs their youth in the woods, attending their flocks and herds; and in that life of quiet and leiſure they often become dextrous in carving with a ſimple knife: they make wooden cups, and whiſtles adorned with fanciful baſs reliefs, which are not void of merit, and at leaſt ſhow the genius of the people.

MORNAY, Philippe de, ſeigneur du Pleſſis Marly, was born at Buhy or Biſhuy in Upper Normandy in France, in 1549, and was educated at Paris. What was then thought a prodigy in a gentleman, he made a rapid progreſs in the belles lettres, in the learned languages, and in theology. He was at firſt deſtined for the church; but the principles of Calviniſm, which he had imbibed from his mother, effectually excluded him from the eccleſiaſtical preferments to which he was entitled by his intereſt, abilities, and birth. After the horrible maſſacre of St Bartholomew, Philippe de Mornay made the tour of Italy, Germany, England, and the Low Countries; and he was equally improved and delighted by his travels. Mornay afterwards joined the king of Navarre, at that time leader of the Proteſtant party, and ſo well known ſince by the name of Henry IV. This prince ſent Mornay, who employed his whole abilities, both as a ſoldier and a writer, in defence of the Proteſtant cauſe, to conduct a negociation with Elizabeth queen of England; and left him wholly to his own diſcretion in the management of that buſineſs. He was ſucceſsful in almoſt every negociation, becauſe he conducted it like an able politician, and not with a ſpirit of intrigue. He tenderly loved Henry IV. and ſpoke to him on all occaſions as to a friend. When he was wounded at Aumale, he wrote to him in theſe words: "Sire, You have long enough acted the part of Alexander, it is now time you ſhould act that of Cæſar. It is our duty to die for your majeſty, &c. It is glorious for you, Sire, that I dare venture to tell you it is your duty to live for us." This faithful ſubject did every thing in his power to raiſe Henry to the throne. But when he deſerted the Proteſtant faith, he reproached him in the bittereſt manner, and retired from court. Henry ſtill loved him; and was extremely affected with an inſult which he received in 1597 from one Saint Phal, who beat him with a cudgel, and left him for dead. Mornay demanded juſtice from the king, who gave him the following anſwer, a proof as well of his ſpirit as of his goodneſs of heart. "Monſieur Dupleſſis, I am exceedingly offended at the inſult you have received; and I ſympathize with you both as your ſovereign and your friend. In the former capacity, I ſhall do juſtice to you and to myſelf; and had I ſuſtained only the character of your friend, there are few perhaps who would have drawn their ſword or ſacrificed their life more cheerfully in your cauſe. Be ſatisfied, then, that I will act the part of a king, a maſter, and a friend," &c. Mornay's knowledge, probity, and valour, made him the ſoul of the Proteſtant party, and procured him the contemptuous appellation of the *Pope of the Huguenots*. He defended their doctrines both by ſpeech and writing. One of his books on the Iniquity of the Maſs, having ſtirred up all the Catholic divines, he refuſed to make any reply to their cenſures and criticiſms except in a public conference. This was accordingly appointed to be held A. D. 1600, at Fountainbleau, where the court then was. The two champions were, Du Perron biſhop of Evreux, and Mornay. After a great many arguments and replies on both ſides, the victory was adjudged to Du Perron. He had boaſted that he would point out to the ſatisfaction of every one five hundred errors in his adverſary's book, and he partly kept his word. The Calviniſts did not fail to claim the victory on this occaſion, and they ſtill continue to do ſo. This conference, inſtead of putting an end to the differences, was productive of new quarrels among the controverſialiſts, and of much profane wit among the libertines. A Huguenot miniſter, who was preſent at the conference, obſerved with great concern to a captain of the ſame party,—"The biſhop of Evreux has already driven Mornay from ſeveral ſtrong holds." "No matter (replied the ſoldier), provided he does not drive him from Saumur." This was an important place on the river Loire, of which Dupleſſis was governor. Hither he retired, his attention being conſtantly occupied in defending the Huguenots, and in making himſelf formidable to the Catholics. When Louis XIII. was making preparations againſt the Proteſtants, Dupleſſis wrote him a letter, diſſuading him from ſuch a meaſure. After employing the moſt plauſible arguments, he concludes in the following manner: "To make war on the ſubject, is an indication of weakneſs in the government. Authority conſiſts in the quiet ſubmiſſion of the people, and is eſtabliſhed by the prudence and juſtice of the governor. Force of arms ought never to be employed except in repelling a foreign enemy. The late king would have ſent the new miniſters of ſtate to learn the firſt elements of politics, who like unſkilful ſurgeons would apply violent remedies to every diſeaſe, and adviſe a man to cut off an arm when his finger aches." Theſe remonſtrances produced no other effect than the loſs of the government of Saumur, of which he was deprived by Louis XIII. in 1621. He died two years after, November 11. 1623, aged 74, in his barony *de la Foret-ſur-Seure* in Poitou. The Proteſtant cauſe never had an abler ſupporter, or one who did it more credit by his virtues and abilities.

Cenſeur des courtiſans, mais à la cour aimé;
Fier ennemi de Rome, et de Rome eſtimé.—HENRIADE.

The following is a liſt of his works: 1. *Un Traité de l'Euchariſte*, 1604, in folio. 2. *Un Traité de la verité de la Religion Chretienne*, 8vo. 3. A book entitled *La Myſtere d'Iniquité*, 4to. 4. *Un diſcours ſur le droit pretendu par ceux de la maiſon de Guiſe*, 8vo. 5. Curious and intereſting *Memoirs* from the year 1572 to 1629, 4 vols. 4to. valuable. 6. *Letters*; which are written with great ſpirit and good ſenſe. David des Liques has given us his life in quarto; a book more intereſting for the matter than the manner.

MORNE-GAROU, a very remarkable volcanic mountain on the iſland of St Vincent's in the Weſt Indies. It was viſited by Mr James Anderſon ſurgeon in the year 1764. See ST VINCENTS.

MOROC, or MAROC, a beautiful bird of Abyſſinia, deſcribed by Mr Bruce, who thinks its name is derived from *mar*, "honey," though he ſays that he never heard it was further concerned in the honey than deſtroying bees. It ſeems to purſue thoſe inſects out of enmity or diverſion as well as for food, leaving great numbers dead on the ground, beſides thoſe which it devours for food.

The moroc reſembles the cuckoo in ſize and ſhape, but differs in other reſpects. Its mouth is very wide, the opening reaching almoſt to its eyes; the inſide of the mouth and throat yellow, the tongue ſharp-pointed, and capable of being drawn almoſt half its length out of the mouth beyond the point of its beak, and is very flexible. The head and neck are brown, without any mixture of other colours: there are likewiſe a number of very ſmall and ſcarcely viſible hairs at the root of the beak.

This ſeems to be the bird mentioned by Sparman under the name of *cuculus indicator*, which (he ſays) has the ſingular property of diſcovering the neſts of wild bees, and leading travellers by a certain cry to the place where the treaſure is depoſited. According to Sparman's account, it makes known theſe diſcoveries by the ſame cry to foxes as well as to the human ſpecies; but Jerome Lobo, who mentions the Abyſſinian bird, takes no notice of the foxes, though he mentions its ſinging melodiouſly when it arrives at the place where the honey is depoſited. Both theſe accounts are ſeverely criticiſed by Mr Bruce, who ſays, that honey is ſo abundant on every hillock and every tree, that a bird poſſeſſing this faculty could be of no uſe to man or to any other animal in that country, and that having never heard of ſuch a bird in Abyſſinia, he conſiders the account of it as a fiction.

MORNING, the beginning of the day, or the time of the ſun riſing. The aſtronomers reckon morning, *mane*, from the time of midnight to that of mid-day. Thus an eclipſe is ſaid to begin at 11 o'clock in the morning, &c.

MORNING ſtar, is the planet Venus, when a little to the weſtward of the ſun; that is, when ſhe riſes a little before. In this ſituation ſhe is called by the Greeks *Phoſphorus*; by the Latins *Lucifer*, &c.

1 Situation and boundaries.

MOROCCO, an empire of Africa, comprehending a conſiderable part of the ancient Mauritania, is bounded on the weſt by the Atlantic ocean; on the eaſt by the river Mulvya, which ſeparates it from Algiers; on the north by the Mediterranean; and on the ſouth by Mount Atlas, or rather by the river Sus, which divides it from the kingdom of Tafilet. Its greateſt length is from the north-eaſt to the ſouth-weſt, amounting to above 590 miles; its breadth is not above 260 where broadeſt, and in the narroweſt places it is not above half that breadth.

2 Hiſtory.

The ancient hiſtory of Morocco has been already given under the article MAURITANIA. It continued under the dominion of the Romans upwards of 400 years. On the decline of that empire it fell under the Goths, who held it till about the year 600, when the Goths were driven out by the Vandals, the Vandals by the Greeks, and they in their turn by the Saracens, who conquered not only this empire, but we may ſay the whole continent of Africa; at leaſt their religion, one way or other, is to be found in all parts of it. The Saracen empire did not continue long united under one head, and many princes ſet up for themſelves in Africa as well as elſewhere, through whoſe diſſenſions the Almoravides were at length raiſed

raiſed to the ſovereignty, as related under the article ALGIERS, N° 2. Yuſef, or Joſeph, the ſecond monarch of that line, built the city of Morocco, conquered the kingdom of Fez, and the Mooriſh dominions in Spain; all which were loſt by his grandſon Abbu Hali, who was defeated and killed by the Spaniards. On this prince's death the crown paſſed to the Mohedians, or Almohedes, with whom it had not continued above three generations, when Mohammed the ſon of Al Manſur loſt the famous battle of Sierra Morena, in which 200,000 Moors were ſlain, and in conſequence of which Alphonſo X. retook a great many of the Mooriſh conqueſts immediately after.

Mohammed died ſoon after this diſgrace, and left ſeveral ſons, between whom a civil war enſued, during which the viceroys of Fez, Tunis, and Tremeſen, found means to eſtabliſh themſelves as independent princes. At length one of the princes of the royal blood of Tremeſen having defeated the Almohedes, made himſelf maſter of the kingdoms of Morocco and Fez, and entailed them on his own family. In a ſhort time, however, this family was expelled by the Merini, the Merini by the Oatazes, and theſe by the Sharifs of Haſcen, who have kept the government ever ſince.

3 Government.

Nothing can be conceived more unjuſt and deſpotic than the government of Morocco, and nothing more degenerate than the character of the people. The emperor is allowed to have not only an uncontrollable power over the lives and fortunes of his ſubjects, but in a great meaſure over their conſciences, in as much as he is the only perſon who, as the ſucceſſor of the prophet, has a right to interpret the Koran; and appoints all the judges under him, of whom thoſe of Morocco and Fez are the chief, whoſe buſineſs it is to explain and diſpenſe all matters relating to their religion; and who, being his creatures and dependents, dare not ſteer otherwiſe than as he directs. Whenever therefore the laws are enacted by him, and proclaimed by his governors in all the provinces, as is commonly done, that none may plead ignorance, they are everywhere received with an implicit and religious ſubmiſſion. On the other hand, the ſubjects are bred up with a notion, that thoſe who die in the execution of his command are entitled to an immediate admittance into paradiſe, and thoſe who have the honour to die by his hand to a ſtill greater degree of happineſs in it. After this we need not wonder at finding ſo much cruelty, oppreſſion, and tyranny on the one ſide, and ſo much ſubmiſſion, paſſiveneſs and miſery on the other.

4 Account of the black troops.

This latter, however, extends no farther than the Moors: for as to the mountaineers, the ſubjection and tribute they pay to thoſe tyrants was always involuntary; and as for the negroes, their zeal and attachment is owing merely to the great ſway and power which they have gained in the government, on various accounts. They were firſt introduced, or rather their importation increaſed, by the policy of Muley Iſhmael, a late emperor, at a period when there was a great decreaſe of population in the empire, occaſioned in ſome degree by the enormous cruelties exerciſed by its former ſovereigns, who have been known not unfrequently, through a ſlight diſguſt, to abandon a whole town or province to the ſword. In the character of Muley Iſhmael were found the moſt ſingular inconſiſtencies; for it is certain, that although a tyrant, yet in other reſpects, as if to repair the miſchief which he committed, he left nothing undone for the encouragement of population.—He introduced large colonies of negroes from Guinea; built towns for them, many of which are ſtill remaining, aſſigned them portions of land, and encouraged their increaſe by every poſſible means. He ſoon initiated them in the Mahometan faith; and had his plan been followed, the country by this time would have been populous, and probably flouriſhing. As the negroes are of a more lively, active and enterpriſing diſpoſition than the Moors, they might ſoon have been taught the arts of agriculture; and their ſingular ingenuity might have been directed to other uſeful purpoſes. It is true, Muley Iſhmael, when he adopted this plan, had more objects in view than that of merely peopling his dominions. He ſaw plainly that his own ſubjects were of too capricious a diſpoſition to form ſoldiers calculated for his tyrannical purpoſes. They had uniformly manifeſted an inclination to change their ſovereigns, though more from the love of variety than to reform the government, or reſtrain the abuſes of tyranny. Muley Iſhmael had diſcernment enough to ſee, that by forming an army of ſlaves, whoſe ſole dependence ſhould reſt upon their maſter, he could eaſily train them in ſuch a manner as to act in the ſtricteſt conformity to his wiſhes. He ſoon learnt that the great object with the negroes was plenty of money and liberty of plunder; in theſe he liberally indulged them, and the plan fully anſwered his expectations. Though, however, Muley Iſhmael had no great merit in introducing ſubjects for the purpoſes of tyranny, yet the good effects of this new colonization were very generally experienced. By intermarrying among themſelves, and intermixing among the Moors (for the Moors will keep negro women as concubines, though they ſeldom marry them), a new race of people ſtarted up, who became as uſeful ſubjects as the native inhabitants, and brought the empire into a much more flouriſhing ſtate than it had ever been in ſince their great revolution.

Sidi Mahomet, his grandſon and ſucceſſor, had different views, and was actuated by different motives. From his inordinate avarice, he ceaſed to act towards his black troops in the generous manner which had diſtinguiſhed his predeceſſor Muley Iſhmael; and they ſoon ſhowed themſelves diſcontented with his conduct. They offered to place his eldeſt ſon Muley Ali, on the throne; but this prince, not unmindful of the duty which he owed his father and ſovereign, declined their offer. They next applied to Muley Yazid, who at firſt accepted of the aſſiſtance they tendered, but in a ſhort time relinquiſhed the plan. Sidi Mahomet, diſguſted with this conduct of the negroes, determined to curb their growing power, by diſbanding a conſiderable part of theſe troops, and baniſhing them to diſtant parts of the empire.

5 Deſpotiſm of the emperors.

A moſt flagrant ſpecies of deſpotiſm, which renders the emperors more formidable to their ſubjects, is their making themſelves their ſole heirs, and, in virtue of that, ſeizing upon all their effects, and making only ſuch proviſion for their families as they think proper; and often, on ſome frivolous pretence, leaving them deſtitute of any, according to the liking or diſlike they bear to the deceaſed; ſo that, upon the whole, they are the only makers, judges, and interpreters, and in many inſtances likewiſe the executioners, of their own laws, which have no other limits than their own arbitrary will. The titles which the emperors of Morocco aſſume, are thoſe of *Moſt glorious, mighty, and noble emperor of Afric; king of Fez and Morocco, Tafilet, Suz, Dorha, and all the Algarbe, and its territories in Afric; grand Sharif* (or, as others write it, *Xarif*, that is, ſucceſſor, or vicegerent), *of the great Prophet Mohammed, &c.*

6
Amini-
ſtion of
juice.

The judges or magiſtrates who act immediately under the emperor are either ſpiritual or temporal, or rather eccleſiaſtical and military. The mufti and the cadis are judges of all religious and civil affairs; and the baſhaws, governors, alcaides, and other military officers, of thoſe that concern the ſtate or the army: all of them the moſt obſequious creatures and ſlaves of their prince, and no leſs the rapacious tyrants of his ſubjects, and from whom neither juſtice nor favour can be obtained but by mere dint of money and extortionate bribery, from the higheſt to the loweſt. Neither can it indeed be otherwiſe in ſuch an arbitrary government, where the higheſt poſts muſt not only be bought of the prince at a moſt extravagant price, and kept only by as exorbitant a tribute, which is yearly paid to him, but where no one is ſure to continue longer than he can bribe ſome of the courtiers to inſinuate to the monarch that he pays to the utmoſt of his power and much beyond what was expected from him. There are inſtances of the ſultan elevating at once a common ſoldier to the rank of a baſhaw, or making him a confidential friend; the following day he would perhaps impriſon him, or reduce him again to the ſtation of a private ſoldier. Yet ſuch is the diſpoſition of theſe people, that they have an unbounded thirſt for rank and power with all their uncertainties; and what is more extraordinary, when they have obtained a high ſtation, they ſeldom fail to afford their ſovereign a plea for ill treating them, by abuſing in ſome way or other their truſt.

7
yal revenes.

From what has been ſaid, it may be reaſonably concluded that the revenue ariſing to the emperor from the laſt-mentioned ſource, that of bribery, extortion, and confiſcation, muſt be very conſiderable, though there is no poſſibility to make any other conjecture of its real amount than that it muſt be an immenſe one. Another conſiderable branch is the piratical trade, which brings the greater income into his treaſury, as he is not at any expence either for fitting out of corſair veſſels, or maintaining their men; and yet has the tenth of all the cargo and of all the captives; beſides which, he appropriates to himſelf all the reſt of them, by paying the captors 50 crowns per head, by which means he engroſſes all the ſlaves to his own ſervice and advantage. This article is indeed a very conſiderable addition to his revenue, not only as he ſells their ranſom at a very high rate, but likewiſe as he has the profit of all their labour, without allowing them any other maintenance than a little bread and oil, or any other aſſiſtance when ſick, than what medicines a Spaniſh convent, which he tolerates there, gives them gratis; and which, nevertheleſs, is forced to pay him an annual preſent for that toleration, beſides furniſhing the court with medicines, and the ſlaves with lodging and diet when they are not able to work. Another branch of his revenue conſiſts in the tenth part of all cattle, corn, fruits, honey, wax, hides, rice, and other products of the earth, which is exacted of the Arabs and Brebes, as well as of the natives; and theſe are levied, or rather farmed, by the baſhaws, governors, alcaides, &c. with all poſſible ſeverity. The Jews and Chriſtians likewiſe pay an income or capitation, the former of ſix crowns *per* head on all males from 15 years and upwards, beſides other arbitrary impoſts, fines, &c. That on the Chriſtians, for the liberty of trading in his dominions, riſes and falls according to their number, and the commerce they drive; but which, whatever it may bring yearly into his coffers, is yet detrimental to trade in general, ſeeing it diſcourages great numbers from ſettling there, notwithſtanding the artful invitations which the emperors and their miniſters make uſe of to invite them to it; for, beſides thoſe arbitrary exactions, there is ſtill another great hardſhip attending them, viz. that they cannot leave the country without forfeiting all their debts and effects to the crown. The duties on all imports and exports is another branch of his income, the amount of which, it is ſaid, does not exceed 165,000l. per annum.

8
Climate of
Morocco.

The climate of the empire of Morocco is in general ſufficiently temperate, healthy, and not ſo hot as its ſituation might lead us to ſuppoſe. The chain of mountains which form Atlas, on the eaſtern ſide, defends it from the eaſt winds, that would ſcorch up the earth were they frequent. The ſummit of theſe mountains is always covered with ſnow; and their abundant deſcending ſtreams ſpread verdure through the neighbourhood, make the winter more cold, and temper the heats of ſummer. The ſea on the weſt ſide, which extends along the coaſt from north to ſouth, alſo refreſhes the land with regular breezes, that ſeldom vary according to their ſeaſons. At a diſtance from the ſea, within land, the heat is ſo great, that the rivulets become dry in ſummer; but as in hot countries dews are plentiful, the nights are there always cool. The rains are tolerably regular in winter; and are even abundant, though the atmoſphere is not loaded with clouds as in northern latitudes. Thoſe rains which fall by intervals are favourable to the earth, and increaſe its fecundity. In January the country is covered with verdure, and enamelled with flowers. Barley is cut in March, but the wheat harveſt is in June. All fruits are early in this climate; and in forward years the vintage is over in the beginning of September. Though in general there is more uniformity and leſs variation in hot than in northern climates, the firſt are nevertheleſs expoſed to the intemperance of weather: too heavy rains often impede the harveſt; and drought has ſtill greater inconveniences, for it enſures the propagation of locuſts.

9
Soil, and

The ſoil of Morocco is exceedingly fertile. It is moſt ſo in the inland provinces. On the weſtern coaſt it is in general light and ſtony, and is better adapted to the vine and olive than the culture of wheat. They annually burn, before the September rains, the ſtubble, which is left rather long; and this and the dung of cattle, every day turned to paſture, form the ſole manure the land receives. The ſoil requires but little labour, and the ploughing is ſo light that the furrows are ſcarcely ſix inches deep; for which reaſon, in ſome provinces, wooden ploughſhares are uſed for cheapneſs.

10
produc-
tions.

The empire of Morocco might ſupply itſelf with all neceſſaries, as well from the abundance and nature of its products, as from the few natural or artificial wants of the Moors occaſioned by climate or education. Its wealth conſiſts in the fruitfulneſs of its ſoil: its corn, fruits,

fruits, flocks, flax, ſalt, gums, and wax, would not only ſupply its neceſſities, but yield a ſuperflux, which might become an object of immenſe trade and barter with other nations. Such numerous exports might return an inexhauſtible treaſure, were its government fixed and ſecure, and did ſubjects enjoy the fruits of their labour and their property in ſafety. The increaſe of corn in Morocco is often as ſixty to one, and thirty is held to be but an indifferent harveſt.

The Moors, naturally indolent, take little care of the culture of their fruits. Oranges, lemons, and thick ſkinned fruits, the trees of which require little nurture, grow in the open fields; and there are very large plantations of them found, which they take the trouble to water in order to increaſe their product. Their vines, which yield excellent grapes, are planted as far as the 33d degree, as in the ſouthern provinces of France, and are equally vigorous. But at Morocco, where they yield a large and delicious grape, they are ſupported by vine poles five and ſix feet above ground; and as they are obliged to be watered, the little wine made there is ſeldom preſerved. Figs are very good in ſome parts of the empire, but toward the ſouth they are ſcarcely ripe before they are full of worms; the heats and night dews may, perhaps, contribute to this ſpeedy decay. Melons, for the ſame reaſon, are rarely eatable; they have but a moment of maturity; which paſſes ſo rapidly that it is with difficulty ſeized. Water melons are everywhere reared, and in ſome provinces are excellent. Apricots, apples, and pears, are in tolerable plenty in the neighbourhood of Fez and Mequinez, where water is leſs ſcarce and the climate more temperate. But in the plain, which extends along the weſtern coaſt, theſe delicate fruits are very indifferent, have leſs juice or taſte, and the peaches there do not ripen. The tree called the prickly pear, or the Barbary fig, is plentifully found in the empire of Morocco; and is planted round vineyards and gardens, becauſe its thick and thorny leaves, which are wonderfully prolific, form impenetrable hedges. From theſe leaves a fruit is produced, covered with a thorny ſkin, that muſt be taken off with care. This fruit is mild, and full of very hard, ſmall kernels. The olive is everywhere found along the coaſt, but particularly to the ſouth.

In the province of Suz, between the 25th and 30th degrees, the inhabitants have an almond harveſt, which varies little becauſe of the mildneſs of the climate; but the fruit is ſmall, for which reaſon they take little care of the trees, and they degenerate with time. The palm tree is common in the ſouthern provinces of Morocco; but dates ripen there with difficulty, and few are good except in the province of Suz and toward Tafilet. On the coaſt of Sallee and Mamora there are foreſts of oak, which produce acorns near two inches long. They taſte like cheſnuts, and are eaten raw and roaſted. Salt abounds in the empire, and in ſome places on the coaſt requires only the trouble of gathering. Independent of the ſalt pits formed by the evaporation of the ſoft water, there are pits and lakes in the country whence great quantities are obtained. It is carried even as far as Tombut, whence it paſſes to the interior parts of Africa.

The Moors cultivate their lands only in proportion to their wants; hence two-thirds of the empire at leaſt lie waſte. Here the *doum*, that is, the fan or wild palm tree, grows in abundance; and from which thoſe people, when neceſſity renders them induſtrious, find great advantage. The ſhepherds, mule-drivers, camel drivers, and travellers, gather the leaves, of which they make mats, fringes, baſkets, hats, *ſhoaris* or large wallets to carry corn, twine, ropes, girths, and covers for their pack ſaddles. This plant, with which alſo they heat their ovens, produces a mild and reſinous fruit that ripens in September and October. It is in form like the raiſin, contains a kernel, and is aſtringent and very proper to temper and counteract the effects of the watery and laxative fruits, of which theſe people in ſummer make an immoderate uſe.

11 Mines. Unacquainted with the ſources of wealth of which their anceſtors were poſſeſſed, the Moors pretend there are gold and ſilver mines in the empire, which the emperors will not permit to be worked, leſt their ſubjects ſhould thus find means to ſhake off their yoke. It is not improbable but that the mountains of Atlas may contain unexplored riches; but there is no good proof that they have ever yielded gold and ſilver. There are known iron mines in the ſouth; but the working of them has been found ſo expenſive, that the natives would rather uſe imported iron, notwithſtanding the heavy duty it pays, by which its price is doubled. There are copper mines in the neighbourhood of Santa Cruz, which are not only ſufficient for the ſmall conſumption of the empire, where copper is little uſed, but are alſo an object of exportation, and would become much more ſo were the duties leſs immoderate.

12 Animals. Neither the elephant nor the rhinoceros is to be found either in this or the other ſtates of Barbary; but the deſerts abound with lions, tigers, leopards, hyænas, and monſtrous ſerpents. The Barbary horſes were formerly very valuable, and thought equal to the Arabian. Though the breed is now ſaid to be decayed, yet ſome very fine ones are occaſionally imported into England. Camels and dromedaries, aſſes, mules, and kumrahs (a moſt ſerviceable creature, begot by an aſs upon a cow), are their beaſts of burden. Their cows are but ſmall, and barren of milk. Their ſheep yield but indifferent fleeces, but are very large, as are their goats. Bears, porcupines, foxes, apes, hares, rabbits, ferrets, weaſels, moles, chameleons, and all kinds of reptiles, are found here. Partridges and quails, eagles, hawks, and all kinds of wild fowl, are frequent on the coaſt.

13 Mountains, &c. The principal mountains form the chain which goes under the name of *Mount Atlas*, and runs the whole length of Barbary from eaſt to weſt, paſſing through Morocco, and abutting upon that ocean which ſeparates the eaſtern from the weſtern continent, and is from this mountain called the *Atlantic Ocean*. See ATLAS. The principal rivers, beſides the Malva or Mulvya above mentioned, which riſes in the deſerts, and running from ſouth to north divides Morocco from the kingdom of Algiers, are the Suz, Ommirabih, Rabbata, Larache, Darodt, Sebon, Gueron, and Tenſift, which riſe in Mount Atlas, and fall into the Atlantic ocean.

14 Inland traffic. The traffic of the empire by land is either with Arabia or Negroland: to Mecca they ſend caravans, conſiſting of ſeveral thouſand camels, horſes, and mules, twice every year, partly for traffic, and partly on a religious account; for numbers of pilgrims take that opportunity of paying their devotions to their great prophet. The goods they carry to the eaſt are woollen manufactures,

manufactures, leather, indigo, cochineal, and oſtrich feathers; and they bring back from thence, ſilk, muſlins, and drugs. By their caravans to Negroland, they ſend ſalt, ſilk, and woollen manufactures, and bring back gold and ivory in return, but chiefly negroes.

15 Traffic.

The caravans always go ſtrong enough to defend themſelves againſt the wild Arabs in the deſerts of Africa and Aſia; though, notwithſtanding all their vigilance, ſome of the ſtragglers and baggage often fall into their hands: they are alſo forced to load one-half of their camels with water, to prevent their periſhing with drought and thirſt in thoſe inhoſpitable deſerts. And there is ſtill a more dangerous enemy, which is the ſand itſelf: when the winds riſe, the caravan is perfectly blinded with duſt; and there have been inſtances both in Africa and Aſia, where whole caravans, and even armies, have been buried alive in the ſands.

16 Foreign commerce.

The natives have hardly any trading veſſels, but are ſeldom without ſome corſairs. Theſe, and European merchant ſhips, bring them whatever they want from abroad; as linen and woollen cloth, ſtuffs, iron wrought and unwrought, arms, gunpowder, lead and the like: for which they take in return, copper, wax, hides, Morocco leather, wool (which is very fine), gums, ſoap, dates, almonds, and other fruits. The duties paid by the Engliſh in the ports of Morocco are but half thoſe paid by other Europeans. It is a general obſervation, that no nation is fond of trading with theſe ſtates, not only on account of their capricious deſpotiſm, but the villany of their individuals, both natives and Jews, many of whom take all opportunities of cheating, and when detected are ſeldom puniſhed.

17 Land forces.

The land forces of the emperor of Morocco conſiſt principally of black troops, and ſome few white; amounting altogether to an army of about 36,000 men upon the eſtabliſhment, two-thirds of which are cavalry. This eſtabliſhment, however, upon occaſion, admits of a conſiderable increaſe, as every man is ſuppoſed to be a ſoldier, and when called upon is obliged to act in that capacity. About 6000 of the ſtanding forces form the emperor's body guard, and are always kept near his perſon; the remainder are quartered in the different towns of the empire, and are under the charge of the baſhaws of the provinces. They are all clothed by the emperor, and receive a trifling pay; but their chief dependence is on plunder, which they have frequent opportunities of acquiring.

The black troops are naturally of a very fiery diſpoſition, capable of enduring great fatigue, hunger, thirſt, and every difficulty to which a military life is expoſed. They appear well calculated for ſkirmiſhing parties, or for the purpoſe of haraſſing an enemy; but were they obliged to undergo a regular attack, from their total want of diſcipline they would ſoon be routed. In all their manœuvres they have no notion whatever of order and regularity, but have altogether more the appearance of a rabble than of an army.

18 Navy.

The emperor's navy conſiſts of about 15 ſmall frigates, a few xebecks, and between 20 and 30 row-galleys. The whole is commanded by one admiral; but as theſe veſſels are principally uſed for the purpoſes of piracy, they ſeldom unite in a fleet. The number of the ſeamen in ſervice is computed at 6000.

19 Coins.

The coins of this empire are a fluce, a blanquil, and ducat. The fluce is a ſmall copper coin, 20 whereof make a blanquil, of the value of twopence ſterling. The blanquil is of ſilver, and the ducat of gold, not unlike that of Hungary, and worth about nine ſhillings. Both theſe pieces are ſo liable to be clipped and filed by the Jews, that the Moors always carry ſcales in their pockets to weigh them; and when they are found to be much diminiſhed in their weight, they are recoined by the Jews, who are maſters of the mint, by which they gain a conſiderable profit; as they do alſo by exchanging the light pieces for thoſe that are full weight. Merchants accounts are kept in ounces, 10 of which make a ducat; but in payments to the government, it is ſaid they reckon 17 one-half for a ducat.

20 Religion and

With reſpect to religion, the inhabitants of Morocco are Mohammedans, of the ſect of Ali; and have a mufti or high-prieſt, who is alſo the ſupreme civil magiſtrate, and the laſt reſort in all cauſes eccleſiaſtical and civil. They have a great veneration for their hermits, and for idiots and madmen; as well as for thoſe who by their tricks have got the reputation of wizzards: all whom they look upon as inſpired perſons, and not only honour as ſaints while they live, but build tombs and chapels over them when dead; which places are not only religiouſly viſited by their devotees far and near, but are eſteemed inviolable ſanctuaries for all ſorts of criminals except in caſes of treaſon.

Notwithſtanding the natives are zealous Mohammedans, they allow foreigners the free and open profeſſion of their religion, and their very ſlaves have their prieſts and chapels in the capital city; though it muſt be owned that the Chriſtian ſlaves are here treated
with the utmoſt cruelty. Here, as in all other Mo- 21 Laws.
hammedan countries, the Alcoran and their comments upon it are their only written laws; and though in ſome inſtances their cadis and other civil magiſtrates are controlled by the arbitrary determinations of their princes, baſhaws, generals, and military officers, yet the latter have generally a very great deference and regard for their laws. Murder, theft, and adultery, are commonly puniſhed with death: and their puniſhments for other crimes, particularly thoſe againſt the ſtate, are very cruel; as impaling, dragging the priſoner through the ſtreets at a mule's heels till all his fleſh is torn off, throwing him from a high tower upon iron hooks.

22 Inhabitants of the empire of Morocco.

The inhabitants of the empire of Morocco, known by the name of *Moors*, are a mixture of Arabian and African nations formed into tribes; with the origin of whom we are but imperfectly acquainted. Theſe tribes, each ſtrangers to the other, and ever divided by traditional hatred or prejudice, ſeldom mingle. It ſeems probable that moſt of the caſts who occupy the provinces of Morocco have been repulſed from the eaſtern to the weſtern Africa, during thoſe different revolutions by which this part of the world has been agitated; that they have followed the ſtandard of their chiefs, whoſe names they have preſerved; and that by theſe they, as well as the countries they inhabit, are diſtinguiſhed. At preſent theſe tribes are called *caſiles* or *cabiles*, from the Arabic word *kobeila*; and they are ſo numerous, that it is impoſſible to have a knowledge of them all.

The native ſubjects of the empire of Morocco may be divided into two principal claſſes; the *Brebes* and the *Moors*.

23
The Brebes, or Mountaineers.

The etymology of the name, and the origin of the people, of the firſt claſs, are equally unknown. Like the Moors, at the time of the invaſion by the Arabs, they may have adopted the Mahometan religion, which is conſonant to their manners and principal uſages; but they are an ignorant people, and obſerve none of the precepts of that religion, but the averſion it enjoins againſt other modes of worſhip.

Confined to the mountains, the Brebes preſerve great animoſity againſt the Moors, whom they confound with the Arabs, and conſider as uſurpers.—They thus contract in their retreats a ferocity of mind, and a ſtrength of body, which makes them more fit for war and every kind of labour than the Moors of the plain in general are. The independence they boaſt of gives even a greater degree of expreſſion to their countenance. The prejudices of their religion make them ſubmit to the authority of the emperors of Morocco; but they throw off the yoke at their pleaſure, and retire into the mountains, where it is difficult to attack or overcome them. The Brebes have a language of their own, and never marry but among each other. They have tribes or caſiles among them who are exceedingly powerful both by their number and courage.

The *Moors* of the plains may be diſtinguiſhed into thoſe who lead a paſtoral life, and thoſe who inhabit the cities.

24
The Moors of the country.

The former live in tents; and that they may allow their ground a year's reſt, they annually change the place of their encampments, and go in ſearch of freſh paſturage; but they cannot take this ſtep without acquainting their governor. Like the ancient Arabs, they are entirely devoted to a paſtoral life: their encampments, which they call *douchars*, are compoſed of ſeveral tents, and form a creſcent; or they are ranged in two parallel lines, and their flocks, when they return from paſture, occupy the centre.

The tents of the Moors, viewed in front, are of a conical figure; they are from 8 to 10 feet high, and from 20 to 25 feet long; like thoſe of high antiquity, they reſemble a boat reverſed. They are made of cloth compoſed of goats and camels hair, and the leaves of the wild palm, by which they are rendered impervious to water; but at a diſtance their black colour gives them a very diſagreeable look.

25
Their ſimple way of life.

The Moors, when encamped, live in the greateſt ſimplicity, and exhibit a faithful picture of the inhabitants of the earth in the firſt ages of the world. The nature of their education, the temperature of the climate, and the rigour of the government, diminiſh the wants of the people, who find in their plains, in the milk and wool of their flocks, every thing neceſſary for food and clothing. Polygamy is allowed among them; a luxury ſo far from being injurious to a people who have few wants, that it is a great convenience in the economy of thoſe ſocieties, becauſe the women are intruſted with the whole care of the domeſtic management.

26
Occupations of the women, &c.

In their half-cloſed tents, they are employed in milking the cows for daily uſe; and when the milk abounds, in making butter, in picking their corn, their barley, and pulſe, and grinding their meal, which they do daily in a mill compoſed of two ſtones about 18 inches in diameter, the uppermoſt having a handle, and turning on an axis fixed in the under one: they make bread likewiſe every day, which they bake between two earthen plates, and often upon the ground after it has been heated by fire. Their ordinary food is the cooſcooſoo; which is a paſte made with their meal in the form of ſmall grains like Italian paſte. This cooſcooſoo is dreſſed in the vapour of boiling ſoup, in a hollow diſh perforated with many ſmall holes in the bottom, and the diſh is encloſed in a kettle where meat is boiled; the cooſcooſoo, which is in the hollow diſh, grows gradually ſoft by the vapour of the broth, with which it is from time to time moiſtened. This ſimple food is very nouriſhing, and even agreeable when one has got the better of the prejudices which every nation entertains for its own cuſtoms. The common people eat it with milk or butter indifferently; but thoſe of higher rank, ſuch as the governors of provinces and lieutenants, who live in the centre of the encampments, add to it ſome ſucculent broth, made with a mixture of mutton, poultry, pigeons, or hedgehogs, and then pour on it a ſufficient quantity of freſh butter.

The women in their tents ſpin wool, and weave it into cloth on looms ſuſpended the whole length of the tent. Each piece is about five ells long, and one and a half broad; it is neither dreſſed nor dyed, and it has no ſeam; they waſh it when it is dirty; and as it is the only habit of the Moors, they wear it night and day. It is called *haick*, and is the true model of the ancient draperies.

27
Dreſs, &c.

The Moors of the plain wear nothing but their woollen ſtuff; they have neither ſhirts nor drawers. Linen among theſe people is a luxury known only to thoſe of the court or the city. The whole wardrobe of a country Moor in eaſy circumſtances conſiſts in a haick for winter, another for ſummer, a red cap, a hood, and a pair of ſlippers. The common people both in the country and in towns wear a kind of tunick of woollen cloth, white, gray, or ſtriped, which reaches to the middle of the leg, with great ſleeves and a hood; it reſembles the habit of the Carthuſians.

The women's dreſs in the country is likewiſe confined to a haick, which covers the neck and the ſhoulders, and is faſtened with a ſilver claſp. The ornaments they are fondeſt of are ear rings, which are either in the form of rings or creſcents, made of ſilver, bracelets, and rings for the ſmall of the leg; they wear theſe trinkets at their moſt ordinary occupations; leſs out of vanity than becauſe they are unacquainted with the uſe of caſkets or cabinets for keeping them. They alſo wear necklaces made of coloured glaſs beads or cloves ſtrung on a cord of ſilk.

The Moors conſider their wives leſs in the light of companions than in that of ſlaves deſtined to labour. Except in the buſineſs of tillage, they are employed in every ſervile operation; nay, in ſome of the poorer quarters a woman is often ſeen yoked in a plough along with a mule, an aſs, or ſome other animal. When the Moors remove their douchars, all the men ſeat themſelves in a circle on the ground; and with their elbows reſting on their knees, paſs the time in converſation, while the women ſtrike the tents, fold them up into bundles, and place them on the backs of their camels or oxen. The old women are then each loaded with a parcel, and the young carry the children on their ſhoulders

ſhoulders ſuſpended in a cloth girt round their bodies. In the more ſouthern parts the women are likewiſe employed in the care of the horſes: the huſband, who in theſe climates is always a deſpot, iſſues his orders, and ſeems only made to be obeyed.

28 Marriages, &c. The marriage ceremonies of the Moors that live in tents pretty much reſemble thoſe of the ſame people that live in the cities. In the douchars they are generally moſt brilliant and gay; the ſtrangers that paſs along are invited, and made to contribute to the feaſt; but this is done more from politeneſs than from any mercenary motive.

The tribes of the plain generally avoid mixing by marriage with one another: the prejudices that divide theſe people are commonly perpetuated; or, if they are partially healed, they never fail to revive upon trifling occaſions, ſuch as a ſtrayed camel, or the preference of a paſture or a well. Marriages have ſometimes taken place among them, that, ſo far from cementing their differences, have occaſioned the moſt tragical ſcenes. Huſbands have been known to murder their wives, and women their huſbands, to revenge national quarrels.

Parents are not encumbered with their children, however numerous they may be, for they are very early employed in domeſtic affairs; they tend the flocks, they gather wood, and they aſſiſt in ploughing and reaping. In the evening, when they return from the field, all the children of the douchar aſſemble in a common tent, where the iman, who himſelf can hardly ſpell, makes them read a few ſentences from the Koran written on boards, and inſtructs them in their religion by the light of a fire made of ſtraw, of buſhes, and cow dung dried in the ſun. As the heat is very great in the inland parts of the country, children of both ſexes go quite naked till the age of nine or ten.

29 Entertainment of travellers. The douchars diſperſed over the plains are always in the neighbourhood of ſome rivulet or ſpring, and they are a kind of inns for the reception of travellers. There is generally a tent erected for their uſe, if they have not brought one along with them, where they are accommodated with poultry, milk, and eggs, and with whatever is neceſſary for their horſes. Inſtead of wood for fuel, they have the cow dung, which, when mixed with charcoal, makes a very briſk fire. A guard is always ſet on the tents of travellers, eſpecially if they are Europeans, becauſe the opinion of their wealth might tempt the avidity of the Moors, who are naturally inclined to thieving.

With reſpect to the roads, a very judicious policy is eſtabliſhed, which is adapted to the character of the Moors, and to their manner of life. The douchars are reſponſible for robberies committed in their neighbourhood and in ſight of their tents: they are not only obliged to make reſtitution, but it gives the ſovereign a pretence for exacting a contribution proportioned to the abilities of the douchar. In order to temper the rigour of this law, they are made reſponſible only for ſuch robberies as are committed during the day; thoſe that happen after ſunſet are not imputed to them, as they could neither ſee nor prevent them: on this account, people here travel only from ſunriſing to ſunſetting.

30 Markets. To facilitate the exchange of neceſſaries, there is in the fields every day, except Friday, which is a day of prayer, a public market in the different quarters of each province. The Moors of the neighbourhood aſſemble to ſell and buy cattle, corn, pulſe, dried fruits, carpets, haicks, and in ſhort all the productions of the country. This market, which is called *Soc*, reſembles our fairs. The buſtle of the people who go and come, gives a better idea of the manner of life of the Moors than can be had in the cities. The alcaides, who command in the neighbourhood, always attend theſe markets with ſoldiers to keep the peace; as it frequently happens that the grudges which theſe tribes harbour againſt one another break out upon ſuch occaſions into open violence.

31 Of the Moors who dwell in cities. The Moors who inhabit the cities differ from the others only in having a little more urbanity and a more eaſy deportment. Though they have the ſame origin with thoſe of the plains, they affect to decline all intercourſe with them. Some writers, without any foundation, have given the name of *Arabs* to the inhabitants of the towns, and that of *Moors* to thoſe of the plains. But the greater part of the cities of this empire are more ancient than the invaſion of the Arabs, who themſelves lived in tents.

32 Their houſes and furniture. The houſes in moſt of the towns in this empire appear at a little diſtance like vaulted tombs in a churchyard; and the entrance into the beſt of them has but a mean appearance. The rooms are generally on the ground floor, and whitened on the outſide. As the roofs are quite flat, they ſerve as *verandas*, where the Mooriſh women commonly ſit for the benefit of the air; and in ſome places it is poſſible to paſs nearly over the whole town without having occaſion to deſcend into the ſtreet.

As the beſt apartments are all backwards, a ſtable, or perhaps ſomething worſe, is the place to which viſitors are firſt introduced. Upon entering the houſe, the ſtranger is either detained in this place, or in the ſtreet, till all the women are deſpatched out of the way; he is then allowed to enter a ſquare court, into which four narrow and long rooms open by means of large folding doors, which, as they have no windows, ſerve likewiſe to introduce light into the apartments. The court has generally in its centre a fountain; and if it is the houſe of a Moor of property, it is floored with blue and white chequered tiling. None of the chambers have fire places; and their victuals are always dreſſed in the court-yard in an earthen ſtove heated with charcoal. When the viſitor enters the room, where he is received by the maſter of the houſe, he finds him ſitting croſs-legged and barefooted on a mattreſs, covered with fine white linen, and placed on the floor or elſe on a common mat. This, with a narrow piece of carpeting, is in general the only furniture he will meet with in Mooriſh houſes, though they are not deſtitute of other ornaments.

33 Dreſs of the men. The wardrobe of the inhabitants of cities is but little different from that of thoſe who live in tents.—Like the latter, they have a haick, and a hood more or leſs fine, and have alſo a hood of coarſe European cloth of dark blue for the winter. What farther diſtinguiſhes them from the country Moors is, that they wear a ſhirt and linen drawers, and an upper garment of cotton in ſummer, and of cloth in winter, which they call a *caftan*. The white or blue hood, the purpoſe of which ſeems to be to guard againſt bad weather, and which is called

bernus, is likewiſe a ceremonial part of dreſs; without which, together with ſabre and canjer (or dagger) worn in a bandelier, perſons of condition never appear before the emperor.

34 Dreſs of the ladies. The Mooriſh women who live in cities are, as in other nations, more addicted to ſhow and finery in dreſs than thoſe of the country; but as they generally leave the houſe only one day in the week, they ſeldom dreſs themſelves. Not allowed to receive male viſitors, they remain in their houſes employed in their families, and ſo totally in deſhabile that they often wear only a ſhift, and another coarſer ſhift over the firſt, tied round their waiſt, with their hair plaited, and ſometimes with, though often without, a cap. When dreſſed, they wear an ample and fine linen ſhift, the boſom embroidered in gold; a rich caftan of cloth, ſtuff, or velvet, worked in gold; and one or two folds of gauze, ſtreaked with gold and ſilk, round the head, and tied behind ſo as that the fringes, intermingled with their treſſes, deſcend as low as the waiſt; to which ſome add a ribband of about two inches broad, worked in gold or pearls, that encircles the forehead in form of a diadem. Their caftan is bound round their waiſt by a crimſon velvet girdle, embroidered in gold, with a buckle of gold or ſilver, or elſe a girdle of tamboured ſtuff, manufactured at Fez.

The women have yellow ſlippers, and a cuſtom of wearing a kind of ſtocking of fine cloth ſomewhat large, which is tied below the knee and at the ankle, over which it falls in folds. This ſtocking is leſs calculated to ſhow what we call a handſome leg, than to make it appear thick; for to be fat is one of the rules of beauty among the Mooriſh women. To obtain this quality, they take infinite pains, feed when they become thin on a diet ſomewhat like forced meat balls, a certain quantity of which is given them daily; and in fine, the ſame care is taken among the Moors to fatten young women as is in Europe to fatten fowls.

35 Negroes. The *Negroes*, who conſtitute a large proportion of the emperor's ſubjects, are better formed than the Moors; and as they are more lively, daring, and active, they are intruſted with an important ſhare in the executive part of government. They conſtitute in fact the moſt conſiderable part of the emperor's army, and are generally appointed to the command of provinces and towns. This circumſtance naturally creates a jealouſy between them and the Moors, the latter conſidering the negroes as uſurpers of a power which they have no right to aſſume. Beſides thoſe negroes which form the emperor's army, there are a great many others in the country, who either are or have been ſlaves to private Moors: every Moor of conſequence, indeed, has his proportion of them in his ſervice. To the diſgrace of Europe, the Moors treat their ſlaves with humanity, employing them in looking after their gardens, and in the domeſtic duties of their houſes. They allow them to marry among themſelves; and after a certain number of years, ſpontaneouſly preſent them with the invaluable boon of liberty. They ſoon are initiated in the Mahometan perſuaſion, though they ſometimes intermix with it a few of their original ſuperſtitious cuſtoms. In every other reſpect they copy the dreſs and manners of the Moors.

36 Renegadoes. Among the inhabitants of Morocco there is another claſs, of whom we muſt not omit to make mention. Theſe are the *Renegadoes*, or foreigners, who have renounced their religion for the faith of Mahomet. Of theſe there are a great number who have been originally Jews: they are held in little eſtimation by the Moors; and would be held in abhorrence by the Jews, if they durſt freely expreſs their averſion. The families of theſe apoſtates are called *Toornadis:* not having at any time married with the Moors, they ſtill preſerve their ancient characteriſtics, and are known almoſt at ſight to be the progeny of thoſe who formerly embraced the Mahometan religion. The Chriſtian renegadoes are but few; and generally are fugitive peculators of Spain, or men fallen from power, who becauſe of their miſconduct, or in deſpair, quit one unfortunate ſituation for another much more deplorable.

37 Jews. The *Jews* were formerly very numerous in this empire. After being proſcribed in Spain and Portugal, multitudes of them paſſed over to Morocco, and ſpread themſelves through the towns and over the country. By the relations they themſelves give, and by the extent of the places aſſigned them to dwell in, it would appear there were more than 30,000 families, of whom at preſent there is ſcarcely a reſidue of one-twelfth; the remainder either having changed their religion, ſunk under their ſufferings, or fled from the vexations they endured, and the arbitrary taxes and tolls impoſed upon them. The Jews poſſeſs neither lands nor gardens, nor can they enjoy their fruits in tranquillity: they muſt wear only black; and are obliged, when they paſs near moſques, or through ſtreets in which there are ſanctuaries, to walk barefoot. The loweſt among the Moors imagines he has a right to ill-treat a Jew; nor dares the latter defend himſelf, becauſe the Koran and the judge are always in favour of the Mahometan.—Notwithſtanding this ſtate of oppreſſion, the Jews have many advantages over the Moors: they better underſtand the ſpirit of trade; they act as agents and brokers, and profit by their own cunning and the ignorance of the Moors.

38 State of knowledge among the Moors. The Moors, who derive their language and religion from the Arabs, ſeem not in any manner to have participated of their knowledge. United and confounded as thoſe of Morocco have been with the Moors of Spain, the latter of whom cultivated the arts and gave birth to Averroes, and many other great men, the Moors of this empire have preſerved no traces of the genius of their anceſtors. They have no conception of the ſpeculative ſciences. Education conſiſts merely in learning to read and write; and as the revenues of the learned are derived from theſe talents, the prieſts and talbes among them are the ſole depoſitories of thus much knowledge: the children of the Moors are taught in their ſchools to read and repeat ſome ſixty leſſons, ſelected from the Koran, which for the ſake of economy are written upon ſmall boards.

The Moors who formerly inhabited Spain gave great application to phyſic and aſtronomy; and they have left manuſcripts behind them which ſtill remain monuments of their genius. The modern Moors are infinitely degenerate; they have not the leaſt inclination to the ſtudy of ſcience; they know the properties of ſome ſimples; but as they do not proceed upon principle, and are ignorant of the cauſes and effects of diſeaſes, they generally make a wrong application of their remedies. Their moſt uſeful phyſicians are their talbes, their fakirs, and their ſaints, in whom they place a ſuperſtitious confidence.

Notwithſtanding the Moors have occupied themſelves little in the ſtudy of aſtronomy, they have been eager after aſtrology. This imaginary ſcience, which made ſo rapid a progreſs at Rome in ſpite of the edicts of the emperors, may be conceived to make ſtill greater advances among a people wholly ſtupid and ignorant, and ever agitated by the dread of preſent evils, or the hope of a more happy futurity. Magic, the companion of aſtrology, has here alſo found its followers, and is particularly ſtudied by the talbes in the ſouthern parts, who ſucceſsfully uſe it in impoſing upon Mooriſh credulity with ſtrange dreams and ambiguous forebodings and prophecies.

39
anufac-
tres and
des.

The Mooriſh manufactures are—The haick, which as was before obſerved, is a long garment compoſed of white wool and cotton, or cotton and ſilk woven together, and is uſed by the Moors for the purpoſe of covering their under dreſs when they go abroad, which they do by totally wrapping themſelves in it in a careleſs but eaſy manner; ſilk handkerchiefs of a particular kind, prepared only at Fez; ſilks checquered with cotton; carpeting, little inferior to that of Turkey; beautiful matting, made of the palmetto or wild palm tree; paper of a coarſe kind; cordovan, commonly called *Morocco leather*; gunpowder of an inferior nature; and long-barrelled muſkets, made of Biſcay iron. The Moors are unacquainted with the mode of caſting cannon: and therefore thoſe few which are now in the country are obtained from Europeans.—The manufacture of glaſs is likewiſe unknown to them; as indeed they make great uſe of earthen ware, and have few or no windows to their houſes, this commodity may be of leſs importance to them than many others. They make butter, by putting the milk into a goat ſkin, with its outward coat turned inwards, and ſhaking it till the butter collects on the ſides, when it is taken out for uſe. From this operation it proves always full of hairs, and has an inſipid flavour. Their cheeſe conſiſts merely of curds hardened and dried, and has uniformly a diſagreeable taſte. The bread in ſome of the principal towns, particularly at Tangier and Sallee, is remarkably good, but in many other places it is coarſe, black, and heavy.

Their looms, forges, ploughs, carpenters tools, &c. are much upon the ſame conſtruction with the unimproved inſtruments of the ſame kind which are uſed at this time in ſome parts of Europe, only ſtill more clumſily finiſhed. In their work, they attend more to ſtrength than neatneſs or convenience; and, like all other ignorant people, they have no idea that what they do is capable of improvement. It is probable, indeed, that the Moors have undergone no very material change ſince the revolution in their arts and ſciences, which took place ſoon after their expulſion from Spain. Previous to that period, it is well known they were an enlightened people, at a time when the greater part of Europe was involved in ignorance and barbariſm; but owing to the weakneſs and tyranny of their princes, they gradually ſunk into the very oppoſite extreme, and may now be conſidered as but a few degrees removed from a ſavage ſtate.

40
Religious
ceremonies.

Their moſques or places of public worſhip are uſually large ſquare buildings, compoſed of the ſame materials as the houſes. The building conſiſts of broad and lofty piazzas, opening into a ſquare court, in a manner in ſome degree ſimilar to the Royal Exchange of London. In the centre of the court is a large fountain, and a ſmall ſtream ſurrounds the piazzas, where the Moors perform the ceremony of ablution. The court and piazzas are floored with blue and white chequered tiling; and the latter are covered with matting, upon which the Moors kneel while repeating their prayers. In the moſt conſpicuous part of the moſque fronting the eaſt, ſtands a kind of pulpit, where the talbe or prieſt occaſionally preaches. The Moors always enter this place of worſhip barefooted, leaving their ſlippers at the door. On the top of the moſque, is a ſquare ſteeple with a flag ſtaff, whither at ſtated hours the talbe aſcends, hoiſts a white flag, and calls the people to prayers, for they have no bells. From this high ſituation the voice is heard at a conſiderable diſtance; and the talbes have a monotonous mode of enunciation, the voice ſinking at the end of every ſhort ſentence, which in ſome meaſure reſembles the ſound of a bell. The moment the flag is diſplayed, every perſon forſakes his employment, and goes to prayers. If they are near a moſque, they perform their devotions within it, otherwiſe immediately on the ſpot where they happen to be, and always with their faces towards the eaſt, in honour of their prophet Mahomet, who it is well known was buried at Medina.

Their Sabbath is on our Friday, and commences from ſix o'clock the preceding evening. On this day they uſe a blue flag inſtead of the white one. As it has been propheſied that they are to be conquered by the Chriſtians on the Sabbath day, the gates of all the towns and of the emperor's palaces are ſhut when at divine ſervice on that day, in order to avoid being ſurpriſed during that period. Their talbes are not diſtinguiſhed by any particular dreſs.

The Moors have three ſolemn devotional periods in the courſe of the year. The firſt, which is named *Aid de Cabier*, is held in commemoration of the birth of Mahomet. It continues ſeven days; during which period, every perſon who can afford the expence kills a ſheep as a ſacrifice, and divides it among his friends. The ſecond is the *Ramadam*. This is held at the ſeaſon when Mahomet diſappeared in his flight from Mecca to Medina. Every man is obliged at that period to faſt (that is, to abſtain from animal food from ſunriſe to ſunſet each day) for 30 days; at the expiration of which time a feaſt takes place, and continues a week. The third is named *Llaſhore*, and is a day ſet apart by Mahomet for every perſon to compute the value of his property, in order for the payment of *zakat*, that is, one-tenth of their income to the poor, and other pious uſes. Although this feaſt only laſts a ſingle day, yet it is celebrated with far greater magnificence than either of the others.

The Moors compute time by lunar months, and count the days of the week by the firſt, ſecond, third, &c. beginning from our Sunday. They uſe a common reed for writing, and begin their manuſcripts from right to left.

41
Language
of the
Moors.

The Moors of the empire of Morocco, as well as thoſe to the northern limits of Africa, ſpeak Arabic; but this language is corrupted in proportion as we retire farther from Aſia, where it firſt took birth; the intermixture which has happened among the African nations, and the frequent tranſmigrations of the Moors, during a ſucceſſion of ages, have occaſioned them to loſe the purity of the Arabic language; its pronunciation has been vitiated, the uſe of many words loſt, and other foreign words have been introduced without thereby rendering it more copious; the pronunciation of the Africans, however, is ſofter to the ear and leſs guttural than that of the Egyptians. The language, when written, is in effect much the ſame at Morocco as at Cairo, except that there are letters and expreſſions among the Moors which differ from thoſe of the Oriental Arabs, who, however, underſtand the Moors in converſation, notwithſtanding their vitiated manner of pronouncing. They mutually read each others writings with ſome difficulty.

42
Their temper and diſpoſition.

The Moors are naturally of a grave and penſive diſpoſition, fervid in profeſſions of friendſhip, but very inſincere in their attachments. They have no curioſity, no ambition of knowledge; an indolent habit, united to the want of mental cultivation, renders them perhaps even more callous than other unenlightened people to every delicate ſenſation; and they require more than ordinary excitement to render them ſenſible of pleaſure or of pain. This languor of ſentiment is, however, unaccompanied with the ſmalleſt ſpark of courage or fortitude. When in adverſity, they manifeſt the moſt abject ſubmiſſion to their ſuperiors; and in proſperity their tyranny and pride are inſupportable.

43
Mode of living, manners, &c.

Perſonal cleanlineſs has been conſidered as one of thoſe circumſtances which ſerve to mark and determine the civilization of a people. It was in vain that Mahomet enjoined the frequency of ablution as a religious duty to the Moors. Their dreſs, which ſhould be white, is but ſeldom waſhed; and their whole appearance evinces that they perform this branch of their religious ceremonies in but a ſlovenly manner. With this degree of negligence as to their perſons, we may be juſtly ſurpriſed to find united a moſt ſcrupulous nicety in their habitations and apartments. They enter their chambers barefooted, and cannot bear the ſlighteſt degree of contamination near the place where they are ſeated. This delicacy again is much confined to the inſides of their houſes. The ſtreets receive the whole of their rubbiſh and filth; and by theſe means the ground is ſo raiſed in moſt parts of the city of Morocco, that the new buildings always ſtand conſiderably higher than the old.

With reſpect to the hours for eating, the people of this country are remarkably regular. Very ſoon after daybreak they take their breakfaſt, which is generally a compoſition of flour and water boiled thin, together with an herb which gives it a yellow tinge. The male part of the family eat in one apartment and the female in another. The children are not permitted to eat with their parents, but take their meals afterwards with the ſervants; indeed in moſt other reſpects they are treated exactly as ſervants or ſlaves by their parents. The meſs is put into an earthen bowl, and brought in upon a round wooden tray. It is placed in the centre of the gueſts, who ſit croſs-legged either on a mat or on the floor, and who form a circle for the purpoſe. Having previouſly waſhed themſelves, a ceremony always performed before and after meals, each perſon with his ſpoon attacks vigorouſly the bowl, while they diverſify the entertainment by eating with it fruit or bread. At twelve o'clock they dine, performing the ſame ceremonies as at breakfaſt. For dinner, from the emperor down to the peaſant, their diſh is univerſally *cooſcooſoo*, the mode of preparing which has been already deſcribed. The diſh is brought in upon a round tray and placed on the floor, round which the family ſit as at breakfaſt, and with their fingers commit a violent aſſault on its contents: they are at the ſame time, however, attended by a ſlave or domeſtic, who preſents them with water and a towel occaſionally to waſh their hands. From the want of the ſimple and convenient invention of knives and forks, it is not uncommon in this country to ſee three or four people pulling to pieces the ſame piece of meat, and afterwards with their fingers ſtirring up the paſte or *cooſcooſoo*, of which they often take a whole handful at once into their mouth. At ſunſet they ſup upon the ſame diſh; and indeed ſupper is their principal meal.

But the common people muſt content themſelves with a little bread and fruit inſtead of animal food, and ſleep in the open ſtreets. This kind of exiſtence ſeems ill calculated to endure even in an inactive ſtate; far more ſevere muſt it therefore be to thoſe who exerciſe the laborious employment of couriers in this country, who travel on foot a journey of three hundred or four hundred miles at the rate of between thirty or forty miles a-day, without taking any other nouriſhment than a little bread, a few figs, and ſome water, and who have no better ſhelter at night than a tree. It is wonderful with what alacrity and perſeverance theſe people perform the moſt fatiguing journeys at all ſeaſons of the year. There is a regular company of them in every town, who are ready to be deſpatched at a moment's warning to any part of the country their employers may have occaſion to ſend them.

As the Moors are not fond of admitting men into their houſes except upon particular occaſions, if the weather be fine they place a mat, and ſometimes a carpet, on the ground before the door, ſeat themſelves upon it croſs-legged, and receive their friends, who form a circle, ſitting in the ſame manner, with their attendants on the outſide of the groupe. Upon theſe occaſions they either drink tea or ſmoke and converſe. The ſtreets are ſometimes crowded with parties of this kind; ſome engaged in playing at an inferior kind of cheſs or draughts, at which they are very expert; but the majority in converſation. The people of this country, indeed, are ſo decidedly averſe to ſtanding up, or walking about, that if only two or three people meet, they ſquat themſelves down in the firſt clean place they can find, if the converſation is to hold but for a few minutes.

44
Their amuſements.

The Moors have in general but few amuſements; the ſedentary life they lead in cities is little variegated except by the care they take of their gardens, which are rather kept for profit than pleaſure. Moſt of theſe gardens are planted with the orange, the lemon tree, and the cedar, in rows, and in ſuch great quantities, that the appearance is rather that of a foreſt than that of a garden. The Moors ſometimes, though rarely, have muſic in theſe retreats: a ſtate of ſlavery but ill agrees with the love of pleaſure: the people of Fez alone, either from a difference in education, or becauſe their organs and ſenſibility are more delicate, make

make muſic a part of their amuſements. There are not in Morocco, as in Turkey, public coffee-houſes, where people meet to inquire the news of the day; but inſtead of theſe, the Moors go to the barbers ſhops, which in all countries ſeem to be the rendezvous of newſmongers. Theſe ſhops are ſurrounded by benches; on which the cuſtomer, the inquiſitive, and the idle, ſeat themſelves, and when there are no more places vacant, they crouch on the ground like monkeys.

A common diverſion in the towns where there are ſoldiers, as well as in the country, is what the Moors call the game of gunpowder; a kind of military exerciſe, that is the more pleaſing to theſe people, inaſmuch as, by the nature of their government, they all are, or are liable to become, ſoldiers, therefore all have arms and horſes. By exploſions of powder, too, they manifeſt their feſtivity on their holidays. Their game of gunpowder conſiſts in two bodies of horſe, each at a diſtance from the other, galloping in ſucceſſive parties of four and four, and firing their pieces charged with powder. Their chief art is in galloping up to the oppoſite detachment, ſuddenly ſtopping, firing their muſkets, facing about, charging, and returning to the attack; all which manœuvres are imitated by their opponents. The Moors take great pleaſure in this amuſement, which is only an imitation of their military evolutions.

45 Management of horſes.

The common topics for converſation among the Moors, are the occurrences of the place, religion, their women, but above all their horſes. This laſt topic, indeed, appears to occupy by far the greateſt portion of their attention. Theſe animals are ſeldom kept in ſtables in Morocco. They are watered and fed only once a-day, the former at one o'clock at noon, and the latter at ſunſet: and the only one mode which they uſe to clean them is by waſhing them all over in a river two or three times a-week, and ſuffering them to dry themſelves.

46 Uſe of muſic.

Like all barbarous nations, the Moors are paſſionately fond of muſic, and ſome few have a taſte for poetry. Their ſlow airs, for want of that variety which is introduced when the ſcience has attained a degree of perfection, have a very melancholy ſameneſs; but ſome of their quick tunes are beautiful and ſimple, and partake in ſome degree of the characteriſtic melody of the Scotch airs. The poetry of their ſongs, the conſtant ſubject of which is love, though there are few nations perhaps who are leſs ſenſible of that paſſion, has certainly leſs merit than the muſic.

Their inſtruments are a kind of hautboy, which differs from ours only in having no keys; the mandoline, which they have learnt to play upon from their neighbours the Spaniards; another inſtrument, bearing ſome reſemblance to a violin, and played upon in a ſimilar manner, but with only two ſtrings; the large drum, the common pipe, and the tabor. Theſe united, and accompanied with a certain number of voices, upon many occaſions form a band, though ſolo muſic is more common in this unſocial country.

47 Marriage ceremonies.

The Moors marry very young, many of their females not being more than 12 years of age at their nuptials. As Mahometans, it is well known that their religion admits of polygamy to the extent of four wives, and as many concubines as they pleaſe; but if we except the very opulent, the people ſeldom avail themſelves of this indulgence, ſince it entails on them a vaſt additional expence in houſe-keeping, and in providing for a large family. In contracting marriage, the parents of both parties are the only agents; and the intended bride and bridegroom never ſee each other till the ceremony is performed. The marriage ſettlements are made before the cadi; and then the friends of the bride produce her portion, or if not, the huſband agrees to ſettle a certain ſum upon her in caſe he ſhould die, or divorce her on account of barrenneſs, or any other cauſe. The children of the wives have all an equal claim to the effects of the father and mother, but thoſe of the concubines can each only claim half a ſhare.

When the marriage is finally agreed upon, the bride is kept at home eight days, to receive her female friends, who pay congratulatory viſits every day. At the ſame time a talbe attends upon her, to converſe with her relative to the ſolemn engagement on which ſhe is about to enter: on theſe occaſions he commonly accompanies his admonitions with ſinging a pious hymn, which is adapted to the ſolemnity. The bridegroom, on the other hand, receives viſits from his male friends in the morning, and in the evening rides through the town accompanied by them, ſome playing on hautboys and drums, while others are employed in firing volleys of muſketry. In all their feſtivals the diſcharge of muſketry indeed forms a principal part of the entertainment. Contrary to the European mode, which particularly aims at firing with exactneſs, the Moors diſcharge their pieces as irregularly as poſſible, ſo as to have a continual ſucceſſion of reports for a few minutes.

On the day of the marriage, the bride in the evening is put into a ſquare or octagonal cage about twelve feet in circumference, which is covered with fine white linen, and ſometimes with gauſes and ſilks of various colours. In this vehicle, which is placed on a mule, ſhe is paraded round the ſtreets, accompanied by her relations and friends, ſome carrying lighted torches, others playing on the hautboys, and a third party again firing volleys of muſketry. In this manner ſhe is carried to the houſe of her intended huſband, who returns about the ſame time from performing ſimilar ceremonies. On her arrival, ſhe is placed in an apartment by herſelf, and her huſband is introduced to her alone for the firſt time, who finds her ſitting on a ſilk or velvet cuſhion (ſuppoſing her to be a perſon of conſequence), with a ſmall table before her, upon which are two wax candles lighted. Her ſhift, or more properly ſhirt, hangs down like a train behind her, and over it is a ſilk or velvet robe with cloſe ſleeves, which at the breaſt and wriſts is embroidered with gold; this dreſs reaches ſomething lower than the calf of the leg. Round her head is tied a black ſilk ſcarf, which hangs behind as low as the ground. Thus attired, the bride ſits with her hands over her eyes, when her huſband appears, and receives her as his wife without any further ceremony: for the agreement made by the friends before the cadi is the only ſpecific contract which is thought neceſſary.

If the huſband ſhould have any reaſon to ſuſpect that his wife has not been ſtrictly virtuous, he is at liberty to divorce her and take another. For ſome time after marriage, the family and the friends are engaged in much feaſting, and a variety of amuſements, which laſt a longer or ſhorter time according to the circumſtances of the parties. It is uſually cuſtomary for the man to remain at home eight days and the woman eight months after they are firſt married; and the woman is at liberty to divorce herſelf from her huſband, if ſhe can prove that he does not provide her with a proper ſubſiſtence.

Women ſuffer but little inconvenience in this country from child-bearing; they are frequently up the next day, and go through all the duties of the houſe with the infant upon their backs. 48 Circumciſion. In celebrating the rite of circumciſion, the child is dreſſed very ſumptuouſly, and carried on a mule, or, if the parents are in poor circumſtances, on an aſs, accompanied with flags flying and muſicians playing on hautboys and beating drums. In this manner they proceed to the moſque, where the ceremony is performed. 49 Education of children. Children, as ſoon as they can be made in the leaſt degree uſeful, are put to the various kinds of labour adapted to their age and ſtrength. Others, whoſe parents are in better circumſtances, are ſometimes ſent to ſchool; and thoſe who are intended for the church, uſually continue their ſtudies till they have nearly learnt the Koran by rote. In that caſe they are enrolled among the talbes, or learned men of the law; and upon leaving ſchool are paraded round the ſtreets on a horſe, accompanied by muſic and a large concourſe of people.

50 Funeral rites. When any perſon dies, a certain number of women are hired for the purpoſe of lamentation; in the performance of which, nothing can be more grating to the ear, or more unpleaſant, than their frightful moans, or rather howlings: at the ſame time, theſe mercenary mourners beat their heads and breaſts, and tear their cheeks with their nails. The bodies are uſually buried a few hours after death. Previous to interment, the corpſe is waſhed very clean, and ſewed up in a ſhroud, with the right hand under the head, which is pointed towards Mecca: it is carried on a bier ſupported upon men's ſhoulders, to the burying place, which is always, with great propriety, on the outſide of the town, for they never bury their dead in the moſques, or within the bounds of an inhabited place.

MOROCCO, a city of the kingdom of Morocco in Barbary, lying about 120 miles to the north of Tarudant, 90 to the eaſt of Mogodore, and 350 to the ſouth of Tangier. It is ſituated in a beautiful valley, formed by a chain of mountains on the northern ſide, and thoſe of Atlas, from which it is diſtant about 20 miles, on the ſouth and eaſt. The country which immediately ſurrounds it is a fertile plain, beautifully diverſified with clumps of palm trees and ſhrubs, and watered by ſmall and numerous ſtreams which deſcend from Mount Atlas. The emperor's out gardens, which are ſituated at the diſtance of about five miles to the ſouth of the city, and are large plantations of olives walled in, add conſiderably to the beauty of the ſcene.

Morocco, though one of the capitals of the empire (for there are three, Morocco, Mequinez, and Fez), has nothing to recommend it but its great extent and the royal palace. It is encloſed by remarkably ſtrong walls built of tabby, the circumference of which is about eight miles. On theſe walls there are no guns mounted; but they are flanked with ſquare towers, and ſurrounded by a wide and deep ditch. The city has a number of entrances, conſiſting of large double porches of tabby in the Gothic ſtyle, the gates of which are regularly ſhut every night at certain hours. As polygamy is allowed by the Mahometan religion, and is ſuppoſed in ſome degree to affect population, it would be difficult to form any computation near the truth with reſpect to the number of inhabitants which this city may contain. The moſques, which are the only public buildings except the palace worth noticing at Morocco, are more numerous than magnificent; one of them is ornamented with a very high and ſquare tower, built of cut ſtone, which is viſible at a conſiderable diſtance from the city. The ſtreets are very narrow, dirty, and irregular, and many of the houſes are uninhabited and falling to ruin. Thoſe which are decent and reſpectable in their appearance are built of tabby, and encloſed in gardens. That of the effendi or prime miniſter (according to Mr Lempriere, from whoſe *Tour* * this account is tranſcribed), was among the beſt in Morocco. This houſe, which conſiſted of two ſtories, had elegant apartments both above and below, furniſhed in a ſtyle far ſuperior to any thing our author ever ſaw in that country. The court, into which the lower apartments opened, was very neatly paved with glazed blue and white tiling, and had in its centre a beautiful fountain. The upper apartments were connected together by a broad gallery, the baluſters of which were painted of different colours. The hot and cold baths were very large, and had every convenience which art could afford. Into the garden, which was laid out in a tolerably neat ſtyle, opened a room adjoining to the houſe, which had a broad arched entrance but no door, beautifully ornamented with chequered tiling; and at both ends of the apartment the walls were entirely covered with looking glaſs. The flooring of all the rooms was covered with beautiful carpeting, the walls ornamented with large and valuable looking glaſſes, intermixed with watches and clocks in glaſs caſes. The ceiling was carved woodwork, painted of different colours; and the whole was in a ſuperior ſtyle of Mooriſh grandeur. This and a few others are the only decent habitations in Morocco. The generality of them ſerve only to impreſs the traveller with the idea of a miſerable and deſerted city.

The Elcaiſſeria is a particular part of the town where ſtuffs and other valuable articles are expoſed to ſale. It conſiſts of a number of ſmall ſhops, formed in the walls of the houſes, about a yard from the ground, of ſuch a height within as juſt to admit a man to ſit in one of them croſs-legged. The goods and drawers are ſo arranged round him, that when he ſerves his cuſtomers, who are ſtanding all the time out in the ſtreet, he can reach down any article he wants without being under the neceſſity of moving. Theſe ſhops, which are found in all the other towns of the empire, are ſufficient to afford a ſtriking example of the indolence of the Moors. There are three daily markets in different parts of the town of Morocco where proviſions are ſold, and two weekly fairs or markets for the diſpoſal of cattle. The city is ſupplied with water by means of wooden pipes connected with the neighbouring ſtreams, which empty themſelves into reſervoirs placed for the purpoſe in the ſuburbs, and ſome few in the centre of the town.

The caſtle is a large and ruinous building, the outer walls

---

* Publiſhed in 1791.

walls of which encloſe a ſpace of ground about three miles in circumference. It has a moſque, on the top of which are three large balls, formed, as the Moors allege, of ſolid gold. The caſtle is almoſt a town of itſelf; it contains a number of inhabitants, who in ſome department or other are in the ſervice of the emperor, and all under the direction of a particular alcaide, who is quite independent of the governor of the town. On the outſide of the caſtle, between the Mooriſh town and the Jewdry, are ſeveral ſmall diſtinct pavilions, encloſed in gardens of orange trees, which are intended as occaſional places of reſidence for ſuch of the emperor's ſons or brothers as happen to be at Morocco. As they are covered with coloured tiling, they have at a ſmall diſtance rather a neat appearance; but upon approaching or entering them, that effect in a great meaſure ceaſes.

The Jews, who are at this place pretty numerous, have a ſeparate town to themſelves, walled in, and under the charge of an alcaide, appointed by the emperor. It has two large gates, which are regularly ſhut every evening about nine o'clock; after which time no perſon whatever is permitted to enter or go out of the Jewdry till they are opened again the following morning. The Jews have a market of their own; and when they enter the Mooriſh town, caſtle, or palace, they are always compelled to be barefooted.

The palace is an ancient building, ſurrounded by a ſquare wall, the height of which nearly excludes from the view of the ſpectator the other buildings. Its principal gates are conſtructed with Gothic arches, compoſed of cut ſtone, which conduct to ſeveral open and ſpacious courts; through theſe it is neceſſary to paſs before we reach any of the buildings. Theſe open courts were uſed by the late emperor for the purpoſes of tranſacting public buſineſs and exerciſing his troops. The habitable part conſiſts of ſeveral irregular ſquare pavilions, built of tabby, and whitened over; ſome of which communicate with each other, others are diſtinct, and moſt of them receive their names from the different towns of the empire. The principal pavilion is named by the Moors the *Douhar*, and is more properly the palace or ſeraglio than any of the others. It conſiſts of the emperor's place of reſidence and the harem, forming altogether a building of conſiderable extent. The other pavilions are merely for the purpoſes of pleaſure or buſineſs, and are quite diſtinct from the douhar. The *Mogodore* pavilion, ſo named from the late emperor's partiality to that town, has by far the faireſt claim to grandeur and magnificence. This apartment was the work of Sidi Mahomet, and is lofty and ſquare. It is built of cut ſtone, handſomely ornamented with windows, and covered with varniſhed tiles of various colours; and its elegance and neatneſs, contraſted altogether with the ſimplicity and irregularity of the other buildings, produce a moſt ſtriking effect. In the inſide, beſides ſeveral other apartments, we find in the pavilion a ſpacious room floored with blue and white chequered tiling, its ceiling covered with curiouſly carved and painted wood, and its ſtuccoed walls variouſly ornamented with looking glaſſes and watches, regularly diſpoſed in glaſs caſes. To this pavilion the late emperor manifeſted an excluſive preference, frequently retiring to it both for the purpoſe of buſineſs and of recreation. The apartments of the emperor have in general a much ſmaller complement of furniture than thoſe of the Moors in the inferior walks of life. Handſome carpeting, a mattreſs on the ground covered with fine linen, a couch, and a couple of European bedſteads, are the principal articles they contain. The gardens within the walls of the palace, of which he has ſeveral, are very neat; they contain orange and olive trees, variouſly diſpoſed and arranged, and interſected with ſtreams of water, fountains, and reſervoirs. Thoſe on the outſide are nothing more than large tracts of ground, irregularly planted with olives; having four ſquare walks, and ſurrounded by walls.

MOROCCO, or *Marroquin*, the ſkin of a goat, or ſome other animal reſembling it, dreſſed in ſumach or galls, and coloured at pleaſure; much uſed in bookbinding, &c. The name is commonly derived from the kingdom of Morocco, whence it is ſuppoſed the manner of preparing theſe ſkins was firſt borrowed. We have Morocco ſkins brought from the Levant, Barbary, Spain, Flanders, and France; red, black, yellow, blue, &c. For the manner of preparing them, ſee LEATHER.

MORON, a town of Spain, in Andaluſia, ſeated in a fertile plain about 30 miles ſouth-eaſt of Seville. W. Long. 5. 20. N. Lat. 37. 0.

MORPETH, a handſome town of Northumberland, 14 miles from Newcaſtle, 286 miles from London, is an ancient borough by preſcription, with a bridge over the Wanſbeck. It had once an abbey and a caſtle, now in ruins, ſituated about a quarter of a mile ſouth of the town and river Wanſbeck, on an eminence which overlooks both. The market-place is conveniently ſituated near the centre of the town; and an elegant townhouſe was built by the Carliſle family in 1714, in which the quarter-ſeſſions is held for the county. It is built of hewn ſtone, with a piazza. The church being a quarter of a mile diſtant from the town, a tower containing a good ring of bells ſtands near the market place. Near the bridge is the county gaol, a modern ſtructure. Here are a free grammar ſchool, a chapel near the river, on the ſite of a chantry that was granted for the ſupport of the foundation of the ſchool, which was part of the old ſtructure, and an hoſpital for infirm people. In 1215, the townſmen themſelves burnt their town, out of pure hatred to King John, that he might find no ſhelter there. Here is a good market on Saturday for corn, cattle, and all neceſſary proviſions; and there is another on Wedneſday, the greateſt in England except Smithfield, for live cattle. This is a poſt town and a thoroughfare, with many good inns, and plenty of fiſh; and here are ſeveral mills.—The earl of Carliſle's ſteward holds a court here twice a-year, one of them the Monday after Michaelmas, when four perſons are choſen by the free burgeſſes, who are about 107, and preſented to the ſteward, who names two of them to the bailiffs, who, with ſeven aldermen, are its governors for the year enſuing. In 1801 the inhabitants amounted to nearly 3000. It has ſeveral fairs, and ſends two members to parliament. W. Long. 1. 24. N. Lat. 55. 12.

MORPHEUS, in fabulous hiſtory, the god of ſleep, or, according to others, one of the miniſters of Somnus. He cauſed ſleepineſs, and repreſented the forms of dreams. Ovid ſtyles him the kindeſt of the deities; and he is uſually deſcribed in a recumbent poſture, and crowned with poppies.

MORRERI, Lewis, author of the Hiſtorical Dictionary, was born at Barge-mont in Provence, in 1643. He learned rhetoric and philoſophy at Aix, and divinity at Lyons. At 18 years of age he wrote a ſmall piece, entitled *Le Pays d'Amour*, and a collection of the fineſt French poems entitled *Doux plaiſirs de la Poeſie*. He learned Spaniſh and Italian; and tranſlated out of Spaniſh into French the book entitled *La Perfection Chretienne de Rodriguez*. He then refined the Saints Lives to the purity of the French tongue. Being ordained prieſt, he preached at Lyons, and undertook, when he was but 30 years of age, a new Hiſtorical Dictionary, printed at Lyons in one vol. folio, 1673. But his continual labour impaired his health; ſo that he died in 1680, aged 37. His ſecond volume was publiſhed after his death; and four more volumes have ſince been added. He left ſome other works behind him.

MORRHINA or Murrhina vasa, were a ſort of cups or vaſes made uſe of by the ancients for drinking out of, and other purpoſes. Authors are not agreed as to the ſubſtance of which they were made. Some ſay it was a ſtone; ſome aſſert that it was a fluid condenſed by being buried under ground. All that we know concerning it is, that it was known by the name of *murrha*, and that Heliogabalus's chamber pot was made of it. The word is ſometimes written *myrrhina*.

MORRISE-dances. See *Moresque-Dances*.

MORS, Death, one of the infernal deities, born of Night without a father. She was worſhipped by the ancients with great ſolemnity. She was not repreſented as an actually exiſting power, but as an imaginary being. Euripides introduces her in one of his tragedies on the ſtage. The moderns repreſent her as a ſkeleton armed with a ſcythe and a ſcimeter.

MORSE. See Trichecus, Mammalia *Index*.

MORTALITY. a term frequently uſed to ſignify a contagious diſeaſe, which deſtroys great numbers of either men or beaſts.

Bills of MORTALITY, are accounts or regiſters ſpecifying the numbers born, married, and buried in any pariſh, town, or diſtrict. In general they contain only theſe numbers; and, even when thus limited, are of great uſe, by ſhowing the degrees of healthineſs and prolifickneſs, and the progreſs of population in the places where they are kept. It is therefore much to be wiſhed, that ſuch accounts had been always correctly kept in every kingdom, and regularly publiſhed at the end of every year. We ſhould then have had under our inſpection the comparative ſtrength of every kingdom, as far as it depends on the number of inhabitants, and its increaſe or decreaſe at different periods. But ſuch accounts are rendered more uſeful, when they include the ages of the dead, and the diſtempers of which they have died. In this caſe they convey ſome of the moſt important inſtructions, by furniſhing us with the means of aſcertaining the law which governs the waſte of human life, the values of annuities dependent on the continuance of any lives, or any ſurvivorſhips between them, and the favourableneſs and unfavourableneſs of different ſituations to the duration of human life. There are but few regiſters of this kind; nor has this ſubject, though ſo intereſting to mankind, ever engaged much attention till lately. The firſt bills containing the ages of the dead were thoſe for the town of Breſlaw in Sileſia. It is well known what uſe has been made of theſe by Dr Halley, and after him by De Moivre. A table of the probabilities of the duration of human life at every age, deduced from them by Dr Halley, has been publiſhed in the Philoſophical Tranſactions, (ſee the Abridgement, vol. iii. p. 699.) and is the firſt table of that ſort that has been ever publiſhed. Since the publication of this table ſimilar bills have been eſtabliſhed in a few towns of this kingdom; and particularly in London, in the year 1728, and at Northampton in 1735.

Two improvements of theſe regiſters have been propoſed: the firſt is, That the ſexes of all that die in every period of life ſhould be ſpecified in them, under the denomination of *boys*, *married men*, *widowers*, and *bachelors*; and of *girls*, *married women*, *widows*, and *virgins*. The ſecond is, That they ſhould ſpecify the number of both ſexes dying of every diſtemper in every month, and at every age. See the end of the 4th eſſay in Dr Price's Treatiſe on Reverſionary Payments. Regiſters of mortality thus improved, when compared with records of the ſeaſons, and with the circumſtances that diſcriminate different ſituations, might contribute greatly to the increaſe of medical knowledge; and they would afford the neceſſary data for determining the difference between the duration of human life among males and females; for ſuch a difference there certainly is much in favour of females, as will appear from the following facts.

At Northampton, though more males are born than females: and nearly the ſame number die; yet the number of living females appeared, by an account taken in 1746, to be greater than the number of males, in the proportion of 2301 to 1770, or 39 to 30.

At Berlin it appeared, from an accurate account which was taken of the inhabitants in 1747, that the number of female citizens exceeded the number of male citizens in the proportion of 459 to 391. And yet out of this ſmaller number of males, more had died for 20 years preceding 1751, in the proportion of 19 to 17.

At Edinburgh, in 1743, the number of females was to the number of males as 4 to 3. (See Maitland's Hiſtory of Edinburgh, p. 220). But the females that died annually from 1749 to 1758, were to the males in no higher proportion than $3\frac{1}{7}$ to 3.

He that will take the pains to examine the accounts in Phil. Tranſ. Abr. vol. vii. part iv. p. 46, &c. will find, that though in the towns there enumerated, the proportion of males and females born is no higher than 19 to 18, yet the proportion of boys and girls that die is 8 to 7; and that, in particular, the ſtill-born and chryſom males are to the ſtill-born and chryſom females as 3 to 2.

In 39 pariſhes of the diſtrict of Vaud in Switzerland, the number of males that died during ten years before 1766 was 8170; of females 8167; of whom the numbers that died under one year of age were 1817 males and 1305 females; and under ten years of age, 3099 males and 2598 females. In the beginning of life, therefore, and before any emigrations can take place, the rate of mortality among males appears to be be greater than among females. And this is rendered yet more certain by the following accounts. At Vevey, in the diſtrict of Vaud juſt mentioned, there died in the courſe of 20 years, ending at 1764, in the firſt month after birth, of males 135 to 89 females; and in the firſt year 225 to 162. To the ſame effect it appears from a table given by Suſmilch, in his Gottliche Ordnung, vol. ii. p. 317, that in Berlin 203 males die in the firſt month, and but 168 females; and in the firſt year, 489 to 395; and alſo, from a table of Struyck's, that in Holland 396 males die in the firſt year to 306 females.

The authorities for the facts here mentioned, and much more on this ſubject, may be found in the 4th eſſay in Dr Price's Treatiſe on Reverſionary Payments, and in the ſupplement at the end of that treatiſe.

We ſhall here only add the following table, taken from a memoir of Mr Wargentin's, publiſhed in the collection of the Memoirs of the Royal Academy of Sciences at Stockholm, printed at Paris in 1772.

In all Sweden for nine years, ending in 1763, the proportion of females to males that died out of a given number living, was

Under the age of one year,		1000 to	1099
From 1 to 3 years of age,		1000 —	1022
3—5	—	—	1042
5—10	—	—	1074
10—15	—	—	1080
15—20	—	—	1097
20—25	—	—	1283
25—30	—	—	1161
30—35	—	—	993
35—40	—	—	1159
40—45	—	—	1115
45—50	—	—	1340
50—55	—	—	1339
55—60	—	—	1292
60—65	—	—	1115
65—70	—	—	1080
70—80	—	—	1022
80—90	—	—	1046
Above 90	—	—	1044

Regiſters of mortality on the improved plan before mentioned, were eſtabliſhed in 1772 at Cheſter, and alſo in 1773 at Warrington in Lancaſhire; and they are ſo comprehenſive and correct, that there is reaſon to expect they will afford much inſtruction on the ſubject of human mortality, and the values of lives.

But the country moſt diſtinguiſhed in this reſpect is Sweden: for in that kingdom exact accounts are taken of the births, marriages, and burials, and of the numbers of both ſexes that die at all ages in every town and diſtrict, and alſo at the end of every period of five years, of the numbers living at every age: and at Stockholm a ſociety is eſtabliſhed, whoſe buſineſs it is to ſuperintend and regulate the enumerations, and to collect from the different parts of the kingdom the regiſters, in order to digeſt them into tables of obſervation. Theſe regulations were begun in Sweden in 1755; and tables, containing the reſult of them from 1755 to 1763, have been publiſhed in Mr Wargentin's memoir juſt referred to; and the moſt material parts of them may be found in an eſſay by Dr Price on the Difference between the Duration of Human Life in Towns and in Country Pariſhes, printed in the 65th volume of the Philoſoph. Tranſ. Part II.

In the fourth eſſay in Dr Price's Treatiſe on Reverſionary Payments and Life Annuities, the following account is given of the principles on which tables of obſervation are formed from regiſters of mortality; and of the proper method of forming them, ſo as to render them juſt repreſentations of the number of inhabitants, and the probabilities of the duration of human life in a town or country.

In every place which juſt ſupports itſelf in the number of its inhabitants, without any recruits from other places; or where, for a courſe of years, there has been no increaſe or decreaſe; the number of perſons dying every year at any particular age, and above it, muſt be equal to the number of the living at that age. The number, for example, dying every year at all ages from the beginning to the utmoſt extremity of life, muſt, in ſuch a ſituation, be juſt equal to the whole number born every year. And for the ſame reaſon, the number dying every year at one year of age and upwards, at two years of age and upwards, at three and upwards, and ſo on, muſt be equal to the numbers that attain to thoſe ages every year; or, which is the ſame, to the numbers of the living at thoſe ages. It is obvious, that unleſs this happens, the number of inhabitants cannot remain the ſame. If the former number is greater than the latter, the inhabitants muſt decreaſe; if leſs, they muſt increaſe. From this obſervation it follows, that in a town or country where there is no increaſe or decreaſe, bills of mortality which give the ages at which all die, will ſhow the exact number of inhabitants, and alſo the exact law according to which human life waſtes in that town or country.

In order to find the number of inhabitants, the mean numbers dying annually at every particular age and upwards muſt be taken as given by the bills, and placed under one another in the order of the ſecond column of the following tables. Theſe numbers will, it has appeared, be the numbers of the living at 1, 2, 3, &c. years of age; and conſequently the ſum diminiſhed by half the number born annually will be the whole number of inhabitants.

This ſubtraction is neceſſary, for the following reaſon. In a table formed in the manner here directed, it is ſuppoſed that the numbers in the ſecond column are all living together at the beginning of every year. Thus the number in the ſecond column oppoſite to 0 in the firſt column, the table ſuppoſes to be all juſt born together on the firſt day of the year. The number, likewiſe, oppoſite to 1, it ſuppoſes to attain to one year of age juſt at the ſame time that the former number is born. And the like is true of every number in the ſecond column. During the courſe of the year, as many will die at all ages as were born at the beginning of the year, and conſequently, there will be an exceſs of the number alive at the beginning of the year above the number alive at the end of the year, equal to the whole number of the annual births; and the true number conſtantly alive together, is the arithmetical mean between theſe two numbers; or agreeably to the rule here given, the ſum of the numbers in the ſecond column of the table leſſened by half the number of annual births.

In ſuch a ſeries of numbers, the exceſs of each number above that which immediately follows it will be the number dying every year out of the particular number alive at the beginning of the year; and theſe exceſſes ſet down regularly as in the third column of the table to which we have referred, will ſhow the different rates at which human life waſtes through all its different periods, and the different probabilities of life at all particular ages.

It muſt be remembered, that what has been now ſaid goes on the ſuppoſition, that the place whoſe bills of mortality are given, ſupports itſelf, by procreation only, in the number of its inhabitants. In towns this very ſeldom happens, on account of the luxury and debauchery which generally prevail in them. They are, therefore, commonly kept up by a conſtant acceſſion of ſtrangers, who remove to them from country pariſhes and villages. In theſe circumſtances, in order to find the true number of inhabitants, and probabilities of life, from bills of mortality containing an account of the ages at which all die, it is neceſſary that the proportion of the annual births to the annual ſettlers ſhould be known, and alſo the period of life at which the latter remove. Both theſe particulars may be diſcovered in the following method.

If for a courſe of years there have been no ſenſible increaſe or decreaſe in a place, the number of annual ſettlers will be equal to the exceſs of the annual burials above the annual births. If there be an increaſe, it will be greater than this exceſs. If there be a decreaſe, it will be leſs.

The period of life at which theſe ſettlers remove, will appear in the bills by an increaſe in the number of deaths at that period and beyond it. Thus in the London bills the number of deaths between 20 and 30 is generally above double, and between 30 and 40 near triple the number of deaths between 10 and 20; and the true account of this is, that from the age of 18 or 20 to 35 or 40, there is an afflux of people every year to London from the country, which occaſions a great increaſe in the number of inhabitants at theſe ages; and conſequently raiſes the deaths for all ages above 20 conſiderably above their due proportion when compared with the number of deaths before 20. This is obſervable in all the bills of mortality for towns with which we are acquainted, not even excepting the Breſlaw bills. Dr Halley takes notice, that theſe bills gave the number of deaths between 10 and 20 too ſmall. This he conſidered as an irregularity in them owing to chance; and, therefore, in forming his table of obſervations, he took the liberty ſo far to correct it, as to render the proportion of thoſe who die to the living in this diviſion of life nearly the ſame with the proportion which, he ſays, he had been informed die annually of the young lads in Chriſt Church hoſpital. But the truth is, that this irregularity in the bills was derived from the cauſe we have juſt aſſigned. During the five years for which the Breſlaw bills are given by Dr Halley, the births did indeed a little exceed the burials; but it appears that this was the effect of ſome peculiar cauſes that happened to operate juſt at that time; for during a complete century, from 1633 to 1734, the annual medium of births was 1089, and of burials 1256. This town, therefore, muſt have been all along kept up by a number of yearly recruits from other places, equal to about a ſeventh part of the yearly births.

It appears from the account in the Philoſophical Tranſactions (Abridgement, vol. vii. N° 382, p. 46, &c.), that from 1717 to 1725, the annual medium of births at Breſlaw was 1252, of burials 1507; and alſo that much the greateſt part of the births died under 10 years of age. From a table in Suſmilch's works, vol. i. p. 38, it appears that in reality the greater part of all that die in this town are children under five years of age.

What has been now obſerved concerning the period of life at which people remove from the country to ſettle in towns, would appear ſufficiently probable were there no ſuch evidence for it as has been mentioned; for it might well be reckoned that theſe people in general muſt be ſingle perſons in the beginning of mature life, who not having yet obtained ſettlements in the places where they were born, migrate to towns in queſt of employments.

Having premiſed theſe obſervations, it will be proper next to endeavour to explain diſtinctly the effect which theſe acceſſions to towns muſt have on tables of obſervation formed from their bills of mortality. This is a ſubject proper to be inſiſted on, becauſe miſtakes have been committed about it; and becauſe alſo the diſcuſſion of it is neceſſary to ſhow how near to truth the value of lives comes as deduced from ſuch tables.

The following general rule may be given on this ſubject. If a place has for a courſe of years been maintained in a ſtate nearly ſtationary, as to number of inhabitants, by recruits coming in every year, to prevent the decreaſe that would ariſe from the exceſs of burials above the births, a table formed on the principle, "that the number dying annually after every particular age, is equal to the number living at that age," will give the number of inhabitants, and the probabilities of life, too great, for all ages preceding that at which the recruits ceaſe: and after this it will give them right. If the acceſſions are ſo great as to cauſe an increaſe in the place, ſuch a table will give the number of inhabitants and the probabilities of life too little after the age at which the acceſſions ceaſe; and too great if there is a decreaſe. Before that age it will in both caſes give them too great; but moſt conſiderably ſo in the former caſe, or when there is an increaſe.

Agreeably to theſe obſervations, if a place increaſes not in conſequence of acceſſions from other places, but of a conſtant exceſs of the births above the deaths, a table conſtructed on the principle that has been mentioned will give the probabilities of life too low through the whole extent of life; becauſe in ſuch circumſtances the number of deaths in the firſt ſtages of life muſt be too great in compariſon of the number of deaths in the latter ſtages; and more or leſs ſo as the increaſe is more or leſs rapid. The contrary in all reſpects takes place where there is a decreaſe ariſing from the exceſs of the deaths above the births.

For example: Let us ſuppoſe that 244 of thoſe born in a town attain annually to 20 years of age, and

and that 250 more, all likewiſe 20 years of age, come into it annually from other places, in conſequence of which it has for a courſe of years been juſt maintained in the number of its inhabitants, without any ſenſible increaſe or decreaſe: in theſe circumſtances, the number of the living in the town of the age of 20 will be always 244 natives, and 250 ſettlers, or 494 in all; and ſince theſe are ſuppoſed all to die in the town, and no more recruits are ſuppoſed to come in, 494 will be likewiſe the number dying annually at 20 and upwards. In the ſame manner it will appear, on theſe ſuppoſitions, that the number of the living at every age ſubſequent to 20 will be equal to the number dying annually at that age and above it; and conſequently that the number of inhabitants and the decrements of life, for every ſuch age, will be given exactly by the table. But for all ages before 20, they will be given much too great. For let 280 of all born in the town reach 10; in this caſe, 280 will be the true number of the living in the town at the age of 10; and the recruits not coming in till 20, the number given by the bills as dying between 10 and 20 will be the true number dying annually of the living in this diviſion of life. Let this number be 36; and it will follow that the table ought to make the numbers of the living at the ages between 10 and 20, a ſeries of decreaſing means between 280 and (280 diminiſhed by 36, or) 244. But in forming the table on the principle juſt mentioned, 250 (the number above 20 dying annually in the town who were not born in it) will be added to each number in this ſeries; and therefore the table will give the numbers of the living, and the probabilities of life in this diviſion of life, almoſt twice as great as they really are. This obſervation, it is manifeſt, may be applied to all the ages under 20.

It is neceſſary to add, that ſuch a table will give the number of inhabitants and the probabilities of life equally wrong before 20, whether the recruits all come in at 20, agreeably to the ſuppoſition juſt made, or only begin then to come in. In this laſt caſe, the table will give the number of inhabitants and probabilities of life too great throughout the whole extent of life, if the recruits come in at all ages above 20. But if they ceaſe at any particular age, it will give them right only from that age; and before, it will err all along on the ſide of exceſs; but leſs conſiderably between 20 and that age than before 20. For example: if, of the 250 ſuppoſed to come in at 20, only 150 then come in, and the reſt at 30; the number of the living will be given 100 too high at every age between 20 and 30; but, as juſt ſhown, they will be given 250 too high at every age before 20. In general, therefore, the number of the living at any particular age muſt be given by the ſuppoſed table as many too great as there are annual ſettlers after that age; and if theſe ſettlers come in at all ages indiſcriminately, during any certain interval of life, the number of inhabitants and the probabilities of life will be continually growing leſs and leſs wrong, the nearer any age is to the end of that interval. Theſe obſervations prove, that tables of obſervation formed in the common way, from bills of mortality for places where there is an exceſs of the burials above the births, muſt be erroneous for a great part of the duration of life, in proportion to the degree of that exceſs. They ſhow likewiſe at what parts of life the errors in ſuch tables are moſt conſiderable, and how they may be in a great meaſure corrected.

All this ſhall be exemplified in the particular caſe of London.

The number of deaths between the ages of 10 and 20 is always ſo ſmall in the London bills, that it ſeems certain few recruits come to London under 20, or at leaſt not ſo many as before this age are ſent out for education to ſchools and univerſities. After 20 great numbers come in till 30, and ſome perhaps till 40 or 50: but at every age after 50, it is probable that more retire from London than come to it. The London tables of obſervation, therefore, being formed on the principle already mentioned, cannot give the probabilities of life right till 40. Between 30 and 40 they muſt be a little too high; but more ſo between 20 and 30, and moſt of all ſo before 20. It follows alſo that theſe tables muſt give the number of inhabitants in London much too great.

The firſt of the following tables is formed in the manner here explained, from the London bills for 10 years, from 1759 to 1768, and adapted to 1000 born as a radix. The ſum of the numbers in the ſecond column, diminiſhed by half the number born, is 25.757. According to this table, then, for every 1000 deaths in London there are $25\frac{3}{4}$ as many inhabitants; or, in other words, the expectation of a child juſt born is $25\frac{3}{4}$; and the inhabitants are to the annual burials as $25\frac{3}{4}$ to 1. But it has appeared, that the numbers in the ſecond column, being given on the ſuppoſition that all thoſe who die in London were born there, muſt be too great; and we have from hence a demonſtration, that the probabilities of life are given in the common tables of London obſervations too high for at leaſt the firſt 30 years of life; and alſo, that the number of inhabitants in London muſt be leſs than $25\frac{3}{4}$ multiplied by the annual burials. The common tables, therefore, of London obſervations undoubtedly need correction, as Mr Simpſon ſuggeſted, and in ſome meaſure performed; though too imperfectly, and without going upon any fixed principles, or ſhowing particularly how tables of obſervation ought to be formed, and how far in different circumſtances, and in different ages, they are to be depended on. The way of doing this, and in general the right method of forming genuine tables of obſervation for towns, may be learned from the following rule:

"From the ſum of all that die annually, after any given age, ſubtract the number of annual ſettlers after that age; and the remainder will be the number of the living at the given time."

This rule can want no explication or proof after what has been already ſaid.

If, therefore, the number of annual ſettlers in a town at every age could be aſcertained, a perfect table of obſervations might be formed for that town from bills of mortality, containing an account of the ages at which all die in it. But no more can be learned in this inſtance from any bills, than the whole number of annual ſettlers, and the general diviſion of life in which they enter. This, however, may be ſufficient to enable us to form tables that ſhall be tolerably exact. For inſtance: Suppoſe the annual deaths in a town which has not increaſed or decreaſed, to have been for many years in the proportion of 4 to 3 to the annual births. It will hence follow, that $\frac{1}{4}$ of the perſons who die in ſuch a town are ſettlers, or emigrants from other places, and not natives; and the ſudden increaſe in the deaths after 20 will alſo ſhow, agreeably to what was before obſerved, that they enter after this age. In forming, therefore, a table for ſuch a town, a quarter of all that die at all ages throughout the whole extent of life muſt be deducted from the ſum of all that die after every given age before 20; and the remainder will be the true number living at that given age. And if at 20, and every age above it, the deduction is omitted, or the number of the living at every ſuch age is taken the ſame with the ſum of all that die after it, the reſult will be (ſuppoſing moſt of the ſettlers to come in before 30, and all before 40) a table exact till 20; too high between 20 and 30; but nearly right for ſome years before 40; and after 40 exact again. Such a table, it is evident, will be the ſame with the table laſt deſcribed at all ages above 20, and different from it only under 20. It is evident alſo, that on account of its giving the probabilities of life too great for ſome years after 20, the number of inhabitants deduced from it may be depended on as ſomewhat greater than the truth; and more or leſs ſo, as the annual recruits enter in general later or ſooner after 20.

Let us now conſider what the reſult of theſe remarks will be, when applied particularly to the London bills.

It muſt be here firſt obſerved, that at leaſt one quarter of all that die in London are ſupplies or ſettlers from the country, and not natives. The medium of annual burials for 10 years, from 1759 to 1768, was 22,956; of births 15,710. The exceſs is 7246, or near a third of the burials. The ſame exceſs during 10 years before 1750 was 10,500, or near half the burials. London was then decreaſing. For the laſt 12 or 15 years it has been increaſing. This exceſs, therefore, agreeably to the foregoing obſervations, was then greater than the number of annual ſettlers, and it is now leſs. It is however here ſuppoſed, that the number of annual ſettlers is now no more than a quarter of the annual burials, in order to allow for more omiſſions in the births than the burials; and alſo, in order to be more ſure of obtaining reſults that ſhall not exceed the truth.

Of every 1000 then who die in London only 750 are natives, and 250 are recruits who come to it after 18 or 20 years of age; and, conſequently, in order to obtain from the bills a more correct table than the firſt of the following tables, 250 muſt be ſubtracted from every one of the numbers in the ſecond column till 20; and the numbers in the third column muſt be kept the ſame, the bills always giving theſe right. After 20, the table is to be continued unaltered; and the reſult will be, a table which will give the numbers of the living at all ages in London much nearer the truth but ſtill ſomewhat too high. Such is the ſecond of the following tables. The ſum of all the numbers in the ſecond column of this table, diminiſhed by 500, is 20,750. For every 1000 deaths, therefore, in London, there are, according to this table, 20,750 living perſons in it; or for every ſingle death $20\frac{1}{4}$ inhabitants. It was before ſhown, that the number of inhabitants in London could not be ſo great as $25\frac{3}{4}$ times the deaths. It now appears (ſince the numbers in the ſecond column of this table are too high) that the number of inhabitants of London cannot be ſo great as even $20\frac{3}{4}$ times the deaths. And this is a concluſion which every one, who will beſtow due attention on what has been ſaid, will find himſelf forced to receive. It will not be amiſs, however, to confirm it by the following fact, the knowledge of which is derived from the particular inquiry and information of Mr Harris, the late ingenious maſter of the royal mathematical ſchool in Chriſt-Church hoſpital. The average of lads in this ſchool has, for 30 years paſt, been 831. They are admitted at all ages between 7 and 11; and few ſtay beyond 16: they are therefore, in general, lads between the age of 8 and 16. They have better accommodations than it can be ſuppoſed children commonly have; and about 300 of them have the particular advantage of being educated in the country. In ſuch circumſtances it may be well reckoned, that the proportion of children dying annually muſt be leſs than the general proportion of children dying annually at the ſame ages in London. The fact is, that for the laſt 30 years $11\frac{4}{5}$ have died annually, or one in $70\frac{2}{5}$.

According to Table II. one in 73 dies between 10 and 20, and one in 70 between 8 and 16. That table, therefore, probably gives the decrements of life in London, at theſe ages, too little, and the numbers of the living too great: and if this is true of theſe ages, it muſt be true of all other ages under 20; and it follows demonſtrably, in conformity to what was before ſhown, that more people ſettle in London after 20 than the fourth above ſuppoſed; and that from 20 to at leaſt 30 or 35, the numbers of the living are given too great, in proportion to the decrements of life.

In this table the numbers in the ſecond column are doubled at 20, agreeably to what really happens in London; and the ſum of the numbers in this column diminiſhed by half the whole number of deaths, gives the expectation of life, not of a child juſt born, as in other tables, but of all the inhabitants of London at the time they enter it, whether that be at birth or at 20 years of age. The *expectations*, therefore, and the *values* of London lives under 20, cannot be calculated from this table. But it may be very eaſily fitted for this purpoſe, by finding the number of births which, according to the given decrements of life, will leave 494 alive at 20; and then adapting the intermediate numbers in ſuch a manner to this radix, as to preſerve all along the number of the living in the ſame proportion to the numbers of the dead. This is done in the third of the following tables; and this table may be recommended as better adapted to the preſent ſtate of London than any other table. The values of lives, however, deduced from it, are in general nearly the ſame with thoſe deduced by Mr Simpſon from the London bills as they ſtood forty years ago; the main difference is, that after 52, and in old age, this table gives them ſomewhat lower than Mr Simpſon's table. The fourth and fifth of the following tables, compared with the two laſt, will give a diſtinct and full view of the difference between the rate of human mortality in great towns and in country pariſhes and villages.

TABLE I.

Showing the Probabilities of Life in London, on the ſuppoſition that all who die in London were born there. Formed from the Bills for 10 years, from 1759 to 1768.

Ages.	Perſons living.	Decr. of Life	Ages.	Perſons living.	Decr. of Life	Ages.	Perſons living.	Decr. of Life
0	1000	240	31	404	9	62	132	7
1	760	99	32	395	9	63	125	7
2	661	42	33	386	9	64	118	7
3	619	29	34	377	9	65	111	7
4	590	21	35	368	9	66	104	7
5	569	11	36	359	9	67	97	7
6	558	10	37	350	9	68	90	7
7	548	7	38	341	9	69	83	7
8	541	6	39	332	10	70	76	6
9	535	5	40	322	10	71	70	6
10	530	4	41	312	10	72	64	6
11	526	4	42	302	10	73	58	5
12	522	4	43	292	10	74	53	5
13	518	3	44	282	10	75	48	5
14	515	3	45	272	10	76	43	5
15	512	3	46	262	10	77	38	5
16	509	3	47	252	10	78	33	4
17	506	3	48	242	9	79	29	4
18	503	4	49	233	9	80	25	3
19	499	5	50	224	9	81	22	3
20	494	7	51	215	9	82	19	3
21	487	8	52	206	8	83	16	3
22	479	8	53	198	8	84	13	2
23	471	8	54	190	7	85	11	2
24	463	8	55	183	7	86	9	2
25	455	8	56	176	7	87	7	2
26	447	8	57	169	7	88	5	1
27	439	8	58	162	7	89	4	1
28	431	9	59	155	8	90	3	1
29	422	9	60	147	8			
30	413	9	61	139	7			

TABLE II.

Showing the true probabilities of Life in London till the age of 19.

Ages	Perſons living.	Decr. of Life	Ages.	Perſons living	Decr. of Life	Ages	Perſons living.	Decr. of Life
0	750	240	9	285	5	18	253	4
1	510	99	10	280	4	19	249	
2	411	42	11	276	4	20	494	
3	369	29	12	272	4	21	487	
4	340	21	13	268	3	&c.	&c.	
5	319	11	14	265	3	The numbers in the ſecond column to be continued as in the laſt table.		
6	308	10	15	262	3			
7	298	7	16	259	3			
8	291	6	17	256	3			

TABLE III.

Showing the true Probabilities of Life in London for all ages. Formed from the Bills for 10 years, from 1759 to 1768.

Ages.	Perſons living	Decr. of Life	Ages.	Perſons living.	Decr. of Life	Ages.	Perſons living.	Decr. of Life
0	1518	486	31	404	9	62	132	7
1	1032	200	32	395	9	63	125	7
2	832	85	33	386	9	64	118	7
3	747	59	34	377	9	65	111	7
4	688	42	35	368	9	66	104	7
5	646	23	36	359	9	67	97	7
6	623	20	37	350	9	68	90	7
7	603	14	38	341	9	69	83	7
8	589	12	39	332	10	70	76	6
9	577	10	40	322	10	71	70	6
10	567	9	41	312	10	72	64	6
11	558	9	42	302	10	73	58	5
12	549	8	43	292	10	74	53	5
13	541	7	44	282	10	75	48	5
14	534	6	45	272	10	76	43	5
15	528	6	46	262	10	77	38	5
16	522	7	47	252	10	78	33	4
17	515	7	48	242	9	79	29	4
18	508	7	49	233	9	80	25	3
19	501	7	50	224	9	81	22	3
20	494	7	51	215	9	82	19	3
21	487	8	52	206	8	83	16	3
22	479	8	53	198	8	84	13	2
23	471	8	54	190	7	85	11	2
24	463	8	55	183	7	86	9	2
25	455	8	56	176	7	87	7	2
26	447	8	57	169	7	88	5	1
27	439	8	58	162	7	89	4	1
28	431	9	59	155	8	90	3	1
29	422	9	60	147	8			
30	413	9	61	139	7			

All the bills, from which the following tables are formed, give the numbers dying under 1 as well as under 2 years; and in the numbers dying under 1 are included, in the country pariſh in Brandenburg and at Berlin, all the ſtillborns. All the bills alſo give the numbers dying in every period of five years.

TABLE

TABLE IV.

Showing the Probabilities of Life in the Diſtrict of Vaud, Switzerland, formed from the Regiſters of 43 Pariſhes, given by Mr Muret, in the Firſt Part of the Bern Memoirs for the Year 1766.

Age.	Living.	Decr.	Age.	Living.	Decr.	Age.	Living.	Decr.
0	1000	189	31	558	5	62	286	12
1	811	46	32	553	5	63	274	12
2	765	30	33	548	4	64	262	12
3	735	20	34	544	5	65	250	14
4	715	14	35	539	6	66	236	16
5	701	13	36	533	6	67	220	18
6	688	11	37	527	7	68	202	18
7	677	10	38	520	7	69	184	16
8	667	8	39	513	7	70	168	15
9	659	6	40	506	6	71	153	13
10	653	5	41	500	6	72	140	11
11	648	5	42	494	6	73	129	10
12	643	4	43	488	6	74	119	10
13	639	4	44	482	6	75	109	11
14	635	4	45	476	7	76	98	13
15	631	5	46	469	8	77	85	14
16	626	4	47	461	10	78	71	13
17	622	4	48	451	10	79	58	12
18	618	4	49	441	10	80	46	10
19	614	4	50	431	9	81	36	7
20	610	4	51	422	8	82	29	5
21	606	4	52	414	8	83	24	4
22	602	5	53	406	9	84	20	3
23	597	5	54	397	9	85	17	3
24	592	5	55	388	11	86	14	3
25	587	5	56	377	13	87	11	2
26	582	5	57	364	16	88	9	2
27	577	5	58	348	17	89	7	2
28	572	5	59	331	17	90	5	1
29	567	4	60	314	15			
30	563	5	61	299	13			

TABLE V.

Showing the Probabilities of Life in a Country Pariſh in Brandenburg, formed from the Bills for 50 Years, from 1710 to 1759, as given by Mr Suſmilch, in his Gottliche Ordnung.

Age.	Living.	Decr.	Age	Living.	Decr	Age.	Living.	Decr.
0	1000	225	31	482	5	62	260	12
1	775	57	32	477	5	63	248	12
2	718	31	33	472	5	64	236	12
3	687	23	34	467	5	65	224	11
4	664	22	35	462	6	66	213	11
5	642	20	36	456	6	67	202	12
6	622	15	37	450	6	68	190	12
7	607	12	38	444	6	69	178	12
8	595	10	39	438	6	70	166	13
9	585	8	40	432	5	71	153	15
10	577	7	41	427	5	72	138	16
11	570	6	42	422	5	73	122	15
12	564	5	43	417	5	74	107	14
13	559	5	44	412	6	75	93	13
14	554	5	45	407	6	76	80	12
15	549	5	46	400	6	77	68	9
16	544	5	47	394	6	78	59	8
17	539	4	48	388	7	79	51	7
18	535	4	49	381	7	80	44	6
19	531	4	50	374	7	81	38	6
20	527	5	51	367	8	82	32	6
21	522	5	52	359	8	83	25	6
22	517	5	53	351	8	84	21	5
23	512	5	54	343	9	85	15	4
24	507	5	55	334	10	86	11	3
25	502	4	56	324	10	87	8	2
26	498	3	57	314	10	88	6	2
27	495	3	58	304	11	89	4	1
28	492	3	59	293	11	90	3	1
29	489	3	60	282	11	91	2	1
30	486	4	61	271	11	92	1	1

TABLE

TABLE VI.

Showing the Probabilities of Life at Vienna, formed from the Bills for eight Years, as given by Mr Suſmilch, in his Gottliche Ordnung, page 32, Tables.

Age.	Living.	Decr.	Age.	Living.	Decr.	Age.	Living	Decr.
0	1495	682	32	358	5	64	116	7
1	813	107	33	353	6	65	109	8
2	706	61	34	347	7	66	101	8
3	645	46	35	340	8	67	93	8
4	599	33	36	332	8	68	85	7
5	566	30	37	324	8	69	78	7
6	536	20	38	316	9	70	71	6
7	516	11	39	307	9	71	65	5
8	505	9	40	298	8	72	60	5
9	496	7	41	290	7	73	55	4
10	489	6	42	283	6	74	51	4
11	483	5	43	277	6	75	47	5
12	478	5	44	271	7	76	42	5
13	473	6	45	264	8	77	37	5
14	467	6	46	256	9	78	32	5
15	461	6	47	247	9	79	27	4
16	455	7	48	238	9	80	23	3
17	448	6	49	229	9	81	20	2
18	442	6	50	220	8	82	19	2
19	436	6	51	212	7	83	16	2
20	430	5	52	205	7	84	14	2
21	425	5	53	198	7	85	12	2
22	420	5	54	191	7	86	10	2
23	415	6	55	184	8	87	8	2
24	409	6	56	176	8	88	6	2
25	403	6	57	168	9	89	4	1
26	397	6	58	159	8	90	3	1
27	391	7	59	151	8	91	2	1
28	381	7	60	143	7	92	1	1
29	377	7	61	136	7			
30	370	6	62	129	6			
31	364	6	63	123	7			

TABLE VII.

Showing the Probabilities of Life at Berlin, formed from the Bills for Four Years, from 1752 to 1755, given by Mr Suſmilch in his Gottliche Ordnung, vol. ii. p. 37, Tables.

Age.	Living	Decr	Age.	Living.	Decr	Age.	Living	Decr.
0	1427	524	32	368	7	64	118	6
1	903	151	33	361	7	65	112	6
2	752	61	34	354	7	66	106	7
3	691	73	35	347	8	67	99	7
4	618	45	36	339	8	68	92	6
5	573	21	37	330	10	69	86	6
6	552	15	38	320	10	70	80	6
7	536	13	39	310	10	71	74	6
8	523	9	40	300	10	72	68	6
9	514	7	41	290	9	73	62	5
10	507	5	42	281	8	74	57	5
11	502	4	43	274	7	75	52	5
12	498	4	44	266	7	76	47	5
13	494	4	45	259	7	77	42	5
14	490	4	46	252	7	78	37	5
15	486	4	47	245	7	79	32	4
16	482	5	48	238	7	80	28	4
17	477	5	49	231	7	81	24	3
18	472	5	50	224	7	82	21	2
19	467	6	51	217	7	83	19	2
20	461	6	52	210	7	84	17	2
21	455	6	53	203	8	85	15	2
22	449	6	54	195	8	86	13	2
23	443	7	55	187	8	87	11	2
24	436	8	56	179	8	88	9	2
25	428	9	57	171	8	89	7	1
26	421	9	58	163	9	90	6	1
27	412	9	59	154	9	91	5	1
28	403	9	60	145	8	92	4	1
29	394	9	61	137	7	93	3	1
30	385	9	62	130	6	94	2	1
31	376	8	63	124	6			

Brief *of* MORTANCESTRY, in *Scots Law;* anciently the ground of an action at the inſtance of an heir, in the ſpecial caſe where he had been excluded from the poſſeſſion of his anceſtor's eſtate by the ſuperior, or other perſon pretending right.

MORTAR, a preparation of lime and ſand mixed with water, which ſerves as a cement, and is uſed by maſons and bricklayers in building walls of ſtone and brick. See Lime, Chemistry *Index*.

Mortar, a chemical utenſil, very uſeful for the diviſion of bodies, partly by percuſſion and partly by grinding. Mortars have the form of an inverted bell. The matter intended to be pounded is to be put into them, and there it is to be ſtruck and bruiſed by a long inſtrument called a *peſtle*. The motion given to the peſtle ought to vary according to the nature of the ſubſtances to be pounded. Thoſe which are eaſily broken, or which are apt to fly out of the mortar, or which are hardened by the ſtroke of the peſtle, require that this inſtrument ſhould be moved circularly, rather by grinding or bruiſing than by ſtriking. Thoſe ſubſtances which are ſoftened by the heat occaſioned by rubbing

rubbing and percuſſion, require to be pounded very ſlowly. Laſtly, Thoſe which are very hard, and which are not capable of being ſoftened, are eaſily pounded by repeated ſtrokes of the peſtle. They require no bruiſing but when they are brought to a certain degree of fineneſs. But theſe things are better learned by habit and practice than by any directions.

As mortars are inſtruments which are conſtantly uſed in chemiſtry, they ought to be kept of all ſizes and materials; as of marble, copper, glaſs, iron, gritſtone, and agate. The nature of the ſubſtance to be pounded determines the choice of the kind of mortar. The hardneſs and diſſolving power of that ſubſtance are particularly to be attended to. As copper is a metal, which is ſoluble by almoſt all menſtrua, and hurtful to health, this metal is rarely or never employed for the purpoſe of making mortars.

One of the principal inconveniences of pulverization in a mortar proceeds from the fine powder which riſes abundantly from ſome ſubſtances during the operation. If theſe ſubſtances be precious, the loſs will be conſiderable; and if they be injurious to health, they may hurt the operator. Theſe inconveniences may be remedied, either by covering the mortar with a ſkin, in the middle of which is a hole, through which the peſtle paſſes; or by moiſtening the matter with a little water when this addition does not injure it; or, laſtly, by covering the mouth and noſe of the operator with a fine cloth, to exclude this powder. Some ſubſtances, as corroſive ſublimate, arſenic, calces of lead, cantharides, euphorbium, &c. are ſo noxious, that all theſe precautions ought to be uſed, particularly when a large quantity is pounded.

Large mortars ought to be fixed upon a block of wood, ſo high, that the mortar ſhall be level with the middle of the operator. When the peſtle is large and heavy, it ought to be ſuſpended by a cord or chain fixed to a moveable pole placed horizontally above the mortar: this pole conſiderably relieves the operator, becauſe its elaſticity aſſiſts the raiſing of the peſtle.

MORTAR-Piece, in the military art, a ſhort piece of ordnance, thick and wide, proper for throwing bombs, carcaſes, ſhells, ſtones, bags filled with grape-ſhot, &c. See GUNNERY, N° 50.

Land MORTARS, are thoſe uſed in ſieges, and of late in battles, mounted on beds made of ſolid timber, conſiſting generally of four pieces, thoſe of the royal and cohorn excepted, which are but one ſingle block; and both mortar and bed are tranſported on block-carriages. There is likewiſe a kind of land mortars, mounted on travelling carriages, invented by Count Buckeburg, which may be elevated to any degree; whereas ours are fixed to an angle of 45 degrees, and firmly laſhed with ropes. The following table ſhows the weight of land mortars and ſhells; together with the quantity of powder the chambers hold when full; the weight of the ſhells, and powder for loading them.

Diameter of mortars.	13-inch.			10-inch.			8-inch.			5.8-inch. royal.			4.6-inch cohorn.		
	C.	qr.	lb.	C.	qr.	lb.	C.	qr.	lb.	C.	qr.	lb.	C.	qr.	lb.
Mortar's weight.	25	0	0	10	2	18	4	0	20	1	1	0	0	3	0
Shell's weight.	1	2	15	0	2	25	0	1	15	0	0	12	0	0	7
	lb.	oz	gr.	lb.	oz.	gr.	lb.	oz.	gr.	lb.	oz.	gr.	lb	oz.	gr.
Shell's cont. of powder.	9	4	8	4	14	12	2	3	8	1	1	8	0	8	0
Chamber's cont. of powder.	9	1	8	4	0	0	2	0	10	1	0	0	0	8	0

Sea MORTARS, are thoſe which are fixed in bomb veſſels for bombarding places by ſea: and as they are generally fired at a much greater diſtance than that which is required by land, they are made ſomewhat longer and much heavier than the land mortars. The following table exhibits the weight of the ſea mortars and ſhells, and alſo of their full charges.

Nature of the mortar.	Powder contained in the chamber when full.		Weight of the mortar.			Weight of the ſhell when fixed	Weight of power contained in the ſhell.	
	lb	oz.	C.	qr.	lb.	lb.	lb.	oz.
10-inch howitzer.	12	0	31	2	26			
13-inch mortar.	30	0	81	2	1	198	7	0
10-inch mortar.	12	0	34	2	11	93		

To Charge or Load a MORTAR, the proper quantity of gunpowder is put into the chamber, and if there be any vacant ſpace they fill it up with hay; ſome chooſe a wooden plug: over this they lay a turf, ſome a wooden tompion fitted to the bore of the piece; and laſtly the bomb; taking care that the fuſe be in the axis thereof, and the orifice be turned from the muzzle of the piece: what ſpace remains is to be filled up with hay, ſtraw, turf, &c. ſo as the load may not be exploded without the utmoſt violence.

The

The quantity of gunpowder to be uſed is found by dividing the weight of the bomb by 30; though this rule is not always to be ſtrictly obſerved.

When the proper quantity of powder neceſſary to charge a ſea mortar is put into the chamber, it is covered with a wad well beat down with the rammer. After this the fixed ſhell is placed upon the wad, as near the middle of the mortar as poſſible, with the fuſe hole uppermoſt, and another wad preſſed down cloſe upon it, ſo as to keep the ſhell firm in its poſition. The officer then points the mortar according to the propoſed inclination.—When the mortar is thus fixed, the fuſe is opened; the priming iron is alſo thruſt into the touch-hole of the mortar to clear it, after which it is primed with the fineſt powder. This done, two of the matroſſes or ſailors, taking each one of the matches, the firſt lights the fuſe, and the other fires the mortar. The bomb, thrown out by the exploſion of the powder, is carried to the place intended: and the fuſe, which ought to be exhauſted at the inſtant of the ſhell's falling, inflames the powder contained in it, and burſts the ſhell in ſplinters; which, flying off circularly, occaſion incredible miſchief whereſoever they reach.

If the ſervice of mortars ſhould render it neceſſary to uſe pound ſhots, 200 of them with a wooden bottom are to be put into the 13 inch mortar, and a quantity of powder not exceeding 5 pounds; and 100 of the above ſhot with 2½ pounds of powder, for the 10 inch mortar, or three pounds at moſt.

To Elevate the MORTAR ſo as its axis may make any given angle with the horizon, they apply the artillery level or gunner's quadrant. An elevation of 70 or 80 degrees is what is commonly choſen for rendering mortars moſt ſerviceable in caſting ſhells into towns, forts, &c. though the greateſt range be at 45 degrees.

All the Engliſh mortars are fixed to an angle of 45 degrees, and laſhed ſtrongly with ropes at that elevation. Although in a ſiege there is only one caſe in which ſhells ſhould be thrown with an angle of 45 degrees; that is, when the battery is ſo far off that they cannot otherwiſe reach the works; for when ſhells are thrown out of the trenches into the works of a fortification, or from the town into the trenches, they ſhould have as little elevation as poſſible, in order to roll along, and not bury themſelves; whereby the damage they do, and the terror they occaſion, are much greater than if they ſink into the ground. On the contrary, when ſhells are thrown upon magazines or any other buildings, with an intention to deſtroy them, the mortars ſhould be elevated as high as poſſible, that the ſhells may acquire a greater force in their fall, and conſequently do greater execution.

If all mortar pieces were, as they ought to be, exactly ſimilar, and their requiſites of powder as the cubes of the diameters of their ſeveral bores, and if their ſhells, bombs, carcaſſes, &c. were alſo ſimilar; then, comparing like with like, their ranges on the plane of the horizon, under the ſame degree of elevation, would be equal; and conſequently one piece being well proved, i. e. the range of the grenado, bomb, carcaſs, &c. being found to any degree of elevation, the whole work of the mortar piece would become very eaſy and exact.

But ſince mortars are not thus ſimilar, it is required, that the range of the piece, at ſome known degree of elevation, be accurately found by meaſuring; and from hence all the other ranges may be determined.

Thus, to find the range of the piece at any other elevation required; ſay, As the ſine of double the angle under which the experiment was made, is to the ſine of double the angle propoſed, ſo is the range known to the range required.

Suppoſe, for inſtance, it be found, that the range of a piece, elevated to 30°, is 2000 yards: to find the range of the ſame piece with the ſame charge when elevated to 45°; take the ſine of 60°, the double of 30°, and make it the firſt term of the rule of three; the ſecond term muſt be the ſine of 90°, the double of 45°, and the third the given range 2000; the fourth term will be 2310, the range of the piece at 45°. If the elevation be greater than 45°, inſtead of doubling it, take the ſine of double its complement to 90°. As ſuppoſe the elevation of a piece be 50°, take the ſine of 80°, the double of 40°. Again, If a determinate diſtance to which a ſhot is to be caſt, be given, and the angle of elevation to produce that effect be required; the range known muſt be the firſt term in the rule of three, which ſuppoſe 2000 yards; the range propoſed, which we ſuppoſe 1600 yards, the ſecond term; and the ſine of 60 double of the elevation for the range of 2000 yards, the third term. The fourth term will be found the ſine of 43° 52′, whoſe half 21° 56′ is the angle of elevation the piece muſt have to produce the deſired effect. And if 21° 56′ be taken from 90°, you will have 68° 4′ for the other elevation of the piece, with which the ſame effect will likewiſe be produced.

Note, To avoid the trouble of finding ſines of double the angles of the propoſed elevations, Galileo and Torricelli give us the following table, wherein the ſines of the angles ſought are had by inſpection.

Degrees.	Degrees.	Ranges.	Degrees.	Degrees.	Ranges.
90	0	0	0	0	0
89	1	349	66	24	7431
88	2	698	65	25	7660
87	3	1045	64	26	7880
86	4	1392	63	27	8090
85	5	1736	62	28	8290
84	6	2709	61	29	8480
83	7	2419	60	30	8660
82	8	2556	59	31	8829
81	9	3090	58	32	8988
80	10	3420	57	33	9135
79	11	3746	56	34	9272
78	12	4067	55	35	9397
77	13	4384	54	36	9511
76	14	4695	53	37	9613
75	15	5000	52	38	9703
74	16	5299	51	39	9781
73	17	5592	50	40	9841
72	18	5870	49	41	9903
71	19	6157	48	42	9945
70	20	6428	47	43	9976
69	21	6691	46	44	9994
68	22	6947	45	45	10000
67	23	7193			

The uſe of the table is obvious. Suppoſe, for inſtance, it be known by experiment, that a mortar elevated 15°, charged with three pounds of powder, will throw a bomb to the diſtance of 350 fathoms; and it be required, with the ſame charge, to throw a bomb 100 fathoms farther; ſeek in the table the number anſwering to 15 degrees, and you will find it 5000. Then as 350 is to 450, ſo is 5000 to a fourth number, which is 6428. Find this number, or the neareſt to it, in the table, and againſt it you will find 20° or 70°; the proper angles of elevation.

MORTGAGE, in *Law*, (*mortuum vadium*, or dead pledge), is where a man borrows of another a ſpecific ſum (e. g. 200l.), and grants him an eſtate in fee, on condition that if he, the mortgager, ſhall pay the mortgagee the ſaid ſum of 200l. on a certain day mentioned in the deed, that then the mortgager may re-enter on the eſtate ſo granted in pledge; or, as is now the more uſual way, that the mortgagee ſhall re-convey the eſtate to the mortgager: in this caſe the land which is ſo put in pledge, is by law, in caſe of nonpayment, at the time limited, for ever dead and gone from the mortgager; and the mortgagee's eſtate in the lands, is then no longer conditional, but abſolute. But ſo long as it continues conditional, that is, between the time of lending the money and the time allotted for payment, the mortgagee is called *tenant in mortgage*. But as it was formerly a doubt, whether, by taking ſuch eſtate in fee, it did not become liable to the wife's dower, and other encumbrances of the mortgage (though that doubt has been long ago overruled by our courts of equity), it therefore became uſual to grant only a long term of years, by way of mortgage; with condition to be void on repayment of the mortgage money: which courſe has been ſince continued, principally becauſe on the death of the mortgagee ſuch term becomes veſted in his perſonal repreſentatives, who only are entitled in equity to receive the money lent, of whatever nature the mortgage may happen to be.

As ſoon as the eſtate is created, the mortgagee may immediately enter on the lands; but is liable to be diſpoſſeſſed, upon performance of the condition by payment of the mortgage money at the day limited. And therefore the uſual way is to agree that the mortgager ſhall hold the land till the day aſſigned for payment: when, in caſe of failure, whereby the eſtate becomes abſolute, the mortgagee may enter upon it, and take poſſeſſion, without any poſſibility at law of being afterwards evicted by the mortgager, to whom the land is now for ever dead. But here again the courts of equity interpoſe; and though a mortgage be thus forfeited, and the eſtate abſolutely veſted in the mortgagee at the common law, yet they will conſider the real value of the tenements compared with the ſum borrowed. And if the eſtate be of greater value than the ſum lent thereon, they will allow the mortgager at any reaſonable time to recal or redeem his eſtate; paying to the mortgagee his principal, intereſt, and expences: for otherwiſe, in ſtrictneſs of law, an eſtate worth 1000l. might be forfeited for non-payment of 100l. or a leſs ſum. This reaſonable advantage, allowed to mortgagers, is called the *equity of redemption;* and this enables a mortgager to call on the mortgagee, who has poſſeſſion of his eſtate, to deliver it back, and account for the rents and profits received on payment of his whole debt and intereſt, thereby turning the *mortuum* into a kind of *vivum vadium;* (ſee VADIUM). But, on the other hand, the mortgagee may either compel the ſale of the eſtate, in order to get the whole of his money immediately; or elſe call upon the mortgager to redeem his eſtate preſently, or, in default thereof, to be for ever foreclosed from redeeming the ſame; that is, to loſe his equity of redemption without poſſibility of recal. And alſo, in ſome caſes of fraudulent mortgages, the fraudulent mortgager forfeits all equity of redemption whatſoever. It is not, however, uſual for mortgagees to take poſſeſſion of the mortgaged eſtate, unleſs where the ſecurity is precarious, or ſmall; or where the mortgager neglects even the payment of intereſt: when the mortgagee is frequently obliged to bring an ejectment, and take the land into his own hands, in the nature of a pledge, or the *pignus* of the Roman law: whereas, while it remains in the hands of the mortgager, it more reſembles their hypotheca, which was where the poſſeſſion of the thing pledged remained with the debtor. But by ſtatute 7 Geo. II. c. 20. after payment or tender by the mortgager of principal, intereſt, and coſts, the mortgagee can maintain no ejectment; but may be compelled to re-aſſign his ſecurities. In Glanvil's time, when the univerſal method of conveyance was by livery of ſeiſin or corporal tradition of the lands, no gage or pledge of lands was good unleſs poſſeſſion was alſo delivered to the creditor; *ſi non ſequatur ipſius vadii traditio, curia domini regis hujuſmodi privatas conventiones tueri non ſolet:* for which the reaſon given is, to prevent ſubſequent and fraudulent pledges of the ſame land; *cum in tali caſu poſſit eadem res pluribus aliis creditoribus tum prius tum poſterius invadiari.* And the frauds which have ariſen, ſince the exchange of theſe public and notorious conveyances for more private and ſecret bargains, have well evinced the wiſdom of our ancient law.

MORTIER, an enſign of dignity, which was borne by the chancellor and grand preſidents of the parliament of France. That borne by the chancellor was a piece of cloth of gold, edged and turned up with ermine; and that of the firſt preſident was a piece of black velvet edged with a double row of gold lace.

MORTIFICATION, or GANGRENE. See MEDICINE and SURGERY *Index*.

MORTIFICATION, in religion, any ſevere penance obſerved on a religious account. See FAST.

MORTISE, or MORTOISE, in carpentry, &c. a kind of joint wherein a hole of a certain depth is made in a piece of timber, which is to receive another piece called a *tenon*.

MORTMAIN, or ALIENATION *in Mortmain* (*in mortua manu*), is an alienation of lands or tenements to any corporation, ſole or aggregate, eccleſiaſtical or temporal *: but theſe purchaſes having been chiefly made by religious houſes, in conſequence whereof the lands became perpetually inherent in one dead hand, this hath occaſioned the general appellation of *mortmain* to be applied to ſuch alienations, and the religious houſes themſelves to be principally conſidered in forming the ſtatutes of mortmain: in deducing the hiſtory of which ſtatutes, it will be matter of curioſity to obſerve the great addreſs and ſubtle contrivance of the eccleſiaſtics, in eluding from time to time the laws in being, and the zeal with which ſucceſſive parliaments have purſued them

* See Co- poratio

them through all their fineſſes: how new remedies were ſtill the parents of new evaſions; till the legiſlature at laſt, though with difficulty, hath obtained a deciſive victory.

By the common law any man might diſpoſe of his lands to any other private man at his own diſcretion, eſpecially when the feodal reſtraints of alienation were worn away. Yet in conſequence of theſe it was always, and is ſtill neceſſary, for corporations to have a licenſe of mortmain from the crown, to enable them to purchaſe lands: for as the king is the ultimate lord of every fee, he ought not, unleſs by his own conſent, to loſe his privilege of eſcheats and other feodal profits, by the veſting of lands in tenants that can never be attainted or die. And ſuch licenſes of mortmain ſeem to have been neceſſary among the Saxons above 60 years before the Norman conqueſt. But, beſides this general licenſe from the king as lord paramount of the kingdom, it was alſo requiſite, whenever there was a meſne or intermediate lord between the king and the alienor, to obtain his licenſe alſo (upon the ſame feodal principles) for the alienation of the ſpecific land. And if no ſuch licenſe was obtained, the king or other lord might reſpectively enter on the land ſo alienated in mortmain, as a forfeiture. The neceſſity of this licenſe from the crown was acknowledged by the Conſtitutions of Clarendon, in reſpect of advowſons, which the monks always greatly coveted, as being the groundwork of ſubſequent appropriations. Yet ſuch were the influence and ingenuity of the clergy, that (notwithſtanding this fundamental principle) we find that the largeſt and moſt conſiderable donations of religious houſes happened within leſs than two centuries after the Conqueſt. And (when a licenſe could not be obtained) their contrivance ſeems to have been this: That as the forfeiture for ſuch alienations accrued in the firſt place to the immediate lord of the fee, the tenant who meant to alienate firſt conveyed his lands to the religious houſe, and inſtantly took them back again to hold as tenant to the monaſtery: which kind of inſtantaneous ſeiſin was probably held not to occaſion any forfeiture: and then, by pretext of ſome other forfeiture, ſurrender, or eſcheat, the ſociety entered into thoſe lands in right of ſuch their newly acquired ſigniory, as immediate lords of the fee. But when theſe donations began to grow numerous, it was obſerved that the feodal ſervices, ordained for the defence of the kingdom, were every day viſibly withdrawn; that the circulation of landed property from man to man began to ſtagnate; and that the lords were curtailed of the fruits of their ſigniories, their eſcheats, wardſhips, reliefs, and the like: and therefore, in order to prevent this, it was ordained by the ſecond of King Henry III.'s great charters, and afterwards by that printed in our common ſtatute books, that all ſuch attempts ſhould be void, and the land forfeited to the lord of the fee.

Blackſt. Comment.

But as this prohibition extended only to religious houſes, biſhops and other ſole corporations were not included therein; and the aggregate eccleſiaſtical bodies (who, Sir Edward Coke obſerves, in this were to be commended, that they ever had of their counſel the beſt learned men that they could get) found many means to creep out of this ſtatute, by buying in lands that were *bona fide* holden of themſelves as lords of the fee, and thereby evading the forfeiture; or by taking long leaſes for years, which firſt introduced thoſe extenſive terms, for a thouſand or more years, which are now ſo frequent in conveyances. This produced the ſtatute *de religioſis*, 7 Edw. I.; which provided, that no perſon, religious or other whatſoever, ſhould buy, or ſell, or receive under pretence of a gift, or term of years, or any other title whatſoever, nor ſhould by any art or ingenuity appropriate to himſelf, any lands or tenements in mortmain; upon pain that the immediate lord of the fee, or, on his default for one year, the lords paramount, and in default of all of them, the king, might enter thereon as a forfeiture.

This ſeemed to be a ſufficient ſecurity againſt all alienations in mortmain: but as theſe ſtatutes extended only to gifts and conveyances between the parties, the religious houſes now began to ſet up a fictitious title to the land, which it was intended they ſhould have, and to bring an action to recover it againſt the tenant; who, by fraud and colluſion, made no defence, and thereby judgment was given for the religious houſe, which then recovered the land by a ſentence of law upon a ſuppoſed prior title. And thus they had the honour of inventing thoſe fictitious adjudications of right, which are ſince become the great aſſurance of the kingdom, under the name of *common* RECOVERIES. But upon this the ſtatute of Weſtminſter the ſecond, 13 Edw. I. c. 32. enacted, that in ſuch caſes a jury ſhall try the true right of the demandants or plaintiffs to the land; and if the religious houſe or corporation be found to have it, they ſhall ſtill recover ſeiſin; otherwiſe it ſhall be forfeited to the immediate lord of the fee, or elſe to the next lord, and finally to the king, upon the immediate or other lord's default. And the like proviſion was made by the ſucceeding chapter, in caſe the tenants ſet up croſſes upon their lands (the badges of knights templars and hoſpitallers) in order to protect them from the feudal demands of their lords, by virtue of the privileges of thoſe religious and military orders. And ſo careful was this provident prince to prevent any future evaſions, that when the ſtatute of *quia emptores*, 18 Edw. I. aboliſhed all ſub-infeudations, and gave liberty for all men to alienate their lands to be holden of their next immediate lord, a proviſo was inſerted that this ſhould not extend to authorize any kind of alienation in mortmain. And when afterwards the method of obtaining the king's licenſe by writ of *ad quod damnum* was marked out by the ſtatute 27 Edw. I. ſt. 2. it was farther provided by ſtatute 34 Edw. I. ſt. 3. that no ſuch licenſe ſhould be effectual without the conſent of the meſne or intermediate lords.

Yet ſtill it was found difficult to ſet bounds to eccleſiaſtical ingenuity: for when they were driven out of all their former holds, they deviſed a new method of conveyance, by which the lands were granted, not to themſelves directly, but to nominal feoffees to the uſe of the religious houſes; thus diſtinguiſhing between the poſſeſſion and the uſe, and receiving the actual profits, while the ſeiſin of the land remained in the nominal feoffee; who was held by the courts of equity (then under the direction of the clergy) to be bound in conſcience to account to his *ceſtuy que uſe* for the rents and emoluments of the eſtate. And it is to theſe inventions that our practiſers are indebted for the introduction of uſes and truſts, the foundation

tion of modern conveyancing. But unfortunately for the inventors themſelves, they did not long enjoy the advantage of their new device; for the ſtatute 15 Richard II. c. 5. enacts, that the lands which had been ſo purchaſed to uſes ſhould be admortiſed by licenſe from the crown, or elſe be ſold to private perſons; and that, for the future, uſes ſhall be ſubject to the ſtatutes of mortmain, and forfeitable like the lands themſelves. And whereas the ſtatutes had been eluded by purchaſing large tracts of land adjoining to churches, and conſecrating them by the name of *churchyards*, ſuch ſubtile imagination is alſo declared to be within the compaſs of the ſtatutes of mortmain. And civil or lay corporations, as well as eccleſiaſtical, are alſo declared to be within the miſchief, and of courſe within the remedy provided by thoſe ſalutary laws. And laſtly, As during the times of popery lands were frequently given to ſuperſtitious uſes, though not to any corporate bodies; or were made liable in the hands of heirs and deviſees to the charge of obits, chantries, and the like, which were equally pernicious in a well-governed ſtate as actual alienations in mortmain; therefore at the dawn of the Reformation, the ſtatute 23 Hen. VIII. c. 10. declares, that all future grants of lands for any of the purpoſes aforeſaid, if granted for any longer term than 20 years, ſhall be void.

But, during all this time, it was in the power of the crown, by granting a licenſe of mortmain, to remit the forfeiture, ſo far as related to its own rights; and to enable any ſpiritual or other corporation to purchaſe and hold any lands or tenements in perpetuity: which prerogative is declared and confirmed by the ſtatute 18 Edw. III. ſt. 3. c. 3. But as doubts were conceived at the time of the Revolution how far ſuch licenſe was valid, ſince the king had no power to diſpenſe with the ſtatutes of mortmain by a clauſe of *non obſtante*, which was the uſual courſe, though it ſeems to have been unneceſſary; and as, by the gradual declenſion of meſne ſigniories through the long operation of the ſtatute of *quia emptores*, the rights of intermediate lords were reduced to a very ſmall compaſs; it was therefore provided by the ſtatute 7 & 8 W. III. c. 37. that the crown for the future at its own diſcretion may grant licenſes to alienate or take in mortmain, of whomſoever the tenements may be holden.

After the diſſolution of monaſteries under Hen. VIII. though the policy of the next popiſh ſucceſſor affected to grant a ſecurity to the poſſeſſors of abbey lands, yet, in order to regain ſo much of them as either the zeal or timidity of their owners might induce them to part with, the ſtatutes of mortmain were ſuſpended for 20 years by the ſtatute 1 & 2 P. & M. c. 8. and during that time any lands or tenements were allowed to be granted to any ſpiritual corporation without any licenſe whatſoever. And long afterwards, for a much better purpoſe, the augmentation of poor livings, it was enacted by the ſtatute 17 Car. II. c. 3. that appropriators may annex the great tithes to the vicarages, and that all benefices under 100l. per annum may be augmented by the purchaſe of lands, without licenſe of mortmain in either caſe; and the like proviſion hath been ſince made in favour of the governors of Queen Anne's bounty. It hath alſo been held, that the ſtatute 13 Hen. VIII. before-mentioned, did not extend to any thing but ſuperſtitious uſes; and that therefore a man may give lands for the maintenance of a ſchool, an hoſpital, or any other charitable uſes. But as it was apprehended from recent experience, that perſons on their deathbeds might make large and improvident diſpoſitions even for theſe good purpoſes, and defeat the political ends of the ſtatutes of mortmain; it is therefore enacted by the ſtatute 9 Geo. II. c. 36. that no lands or tenements, or money to be laid out thereon, ſhall be given for or charged with any charitable uſes whatſoever, unleſs by deed indented, executed in the preſence of two witneſſes 12 kalender months before the death of the donor, and enrolled in the court of chancery within ſix months after its execution (except ſtocks in the public funds, which may be transferred within ſix months previous to the donor's death), and unleſs ſuch gift be made to take effect immediately, and be without power of revocation; and that all other gifts ſhall be void. The two univerſities, their colleges, and their ſcholars upon the foundation of the colleges of Eton, Wincheſter, and Weſtminſter, are excepted out of this act: but ſuch exemption was granted with this proviſo, that no college ſhall be at liberty to purchaſe more advowſons than are equal in number to one moiety of the fellows or ſtudents upon the reſpective foundations.

MORTUARY, in *Law*, is a ſort of eccleſiaſtical heriot *, being a cuſtomary gift claimed by and due to the miniſter in very many pariſhes on the death of his pariſhioners. They ſeem originally to have been only a voluntary bequeſt to the church; being intended, as Lyndewode informs us from a conſtitution of Archbiſhop Langham, as a kind of expiation and amends to the clergy for the perſonal tithes, and other eccleſiaſtical duties, which the laity in their life time might have neglected or forgotten to pay. For this purpoſe, after the lord's heriot or beſt good was taken out, the ſecond beſt chattel was reſerved to the church as a mortuary. And therefore in the laws of King Canute, this mortuary is called *ſoul-ſcot*, or *ſymbolum animæ*. And, in purſuance of the ſame principle, by the laws of Venice, where no perſonal tithes have been paid during the life of the party, they are paid at his death out of his merchandiſe, jewels, and other moveables. So alſo, by a ſimilar policy in France, every man that died without bequeathing a part of his eſtate to the church, which was called *dying without confeſſion*, was formerly deprived of Chriſtian burial; or, if he died inteſtate, the relations of the deceaſed, jointly with the biſhop, named proper arbitrators to determine what he ought to have given to the church, in caſe he had made a will. But the parliament, in 1409, redreſſed this grievance.

It was anciently uſual in England to bring the mortuary to church along with the corpſe when it came to be buried; and thence it is ſometimes called a *corpſe-preſent*: a term which beſpeaks it to have been once a voluntary donation. However, in Bracton's time, ſo early as Henry III. we find it rivetted into an eſtabliſhed cuſtom; inſomuch that the bequeſts of heriots and mortuaries were held to be neceſſary ingredients in every teſtament of chattels. *Imprimis autem debet quilibet, qui teſtamentum fecerit, dominum ſuum de meliori re quam habuerit recognoſcere; et poſtea eccleſiam de alia meliore*: the lord muſt have the beſt good left him as a heriot; and the church the ſecond beſt as a mortuary.

* See *Heriot.*

Mortuary.

tuary. But yet this cuſtom was different in different places: *in quibuſdam locis habet eccleſia melius animal de conſuetudine; in quibuſdam ſecundum, vel tertium melius; et in quibuſdam nihil: et ideo conſideranda eſt conſuetudo loci.* This cuſtom ſtill varies in different places, not only as to the mortuary to be paid, but the perſon to whom it is payable. In Wales a mortuary or corſe-preſent was due upon the death of every clergyman to the biſhop of the dioceſe; till aboliſhed, upon a recompenſe given to the biſhop, by the ſtatute, 12 Ann. ſt. 2. c. 6. And in the archdeaconry of Cheſter a cuſtom alſo prevailed, that the biſhop, who is alſo archdeacon, ſhould have, at the death of every clergyman dying therein, his beſt horſe or mare, bridle, ſaddle, and ſpurs; his beſt gown or cloak, hat, upper garment under his gown, and tippet, and alſo his beſt ſignet or ring. But by ſtatute 28 Geo. II. c. 6. this mortuary is directed to ceaſe, and the act has ſettled upon the biſhop an equivalent in its room. The king's claim to many goods, on the death of all prelates in England, ſeems to be of the ſame nature; though Sir Edward Coke apprehends, that this is a duty upon death, and not a mortuary: a diſtinction which ſeems to be without a difference. For not only the king's eccleſiaſtical character, as ſupreme ordinary, but alſo the ſpecies of the good claimed, which bear ſo near a reſemblance to thoſe in the archdeaconry of Cheſter, which was an acknowledged mortuary, puts the matter out of diſpute. The king, according to the record vouched by Sir Edward Coke, is entitled to ſix things; the biſhop's beſt horſe or palfrey, with his furniture; his cloak or gown, and tippet; his cup and cover; his baſon and ewer; his gold ring; and laſtly, his *muta canum*, his mew or kennel of hounds.

This variety of cuſtoms with regard to mortuaries, giving frequently a handle to exactions on the one ſide, and frauds or expenſive litigations on the other, it was thought proper by ſtatute 21 Henry VIII. c. 6. to reduce them to ſome kind of certainty. For this purpoſe it is enacted, that all mortuaries, or corſe-preſents to parſons of any pariſh, ſhall be taken in the following manner, unleſs where by cuſtom leſs or none at all is due; viz. for every perſon who does not leave goods to the value of ten marks, nothing; for every perſon who leaves goods to the value of ten marks and under 30 pounds, 3s. 4d.; if above 30 pounds, and under 40 pounds, 6s. 8d.; if above 40 pounds, of what value ſoever they may be, 10s. and no more. And no mortuary ſhall throughout the kingdom be paid for the death of any feme-covert; nor for any child; nor for any one of full age, that is not a houſekeeper; nor for any wayfaring man; but ſuch wayfaring man's mortuary ſhall be paid in the pariſh to which he belongs. And upon this ſtatute ſtands the law of mortuaries to this day.

Mortuary
||
Moſaic
Law.

MORUS, the Mulberry Tree, a genus of plants belonging to the monœcia claſs, and in the natural method ranking under the 53d order, *Scabridæ*. See Botany *Index*.

MOSA, in *Ancient Geography*, a river of Belgica, riſing in Mount Vogeſus on the borders of the Lingones, and which, after receiving a part of the Rhine called *Vahalis*, forms the iſland of the Batavi, and paſſes off into the ſea, at the diſtance of 80 miles. Now called the *Maeſe*, or *Meuſe*; riſing in Champagne, on the borders of the county of Burgundy, or Franche Compté, at a village called *Meuſe*, whence the appellation; and running north through Lorrain and Champagne into the Netherlands: it afterwards directs its courſe north-eaſt and then weſt; and joining the Waal, runs to Dort, and falls into the German ſea, a little below the Briel.

MOSÆ Pons, in *Ancient Geography*, ſuppoſed to be Maeſtricht, ſituated on the Maeſe. E. Long. 5. 40. N. Lat. 50. 55.

Wilſon's *Archæol. Dict.*

MOSAIC Law, or the *Law of Moses*, is the moſt ancient that we know of in the world, and is of three kinds; the moral law, the ceremonial law, and the judicial law. The different manner in which each of theſe was delivered, may perhaps ſuggeſt to us a right idea of their different natures. The moral law, or ten commandments, for inſtance, was delivered on the top of the mountain, in the face of the whole world, as being of univerſal influence, and obligatory on all mankind. The ceremonial was received by Moſes in private in the tabernacle, as being of peculiar concern, belonging to the Jews only, and deſtined to ceaſe when the tabernacle was down, and the vail of the temple rent. As to the judicial law, it was neither ſo publicly nor ſo audibly given as the moral law, nor yet ſo privately as the ceremonial; this kind of law being of an indifferent nature, to be obſerved or not obſerved, as its rites ſuit with the place and government under which we live. The five books of Moſes called the *Pentateuch*, are frequently ſtyled, by way of emphaſis *the Law*. This was held by the Jews in ſuch veneration, that they would not allow it to be laid upon the bed of any ſick perſon, leſt it ſhould be polluted by touching the dead.

A TABLE or HARMONY of the MOSAIC LAW, digeſted into proper Heads, with References to the ſeveral Parts of the Pentateuch where the reſpective Laws occur.

Class I. The Moral Law written on the two Tables, containing the Ten Commandments.

	Exod. chap.	Levitic. chap.	Numb. chap.	Deut. chap.
The *firſt table*, which includes				
The firſt commandment - -	20. 23.	—	—	5. 6. 13.
The ſecond commandment, - -	20. 23. 34.	19. 20. 26.	—	4. 5. 6. 7. 8. 10. 11. 12. 13.
The third commandment, - -	20. 23.	—	—	5.

The

	Exod. chap.	Levitic. chap.	Numb. chap.	Deut. chap.
The fourth commandment, - -	20. 23. 31. 34. 35.	19. 23. 26.	—	—
The *ſecond table* includes				
The fifth commandment, - -	20. 22.	19.	—	5.
The ſixth commandment, - -	20.	19.	—	5.
The ſeventh commandment, - -	20.	18. 19.	—	5. 23.
The eighth commandment, - -	20. 23.	19.	—	5.
The ninth commandment, - -	20. 23.	19.	—	5.
The tenth commandment, - -	20.	—	—	5.
The ſum of both tables, - -	—	19.	—	6.
CLASS II. The Ceremonial Law may be fitly reduced to the following heads, viz.				
Of the holy place, - - -	20.	17.	—	12.
Of the matter and ſtructure of the tabernacle.	25. 26. 27. 35.	—	—	—
Of the inſtruments of the ſame, viz. - -				
The laver of braſs, - - -	30.	—	—	—
The altar of burnt offering, - -	27.	—	—	—
The altar of incenſe, - - -	30.	—	—	—
The candleſtick of pure gold, - -	25.	—	—	—
The table of ſhew-bread, - -	25. 26.	—	—	—
Of the prieſts and their veſtments for glory and beauty,	28.	—	—	—
Of the chooſing of the Levites, - -	—	—	18. 3. 8.	—
Of the prieſts office in general, - -	—	—	3. 18.	—
Of their office in teaching, - -	—	19. 10.	—	18. 12. 17. 31.
Of their office in bleſſing, - -	—	—	6.	—
Of their office in offering; which function largely ſpreading itſelf, is divided into theſe heads, viz. - -				
What the ſacrifice ought to be, - -	—	22.	—	15. 17.
Of the continual fire, - - -	—	6.	—	—
Of the manner of the burnt offerings, - -	—	6. 7.	—	—
————— the peace offerings, - -	—	3. 7.	—	—
Of the manner of the ſacrifices according to their ſeveral kinds, viz.				
For ſin committed through ignorance of the law, -	—	4.	5.	—
For ſin committed through ignorance of the fact, -	—	5. 7.	—	—
For ſin committed wittingly, yet not through impiety,	—	6.	5.	—
The ſpecial law of ſacrifices for ſin, - -	—	6. 7.	—	—
Of things belonging to the ſacrifices, - -	—	2. 6. 7.	15.	—
Of the ſhew-bread, - - - -	—	24.	—	—
Of the lamps, - - - -	27.	24.	8.	—
Of the ſweet incenſe, - - - -	30.	—	—	—
Of the uſe of ordinary oblations, whereof there were ſeveral kinds obſerved by the prieſts,				
Of the conſecration of the high prieſts and other prieſts,	29. 30.	6. 8.	—	—
Of the conſecration and office of the Levites, -	—	—	8.	—
Of the dwelling of the Levites, - -	—	—	35.	—
Of the anointing the altar, and all the inſtruments of the tabernacle,	29. 30.	—	—	—
Of the continual daily ſacrifices, - -	29.	—	28.	—
Of the continual Sabbath day's ſacrifices,	—	—	28.	—
Of the ſolemn ſacrifice for feaſt days, which were diverſe, and had peculiar rites, diſtinguiſhed into theſe, viz.				
Of trumpets, - - -	—	—	10.	—
Of beginning of months, - -	—	—	28.	—
Of the three moſt ſolemn feaſts in general, -	23. 34.	23.	—	16.
Of the feaſt of paſſover, - -	12. 13. 25. 34.	23.	9.28	16.
Of the feaſt of pentecoſt, - -	23. 24.	23.	28.	16.
Of the feaſt of tabernacles, - -	23. 34.	23.	29.	16.
Of the feaſt of blowing the trumpets, - -	—	23.	29.	—

Of

		Exod. chap.	Levitic. chap.	Numb. chap.	Deut. chap.
Of the feaſt of expiation,		30.	16. 13.	29.	—
Of the firſt fruits,		22. 23. 34.	2.	15.	26.
Of tythes,		—	21.	18.	12. 14. 26.
Of fruits growing and not eaten of,		—	19.	—	—
Of the firſt born,		13. 22. 34.	—	—	15.
Of the ſabbatical year,		23.	25.	—	—
Of the year of jubilee,		—	25.	—	—
Of vows in general,		—	27.	30.	13.
What perſons ought not to make vows,		—	—	30.	—
What things cannot be vowed,		—	27.	—	23.
Of redemption of vows,		—	27.	—	—
Of the vows of the Nazarites,		—	—	6.	—
Of the laws proper for the prieſts, viz.					
Of pollutions,		—	22.	—	—
Of the high prieſt's mourning,		—	21.	—	—
Of his marriage,		—	21.	—	—
Of the mourning of the ordinary prieſts,		—	21.	—	—
Of their marriage,		—	21.	—	—
Of their being forbidden the uſe of wine, &c.		—	10.	—	—
Of ſanctified meats,		—	6. 17. 19. 20.	5. 18.	12. 15. 18.
Of the office of the Levites, viz.					
Teaching,		—	—	—	17. 27. 31.
Offering,		—	—	3. 4. 18.	10.
Other promiſcuous ceremonial laws, viz.					
Of uncleanneſs in general,		—	15. 19.	5.	—
Of uncleanneſs in meats, viz.					
Of blood,	Gen. ix.	23.	7. 17. 19.	—	12.
Of fat,		—	3. 7.	—	—
Of dead carcaſes,		22.	17.	—	14.
Other meats, and diverſe living creatures,		—	11. 20.	—	14.
Of uncleanneſs in the iſſue of ſeed and blood,		—	15. 12.	—	23.
In the dead bodies of men,		—	—	19.	—
In the leproſy,		—	13. 14.	5.	—
Of circumciſion,	Gen. xvii.	—	12.	—	—
Of the water of expiation,		—	—	19.	—
Of the mourning of the Iſraelites,		—	19.	—	14.
Of mixtures,		—	19.	—	14.
Of their garments, and writing the law privately,		—	—	15.	6. 11. 22.
Of young birds not to be taken with the dam,		—	—	—	22.
Of their paddle ſtaves,		—	—	—	23.

CLASS III. The Political Law.

N. B. The Magiſtrate is the keeper of the precepts of both Tables, and to have reſpect to human ſociety;—therefore the Political laws of the Iſraelites are referred to both the Tables, and are to be reduced to the ſeveral precepts of the Moral Law.

	Exod. chap.	Levitic. chap.	Numb. chap.	Deut. chap.
Laws referred to the firſt table, namely,				
1ſt, To the firſt and ſecond commandments, viz.				
Of idolaters and apoſtates,	22.	20.	—	13. 17.
Of aboliſhing idolatry,	23. 24.	—	33.	7. 12.
Of diviners and falſe prophets,	22.	19. 20.	—	18.
Of covenants with other gods,	23. 24.	—	—	7.
2d, To the third commandment, viz.				
Of blaſphemies,	—	24.	15.	—
3d, To the fourth commandment, viz.				
Of breaking the Sabbath,	31. 35.	—	15.	—
Political laws referred to the ſecond table,				

1ſt, To

	Exod. chap.	Levitic. chap.	Numb. chap.	Deut. chap.
1ſt, To the fifth commandment, viz.				
Of magiſtrates and their authority,	18. 30	—	11.	1. 13. 17. 23.
Of the power of fathers,				
2d, To the ſixth commandment, viz.				
Of capital puniſhments,	—	—	—	21. 24.
Of wilful murder,	21.	24.	35.	19.
Of manſlaughter unwittingly committed, and of the cities of refuge,	21.	—	35.	19.21.22.
Of heinous injury,	21.	24.	—	25.
Of puniſhments not capital,	—	—	—	25.
Of the law of war,	—	—	—	25.
3d, To the ſeventh commandment, viz.				
Of unlawful marriages,	—	18. 20.	—	7. 21.
Of fornication,	—	19.	—	23.
Of whoredom,	22.	21.	—	22.
Of adultery and jealouſy,	—	19. 20.	—	—
Of copulation againſt nature,	22.	18. 22.	—	—
Of divorcements,	—	—	—	24.
Other matrimonial laws,	21.	18. 20.	—	21.22.24. 25.
4th, To the eighth commandment, viz.				
Of the puniſhment of thefts,	22.	—	5.	—
Of ſacrilege,	—	—	—	—
Of not injuring ſtrangers,	22. 23.	19.	—	10.
Of not defrauding hirelings,	—	19.	—	26. 25.
Of juſt weights,	—	19.	—	25.
Of removing the land-mark,	—	—	—	19.
Of loſt goods,	22.	—	—	—
Of ſtrayed cattle,	22. 23.	—	—	22.
Of corrupted judgments,	23.	19.	—	16. 24.
Of fire breaking out by chance,	22.	—	—	—
Of manſtealing,	—	—	—	24.
Of the fugitive ſervant,	—	—	—	23.
Of gathering fruits,	—	19. 23.	—	23. 24.
Of contracts, viz.				
Borrowing,	—	—	—	15.
Of the pledge,	22.	—	—	24.
Of uſury,	22.	25.	—	23.
Of ſelling,	21.	25.	—	15.
Of the thing lent,	22.	—	—	—
Of a thing committed to be kept,				
Of heirs,				
5th, To the ninth commandment, viz.				
Of witneſſes,	—	5.	—	17. 19.
The eſtabliſhing the political law,	—	—	—	4.
The eſtabliſhing the divine law in general,	—	—	—	6. 11. 29. 30. 31.
From the dignity of the lawgiver,	—	19.20.22.	15.	4.5.6.7.8. 10.26.27.
From the excellency of the laws,	—	—	—	4.26.
From the promiſes,	15.19.23. 24.	18. 26.	—	4. 5. 6. 7. 10.11.12. 28.
From the threatenings,	23.	26.	—	4. 7. 11. 27.28.29. 30.

MOSAIC, or Mosaic Work, an aſſemblage of little pieces of glaſs, marble, precious ſtones, &c. of various colours, cut ſquare, and cemented on a ground of ſtucco, in ſuch a manner as to imitate the colours and gradations of painting. The critics are divided as to the origin and reaſon of the name. Some derive it it from *moſaicum*, a corruption of *muſaicum*, as that is of *muſivum*, as it was called among the Romans. Scaliger derives it from the Greek μυσα, and imagines the name was given to this ſort of works as being very fine and ingenious. Nebricenſis is of opinion it was ſo called, becauſe *ex illis picturis ornabantur muſca*.

1. Method of performing moſaic work of glaſs is this: They provide little pieces of glaſs, of as many different colours and ſizes as poſſible.

Now, in order to apply theſe ſeveral pieces, and out of them to form a picture, they in the firſt place procure a cartoon or deſign to be drawn; this is tranſferred to the ground or plaſter by chalking as in painting in freſco. See FRESCO.

As this plaſter is to be laid thick on the wall, and therefore will continue freſh and ſoft a conſiderable time, ſo there may be enough prepared at once to ſerve for as much work as will take up three or four days.

This plaſter is compoſed of lime made of hard ſtone, with brick duſt very fine, gum tragacanth, and whites of eggs; when this plaſter has been thus prepared and laid on the wall, and made the deſign of what is to be repreſented, they take out the little pieces of glaſs with a pair of plyers, and range them one after another, ſtill keeping ſtrictly to the light, ſhadow, different teints and colours repreſented in the deſign before; preſſing or flatting them down with a ruler, which ſerves both to ſink them within the ground and to render the ſurface even.

Thus, in a long time, and with a great deal of labour, they finiſh the work, which is ſtill the more beautiful, as the pieces of glaſs are more uniform and ranged at an even height.

Some of theſe pieces of moſaic work are performed with that exactneſs, that they appear as ſmooth as a table of marble, and as finiſhed and maſterly as a painting in freſco; with this advantage, that they have a fine luſtre, and will laſt ages.

The fineſt works of this kind that have remained till our time, and thoſe by whom the moderns have retrieved the art, which was in a manner loſt, are thoſe in the church of St Agnes, formerly the temple of Bacchus, at Rome; and ſome at Piſa, Florence, and other cities of Italy. The moſt eſteemed among the works of the moderns are thoſe of Joſeph Pine and the Chevalier Lanfranc, in the church of St Peter at Rome: there are alſo very good ones at Venice.

2. The method of performing moſaic work of *marble* is this: The ground of moſaic works, wholly marble, is uſually a maſſive marble either white or black. On this ground the deſign is cut with a chiſel, after it has been firſt chalked. After it has been cut of a conſiderable depth, i. e. an inch or more, the cavities are filled up with marble of a proper colour, firſt faſhioned according to the deſign, and reduced to the thickneſs of the indentures with various inſtruments. To make the piece thus inſerted into the indentures cleave faſt, whoſe ſeveral colours are to imitate thoſe of the deſign, they uſe a ſtucco, compoſed of lime and marble duſt; or a kind of maſtich, which is prepared by each workman, after a different manner peculiar to himſelf. The figures being marked out, the painter or ſculptor himſelf draws with a pencil the colours of the figures not determined by the ground, and in the ſame manner makes ſtrokes or hatchings in the place where ſhadows are to be: and after he has engraven with the chiſel all the ſtrokes thus drawn, he fills them up with a black maſtich, compoſed partly of Burgundy pitch poured on hot; taking off afterwards what is ſuperfluous with a piece of ſoft ſtone or brick, which, together with water and beaten cement, takes away the maſtich, poliſhes the marble, and renders the whole ſo even that one would imagine it only conſiſted of one piece. This is the kind of moſaic work that is ſeen in the pompous church of the invalids at Paris, and the fine chapel at Verſailles, with which ſome entire apartments of that palace are incruſtated.

3. As for moſaic work of precious ſtones, other and finer inſtruments are required than thoſe uſed in marble; as drills, wheels, &c. uſed by lapidaries and engravers on ſtone. As none but the richeſt marbles and ſtones enter this work, to make them go the farther, they are ſawn into the thinneſt leaves imaginable, ſcarcely exceeding half a line in thickneſs; the block to be ſawn is faſtened firmly with cords on the bench, and only raiſed a little on a piece of wood, one or two inches high. Two iron pins, which are on one ſide the block, and which ſerve to faſten it, are put into a vice contrived for the purpoſe; and with a kind of ſaw or bow, made of fine braſs wire, bent on a piece of ſpongy wood, together with emery ſteeped in water, the leaf is gradually faſhioned by following the ſtroke of the deſign made on paper, and glued on the piece. When there are pieces enough faſtened to form an entire flower, or ſome other part of the deſign, they are applied to the ground.

The ground which ſupports this moſaic work is uſually of freeſtone. The matter with which the ſtones are joined together is a maſtich, or kind of ſtucco, laid very thin on the leaves as they are faſhioned; and this being done, the leaves are applied with plyers.

If any contour, or ſide of a leaf, be not either ſquared or rounded ſufficiently, ſo as to fit the place exactly into which it is to be inſerted, when it is too large, it is to be brought down with a braſs file or raſp; and if it be too little, it is managed with a drill and other inſtruments uſed by lapidaries.

Moſaic work of marble is uſed in large works, as in pavements of churches, baſilics, and palaces; and in the incruſtation and veneering of the walls of the ſame edifices.

As for that of precious ſtones, it is only uſed in ſmall works, as ornaments for altar pieces, tables for rich cabinets, precious ſtones being ſo very dear.

4. Manner of performing moſaic work of *gypſum*. Of this ſtone calcined in a kiln, beaten in a mortar and ſifted, the French workmen make a ſort of artificial marbles, imitating precious ſtones; and of theſe they compoſe a kind of moſaic work, which does not come far ſhort either of the durableneſs or the vivacity of the natural ſtones; and which beſides has this advantage that it admits of continued pieces or paintings of entire compartments without any viſible joining.

Some make the ground of plaſter of Paris, others of freeſtone. If it be of plaſter of Paris, they ſpread it in a wooden frame, of the length and breadth of the work intended, and in thickneſs about an inch and a half. This frame is ſo contrived, that the tenons being only joined to the mortiſes by ſingle pins, they may be taken aſunder, and the frame be diſmounted when the plaſter is dry. The frame is covered on one ſide with a ſtrong linen cloth, nailed all round; which being placed horizontally with the linen at the bottom, is filled with plaſter paſſed through a wide ſieve. When the plaſter is half dry, the frame is ſet up perpendicularly, and left till it is quite dry; then it is taken out, by taking the frame to pieces.

In this moſaic, the ground is the moſt important part. Now in order to the preparation of this ſifted gypſum, which is to be applied on this ground, it is diſſolved and boiled in the beſt Engliſh glue, and mixed with the colour that it is to be of; then the whole is worked up together into the uſual conſiſtence of plaſter, and then is taken and ſpread on the ground five or ſix inches thick. If the work be ſuch, as that mouldings are required, they are formed with gouges and other inſtruments.

It is on this plaſter, thus coloured like marble or precious ſtone, and which is to ſerve as a ground to a work, either of lapis, agate, alabaſter, or the like, that the deſign to be repreſented is drawn: having been firſt pounced or chalked. To hollow or impreſs the deſign, they uſe the ſame inſtruments that ſculptors do; the ground whereon they are to work not being much leſs hard than the marble itſelf. The cavities being thus made in the ground, are filled with the ſame gypſum boiled in glue, only differently coloured, and thus are the different colours of the original repreſented. In order that the neceſſary colours and teints may be ready at hand, the quantities of the gypſum are tempered with the ſeveral colours in pots. After the deſign has been thus filled and rendered viſible, by half poliſhing it with brick and ſoft ſtone, they go over it again, cutting ſuch plates as are either to be weaker or more ſhadowed, and filling them with gypſum; which work they repeat till all the colours being added one after the other, repreſent the original to the life. When the work is finiſhed, they ſcour it with ſoft ſtone, ſand, and water; after that with a pumice ſtone; and in the laſt place poliſh it with a wooden mullet and emery. Laſtly, they give it a luſtre, by ſmearing it over with oil, and rubbing it a long time with the palm of the hand, which gives it a luſtre nowiſe inferior to that of natural marble.

5. In Clavigero's hiſtory of Mexico is deſcribed a curious kind of moſaic work, made by the ancient Mexicans of the moſt delicate and beautiful *feathers* of birds. They raiſed for this purpoſe various ſpecies of birds of fine plumage with which that country abounds, not only in the palaces of the king, where there were all ſorts of animals, but likewiſe in private houſes; and at certain ſeaſons they carried off their feathers to make uſe of them on this kind of work, or to ſell them at market. They ſet a high value on the feathers of thoſe wonderful little birds which they called *Huitzitzilin*, and the Spaniards *Picaflores*, on account of the ſmallneſs, the fineneſs, and the various colours of them. In theſe and other beautiful birds, nature ſupplied them with all the colours which art can produce, and alſo ſome which art cannot imitate. At the undertaking of every moſaic work ſeveral artiſts aſſembled: After having agreed upon a deſign, and taken their meaſures and proportions, each artiſt charged himſelf with the execution of a certain part of the image, and exerted himſelf ſo diligently in it, with ſuch patience and application, that he frequently ſpent a whole day in adjuſting a feather; firſt trying one, then another, viewing it ſometimes one way, then another, until he found one which gave his part that ideal perfection propoſed to be attained. When the part which each artiſt undertook was done, they aſſembled again to form the entire image from them.—If any part was accidentally the leaſt deranged, it was wrought again until it was perfectly finiſhed. They laid hold of the feathers with ſmall pinchers, that they might not do them the leaſt injury, and paſted them on the cloth with *tzauhtli*, or ſome other glutinous matter; then they united all the parts upon a little table, or a plate of copper, and flattened them ſoftly until they left the ſurface of the image ſo equal and ſmooth that it appeared to be the work of a pencil.

Theſe were the images ſo much celebrated by the Spaniards and other European nations. Whoever beheld them was at a loſs whether he ought to have praiſed moſt the life and beauty of the natural colours, or the dexterity of the artiſt and the ingenious diſpoſition of art. "Theſe images (ſays Acoſta) are deſervedly admired; for it is wonderful how it was poſſible, with the feathers of birds, to execute works ſo fine and ſo equal, that they appear the performance of the pencil; and, what neither the pencil nor the colours in painting can effect, they have, when viewed from a ſide, an appearance ſo beautiful, ſo lively, and animated, that they give delight to the ſight. Some Indians, who are able artiſts, copy whatever is painted with a pencil ſo perfectly with plumage, that they rival the beſt painters of Spain." Theſe works of feathers were even ſo highly eſteemed by the Mexicans as to be valued more than gold. Cortes, Bernal Diaz, Gomara, Torquemada, and all the other hiſtorians who ſaw them, were at a loſs for expreſſions ſufficient to praiſe their perfection. Several works of this kind, our author ſays, are ſtill preſerved in the muſeums of Europe, and many in Mexico; but few, he apprehends, belong to the ſixteenth century, and ſtill fewer, if any, are of thoſe made before the conqueſt. The moſaic works alſo which the Mexicans made of broken ſhells were extremely curious: this art is ſtill practiſed in Guatimala.

MOSAMBIQUE, a kingdom of Africa, lying ſouth of Quiloa, and taking its name from the chief town, which is ſituated on an iſland, at the mouth of a river of the ſame name, in 15 deg. S. Lat. The iſland is 30 miles in circumference, and very populous, though the air is ſaid to be very hot, and the ſoil in general dry, ſandy, and barren; yet they have moſt of the tropical fruits, with black cattle, hogs, and ſheep. There is a kind of fowl here, both the feathers and fleſh of which are black, inſomuch that, when they are boiled, the broth looks like ink; and yet their fleſh is very delicate and good food. The town of Moſambique is regularly fortified, and has a good harbour, defended by a citadel, with ſeveral churches and monaſteries. The Portugueſe ſhipping to and from India touch here for refreſhments. As the iſland abounds in cattle, the Portugueſe ſlaughter and ſalt up a great deal of beef, which they afterwards ſend to the Brazils, or ſell to the European ſhipping. They alſo barter European goods with the natives for gold, elephants teeth, and ſlaves. There is another town, called *Mongala*, ſituated alſo on an iſland, and garriſoned by the Portugueſe, being their chief magazine for European goods. The gold they receive from the natives is found near the ſurface of the earth, or in the ſands of rivers; no gold mines, or at leaſt very few, being at preſent wrought in Africa.

MOSCHION, a name common to four different writers, whoſe compoſitions, character, and native place, are unknown. Some fragments of their writings remain, ſome few verſes, and a treatiſe *De mulierum affectibus*.

MOSCHUS a Grecian poet of antiquity, uſually coupled with Bion; and they were both of them cotemporaries with Theocritus. In the time of the latter Grecians, all the ancient idylliums were collected and attributed to Theocritus; but the claims of Moſchus and Bion have been admitted to ſome few little pieces; and this is ſufficient to make us inquiſitive about their characters and ſtory; yet all that can be known about them muſt be collected from their own remains. Moſchus, by compoſing his delicate elegy on Bion, has given the beſt memorials of Bion's life. See Bion. Moſchus and Theocritus have by ſome critics been ſuppoſed the ſame perſon; but there are irrefragable evidences againſt it: others will have him as well as Bion to have lived later than Theocritus, upon the authority of Suidas: while others again ſuppoſe him to have been the ſcholar of Bion, and probably his ſucceſſor in governing the poetic ſchool; which, from the elegy of Moſchus, does not ſeem unlikely. Their remains are to be found in all the editions of the *Poetæ Minores*.

Moschus, a genus of quadrupeds, of the order of pecora, having no horns. See Mammalia *Index*.

MOSCOW, the chief province of the empire of Ruſſia, deriving its name from the river Muſcova, or Moſkva, on which the capital is ſituated. It was from this duchy that the czars of old took the title of *dukes of Muſcovy*. The province is bounded on the north by the duchies of Twere, Roſtow, Suſdal, and Wolodimer; on the ſouth by Rezan, from which it is ſeparated by the river Occa; on the eaſt by the principality of Cachine, and the ſame river Occa parting it from Niſi-Novogorod; and on the weſt by the duchies of Rzeva, Bielar and Smolenſko. It extends about 200 miles in length, and about 100 in breadth; and is watered by the Moſkva, Occa, and Cleſma, which fall into the Wolga: nevertheleſs, the ſoil is not very fertile. The air, however, though ſharp, is ſalubrious; and this conſideration, with the advantage of its being ſituated in the midſt of the beſt provinces in the empire, induced the czars to make it their chief reſidence. In the weſtern part of Moſcow is a large foreſt, from whence flows the celebrated river Dnieper, or Boryſthenes, which, traverſing the duchy of Smolenſko, winds in a ſerpentine courſe to Ukraine, Lithuania, and Poland.

Moscow, the capital of the above province, and till the beginning of the laſt century the metropolis of all Ruſſia, is ſituated in a ſpacious plain on the banks of the river Moſkva. E. Long. 37. 31. N. Lat. 55.45. The Ruſſian antiquaries differ conſiderably in their opinions concerning the firſt foundation of Moſcow; the following relation, Mr Coxe ſays, is generally eſteemed by the beſt authors the moſt probable account.

Kiof was the metropolis, when George ſon of Vladimir Monomaka aſcended in 1154 the Ruſſian throne. That monarch, being inſulted in a progreſs through his dominions by a rich and powerful nobleman named Stephen Kutchko, put him to death, and confiſcated his domains, which conſiſted of the lands now occupied by the city of Moſcow and the adjacent territory. Pleaſed with the ſituation of the ground lying at the conflux of the Moſkva and Neglina, he laid the foundation of a new town, which he called Moſkva from the river of that name. Upon the demiſe of George, the new town was not neglected by his ſon Andrew, who transferred the ſeat of empire from Kiof to Vladimir; but it fell into ſuch decay under his immediate ſucceſſors, that when Daniel, ſon of Alexander Nevſki, received, in the diviſion of the empire, the duchy of Muſcovy as his portion, and fixed his reſidence upon the conflux of the Moſkva and Neglina, he may be ſaid to have new founded the town. The ſpot now occupied by the Kremlin was at that time overſpread with a thick wood and a moraſs, in the midſt whereof was a ſmall iſland containing a ſingle wooden hut. Upon this part Daniel conſtructed churches and monaſteries, and various buildings, and encloſed it with wooden fortifications: he firſt aſſumed the title of duke of Moſcow; and was ſo attached to this ſituation, that when in 1304 he ſucceeded his brother Andrew Alexandrovich in the great duchy of Vladimir, he did not remove his court to Vladimir, but continued his reſidence at Moſcow, which then became the capital of the Ruſſian dominions. His ſucceſſors followed his example; among whom his ſon Ivan conſiderably enlarged the new metropolis, and in 1367 his grandſon Demetrius Ivanovitch Donſki ſurrounded the Kremlin with a brick wall. Theſe new fortifications, however, were not ſtrong enough to prevent Tamerlane in 1382, from taking the town after a ſhort ſiege. Being ſoon evacuated by that deſultory conqueror, it again came into the poſſeſſion of the Ruſſians; but was frequently invaded and occupied by the Tartars, who in the 14th and 15th centuries overran the greateſt part of Ruſſia, and who even maintained a garriſon in Moſcow until they were finally expelled by Ivan Vaſſilievitch I. To him Moſcow is indebted for its principal ſplendour, and under him it became the principal and moſt conſiderable city of the Ruſſian empire.

Moſcow continued the metropolis of Ruſſia until the beginning of the 18th century, when, to the great diſſatisfaction of the nobility, but with great advantage probably to the ſtate, the ſeat of empire was transferred to Peterſburgh.

Notwithſtanding the predilection which Peter conceived for Peterſburgh, in which all the ſucceeding ſovereigns excepting Peter the II. have fixed their reſidence, Moſcow, according to Mr Coxe, is ſtill the moſt populous city of the Ruſſian empire. Here the chief nobles who do not belong to the court reſide: they here ſupport a large number of retainers; they love to gratify their taſte for a ruder and more expenſive magnificence in the ancient ſtyle of feudal grandeur; and are not, as at Peterſburgh, eclipſed by the ſuperior ſplendour of the court.

Moſcow.

Moſcow is repreſented as the largeſt town in Europe; its circumference within the rampart, which encloſes the ſuburbs, being exactly 39 verſts or 26 miles; but it is built in ſo ſtraggling and disjointed a manner, that its population in no degree correſponds to its extent. Some Ruſſian authors ſtate its inhabitants at 500,000 ſouls, a number evidently exaggerated. According to a computation, which Mr Coxe ſays may be depended upon, Moſcow contains within the ramparts 250,000 ſouls, and in the adjacent villages 50,000. The ſtreets of Moſcow are in general exceedingly long and broad; ſome of them are paved; others, particularly thoſe in the ſuburbs, are formed with trunks of trees, or are boarded with planks like the floor of a room; wretched hovels are blended with large palaces; cottages of one ſtory ſtand next to the moſt ſuperb and ſtately manſions. Many brick ſtructures are covered with wooden tops; ſome of the wooden houſes are painted; others have iron doors and roofs. Numerous churches preſent themſelves in every quarter, built in a peculiar ſtyle of architecture; ſome with domes of copper, others of tin, gilt or painted green, and many roofed with wood. In a word, ſome parts of this vaſt city have the look of a ſequeſtered deſert, other quarters of a populous town; ſome of a contemptible village, others of a great capital.

Moſcow may be conſidered as a town built upon the Aſiatic model, but gradually becoming more and more European, and exhibiting in its preſent ſtate a motley mixture of diſcordant architecture. It is diſtributed into the following diviſions. 1. The Kremlin. This ſtands in the central and higheſt part of the city; is of a triangular form, and about two miles in circumference; and is ſurrounded by high walls of ſtone and brick; which were conſtructed in the year 1491, under the reign of Ivan Vaſſilievitch I. It contains the ancient palace of the czars, ſeveral churches, two convents, the patriarchal palace, the arſenal now in ruins, and one private houſe, which belonged to Boris Godunof before he was raiſed to the throne. 2. Khitaigorod, or the Chineſe town, is encloſed on one ſide by that wall of the Kremlin which runs from the Moſkva to the Neglina; and on the other ſide by a brick wall of inferior height. It is much larger than the Kremlin, and contains the univerſity, the printing-houſe and many other public buildings, and all the tradeſmen's ſhops. The edifices are moſtly ſtuccoed or white waſhed, and it has the only ſtreet in Moſcow in which the houſes ſtand cloſe to one another without any intervals between them. 3. The Bielgorod, or White Town, which runs quite round the two preceding diviſions, is ſuppoſed to derive its name from a white wall with which it was formerly encloſed, and of which ſome remains are ſtill to be ſeen. 4. Semlainogorod, which environs all the three other quarters, takes its denomination from a circular rampart of earth with which it is encompaſſed. Theſe two laſt mentioned diviſions exhibit a groteſque groupe of churches, convents, palaces, brick and wooden houſes, and mean hovels, in no degree ſuperior to peaſants cottages. 5. The Sloboda, or ſuburbs, form a vaſt exterior circle round all the parts already deſcribed, and are inveſted with a low rampart and ditch. Theſe ſuburbs contain, beſide buildings of all kinds and denominations, corn fields, much open paſture, and ſome ſmall lakes, which give riſe to the Neglina. The river *Moſkva*, from which the city takes its name, flows through it in a winding channel; but excepting in ſpring is only navigable for rafts. It receives the Yauſa in the Semlainogorod, and the Neglina at the weſtern extremity of the Kremlin; the beds of both theſe laſt-mentioned rivulets are in ſummer little better than dry channels.

Moſcow.

The places of divine worſhip at Moſcow are exceedingly numerous; including chapels, they amount to above 1000: there are 484 public churches, of which 199 are of brick; and the others of wood; the former are commonly ſtuccoed or white-waſhed, the latter painted of a red colour. The moſt ancient churches of Moſcow are generally ſquare buildings, with a cupola and four ſmall domes, ſome whereof are of copper or iron gilt; others of tin, either plain or painted green. Theſe cupolas and domes are for the moſt part ornamented with croſſes entwined with thin chains or wires. The church of the Holy Trinity, ſometimes called the church of Jeruſalem, which ſtands in the Khitaigorod, cloſe to the gate leading into the Kremlin, has a kind of high ſteeple and nine or ten domes: it was built in the reign of Ivan Vaſſilievitch II. The inſide of the churches is moſtly compoſed of three parts; that called by the Greeks ὠδοναος, by the Ruſſians trapeza; the body; and the ſanctuary or ſhrine. Over the door of each church is the portrait of the ſaint to whom it is dedicated, to which the common people pay their homage as they paſs along, by taking off their hats, croſſing themſelves, and occaſionally touching the ground with their heads. The bells, which form no inconſiderable part of public worſhip in this country, as the length or ſhortneſs of their peals aſcertains the greater or leſſer ſanctity of the day, are hung in belfrys detached from the church: they do not ſwing like our bells; but are fixed immoveably to the beams, and are rung by a rope tied to the clapper and pulled ſidewiſe. Some of theſe bells are of a ſtupendous ſize; one in the tower of St Ivan's church weighs 3551 Ruſſian poods, or 127,836 Engliſh pounds. It has always been eſteemed a meritorious act of religion to preſent a church with bells; and the piety of the donor has been meaſured by their magnitude. According to this mode of eſtimation, Boris Godunof, who gave a bell of 288,000 pounds to the cathedral of Moſcow, was the moſt pious ſovereign of Ruſſia, until he was ſurpaſſed by the empreſs Anne, at whoſe expence a bell was caſt weighing 432,000 pounds, and which exceeded in bigneſs every bell in the known world. The height of this enormous bell is 19 feet, its circumference at the bottom 21 yards 11 inches; its greateſt thickneſs 23 inches. The beam to which this vaſt machine was faſtened being accidentally burnt, the bell fell down, and a fragment was broken off towards the bottom, which left an aperture large enough to admit two perſons abreaſt without ſtooping.

The palace, inhabited by the ancient czars, ſtands at the extremity of the Kremlin. Part of this palace is old, and remains in the ſame ſtate in which it was built under Ivan Vaſſilievitch I. The remainder has been ſucceſſively added at different intervals, without any plan, and in various ſtyles of architecture, which has produced a motley pile of building, remarkable for nothing but the incongruity of the ſeveral ſtructures. The top is thickly ſet with numerous little gilded ſpires and globes; and a large portion of the front is decorated with the arms of all the provinces which compoſe the Ruſſian empire. The apartments are in general exceedingly ſmall, excepting one ſingle room called the council chamber, in which the ancient czars uſed to give audience to foreign ambaſſadors, and which has been repeatedly deſcribed by ſeveral Engliſh travellers who viſited Moſcow before the imperial reſidence was transferred to Peterſburgh. The room is large and vaulted, and has in the centre an enormous pillar of ſtone which ſupports the ceiling. In this palace Peter the Great came into the world, in the year 1672. In that part called the treaſury are depoſited the crown, jewels, and royal robes, uſed at the coronation of the ſovereign, beſides ſeveral curioſities relative to the hiſtory of the country. Of the great number of churches contained in this city, two in particular, namely, that of St Michael and that of the Aſſumption of the Virgin Mary, are remarkable; the one for being the place where the ſovereigns of Ruſſia were formerly interred, and the other where they are crowned. Theſe edifices, which are ſituated in the Kremlin, are both in the ſame ſtyle of architecture; and their exterior form, though modelled according to the ancient ſtyle of the country, is not abſolutely inelegant. In the cathedral of St Michael, which contains the tombs of the Ruſſian ſovereigns, the bodies are not, as with us, depoſited in vaults, or beneath the pavement, but are entombed in raiſed ſepulchres, moſtly of brick, in the ſhape of a coffin, and about two feet in height. When Mr Coxe viſited the cathedral, the moſt ancient were covered with palls of red cloth, others of red velvet, and that of Peter II. with gold tiſſue, bordered with ſilver fringe and ermine. Each tomb has at its lower extremity a ſmall ſilver plate, upon which is engraven the name of the deceaſed ſovereign, and the era of his death.

The cathedral of the Aſſumption of the Virgin Mary, which has long been appropriated to the coronation of the Ruſſian ſovereigns, is the moſt ſplendid and magnificent in Moſcow. The ſcreen is in many parts covered with plates of ſolid ſilver and gold richly worked. From the centre of the roof hangs an enormous chandelier of maſſy ſilver, weighing 2940 pounds: it was made in England, and was a preſent from Moroſof, prime miniſter and favourite of Alexey Michaelovitch. The ſacred utenſils and epiſcopal veſtments are extraordinarily rich, but the taſte of the workmanſhip is in general rude, and by no means equal to the materials. Many of the paintings which cover the inſide walls are of a coloſſal ſize: ſome are very ancient, and were executed ſo early as in the latter end of the 15th century. It contains, amongſt the reſt a head of the Virgin, ſuppoſed to have been delineated by St Luke, and greatly celebrated in this country for its ſanctity and the power of working miracles. Its face is almoſt black; its head is ornamented with a glory of precious ſtones, and its hands and body are gilded, which gives it a moſt groteſque appearance. It is placed in the ſkreen, and encloſed within a large ſilver covering, which is only taken off on great feſtivals, or for the curioſity of ſtrangers. In this cathedral are depoſited the remains of the Ruſſian patriarchs.

The place in the Khitaigorod, where the public archives are depoſited, is a ſtrong brick building, containing ſeveral vaulted apartments with iron floors. Theſe archives, conſiſting of a numerous collection of ſtate papers, were crowded into boxes and thrown aſide like common lumber, until the empreſs Catharine ordered them to be reviſed and arranged. In conformity to this mandate, Mr Muller has diſpoſed them in chronological order with ſuch perfect regularity, that any ſingle document may be inſpected with little trouble. They are encloſed in ſeparate cabinets with glaſs doors: thoſe relative to Ruſſia are all claſſed according to the ſeveral provinces which they concern; and over each cabinet is inſcribed the name of the province to which it is appropriated. In the ſame manner the manuſcripts relative to foreign kingdoms are placed in ſeparate diviſions under the reſpective titles of Poland, Sweden, England, France, Germany, &c.

The univerſity of Moſcow, all ſituated in the Khitaigorod, was founded, at the inſtance of Count Shuvalof, by the empreſs Elizabeth, for 600 ſtudents; who are clothed, boarded, and inſtructed, at the expence of the crown. Beſides this inſtitution, there are two gymnaſia or ſeminaries for the education of youth, endowed alſo by Elizabeth; in which are taught, by twenty-three profeſſors, divinity, claſſics, philoſophy, the Greek, Latin, Ruſſian, German, French, Italian, and Tartar languages; hiſtory, geography, mathematics, architecture, fortification, artillery, algebra, drawing and painting, muſic, fencing, dancing, reading and writing.

Moſcow is the centre of the inland commerce of Ruſſia, and particularly connects the trade between Europe and Siberia. The only navigation to this city is formed by the Moſkva, which falling into the Occa near Columna, communicates by means of that river with the Volga. But as the Moſkva is only navigable in ſpring upon the melting of the ſnows, the principal merchandiſe is conveyed to and from Moſcow upon ſledges in winter. The whole of the retail trade is carried on in the Khitaigorod; where according to a cuſtom common in Ruſſia, as well as in moſt kingdoms of the Eaſt, all the ſhops are collected together in one ſpot. The place is like a kind of fair, conſiſting of many rows of low brick buildings; the intervals between them reſembling alleys. Theſe ſhops or booths occupy a conſiderable ſpace; they do not, as with us, make part of the houſes inhabited by the tradeſmen, but are quite detached from their dwellings, which for the moſt part are at ſome diſtance in another quarter of the town. The tradeſman comes to his ſhop in the morning, remains there all day, and returns home to his family in the afternoon. Every trade has its ſeparate department; and they who ſell the ſame goods have booths adjoining to each other. Furs and ſkins form the moſt conſiderable article of commerce in Moſcow; and the ſhops which vend thoſe commodities occupy ſeveral ſtreets.

Amongſt the curioſities of Moſcow, the market for the ſale of houſes is not the leaſt remarkable. It is held in a large open ſpace in one of the ſuburbs; and exhibits a great variety of ready made houſes, thickly ſtrewed upon the ground. The purchaſer who wants a dwelling, repairs to this ſpot, mentions the number of rooms he requires, examines the different timbers, which are regularly numbered, and bargains for that which ſuits him. The houſe is ſometimes paid for on the ſpot, and taken away by the purchaſer; or ſometimes the vender contracts to tranſport and erect it upon the place where it is deſigned to ſtand. It may appear incredible to aſſert, that a dwelling may be thus bought,

bought, removed, raiſed and inhabited, within the ſpace of a week; but we ſhall conceive it practicable by conſidering that theſe ready-made houſes are in general merely collections of trunks of trees tenoned and mortiſed at each extremity into one another, ſo that nothing more is required than the labour of tranſporting and adjuſting them. But this ſummary mode of building is not always peculiar to the meaner hovels; as wooden ſtructures of very large dimenſions and handſome appearance are occaſionally formed in Ruſſia with an expedition almoſt inconceivable to the inhabitants of other countries. A remarkable inſtance of this deſpatch was diſplayed the laſt time the empreſs came to Moſcow. Her majeſty propoſed to reſide in the manſion of Prince Galitzin, which is eſteemed the completeſt edifice in this city; but as it was not ſufficiently ſpacious for her reception, a temporary addition of wood, larger than the original houſe, and containing a magnificent ſuite of apartments, was begun and finiſhed within the ſpace of ſix weeks. This meteor-like fabric was ſo handſome and commodious, that the materials which were taken down at her majeſty's departure, were to be re-conſtructed as a kind of imperial villa upon an eminence near the city. Mr Coxe mentions an admirable police in this city for preventing riots, or for ſtopping the concourſe of people in caſe of fires, which are very frequent and violent in thoſe parts, where the houſes are moſtly of wood, and the ſtreets are laid with timber. At the entrance of each ſtreet there is a chevaux-de-frize gate, one end whereof turns upon a pivot, and the other rolls upon a wheel; near it is a centry box in which a man is occaſionally ſtationed. In times of riot or fire the centinel ſhuts the gate, and all paſſage is immediately ſtopped.

Among the public inſtitutions of Moſcow, the moſt remarkable is the Foundling Hoſpital, endowed in 1764 by the empreſs Catharine, and ſupported by voluntary contributions and legacies, and other charitable gifts. In order to encourage donations, her majeſty granted to all benefactors ſome valuable privileges, and a certain degree of rank in proportion to the extent of their liberality. Among the principal contributors muſt be mentioned a private merchant named *Dimidof*, a perſon of great wealth, who has expended in favour of this charity above 100,000l. The hoſpital, which is ſituated in a very airy part of the town upon a gentle aſcent near the river Moſkva, is an immenſe pile of building of a quadrangular ſhape, part of which was only finiſhed when Mr Coxe (whoſe account we are tranſcribing) was at Moſcow. It contained, at that time, three thouſand foundlings; and, when the whole is completed, will receive eight thouſand. The children are brought to the porter's lodge, and admitted without any recommendation. The rooms are lofty and large; the dormitories, which are ſeparate from the work rooms, are very airy, and the beds are not crowded: each foundling, even each infant, has a ſeparate bed The children remain two years in the nurſery, when they are admitted into the loweſt claſs; the boys and girls continue together until they are ſeven years of age, at which time they are ſeparated. They all learn to read, write, and caſt accounts. The boys are taught to knit; they occaſionally card hemp, flax, and wool, and work in the different manufactures. The girls learn to knit, net, and all kinds of needle work; they ſpin and weave lace; they are employed in cookery, baking, and houſe work of all ſorts. At the age of fourteen the foundlings enter into the firſt claſs; when they have the liberty of chooſing any particular branch of trade; and for this purpoſe there are different ſpecies of manufactures eſtabliſhed in the hoſpital, of which the principal are embroidery, ſilk ſtockings, ribbands, lace, gloves, buttons, and cabinet work. A ſeparate room is appropriated to each trade. Some boys and girls are inſtructed in the French and German languages, and a few boys in the Latin tongue; others learn muſic, drawing, and dancing. Moſcow was taken and plundered by the French in 1812.

MOSELLE, a river of Germany, which riſes in the mountains of Voſges in Lorraine, and falls into the Rhine at Coblentz.

MOSELLE is alſo the name of a department of France, which includes part of the late province of Lorrain.

MOSES, the ſon of Amram and Jochebed, was born in the year 1571 before Chriſt. Pharaoh king of Egypt, perceiving that the Hebrews were become a formidable nation, iſſued forth an edict commanding all the male children to be put to death. To avoid this cruel edict, Jochebed, the mother of Moſes, having concealed her ſon for three months, at length made an ark or baſket of bulruſhes, daubed it with pitch, laid the child in it, and expoſed him on the banks of the Nile. Thermuthis the king's daughter, who happened to be walking by the river's ſide, perceived the floating cradle, commanded it to be brought to her, and ſtruck with the beauty of the child, determined to preſerve his life. In three years afterwards the princeſs adopted him for her own ſon, called his name *Moſes*, and cauſed him be diligently inſtructed in all the learning of the Egyptians. But his father and mother, to whom he was reſtored by a fortunate accident, were at ſtill greater pains to teach him the hiſtory and religion of his fathers. Many things are related by hiſtorians concerning the firſt period of Moſes's life, which are not to be found in the Old Teſtament. According to Joſephus and Euſebius, he made war on the Ethiopians, and completely defeated them. They add, that the city Saba, in which the enemy had been forced to take refuge, was betrayed into his hands by the king's daughter, who became deeply enamoured of him, when ſhe beheld from the top of the walls his valorous exploits at the head of the Egyptian army. But as the truth of this expedition is more than doubtful, we ſhall therefore confine ourſelves to the narrative of ſacred writ, which commences at the fortieth year of Moſes's life. He then left the court of Pharaoh, and went to viſit his countrymen the Hebrews, who groaned under the ill uſage and oppreſſion of their unfeeling maſters. Having perceived an Egyptian ſmiting a Hebrew, he ſlew the Egyptian, and buried him in the ſand. But he was obliged, in conſequence of this murder, to fly into the land of Midian, where he married Zipporah, daughter of the prieſt Jethro, by whom he had two ſons, Gerſhom and Eliezar. Here he lived 40 years; during which time his employment was to tend the flocks of his father-in-law. Having one day led his flock towards Mount Horeb, God appeared to him in the midſt of a buſh which burned with fire but was not conſumed, and commanded him to go and deliver his brethren from their bondage. Moſes at firſt refuſed to go; but was at length prevailed on by two miracles

racles which the Almighty wrought for his conviction. Upon his return to Egypt, he, together with his brother Aaron, went to the court of Pharaoh, and told him that God commanded him to let the Hebrews go to offer ſacrifices in the deſert of Arabia. But the impious monarch diſregarded this command, and cauſed the labour of the Iſraelites to be doubled. The meſſengers of the Almighty again returned to the king, and wrought a miracle in his ſight, that they might move his heart, and induce him to let the people depart. Aaron having caſt down his miraculous rod, it was immediately converted into a ſerpent: but the ſame thing being performed by the magicians, the king's heart was hardened more and more; and his obſtinacy at laſt drew down the judgments of the Almighty on his kingdom, which was afflicted with ten dreadful plagues. The firſt was the changing of the waters of the Nile and of all the rivers into blood, ſo that the Egyptians died of thirſt. In conſequence of the ſecond plague, the land was covered with innumerable ſwarms of frogs, which entered even into Pharaoh's palace. By the third plague, the duſt was converted into lice, which cruelly tormented both man and beaſt. The fourth plague was a multitude of deſtructive flies which ſpread throughout Egypt, and infeſted the whole country. The fifth was a ſudden peſtilence, which deſtroyed all the cattle of the Egyptians, without injuring thoſe of the Iſraelites. The ſixth produced numberleſs ulcers and fiery boils upon man and upon beaſt. The ſeventh was a dreadful ſtorm of hail, accompanied with thunder and lightning, which deſtroyed every thing that was in the field, whether man or beaſt, and ſpared only the land of Goſhen, where the children of Iſrael dwelt. By the eighth plague ſwarms of locuſts were brought into the country, which devoured every green herb, the fruit of the trees and the produce of the harveſt. By the ninth plague thick darkneſs covered all the land of Egypt, except the dwellings of the children of Iſrael. The tenth and laſt plague was the death of the firſtborn in Egypt, who were all in one night cut off by the deſtroying angel, from the firſtborn of the king to the firſtborn of the ſlaves and of the cattle. This dreadful calamity moved the heart of the hardened Pharaoh, and he at length conſented to allow the people of Iſrael to depart from his kingdom.

Profane authors who have ſpoken of Moſes, ſeem to have been in part acquainted with theſe mighty wonders. That he performed miracles, muſt have been allowed by many, by whom he was conſidered as a famous magician; and he could ſcarcely appear in any other light to men who did not acknowledge him for the meſſenger of the Almighty. Both Diodorus and Herodotus mention the diſtreſſed ſtate to which Egypt was reduced by theſe terrible calamities. The Hebrews, amounting to the number of 600,000 men, without reckoning women and children, left Egypt on the 15th day of the month Niſan, which, in memory of this deliverance, was thenceforth reckoned the firſt month of their year. Scarcely had they reached the ſhore of the Red ſea when Pharaoh with a powerful army ſet out in purſuit of them. On this occaſion Moſes ſtretched forth his rod upon the ſea; and the waters thereof being divided, remained ſuſpended on both ſides till the Hebrews paſſed through dry-footed.—The Egyptians determined to follow the ſame courſe; but God cauſed a violent wind to blow, which brought back the waters to their bed, and the whole army of Pharaoh periſhed in the waves.

After the miraculous paſſage of the Red ſea, the army proceeded towards Mount Sinai, and arrived at Marah, where the waters were bitter; but Moſes, by caſting a tree into them, rendered them fit for drinking. Their tenth encampment was at Rephidim, where Moſes drew water from the rock in Horeb, by ſmiting it with his rod. Here likewiſe Amalek attacked Iſrael. While Joſhua fought againſt the Amalekites, Moſes ſtood on the top of a hill, and lifted up his hands; in conſequence of which the Iſraelites prevailed, and cut their enemies in pieces. They at length arrived at the foot of Mount Sinai on the third day of the ninth month after their departure from Egypt. Moſes having aſcended ſeveral times into the mount, received the law from the hand of God himſelf in the midſt of thunders and lightnings, and concluded the famous covenant betwixt the Lord and the children of Iſrael. When he deſcended from Sinai, he found that the people had fallen into the idolatrous worſhip of the golden calf. The meſſenger of God, ſhocked at ſuch ingratitude, broke in pieces the tables of the law which he carried in his hands, and put 23,000 of the tranſgreſſors to the ſword. He afterwards reaſcended into the mountain, and there obtained new tables of ſtone on which the law was inſcribed. When Moſes deſcended, his face ſhone ſo that the Iraelites dared not to come nigh unto him, and he was obliged to cover it with a veil. The Iſraelites were here employed in conſtructing the tabernacle according to a pattern ſhown them by God. It was erected and conſecrated at the foot of the Mount Sinai on the firſt day of the firſt month of the ſecond year after their departure from Egypt; and it ſerved the Iſraelites inſtead of a temple till the time of Solomon, who built a houſe for the God of his fathers after a model ſhown him by David.

Moſes having dedicated the tabernacle, he conſecrated Aaron and his ſons to be its miniſters, and appointed the Levites to its ſervice. He likewiſe gave various commandments concerning the worſhip of God and the political government of the Jews. This was a *theocracy* in the full extent of the word. God himſelf governed them immediately by means of his ſervant Moſes, whom he had choſen to be the interpreter of his will to the people; and he required all the honours belonging to their king to be paid unto himſelf. He dwelt in his tabernacle, which was ſituated in the middle of the camp, like a monarch in his palace. He gave anſwers to thoſe who conſulted him, and himſelf denounced puniſhments againſt the tranſgreſſors of his laws. This properly was the time of the theocracy, taken in its full extent; for God was not only conſidered as the divinity who was the object of their religious worſhip, but as the ſovereign to whom the honours of ſupreme majeſty were paid. The caſe was nearly the ſame under Joſhua; who, being filled with the ſpirit of Moſes, undertook nothing without conſulting God. Every meaſure, both of the leader and of the people, was regulated by the direction of the Almighty, who rewarded their fidelity and obedience by a ſeries of miracles, victories, and ſucceſſes. After Moſes had regulated every thing regarding the civil adminiſtration,

tion, and the marching of the troops, he led the Iſraelites to the confines of Canaan, to the foot of Mount Nebo. Here the Lord commanded him to aſcend into the mountain; whence he ſhowed him the promiſed land, whereinto he was not permitted to enter. He immediately after yielded up the ghoſt, without ſickneſs or pain, in the 120th year of his age, and 1451 years before Jeſus Chriſt.

Moſes is inconteſtably the author of the firſt five books of the Old Teſtament, which go by the name of the *Pentateuch;* and which are acknowledged to be inſpired, by the Jews and by Chriſtians of every perſuaſion. Some, however, have denied that Moſes was the author of theſe books; and have founded their opinion on this, that he always ſpeaks of himſelf in the third perſon. But this manner of writing is by no means peculiar to Moſes: it occurs alſo in ſeveral ancient hiſtorians; ſuch as Xenophon, Cæſar, Joſephus, &c. who poſſeſſed of more modeſty or good ſenſe than ſome modern hiſtorians, whoſe egotiſm is altogether diſguſting, have not like them left to poſterity a ſpectacle of ridiculous vanity and ſelf-conceit. After all, it is proper to obſerve, that profane authors have related many falſehoods and abſurdities concerning Moſes, and concerning the origin and the religion of the Jews, with which they were but little acquainted. Plutarch, in his book concerning Iſis and Oſiris, ſays that Judæus and Hieroſolymus were brothers, and deſcended from Typhon; and that the former gave his name to the country and its inhabitants, and the latter to the capital city. Others ſay that they came from Mount Ida in Phrygia. Strabo is the only author who ſpeaks any thing like reaſon and truth concerning them; though he too ſays that they were deſcended from the Egyptians, and conſiders Moſes their legiſlator as an Egyptian prieſt. He acknowledges, however, that they were a people ſtrictly juſt and ſincerely religious. Other authors by whom they are mentioned, ſeem not to have had the ſmalleſt acquaintance either with their laws or their worſhip. They frequently confound them with the Chriſtians, as is the caſe with Juvenal, Tacitus, and Quintilian.

MOSHEIM, JOHN LAURENCE, an illuſtrious German divine, was born in 1695, of a noble family, which might ſeem to open to his ambition a fair path to civil promotion; but his zeal for the intereſts of religion, his thirſt after knowledge, and particularly his taſte for ſacred literature, induced him to conſecrate his talents to the ſervice of the church. The German univerſities loaded him with literary honours; the king of Denmark invited him to ſettle at Copenhagen; the duke of Brunſwick called him thence to Helmſtadt, where he filled the academical chair of divinity; was honoured with the character of eccleſiaſtical counſellor to the court; and preſided over the ſeminaries of learning in the duchy of Wolfenbuttle and the principality of Blackenburgh. When a deſign was formed of giving an uncommon degree of luſtre to the univerſities of Gottingen, by filling it with men of the firſt rank in letters, Dr Moſheim was deemed worthy to appear at the head of it, in quality of chancellor; and here he died, in 1755, univerſally lamented. In depth of judgment, in extent of learning, in purity of taſte, in the powers of eloquence, and in a laborious application to all the various branches of erudition and philoſophy, he had certainly very few ſuperiors. His Latin tranſlation of Cudworth's Intellectual Syſtem, enriched with large annotations, diſcovered a profound acquaintance with ancient learning and philoſophy. His illuſtrations of the Scriptures, his labours in defence of Chriſtianity, and the light he caſt upon religion and philoſophy, appear in many volumes of ſacred and profane literature; and the Eccleſiaſtical Hiſtory, from the birth of Chriſt to the beginning of the 18th century, is unqueſtionably the beſt that is extant. This work, written in Latin, has been tranſlated into Engliſh, and accompanied with notes and chronological tables by Archibald Maclaine, D. D. and from this tranſlator's preface to the ſecond edition, 1758, in 5 vols 8vo, this ſhort account is taken.

MOSKITO, or MOSQUITO COUNTRY, is ſituated in North America, between 85 and 88 degrees of weſt longitude, and between 13 and 15 degrees of north latitude; having the north ſea on the north and eaſt, Nicaragua on the ſouth, and Honduras on the weſt; and indeed the Spaniards eſteem it a part of the principality of Honduras, though they have no colonies in the Moſkito country. When the Spaniards firſt invaded this part of Mexico, they maſſacred the greateſt part of the natives, which gave thoſe that eſcaped into the inacceſſible part of the country an inſuperable averſion to them; and they have always appeared ready to join any Europeans that come upon their coaſts againſt the Spaniards, and particularly the Engliſh, who frequently come hither; and the Moſkito men being excellent markſmen, the Engliſh employ them in ſtriking the manati fiſh, &c. and many of the Moſkito Indians come to Jamaica, and ſail with the Engliſh in their voyages.

Theſe people are ſo ſituated between moraſſes and inacceſſible mountains, and a coaſt full of rocks and ſhoals, that no attempts againſt them by the Spaniards, whom they mortally hate, could ever ſucceed. Nevertheleſs, they are a mild inoffenſive people, of great morality and virtue, and will never truſt a man who has once deceived them. They have ſo great a veneration towards the Engliſh, that they have ſpontaneouſly put themſelves and their lands under the protection and dominion of the crown of England. This was firſt done when the duke of Albermarle was governor of Jamaica, and the king of the Moſkitos received a commiſſion from his grace, under the ſeal of that iſland; and ſince this time they have been ſteady in their alliance with the Engliſh. But in the year 1786, this country was ceded to Spain, and conſequently became a Spaniſh province.

MOSQUE, a temple or place of religious worſhip among the Mahometans.

All moſques are ſquare buildings, generally conſtructed of ſtone. Before the chief gate there is a ſquare court paved with white marble; and low galleries round it, whoſe roof is ſupported by marble pillars. In theſe galleries the Turks waſh themſelves before they go into the moſque. In each moſque there is a great number of lamps; and between theſe hang many cryſtal rings, oſtriches eggs, and other curioſities, which, when the lamps are lighted, make a fine ſhow. As it is not lawful to enter the moſque with ſtockings or ſhoes on, the pavements are covered with pieces of ſtuff ſewed together, each being wide enough to hold a row of men kneeling, ſitting, or proſtrate. The women are

not

not allowed to enter the moſque, but ſtay in the porches without. About every moſque there are ſix high towers, called *minarets*, each of which has three little open galleries, one above another: theſe towers, as well as the moſques, are covered with lead, and adorned with gilding and other ornaments; and from thence, inſtead of a bell, the people are called to prayers by certain officers appointed for that purpoſe. Moſt of the moſques have a kind of hoſpital belonging to them, in which travellers of what religion ſoever, are entertained three days. Each moſque has alſo a place called *tarbe*, which is the burying-place of its founders; within which is a tomb ſix or ſeven feet long, covered with green velvet or ſatin; at the ends of which are two tapers, and round it ſeveral ſeats for thoſe who read the Koran and pray for the ſouls of the deceaſed.

MOSS, or MOSSES. See MUSCI, BOTANY *Index*.

Moss on Trees, in gardening. The growth of large quantities of moſs on any kind of tree is a diſtemper of very bad conſequence to its increaſe, and much damages the fruit of the trees of our orchards.

The preſent remedy is the ſcraping it off from the body and large branches by means of a kind of wooden knife that will not hurt the bark, or with a piece of rough hair cloth, which does very well after a ſoaking rain. But the moſt effectual cure is the taking away the cauſe. This is to be done by draining off all the ſuperfluous moiſture from about the roots of the trees, and may be greatly guarded againſt in the firſt planting of the trees, by not ſetting them too deep.

If trees ſtand too thick in a cold ground, they will always be covered with moſs; and the beſt way to remedy the fault is to thin them. When the young branches of trees are covered with a long and ſhaggy moſs, it will utterly ruin them; and there is no way to prevent it but to cut off the branches near the trunk, and even to take off the head of the tree if neceſſary; for it will ſprout again; and if the cauſe be in the mean time removed by thinning the plantation, or draining the land and ſtirring the ground well, the young ſhoots will continue clear after this.

If the trees be covered with moſs in conſequence of the ground's being too dry, as this will happen from either extreme in the ſoil, then the proper remedy is the laying mud from the bottom of a pond or river pretty thick about the root, opening the ground to ſome diſtance and depth to let it in; this will not only cool it, and prevent its giving growth to any great quantity of moſs, but it will alſo prevent the other great miſchief which fruit-trees are liable to in dry grounds, which is the falling off of the fruit too early.

The moſſes which cover the trunks of trees, as they always are freſheſt and moſt vigorous on the ſide which points to the north, if only produced on that, ſerve to preſerve the trunk of the tree from the ſeverity of the north winds, and direct the traveller in his way, by always plainly pointing out that part of the compaſs.

Moss is alſo a name given to boggy ground in many parts of England, otherwiſe called a *fen* and *bog*.

In many of theſe grounds, as well in England and Ireland as in other parts of the world, there are found vaſt number of trees ſtanding with their ſtumps erect, and their roots piercing the ground in a natural poſture as when growing Many of thoſe trees are broken or cut off near the roots, and lie along, and this uſually in a north-eaſt direction. People who have been willing to account for this, have uſually reſolved it into the effect of the deluge in the days of Noah; but this is a very wild conjecture, and is proved falſe by many unanſwerable arguments. The waters of this deluge might indeed have waſhed together a great number of trees, and buried them under loads of earth; but then they would have lain irregularly and at random; whereas they all lie lengthwiſe from ſouth-weſt to north-eaſt, and the roots all ſtand in their natural perpendicular poſture, as cloſe as the roots of trees in a foreſt.

Beſides, theſe trees are not all in their natural ſtate, but many of them have the evident marks of human workmanſhip upon them, ſome being cut down with an axe, ſome ſplit, and the wedges ſtill remaining in them; ſome burnt in different parts, and ſome bored through with holes. Theſe things are alſo proved to be of a later date than the deluge, by other matters found among them, ſuch as utenſils of ancient people, and coins of the Roman emperors.

It appears from the whole, that all the trees which we find in this foſſile ſtate, originally grew in the very places where we now find them, and have only been thrown down and buried there, not brought from elſewhere. It may appear indeed an objection to this opinion, that moſt of theſe foſſile trees are of the fir kind; and that Cæſar ſays expreſsly, that no firs grew in Britain in his time; but this is eaſily anſwered, by obſerving, that theſe trees, though of the fir kind, yet are not the ſpecies uſually called the *fir*, but pitch-tree; and Cæſar has no where ſaid that pitch-trees did not grow in England. Norway and Sweden yet abound with theſe trees; and there are at this time whole foreſts of them in many parts of Scotland, and a large number of them wild upon a hill at Wareton in Staffordſhire to this day.

In Hatfield marſh, where ſuch vaſt numbers of the foſſile trees are now found, there has evidently once been a whole foreſt of them growing. The laſt of theſe was found alive, and growing in that place within 70 years laſt paſt, and cut down for ſome common uſe.

It is alſo objected by ſome to the ſyſtem of the firs growing where they are found foſſile, that theſe countries are all bogs and moors, whereas theſe ſorts of trees grow only in mountainous places. But this is founded on an error; for though in Norway and Sweden, and ſome other cold countries, the fir kinds all grow upon barren and dry rocky mountains, yet in warmer places they are found to thrive as well on wet plains. Such are found plentifully in Pomerania, Livonia, and Courland, &c. and in the weſt parts of New England there are vaſt numbers of fine ſtately trees of them in low grounds. The whole truth ſeems to be, that theſe trees love a ſandy ſoil; and ſuch as is found at the bottoms of all the moſſes where theſe trees are found foſſile. The roots of the fir kind are always found fixed in theſe; and thoſe of oaks, where they are found foſſile in this manner, are uſually found fixed in clay; ſo that each kind of tree is always found rooted in the places where they ſtand in their proper ſoil; and there is no doubt to be made but that they originally grew there. When we have thus found that all the foſſile trees we meet with once grew in the places where they are now buried, it is plain that in theſe places there were once noble foreſts, which have been deſtroyed at ſome time; and the queſtion only remains how and by whom they were deſtroyed. This we have reaſon to believe, by the Roman coins found among them, was done by the people of that empire, and that at the time when they were eſtabliſhed or eſtabliſhing themſelves here.

Their own hiſtorian tells us, that when their armies purſued the wild Britons, theſe people always ſheltered themſelves in the miry woods and low watery foreſts. Cæſar expreſsly ſays this; and obſerves, that Caſſibelanus and his Britons, after their defeat, paſſed the Thames, and fled into ſuch low moraſſes and woods, that there was no purſuing them: and we find that the Silures ſecured themſelves in the ſame manner when attacked by Oſtorius and Agricola. The ſame thing is recorded of Venutius king of the Brigantes, who fled to ſecure himſelf into the boggy foreſts of the midland part of this kingdom: and Herodian expreſsly ſays, that in the time of the Romans puſhing there conqueſts in theſe iſlands, it was the cuſtom of the Britons to ſecure themſelves in the thick foreſts which grew in their boggy and wet places, and when opportunity offered, to iſſue out thence and fall upon the Romans. The conſequence of all this was the deſtroying all theſe foreſts; the Romans finding themſelves ſo plagued with parties of the natives iſſuing out upon them at times from theſe foreſts, that they gave orders for the cutting down and deſtroying all the foreſts in Britain which grew on boggy and wet grounds. Theſe orders were punctually executed; and to this it is owing that at this day we can hardly be brought to believe that ſuch foreſts ever grew with us as are now found buried.

The Roman hiſtorians all agree, that when Suetonius Paulinus conquered Angleſea, he ordered all the woods to be cut down there, in the manner of the Roman generals in England: and Galen tells us, that the Romans, after their conqueſt in Britain, kept their ſoldiers conſtantly employed in cutting down foreſts, draining of marſhes, and paving of bogs. Not only the Roman ſoldiers were employed in this manner, but all the native Britons made captives in the wars were obliged to aſſiſt in it: and Dion Caſſius tells us, that the emperor Severus loſt no leſs than 50,000 men in a few years time in cutting down the woods and draining the bogs of this iſland. It is not to be wondered at, that ſuch numbers executed the immenſe deſtruction which we find in theſe buried foreſts. One of the greateſt ſubterranean treaſures of wood is that near Hatfield; and it is eaſy to prove, that theſe people, to whom this havock is thus attributed, were upon the ſpot where theſe trees now lie buried. The common road of the Romans out of the ſouth into the north, was formerly from Lindum (Lincoln), to Segelochum (Little Burrow upon Trent), and from thence to Danum (Doncaſter), where they kept a ſtanding garriſon of Criſpinian horſe. A little off on the eaſt, and north-eaſt of their road, between the two laſt-named towns, lay the borders of the greateſt foreſt, which ſwarmed with wild Britons, who were continually making their ſallies out, and their retreats into it again, intercepting their proviſions, taking and deſtroying their carriages, killing their allies and paſſengers, and diſturbing their garriſons. This at length ſo exaſperated the Romans, that they were determined to deſtroy it; and to do this ſafely and effectually, they marched againſt it with a great army, and encamped on a great moor not far from Finningly: this is evident from their fortifications yet remaining.

There is a ſmall town in the neighbourhood called *Oſterfield;* and as the termination *field* ſeems to have been given only in remembrance of battles fought near the towns whoſe names ended with it, it is not improbable that a battle was fought here between all the Britons who inhabited this foreſt and the Roman troops under Oſtorius. The Romans ſlew many of the Britons, and drove the reſt back into this foreſt, which at that time overſpread all this low country. On this the conquerors taking advantage of a ſtrong ſouth-weſt wind, ſet fire to the pitch-trees, of which this foreſt was principally compoſed; and when the greater part of the trees were thus deſtroyed, the Roman ſoldiers and captive Britons cut down the remainder, except a few large ones which they left ſtanding as remembrances of the deſtruction of the reſt. Theſe ſingle trees, however, could not ſtand long againſt the winds, and theſe falling into the rivers which run through the country, interrupted their currents; and the water then overſpreading the level country, made one great lake, and gave origin to the moſſes or moory bogs, which were afterwards formed there, by the workings of the waters, the precipitation of earthy matter from them, and the putrefaction of rotten boughs and branches of trees, and the vaſt increaſe of water-moſs and other ſuch plants which grow in prodigious abundance in all theſe ſorts of places. Thus were theſe burnt and felled trees buried under a new-formed ſpongy and watery earth, and afterwards found on the draining and digging through this earth again.

Hence it is not ſtrange that Roman weapons and Roman coins are found among theſe buried trees; and hence it is that among the buried trees ſome are found burnt, ſome chopped and hewn; and hence it is that the bodies of the trees all lie by their proper roots, and with their tops lying north-eaſt, that is, in that direction in which a ſouth-weſt wind would have blown them down: hence alſo it is, that ſome of the trees are found with their roots lying flat, theſe being not cut or burned down, but blown up by the roots afterwards when left ſingle; and it is not wonderful, that ſuch trees as theſe ſhould have continued to grow even after their fall, and ſhoot up branches from their ſides which might eaſily grow into high trees. Phil. Tranſ. N° 275.

By this ſyſtem it is alſo eaſily explained why the moor ſoil in the country is in ſome places two or three yards thicker than in others, or higher than it was formerly, ſince the growing up of peat-earth or bog-ground is well known, and the ſoil added by overflowing of waters is not a little.

As the Romans were the deſtroyers of this great and noble foreſt, ſo they were probably alſo of the ſeveral other ancient foreſts; the ruins of which furniſh us with the bog-wood of Staffordſhire, Lancaſhire, Yorkſhire, and other counties. But as the Romans were not much in Wales, in the Iſle of Man, or

in

in Ireland, it is not to be ſuppoſed that foreſts cut down by theſe people gave origin to the foſſile wood found there; but though they did not cut down theſe foreſts, others did; and the origin of the bog-wood is the ſame with them and with us. Holingſhed informs us, that Edward I. being not able to get at the Welſh becauſe of their hiding themſelves in boggy woods, gave orders at length that they ſhould all be deſtroyed by fire and by the axe; and doubtleſs the roots and bodies of trees found in Pembrokeſhire under ground, are the remains of the execution of this order. The foſſile wood in the bogs of the iſland of Man is doubtleſs of the ſame origin, though we have not any accounts extant of the time or occaſion of the foreſts there being deſtroyed; but as to the foſſile trees of the bogs of Ireland, we are expreſsly told, that Henry II. when he conquered that country, ordered all the woods to be cut down that grew in the low parts of it, to ſecure his conqueſts, by cutting away the places of reſort of rebels. For a fuller detail of the natural hiſtory of moſſes, ſee Eſſays on this ſubject by the Rev. Mr Rennie of Kilſyth.

Moving-MOSS. We have an account in the Philoſophical Tranſactions of a moving moſs near Churchtown in Lancaſhire, which greatly alarmed the neighbourhood as miraculous. The moſs was obſerved to riſe to a ſurpriſing height, and ſoon after ſunk as much below the level, and moved ſlowly towards the ſouth.

A very ſurpriſing inſtance of a moving moſs is that of Solway in Scotland, which happened in the year 1771, after ſevere rains which had produced terrible inundations of the rivers in many places. For the better underſtanding of this event, we ſhall give the following deſcription of the ſpot of ground where it happened. Along the ſide of the river Eſk there is a vale, about a mile broad, leſs or more in different places. It is bounded on the ſouth-eaſt by the river Eſk, and on the north-weſt by a ſteep bank 30 feet in height above the level of the vale. From the top of the bank the ground riſes in an eaſy aſcent for about a quarter of a mile, where it is terminated by the moſs; which extends about two miles north and ſouth, and about a mile and a half eaſt and weſt, and is bounded on the north-weſt by the river Sark. It is probable that the ſolid ground from the top of the bank above the vale was continued in the ſame direction under the moſs, before its eruption, for a conſiderable ſpace; for the moſs at the place where the eruption happened, was inclined towards the ſloping ground. From the edge of the moſs there was a gully or hollow, called by the country people *the gap*, and ſaid to be 30 yards deep where it entered the vale; down which ran a ſmall rill of water, which was often dry in ſummer, having no ſupply but what filtered from the moſs. The eruption happened at the head of this gap, on Saturday November 16. 1771, about ten or eleven at night, when all the neighbouring rivers and brooks were prodigiouſly ſwelled by the rains. A large body of the moſs was forced, partly by the great fall of rain, and partly by ſome ſprings below it, into a ſmall beck or burn, which runs within a few yards of its border to the ſouth-eaſt. By the united preſſure of the water behind it, and of this beck, which was then very high, it was carried down a narrow glen between two banks about 300 feet high, into a wide and ſpacious plain, over part of which it ſpread with great rapidity. The moſs continued for ſome time to ſend off conſiderable quantities; which, being borne along by the torrent on the back of the firſt great body, kept it for many hours in perpetual motion, and drove it ſtill farther on. This night at leaſt 400 acres of fine arable land were covered with moſs from 3 to 12 or 15 feet deep. Several houſes were deſtroyed, a good deal of corn loſt, &c. but all the inhabitants eſcaped. When the waters ſubſided, the moſs alſo ceaſed to flow; but two pretty conſiderable ſtreams continued to run from the heart of it, and carried off ſome pieces of moſſy matter to the place where it burſt. There they joined the beck already mentioned; which, with this addition, reſumed its former channel; and, with a little aſſiſtance from the people of the neighbourhood, made its way to the Eſk, through the midſt of that great body of moſs which obſtructed its courſe. Thus, in a great meaſure drained, the new moſs fell ſeveral feet, when the fair weather came in the end of November, and ſettled in a firmer and more ſolid body on the lands it had overrun. By this inundation about 800 acres of arable ground were overflowed before the moſs ſtopped, and the habitations of 27 families deſtroyed. Tradition has preſerved the memory of a ſimilar inundation in Monteith in Scotland. A moſs there altered its courſe in one night, and covered a great extent of ground.

Moss Troopers, a rebellious ſort of people in the north of England, who lived by robbery and rapine, not unlike the tories in Ireland, the bucaniers in Jamaica, or banditti of Italy. The counties of Northumberland and Cumberland were formerly charged with a yearly ſum, and a command of men, to be appointed by juſtices of the peace, to apprehend and ſuppreſs them.

MOSTRA, in the Italian muſic, a mark at the end of a line or ſpace, to ſhow that the firſt note of the next line is in that place: and if this note be accompanied with a ſharp or flat, it is proper to place theſe characters along with the moſtra.

MOSUL, or Mousul. See Mousul.

MOTACILLA, the Wagtail and Warbler; a genus of birds of the order of paſſeres. See Ornithology *Index*.

MOTE, in law books, ſignifies court or convention; as ward mote, burgh mote, ſwain mote, &c.

Mote was alſo uſed for a fortreſs or caſtle; as *mota de Windſor*, &c.

Mote alſo denoted a ſtanding water to keep fiſh in; and ſometimes a large ditch encompaſſing a caſtle or dwelling houſe.

Mote-Bell, or *Mot-Bell*, the bell ſo called, which was uſed by the Engliſh Saxons to call people together to the court. See Folkmote.

MOTH. See Phalæna, Entomology *Index*.

MOTHER, a term of relation, denoting a woman who hath born a child.

Mother-of-Pearl. See Mytilus, Conchology *Index*.

1 Motion.

MOTION is now generally conſidered as incapable of definition, being a ſimple idea or notion received by the ſenſes. The ancients, however, thought differently. Some of them defined it to be a paſſage out of one *ſtate* into another; which conveys no idea to him

2
Several definitions of.

who is ignorant of the nature of motion.—The Peripatetic definition has been mentioned elſewhere and ſhown to be wholly unintelligible, as well as their celebrated diviſion of motion into four claſſes, belonging to the three categories, *quality*, *quantity*, and *where*; (ſee METAPHYSICS, N° 188, 189, 190.). The Carteſians, too, among the moderns, pretend to define motion, by calling it a paſſage or removal of one part of matter, out of the neighbourhood of thoſe parts to which it is immediately contiguous, into the neighbourhood of others. Borelli defines motion to be the ſucceſſive paſſage of a body from place to place. Others ſay that it is the application of a body to different parts of infinite and immoveable ſpace; and a late writer[*] of uncommon acuteneſs has given as a definition of motion—*change of place*.

We have elſewhere offered our opinion of every poſſible attempt to define motion: but as the author of the laſt quoted definition has endeavoured to obviate ſuch objections as ours, candour requires that he be heard for himſelf. "It is ſaid (he obſerves) by ſome, that change implies motion, and therefore cannot be a part of its definition, being the very thing defined. To this I anſwer, We are ſpeaking of the ſenſible idea of motion, as it appears to our ſight; now changes do appear to our view, and to all our ſenſes, which give us no idea of motion. Changes in heat or cold; in colour, flavour, ſmell, ſound, hardneſs, ſoftneſs, pain, pleaſure; in theſe, and many other ideas, changes do not produce ideas like that produced by a ball rolling or a ſtone falling. We may perhaps ultimately trace them to motion, but to inſenſible motions; to motions which ariſe only in reflection, and conſtitute no part of the actual idea of change. We can therefore conceive of change, without conceiving at the ſame time of motion.—Change is a generic idea, including many ſpecies; motion, as a ſenſible idea, is a ſpecies of that genus. Change is therefore a neceſſary part of the definition of motion; it marks the genus of the thing defined. Motion is a change; but as there are many ſpecies of change, which of thoſe ſpecies is motion? The anſwer is, It is a change of place. This marks the ſpecies; and diſtinguiſhes it from change of colour, of temperament and figure."

This is the ableſt defence of an attempt to define motion that we have ever ſeen; and at firſt view the definition itſelf appears to be perfect. Ariſtotle, the prince of definers, "conſiders a definition[†] as a ſpeech declaring what a thing is. Every thing eſſential to the thing defined, and nothing more, muſt be contained in the definition. Now the eſſence of a thing conſiſts of theſe two parts: firſt, what is *common* to it with other things of the ſame kind; and ſecondly, what *diſtinguiſhes* it from other things of the ſame kind. The firſt is called the *genus* of the thing; the ſecond, its *ſpecific difference*. The definition, therefore, conſiſts of theſe two parts."

3
Shown not to declare what the thing is; and therefore to be no definition.

In obedience to this rule, the definition under conſideration ſeems to conſiſt of the *genus*, ſignified by the word *change*; and of the *ſpecific difference*, denoted by the words *of place*. But does the ſpeech *change of place* really declare what motion is? We cannot admit that it does; as, in our apprehenſion, a *change of place* is the *effect* of motion, and not *motion itſelf*. Suppoſe a lover of dialectic undertaking to define the ſtroke by which he ſaw his neighbour wounded with a bludgeon; what ſhould we think of his art were he to call it a contuſion on the head? He might ſay that *contuſion* is a general term, as contuſions may be produced on the arms, on the legs, and on various parts of the body; and as there are many ſpecies of contuſion, if he were aſked which of thoſe ſpecies was the ſtroke to be defined, he might anſwer, "a contuſion on the head." Here would be apparently the *genus* and *ſpecific difference*; the former denoted by *contuſion*, and the latter by the words *on the head*. But would this be a definition of a ſtroke? No, ſurely: a contuſion on the head may be the *effect* of a ſtroke; but it can no more be the *ſtroke itſelf*, than a blow can be a bludgeon, or a fleſh wound the point of a ſword. Equally evident it is, that a change of place cannot be motion; becauſe every body muſt have been actually moved before we can diſcern, or even conceive, a change of its place.

The *act of changing the place* would perhaps come nearer to a definition of motion; but ſo far would it be from "a ſpeech declaring what motion is," that we are confident a man who had never by any of his ſenſes perceived a body in actual motion, would acquire no ideas whatever from the words "act of changing place." He might have experienced changes in heat, cold, ſmell, and ſound; but he could not poſſibly combine the ideas of ſuch changes with the ſignification of the word *place*, were he even capable of underſtanding that word, which to us appears to be more than doubtful. (See METAPHYSICS, N° 40, 41.).

4
The diſtinctions of motion into different kinds inſignificant.

The diſtinctions of motion into different kinds have been no leſs various, and no leſs inſignificant, than the ſeveral definitions of it. The moderns who reject the Peripatetic diviſion of motion into four claſſes, yet conſider it themſelves as either *abſolute* or *relative*. Thus we are told, that "*abſolute motion* is the change of abſolute *place*, and that its celerity muſt be meaſured by the quantity of *abſolute ſpace* which the moving body runs through in a given time." "*Relative motion*, on the other hand, is a mutation of the *relative* or *vulgar place* of the moving body, and has its celerity eſtimated by the quantity of *relative ſpace* run through."

Now it is obvious, that this diſtinction conveys no ideas without a farther explanation of the terms by which it is expreſſed; but that explanation is impoſſible to be given. Thus, before we can underſtand what *abſolute motion* is, we muſt underſtand what is meant by *abſolute place*. But abſolute place is a contradiction; for all *place* is *relative*, and conſiſts in the poſitions of different bodies with regard to one another. Were a globe in the regions of empty ſpace to be put in motion by Almighty Power, and all the reſt of the corporeal world to be ſoon afterwards annihilated, the motion would undoubtedly continue unchanged; and yet, according to this diſtinction, it would be at firſt *relative*, and afterwards *abſolute*. That the beginning of ſuch a motion would be *perceptible*, and the remainder of it *imperceptible*, is readily granted; but on this account to conſider it as of two kinds, is as abſurd as to ſuppoſe the motion of the minute hand of a clock to be affected by our looking at it.

5
The opinions of the Carteſians and of Newton reſpecting the ſource of motion.

Leaving therefore theſe unintelligible diſtinctions, we now come to conſider a queſtion ſtill of a very abſtruſe nature, but much agitated among philoſophers,

---

[*] See *An Eſſay on the Powers and Mechaniſm of Nature*, by Robert Young.

[†] See Dr Reid's account of Ariſtotle's logic, in Lord Kames's *Sketches of Man*.

viz. What is the original ſource of motion in the creation: Is it natural to matter? or are we to aſcribe it to the immediate and continual agency of ſome *immaterial* being? The former has been ſtrenuouſly argued by the Carteſians, and the latter by the Newtonians. The arguments of the former, founded upon the chimerical hypotheſis of vortices and the original conſtruction of matter, were evidently inconcluſive; and the hypotheſis of Sir Iſaac Newton, who aſſerted that it was naturally *incapable* of motion, appeared more probable. To account for the quantity of motion in the univerſe, therefore, it became neceſſary to have recourſe either to the Deity, or to ſome ſubordinate ſpiritual agent; and this became the more neceſſary, as the doctrine of an abſolute vacuum in the celeſtial ſpaces, that is, throughout the incomparably greateſt part of the creation, was one of the fundamental maxims of the ſyſtem. As it was abſolutely denied that matter exiſted in theſe ſpaces, and it was plain that the celeſtial bodies affected one another at immenſe diſtances, the powers of attraction and repulſion were naturally called in as the ſources of motion by their impulſe upon inert and ſluggiſh matter. Theſe being admitted, a ſpeculation enſued concerning their nature. *Spiritual*, it was confeſſed, they were; but whether they were to be accounted the immediate action of the divine Spirit himſelf, or that of ſome ſubordinate and inferior ſpirit, was a matter of no little diſpute. Sir Iſaac Newton, towards the latter part of his life, began to relax ſomewhat of the rigidity of his former doctrine; and allowed that a very ſubtile medium, which he called *æther*, might be the cauſe of attraction and repulſion, and thus of the whole phenomena of nature. Since his time the multitude of diſcoveries in electricity, the ſimilarity of that fluid to fire and light, with the vaſt influence it has on every part of the creation with which we are acquainted, have rendered it very probable that the æther mentioned by Sir Iſaac is no other than the element of fire, "the moſt ſubtile † and elaſtic of all bodies, which ſeems to pervade and expand itſelf throughout the whole univerſe. Electrical experiments ſhow that this mighty agent is everywhere preſent, ready to break forth into action, if not reſtrained and governed with the greateſt wiſdom. Being always reſtleſs and in motion, it actuates and enlivens the whole viſible maſs; is equally fitted to produce and to deſtroy; diſtinguiſhes the various ſtages of nature, and keeps up the perpetual round of generations and corruptions, pregnant with forms which it conſtantly ſends forth and reſorbs. So quick in its motions, ſo ſubtle and penetrating in its nature, ſo extenſive in its effects, it ſeemeth no other than the vegetative ſoul or vital ſpirit of the world.

6
A ſubtle æther the probable cauſe of attraction and repulſion.

7
The opinions of the ancients on this ſubject.

"The animal ſpirit in man is the inſtrument both of ſenſe and motion. To ſuppoſe ſenſe in the corporeal world would be groſs and unwarranted; but locomotive faculties are evident in all its parts. The Pythagoreans, Platoniſts, and Stoics, held the world to be an animal; though ſome of them have choſen to conſider it as a vegetable. However, the phenomena do plainly ſhow, that there is a ſpirit that moves, and a mind or providence that preſides. This providence, Plutarch ſaith, was thought to be in regard to the world what the ſoul is in regard to man. The order and courſe of things, and the experiments we daily make, ſhow that there is a mind which governs and actuates this mundane ſyſtem as the proper and real agent and cauſe; and that the inferior inſtrumental cauſe is pure æther, fire, or the ſubſtance of light, which is applied and determined by an infinite mind in the macrocoſm or univerſe, with unlimited power, and according to ſtated rules, as it is in the microcoſm with limited power and ſkill by the human mind. We have no proof either from experiment or reaſon of any other agent or efficient cauſe than the mind or ſpirit. When, therefore, we ſpeak of corporeal agents, or corporeal cauſes, this is to be underſtood in a different, ſubordinate, and improper ſenſe; and ſuch an agent we know light or elementary fire to be."

8
Experiments proving that a ſubtle æther may be the immediate cauſe of the planetary motions, &c.

That this elementary fire, abſorbed and fixed in all bodies, *may* be the cauſe of the univerſal principle of gravity, is made ſufficiently evident by numberleſs experiments. Homberg having calcined in the focus of a burning glaſs ſome regulus of antimony, found that it had gained one-tenth in weight, though the regulus, during the whole time of the operation, ſent up a thick ſmoke, and thereby loſt a conſiderable part of its own ſubſtance. It is vain to allege that any heterogeneous matter floating in the air, or that the air itſelf, may have been hurried into the maſs by the action of the fire, and that by this additional matter the weight was increaſed; for it is known experimentally, that if a quantity of metal be even hermetically ſecured within a veſſel of glaſs to keep off the air and all foreign matter, and the veſſel be placed for ſome time in a ſtrong fire, it will exhibit the ſame effect. "I have ſeen the operation performed (ſays Mr Jones †) on two ounces of pewter filings, hermetically ſealed up in a Florence flaſk, which in two hours gained 55 grains, that is nearly one 17th. Had it remained longer in the fire, it might probably have gained ſomething more; as, in one of Mr Boyle's experiments, ſteel filings were found to have gained a fourth.

"Of accounting for theſe effects there are but two poſſible ways: 1. If the quantity of matter be the ſame, or, in the caſe of calcination, be ſomewhat leſs, after being expoſed to the action of the fire, while the gravity of the whole is become greater; then does it follow, that gravity is not according to the quantity of matter, and of courſe is not one of its properties. 2. If there be an increaſe of the maſs, it can be imputed to nothing but the matter of light or fire entangled in its paſſage through the ſubſtance, and ſo fixed in its pores, or combined with its ſolid parts, as to gravitate together with it. Yet it is certain, from the phenomenon of light darting from the ſun, that this elementary fire does not gravitate till it is fixed in metal, or ſome other ſolid ſubſtance.—Here then we have a fluid which gravitates, if it gravitate at all, in ſome caſes and not in others. So that which way ſoever the experiment be interpreted, we are forced to conclude that elementary or ſolar fire may be the cauſe of the law of gravitation."

That it is likewiſe in many caſes the cauſe of repulſion, is known to every one who has ſeen it fuſe metals, and convert water and mercury into elaſtic vapour. But there is a fact recorded by Mr Jones, which ſeems to evince that the ſame fluid, which as it iſſues from the ſun exhibits itſelf in the form of light and heat, is in other circumſtances converted into a very fine air,

---

† *Siris*, Nº 153, &c.

† *Eſſay on the Firſt Principles of Natural Philoſophy.*

or cold æther, which ruſhes very forcibly towards the body of that luminary. "As a ſequel to what has been obſerved (ſays he) concerning the impregnation of ſolid ſubſtances with the particles of fire, give me leave to ſubjoin an experiment of M. de Stair. He tells us, that upon heating red lead in a glaſs, whence the air was exhauſted by the rays of the ſun collected in a burning glaſs, the veſſel in which the ſaid red lead was contained burſt in pieces with a great noiſe. Now, as all exploſions in general muſt be aſcribed either to an admiſſion of the air into a rarefied ſpace, or to what is called the *generation* of it; and as air was not admitted upon this occaſion, it muſt have been generated from the calx within the veſſel; and certainly was ſo, becauſe Dr Hales has made it appear that this ſubſtance, like crude tartar and many others, will yield a conſiderable quantity of *air* in diſtillation. What went into the metal therefore as *fire*, came out of it again as *air;* which in a manner forces upon us concluſions of ineſtimable value in natural philoſophy, and ſuch as may carry us very far into the moſt ſublime part of it."

One of the concluſions which the ingenious author thinks thus forced upon us, is, that the motion of the planets round the ſun, as well as round their own axes, is to be attributed to the continual agency of this fluid, under its two forms of elementary fire and pure air. As fire and light, we know that it ruſhes with inconceivable rapidity from the body of the ſun, and penetrates every corporeal ſubſtance, exerting itſelf ſometimes with ſuch force as nothing with which we are acquainted is able to reſiſt. If it be indeed a fact, that this elementary fire, or principle of light and heat, afterwards cools, and becomes pure air, there cannot be a doubt, but that under ſuch a form it will return with great force, though ſurely in a ſomewhat different direction, towards the ſun, forming a vortex, in which the planets are included, and by which they muſt of courſe be carried round the centre. Mr Jones does not ſuppoſe that the air into which the principle of light and heat is converted, is of ſo groſs a nature as our atmoſphere. He rather conſiders it as cool æther, juſt as he repreſents light to be æther heated: but he maintains, that this æther, in its aërial form, though not fit for human reſpiration, is a better *pabulum* of fire than the air which we breathe.

This theory is exceedingly plauſible; and the author ſupports it by many experiments. He has not, indeed, convinced us that the ſolar light is converted or convertible into pure air; but he has, by juſt reaſoning from undoubted facts, proved that the whole expanſe of heaven, as far as comets wander, is filled not only with light, which is indeed obvious to the ſenſes, but alſo with a fluid, which, whatever it may be called, ſupplies the place of the air in feeding the fire of theſe ignited bodies.

9 The exiſtence of ſuch an æther, however, does not completely ſolve the phenomena.

That the motion of the heavenly bodies ſhould reſult from the perpetual agency of ſuch a medium, appears to us a much more rational hypotheſis, than that which makes them act upon each other at immenſe diſtances through empty ſpace. But the hypotheſis is by no means ſo complete a ſolution of the phenomena as ſome of its fond admirers pretend to think it. This fluid, whether called æther, heat, light, or air, is ſtill material; and the queſtion returns upon him who imagines that it is ſufficient to account for gravitation, repulſion, magnetiſm, and coheſion, &c. "What moves the fluid itſelf, or makes the parts of which it is compoſed cohere together?" However widely it may be extended, it is incapable of poſitive infinity; and therefore *may be* divided into parts ſeparated from each other; ſo that it muſt be held together by a foreign force, as well as a ball of lead, or a piece of wax. As matter is not eſſentially active, the motion of this æther, under both its forms, muſt likewiſe be conſidered as an effect, for which we do not think that any propelling power in the body of the ſun can be admitted as a ſufficient cauſe. For how comes the ſun to poſſeſs that power, and what makes the fluid return to the ſun? We have no notion of power, in the proper ſenſe of the word, but as intelligence and volition; and, by the pious and excellent author of the Eſſay on the Firſt Principles of Natural Philoſophy, we are certain that the ſun was never ſuppoſed to be intelligent.

10 It is therefore by ſome ſuppoſed to be animated.

Biſhop Berkeley, who admits of light or æther as the inſtrumental cauſe of all corporeal motion, gets rid of this difficulty, by ſuppoſing, with the ancients, that this powerful agent is animated. "According to the Pythagoreans and Platoniſts (ſays his Lordſhip *), there is a life infuſed throughout all things; the πυϱ νοεϱον, πυϱ τεχνικον, an intellectual and artificial fire, an inward principle, animal ſpirit, or natural life, producing and forming within, as art doth without; regulating, moderating, and reconciling the various motions, qualities, and parts of this mundane ſyſtem. By virtue of this life, the great maſſes are held together in their ordinary courſes, as well as the minuteſt particles governed in their natural motions, according to the ſeveral laws of attraction, gravity, electricity, magnetiſm, and the reſt. It is this gives inſtincts, teaches the ſpider her web, and the bee her honey. This it is that directs the roots of plants to draw forth juices from the earth, and the leaves and cortical veſſels to ſeparate and attract ſuch particles of air and elementary fire as ſuit their reſpective natures."

This life or animal ſpirit ſeems to be the ſame thing which Cudworth calls plaſtic nature, and which has been conſidered elſewhere. (See METAPHYSICS, N° 200, and *PLASTIC Nature*). We ſhall therefore diſmiſs it at preſent, with juſt admitting the truth of the biſhop's poſition, "that if nature be ſuppoſed the life of the world, animated by one ſoul, compacted into one frame, and directed or governed in all its parts by one ſupreme and diſtinct intelligence, this ſyſtem cannot be accuſed of atheiſm, though perhaps it may of miſtake or impropriety."

11 A new theory of motion,

A theory of motion ſomewhat ſimilar to that of Berkeley, though in ſeveral reſpects different from it, was not many years ago ſtated with great clearneſs, and ſupported with much ingenuity, in An Eſſay on the Powers and Mechaniſm of Nature, intended to improve, and more firmly eſtabliſh, the grand ſuperſtructure of the Newtonian ſyſtem. Mr Young, the author of the eſſay, admits with moſt other philoſophers of the preſent age, that body is compoſed of atoms which are impenetrable to each other, and may be denominated ſolid. Theſe atoms, however, he does not conſider as primary and ſimple elements, incapable of reſolution into principles:

---

* *Siris*, N° 277.

ciples; but thinks that they are formed by certain motions of the parts of a ſubſtance immaterial and eſſentially active.

12 by ſuppoſing that a ſubſtance eſſentially active pervades the univerſe.

As this notion is uncommon, and the offspring of a vigorous mind, we ſhall conſider it more attentively under the article *PLASTIC Nature*. It is mentioned at preſent as a neceſſary introduction to the author's theory of motion, of which he attributes both the origin and the continuance to the agency of this elementary ſubſtance pervading the moſt ſolid atoms of the denſeſt bodies. Of every body and every atom he holds the conſtituent principles to be eſſentially active: but thoſe principles act in ſuch a manner as to counterbalance each other; ſo that the atom or body conſidered as a whole is inert, unleſs in ſo far as it reſiſts the compreſſion or ſeparation of its parts. No body or atom can of itſelf begin to move, or continue in motion for a ſingle inſtant: but being pervious to the active ſubſtance, and coaleſcing with it, that ſubſtance, when it enters any body, it carries it along with it, till, meeting ſome other body in the way, either the whole of the active ſubſtance lodged in the former body paſſes into the obſtacle, in which caſe the impelling body inſtantly ceaſes to move: or elſe part of that ſubſtance paſſes into the obſtacle, and part remains in the impelling body; and in this caſe both bodies are moved with a velocity in proportion to the quantity of matter which each contains, combined with the quantity of active ſubſtance by which they are reſpectively penetrated.

13 Proofs of the exiſtence of ſuch a ſubſtance.

In order to pave the way for his proof of the exiſtence of one uniform active ſubſtance, he obſerves, that "*change* being an eſſentially conſtituent part of motion, and change implying action, it follows that *all motion implies action, and depends on an active cauſe*. Every motion (he continues) has a beginning, a middle, and an end. The beginning is a change from reſt to motion; the middle is a continuance in motion; the end is a change from motion to reſt." He then proceeds to ſhow, that the beginning of motion is by an action begun; the continuance of motion by an action continued; and the end of motion by a ceſſation of action.

"The firſt of theſe poſitions is admitted by every body. That the *continuance* of motion is by an action *continued*, will be proved, if it ſhall be ſhown that the continuance of a motion is nothing different from its beginning, in regard to any point of time aſſumed in the continued motion. Now the beginning of motion (he ſays) conſiſts in the beginning of change of place. But if any given portions of time and of ſpace are aſſumed, a body beginning to move in the commencement of that time, and in the firſt portion of the ſpace aſſumed, then and there begins that particular motion: and whether before the body began to move in that ſpace it was moving in other ſpaces and times, has no relation to the motion in queſtion; for this being in a ſpace and time altogether diſtinct, is a diſtinct motion from any which might have preceded it immediately, as much as from a motion which preceded it a thouſand years before. It is therefore a new motion begun; and ſo it may be ſaid of every aſſumable point in the continued motion. The term *continued* ſerves only to connect any two diſtinct motions, the end of one with the beginning of the other; but does not deſtroy their diſtinctneſs."

He then proceeds to combat, which he does very ſucceſsfully, the arguments by which the more rigid Newtonians endeavour to prove that a body in motion will continue to be moved by its own *inertia*, till ſtopt by ſome oppoſite force. Having done this, he eſtabliſhes the contrary concluſion by the following ſyllogiſms:

"I. Whatever requires an active force to ſtop its motion, is diſpoſed to move.
Every body in motion requires an active force to ſtop its motion:
Therefore every body in motion is diſpoſed to move.

"II. Whatever is diſpoſed to motion is poſſeſſed of action.
But a body in motion is diſpoſed to continue in motion:
Therefore a body in motion is poſſeſſed of action.

Thus it appears, that the middle part of any motion is action equally with the beginning.

"The laſt part of motion is its *termination*. It is admitted that all motion is terminated by an action contrary to the direction of the motion. It is admitted, too, that the moving body *acts* at the time its motion is deſtroyed. Thus the *beginning* and the *end* of any uniform motion are confeſſed to be actions; but all the intermediate *continuation* which connects the beginning with the end is denied to be action. What can be more unaccountable than this denial? Is it not more conſonant to reaſon and analogy, to aſcribe to the whole continued motion one uninterrupted action? Such a concluſion true philoſophy, we think, requires us to make.

"To move or act, is an attribute which cannot be conceived to exiſt without a ſubſtance. The *action of a body in motion* is indeed the attribute of the body, and the body relatively to its own motion is truly a ſubſtance, having the attribute or quality of motion. But the body being a name ſignifying a combination of certain ideas, which ideas are found to ariſe from action (ſee *PLASTIC Nature*), that action which is productive of thoſe ideas whoſe combination we denominate body, is of the nature of an attribute ſo long as it is conſidered as conſtituted of action.—To this attribute we muſt neceſſarily aſſign its ſubſtance. The actions which conſtitute body muſt be actions of ſomething, or there muſt be ſomething which acts. What then is this ACTIVE SOMETHING, from whoſe agency we get the idea of body, or whoſe actions conſtitute body? Is it not ſufficient that it is ſomething active? A name might be ſurely given it, but a name would not render the idea more clear. Its deſcription may be found in every ſenſation; it is colour to the eye, flavour to the palate, odour to the noſe, ſound to the ear, and feeling to the touch; for all our ſenſations are but ſo many ways in which this ACTIVE SOMETHING is manifeſted to us. A ſubſtratum of ſolidity philoſophers have imagined to exiſt, and have in vain ſought to find. Our ACTIVE SUBSTANCE is the ſubſtratum ſo long ſought for, and with ſo little ſucceſs. We give it a quality by which it may be perceived; it ACTS. One modification of *action* produces MATTER, another generates MOTION. Theſe modifications of action are modes of the active ſubſtance, whoſe preſence is action: matter and motion conſtitute the whole of nature. THERE IS THEREFORE THROUGHOUT NATURE AN ACTIVE SUBSTANCE, THE CONSTITUENT ESSENCE OF MATTER, AND IMMEDIATE NATURAL AGENT IN ALL EFFECTS."

14
Which is unintelligent,

By an argument which we do not think very concluſive, our author determines this active ſubſtance to be unintelligent. "In our ſenſations individually, not diſcovering (ſays he) the traces, not ſeeing the characters of intelligence, but finding only action preſent and neceſſary, our inferences go no farther than our obſervations warrant us to do; and we conclude in all theſe things an action only, and that action unintelligent." Having given our opinion of real agency elſewhere (ſee METAPHYSICS, N° 118.), we ſhall not here ſtop to examine this reaſoning.—We may however aſk, Whether all our ſenſations individually be not excited for a *certain end?* If they be, according to our author's mode of arguing in another place, the exciting agent ſhould be an intelligent being. By this we are far from meaning to deny the reality of a ſecondary or inſtrumental cauſe of ſenſation which is deſtitute of intelligence. We are ſtrongly inclined to think that there is ſuch a cauſe, though our perſuaſion reſults not from this argument of our author's. In our opinion, he reaſons better when he ſays, "that a ſubordinate agent conſtructed as the matter of creation, inveſted with perpetual laws, and producing agreeably to thoſe laws all the forms of being, through the varieties of which inferior intelligences can, by progreſſive ſteps, arrive ultimately at the ſupreme contriver, is more agreeable to our ideas of dignity, and tends to impreſs us with more exalted ſentiments, than viewing the Deity directly in all the individual impreſſions we receive, divided in the infinity of particular events, and unawful, by his continual preſence in operations to our view inſignificant and mean."

15
and neither matter nor mind.

This active ſubſtance, or ſecondary cauſe, our author concludes to be neither matter nor mind. "Matter (ſays he) is a being, as a whole quieſcent and inactive, but conſtituted of active parts, which reſiſt ſeparation, or cohere, giving what is uſually denominated ſolidity to the maſs. Mind is a ſubſtance which thinks. A being which ſhould anſwer to neither of theſe definitions, would be neither matter nor mind; but an *immaterial*, and, if I may ſo ſay, an *immental* ſubſtance." Such is the active ſubſtance of Mr Young, which, conſidered as the cauſe of motion, ſeems not to differ greatly from the *plaſtic nature*, *hylarchical principle*, or *vis genitrix*, of others. The manner in which it operates is indeed much more minutely detailed by our author than by any other philoſopher, ancient or modern, with whoſe writings we have any acquaintance.

16
The manner in which it is ſuppoſed to operate.

"Every thing (he ſays) muſt be in its own nature either diſpoſed to reſt or motion; conſequently the ACTIVE SUBSTANCE muſt be conſidered as a being naturally either quieſcent or motive. But it cannot be naturally quieſcent; for then it could not be active, becauſe activity, which is a tendency to motion, cannot originate in a tendency to reſt. Therefore the ACTIVE SUBSTANCE is by nature motive, that is, tending to motion. The ACTIVE SUBSTANCE is not ſolid, and does not reſiſt penetration. It is, therefore, incapable of impelling or of ſuſtaining impulſe. Whence it follows, that as it tends to move, and is incapable of having its motion impeded by impulſe, it muſt actually and continually move: in other words, MOTION IS ESSENTIAL TO THE ACTIVE SUBSTANCE.

"In order that this ſubſtance may *act*, ſome other thing upon which it may produce a change is neceſſary; for whatever ſuffers an action, receives ſome change. The active ſubſtance, in acting on ſome other thing, muſt impart and unite itſelf thereto; for its *action* is communicating its *activity*. But it cannot communicate its activity without imparting its ſubſtance: becauſe it is the ſubſtance alone which poſſeſſes activity, and the quality cannot be ſeparated from the ſubſtance. THEREFORE THE ACTIVE SUBSTANCE ACTS BY UNITING ITSELF WITH THE SUBSTANCE ON WHICH IT ACTS. The union of this ſubſtance with bodies, is not to be conceived of as a junction of ſmall parts intimately blended together and attached at their ſurfaces; but as an entire diffuſion and incorporation of one ſubſtance with another in perfect coaleſcence. As bodies are not naturally active, whenever they become ſo, as they always do in motion, it muſt be by the acceſſion of ſome part of the active ſubſtance. The active ſubſtance being imparted to a body, penetrates the moſt ſolid or reſiſting parts, and does not reſide in the pores without, and at the ſurfaces of the ſolid parts. For the activity is imparted to the body itſelf; and not to its pores, which are no parts of the body: therefore if the active ſubſtance remained within the pores, the cauſe would not be preſent with its effect; but the cauſe would be in one place and the effect in another, which is impoſſible.

"Bodies by their impulſe on others loſe their activity in proportion to the impulſe. This is matter of obſervation. Bodies which ſuffer impulſe acquire activity in proportion to the impulſe. This alſo is matter of obſervation. In impulſe, therefore, the active ſubſtance paſſes out of the impelling body into the body impelled. For ſince bodies in motion are active, and activity conſiſts in the preſence of the active ſubſtance, and by impulſe bodies loſe their activity, therefore they loſe their active ſubſtance, and the loſs is proportional to the impulſe. Bodies impelled acquire activity; therefore acquire active ſubſtance, and the acquiſition is proportioned to the impulſe. But the active ſubſtance loſt by the impelling body ought to be concluded to be that found in the other; becauſe there is no other receptacle than the impelled body to which the ſubſtance parted from can be traced, nor any other ſource than the active body whence that which is found can be derived. Therefore, in impulſe, the active ſubſtance ought to be concluded to paſs from the impelling body to the body impelled. The flowing of ſuch a ſubſtance is a ſufficient cauſe of the communication of activity, and no other rational cauſe can be aſſigned.

"The continued motion of a body depends not upon its *inertia*, but upon the continuance of the active ſubſtance within the body. The motion of a body is produced by the motion of the active ſubſtance in union with the body. It being evident, that ſince the active ſubſtance itſelf does always move, whatever it is united to will be moved along with it, if no obſtacle prevent. In mere motion, the body moved is the patient, and the active ſubſtance the agent. In impulſe, the body in motion may be conſidered as an agent, as it is made active by its active ſubſtance.—While the active ſubſtance is flowing out of the active body into the obſtacle or impelled body, the active body will preſs or impel the obſtacle. For while the active ſubſtance is yet within the body, although flowing through it, it does not ceaſe to impart to the body its own nature, nor can the body ceaſe to be active becauſe not yet deprived of the active ſubſtance. Therefore during its paſſing out of the body, ſuch portion of the active ſubſtance as is yet within, is urging and diſpoſing the body to move, in like manner as if the active ſubſtance were continuing in the body; and the body being thus urged to move, but impeded from moving, preſſes or impels the obſtacle.

17
produces impulſe,

“ We ſee here (ſays our author) an obvious explanation of impulſe; it conſiſts in the flowing of the motive ſubſtance from a ſource into a receptacle;” and he thinks, that although the exiſtence of ſuch a ſubſtance had not been eſtabliſhed on any previous grounds, the communication of motion by impulſe does alone afford a ſufficient proof of its reality.

He employs the agency of the ſame ſubſtance to account for many other apparent activities in bodies, ſuch as thoſe of *fire*, *electricity*, *attraction*, *repulſion*, *elaſticity*, &c. All the apparent origins of corporeal activity ſerve, he ſays, to impart the active ſubſtance to bodies; “ and where activity is without any *manifeſt* origin, the active ſubſtance is derived from an inviſible ſource.”

Our limits will not permit us to attend him in his ſolution of all the apparent activities in bodies; but the orbicular motions of the planets have been accounted for in ſo many different ways by philoſophers ancient and modern, and each account has been ſo little ſatisfactory to him who can think, and wiſhes to trace effects from adequate cauſes, that we conſider it as our duty to furniſh our readers with the account of this phenomenon which is given by Mr Young.

18
and cauſes the motion of the heavenly bodies.

The queſtion which has been ſo long agitated, “ Whence is the origin of motion?” our author conſiders as implying an abſurdity. “ It ſuppoſes (ſays he) that reſt was the primitive ſtate of matter, and that motion was produced by a ſubſequent act. But this ſuppoſition muſt ever be rejected, as it is giving precedency to the inferior, and inverting the order of nature.” The ſubſtance which he holds to be the baſis of matter is eſſentially active; and its action is motion. This motion, however, in the original element, was *power* without direction, agency without order, activity to no end. To this power it was neceſſary that a Law ſhould be ſuperadded; that its agency ſhould be guided to ſome regular purpoſe, and its motion conſpire to the production of ſome uniform effects. Our author ſhows, or endeavours to ſhow, by a proceſs of reaſoning which ſhall be examined elſewhere, that the primary atoms of matter are produced by the circular motion of the parts of this ſubſtance round a centre; and that a ſimilar motion of a number of theſe atoms around another centre common to them all, produces what in common language is called a *ſolid body*; a cannon ball, for inſtance, the terreſtrial globe, and the body of the ſun, &c. In a word, he labours to prove, and with no ſmall ſucceſs, that a principle of union is implied in the revolving or circulating movements of the active ſubſtance.

“ But we may alſo aſſume (he ſays) *à priori*, that a principle of union is a general law of nature; becauſe we ſee in fact all the component parts of the univerſe are united ſyſtems, which ſucceſſively combine into larger unions, and ultimately form *one* whole.” Let us then ſuppoſe the ſun with all his planets, primary and ſecondary, to be already formed for the purpoſe of making one ſyſtem, and the orbits of all of them, as well as theſe great bodies themſelves, to be pervaded by the active ſubſtance, which neceſſarily exiſts in a ſtate of motion, and is the cauſe of the motion of every thing corporeal. “ If to this motion a principle of union be added, the effect of ſuch a principle would be a determination of all the parts of the active ſubſtance, and of courſe all the bodies to which it is united, towards a common centre, which would be at reſt, and void of any tendency in any direction. But this determination of all the parts of the ſyſtem towards a common centre, tends to the deſtruction both of the motion of the active ſubſtance and of the ſyſtem; for ſhould all the parts continually approximate from a circumference towards a centre, the ſun and planets would at laſt meet, and form one ſolid and quieſcent maſs. But to preſerve exiſtence, and conſequently motion, is the firſt law of the active ſubſtance, as of all being; and it cannot be doubted, that to preſerve diſtinct the ſeveral parts of the ſolar ſyſtem, is the firſt law given to the ſubſtance actuating that ſyſtem. The union of the ſyſtem is a ſubſequent law.

“ When the *direct* tendency of any inferior law is obviated by a higher law, the inferior law will operate *indirectly* in the manner the neareſt to its direct tendency that the ſuperior law will permit. If a body in motion be obliquely obſtructed, it will move on in a direction oblique to its firſt motion. Now the law of union, which pervades the ſolar ſyſtem, being continually obſtructed by the law of ſelf-preſervation, the motion of the active ſubſtance, and of the bodies to which it is united, can be no other than a revolving motion *about* the common centre of approach, *towards* which all the parts have a determination. But when this revolution has actually taken place, it gives birth to a new tendency, which ſuperſedes the operation of the law of ſelf-preſervation. It has been ſhown, that the motion eſſential to the active ſubſtance, required to be governed by ſome law to give being to an orderly ſtate of things. Now, there are motions ſimple and motions complex; the more ſimple is in all things firſt in order, and out of the more ſimple the more complex ariſes in order poſterior. The moſt ſimple motion is rectilineal; therefore a rectilineal motion is to be conſidered as that which is the original and natural ſtate of things, and conſequently that to which *all things tend*. It will follow from hence, that when any portion of active ſubſtance in which the *law of union* operates, has in the manner above explained been compelled to aſſume a revolving motion, that is, a motion in ſome curve; a tendency to a rectilineal motion will continually exiſt in every part of the revolving portion, and in every point of the curve which it deſcribes during its revolution. And this rectilineal tendency will be a tendency to recede from the centre in every point of the revolving orbit, and to proceed in a tangent to the orbit at each point. Theſe two tendencies, if not originally equal, muſt neceſſarily in all caſes arrive at an equality. For the tendency towards the centre, called the *centripetal* tendency, that is, the *law of union*, operating firſt, if we ſuppoſe the motion approaches the centre, the tendency to recede from it, called the *centrifugal* tendency, will have its proportion to the centripetal continually increaſed as the orbit of revolution grows leſs, ſo as ultimately to equal the centripetal tendency, and reſtrain the motion from its central courſe, at which point it will no longer ſeek the centre but revolve round it."

As our author holds that every atom of matter is formed by the motion of parts of the active ſubſtance, and every body formed by the motion of atoms; ſo he maintains, not only that the ſun, moon, earth, planets, and ſtars, are penetrated by the ſame ſubſtance, but that each is the centre of a vortex of that ſubſtance, and that of theſe vortices ſome are included within others. "The ſubtle revolving fluid, the centre of whoſe vortex the earth occupies, not only ſurrounds but pervades the earth, and other vortices their earths, to their centres; and the earth and planets are by its revolutions carried around on their own axes. The earth is an inactive maſs, and all its component maſſes are ſeverally as well as collectively inactive; but the earth and all its parts have various collective and ſeparate movements, imparted from the fluid which ſurrounds, pervades, and conſtitutes it. Being immerſed together with its proper ſurrounding ſphere or vortex in the larger ſphere or vortex of the ſun, it is carried thereby in a larger orbit about the ſun, at the ſame time that by the revolution of its proper ſphere it rotates on its own axis."

19
Objections to this theory.

Such is the moſt complete view which our limits will permit us to give of Mr Young's theory of motion. To the philoſopher who conſiders experiment as the only teſt of truth, and who in all his inquiries employs his hands more than his head, we are fully aware that it will appear in no better light than as "the baſeleſs fabric of a viſion." Even to the intellectual philoſopher who is not frightened at the word *metaphyſics*, we are afraid that ſuch an active ſubſtance as the author contends for, will appear as inadequate to the production of the phenomena of gravitation and repulſion as the material æther of Mr Jones and his followers. A being void of intelligence, whether it be material or immaterial, quieſcent or motive, cannot be the ſubject of law, in the proper ſenſe of the word. The laws of which Mr Young ſpeaks as neceſſary to regulate the motions of the active ſubſtance, muſt be mere *forces*, applied by ſome extrinſic and ſuperior power. And ſince "motion, as it is *eſſential* to the active ſubſtance, is power without direction, agency without order, activity to no end; ſince it is of ſuch a nature, that from its unguided agitations there could reſult neither connection, order, nor harmony;" it follows that thoſe extrinſic forces muſt be *perpetually* applied, becauſe what is *eſſential* to any ſubſtance can never be deſtroyed or changed ſo long as the ſubſtance itſelf remains.

Forces producing order out of confuſion, can be applied only by a being poſſeſſed of intelligence; and if the immediate and perpetual agency of an intelligent being be neceſſary to regulate the motions of the active ſubſtance, that ſubſtance itſelf may be thought ſuperfluous, and its very exiſtence be denied. *Entia non ſunt multiplicanda abſque neceſſitate*, is a rule of philoſophizing which every man of ſcience acknowledges to be juſt. And it will hardly be denied that the immediate and perpetual agency of an intelligent being upon Mr Jones's etherial fluid, or even upon the matter of ſolid bodies themſelves, would be capable of producing every kind of motion without the inſtrumentality of a ſubſtance which is neither mind nor matter.

20
Other theories more ancient and rational.

Such, we conceive, are the objections which our metaphyſical readers may make to this theory. Part of their force, however, will perhaps be removed by the ingenious manner in which our author analyzes matter into an immaterial principle. But ſo much of it remains, that the writer of this article is inclined to believe that no mechanical account can be given of the motions of the heavenly bodies, the growth of plants, and various other phenomena which are uſually ſolved by attraction and repulſion. In the preſent age, philoſophers in general are ſtrangely averſe from admitting on any occaſion the agency of mind; yet as every effect muſt have a cauſe, it is ſurely not irrational to attribute ſuch effects as mechaniſm cannot produce to the operation either of intelligence or inſtinct. To ſuppoſe the Deity the immediate agent in the great motions of the univerſe, has been deemed impious; and it muſt be confeſſed that very impious concluſions have been deduced from that principle. But there is ſurely no impiety in ſuppoſing, with the excellent biſhop of Cloyne, that the fluid which is known to pervade the ſolar ſyſtem, and to operate with reſiſtleſs force, may be animated by a powerful mind, which acts inſtinctively for ends of which itſelf knows nothing. For the exiſtence of ſuch a mind, no other evidence, indeed, can be brought than what is afforded by a very ancient and very general tradition, and by the impoſſibility of accounting for the phenomena upon principles of mere mechaniſm. Perhaps ſome of our more pious readers may be inclined to think that the Supreme Being has committed the immediate government of the various planetary ſyſtems to powerful *intelligences*, or ANGELS, who, as his miniſters, direct their motions with wiſdom and foreſight. Such an opinion is certainly not abſurd in itſelf; and it ſeems to be countenanced by an ancient writer *, who, though not known by the name of a philoſopher, knew as much of the matter as any founder of the moſt celebrated ſchool.

To object to either of theſe hypotheſes, as has been ſometimes done, that it repreſents the government of the world as a perpetual miracle, betrays the groſſeſt ignorance; for we might as well call the movements of the bodies of men and brutes, which are certainly produced by minds, miraculous. We do not affirm that either hypotheſis is certainly true; but they are both as probable and as ſatisfactory as the hypotheſis which attributes agency to attraction and repulſion, to a ſubtle æther, or to a ſubſtance which is neither mind nor matter. Were the immediate agency of intellect to be admitted, there would be no room for many of thoſe diſputes which have been agitated among philoſophers, about the increaſe or diminution of motion

---

* *Pſal.* civ.

in the univerſe; becauſe an intelligent agent, which could begin motion as well as carry it on, might increaſe or diminiſh it as he ſhould judge proper. If inſtinctive agency, or ſomething ſimilar to it, be adopted, there is the ſame room for inveſtigation as upon the principles of mechaniſm; becauſe inſtinct works blindly, according to ſteady laws impoſed by a ſuperior mind, which may be diſcovered by obſervation of their effects. As we conſider this as by much the moſt probable hypothesis of the two, we find ourſelves involved in the following queſtion: “If a certain quantity of motion was originally communicated to the matter of the univerſe, how comes it to paſs that the original quantity ſtill remains?” Conſidering the many oppoſite and contradictory motions which ſince the creation have taken place in the univerſe, and which have undoubtedly deſtroyed a great part of the original quantity, by what means has that quantity been reſtored?

21 The queſtion, Whether the original quantity of motion in the world remains unimpaired? anſwered by

If this queſtion can be ſolved by natural means, it muſt be upon the principles of Newton; for, “in every caſe * where quantities and relations of quantities are required, it is the province of mathematics to ſupply the information ſought; “and all philoſophers agree that Sir Iſaac's doctrine of the compoſition and reſolution of motion, though in what reſpects the heavenly bodies it may have no phyſical reality, is ſo mathematically juſt, as to be the only principle from which the quantity of motion, or the force of powers, can in any caſe be computed. If we chooſe to anſwer the queſtion, by ſaying that the motion left is reſtored by the interpoſition of the Deity, then we might as well have had recourſe to him at firſt, and ſay that he alone is the true principle of motion throughout the creation.

* *Young's Eſſay on the Powers and Mechaniſm, &c.*

22 The Carteſians, and

23 by Newton.

Before we are reduced to this dilemma, however, it is neceſſary, in the firſt place, to inquire whether there is or can be any real diminution of the quantity of motion throughout the univerſe? In this queſtion the Carteſians take the negative ſide; and maintain, that the Creator at the beginning impreſſed a certain quantity of motion on bodies, and that under ſuch laws as that no part of it ſhould be loſt, but the ſame portion of motion ſhould be conſtantly preſerved in matter: and hence they conclude, that if any moving body ſtrike on any other body, the former loſes no more of its motion than it communicates to the latter. Sir Iſaac Newton takes the contrary ſide, and argues in the following manner: “From the various compoſitions of two motions, it is manifeſt there is not always the ſame quantity of motion in the world; for if two balls, joined together by a ſlender wire, revolve with an uniform motion about their common centre of gravity, and at the ſame time that centre be carried uniformly in a right line drawn in the plane of their circular motion, the ſum of the motions of the two balls, as often as they are in a right line, drawn from their common centre of gravity, will be greater than the ſum of their motions when they are in a line perpendicular to that other. Whence it appears, that motion may be both generated and loſt. But, by reaſon of the tenacity of fluid bodies, and the friction of their parts, with the weakneſs of the elaſtic power in ſolid bodies, nature ſeems to incline much rather to the deſtruction than the production of motion; and in reality, motion becomes continually leſs and leſs.— For bodies which are either ſo perfectly hard or ſo ſoft as to have no elaſtic power, will not rebound from each other; their impenetrability will only ſtop their motion. And if two ſuch bodies equal to one another be carried with equal but oppoſite motions, ſo as to meet in a void ſpace, by the laws of motion they muſt ſtop in the very place of concourſe, loſe all their motion, and be at reſt for ever, unleſs they have an elaſtic power to give them a new motion. If they have elaſticity enough to make them rebound with one-fourth, one-half, or three-fourths, of the force they meet with, they will loſe three-fourths, one-half, or one-fourth, of their motion. And this is confirmed by experiments: for if two equal pendulums be let fall from equal heights, ſo as to ſtrike full upon each other; if thoſe pendulums be of lead or ſoft clay, they will loſe all, or almoſt all, their motion; and if they be of any elaſtic matter, they will only retain ſo much motion as they receive from their elaſtic power.”

Motion, therefore, being thus, in the opinion of our celebrated author, *loſt*, or *abſolutely deſtroyed*, it is neceſſary to find ſome cauſe by which it may be renewed. Such renovation Sir Iſaac attributes to *active* principles; for inſtance, “the cauſe of gravity, whereby the planets and comets preſerve their motions in their orbits, and all bodies acquire a great degree of motion in falling; and the cauſe of fermentation, whereby the heart and blood of animals preſerve a perpetual warmth and motion, the inner parts of the earth are kept perpetually warmed; many bodies burn and ſhine, and the ſun himſelf burns and ſhines, and with his light warms and cheers all things.”

Elaſticity is another cauſe of the renovation of motion mentioned by Sir Iſaac. “We find but little motion in the world (ſays he), except what plainly flows either from theſe active principles, or from the command of the willer.”

24 No power of motion ever loſt or deſtroyed,

With regard to the *deſtruction* or poſitive *loſs* of motion, however, we muſt obſerve, that notwithſtanding the authority of Sir Iſaac Newton, it is altogether impoſſible that any ſuch thing can happen. All moving bodies which come under the cognizance of our ſenſes are merely paſſive, and acted upon by ſomething which we call *powers* or *fluids*, and which are to us totally inviſible. Motion, therefore, cannot be loſt without a deſtruction or diminution of one of theſe *powers*, which we have no reaſon to think can ever happen. When two pendulums ruſh againſt each other, the motion is the mere effect of the action of gravity; and that action, which in this caſe is the *power*, continues to be the very ſame whether the pendulum moves or moves not. Could motion, therefore, be exhauſted in this caſe, we muſt ſuppoſe, that by ſeparating two pendulums to the ſame diſtance from each other, and then letting them come together for a great number of times, they would at laſt meet with leſs force than before. But there is certainly not the leaſt foundation for this ſuppoſition; and no rational perſon will take it into his head, that ſuppoſing the whole human race had employed themſelves in nothing elſe from the creation to the preſent day, but ſeparating pendulums and letting them ſtop each other's motion, they would now come together with leſs force than they did at firſt. *Power*, therefore, which is the cauſe of motion, is abſolutely indeſtructible. Powers may indeed counteract one another, or they may be made to counteract themſelves; but the moment that the obſtacle is removed, they ſhow themſelves in their priſtine vigour, without the leaſt ſymptom of abatement or decay.

Whether, therefore, we reckon the ultimate ſource of motion to be ſpiritual or material, it is plain that it muſt be to our conceptions *infinite;* neither will the phenomena of nature allow us to give any other explanation than we have done: for no power whatever can loſe more than its own quantity; and it ſeems abſurd to think that the Deity would create the world in ſuch a manner that it would ultimately become immoveable, and then have recourſe to unknown principles to remedy the ſuppoſed defect. On the principle we have now juſt laid down, however, the matter becomes exceedingly plain and obvious. The Creator at firſt formed two oppoſite powers, the action of which is varied according to the circumſtances of the bodies upon which they act; and theſe circumſtances are again varied by the action of the powers themſelves in innumerable ways upon one another, and the approach of one body to another, or their receding to a greater diſtance. Where theſe powers happen to oppoſe each other directly, the body on which they act is at reſt; when they act obliquely, it moves in the diagonal; or if the force acting upon one ſide is by any means leſſened, the body certainly muſt move towards that ſide, as is evident from the caſe of the atmoſphere, the preſſure of which, when removed from one ſide of a body, will make it move very violently towards that ſide; and if we could continually keep off the preſſure in this manner, the motion would aſſuredly be *perpetual.* We muſt not imagine that motion is *deſtroyed* becauſe it is *counteracted;* for it is impoſſible to deſtroy motion by any means but removing the cauſe; counteracting the effect is only a temporary obſtacle, and muſt ceaſe whenever the obſtacle is removed. Nature, therefore, having in itſelf an *infinite* quantity of motion produces greater or leſſer motions, according to the various action of the moving powers upon different bodies or upon one another, without a poſſibility of the general ſtock being either augmented or diminiſhed, unleſs one of the moving powers was to be withdrawn by the Creator; in which caſe, the other would deſtroy the whole ſyſtem in an inſtant. As to the nature of theſe great original powers, we muſt confeſs ourſelves totally ignorant; nor do we perceive any data from which the nature of them can be inveſtigated. The elements of light, air, &c. are the agents; but in what manner they act, or in what manner they received their action, can be known only to the Creator.

25
The nature of the moving powers unknown.

Perpetual MOTION, in *Mechanics*, a motion which is ſupplied and renewed from itſelf, without the intervention of any external cauſe; or it is an uninterrupted communication of the ſame degree of motion from one part of matter to another, in a circle or other curve returning into itſelf, ſo that the ſame momentum ſtill returns undiminiſhed upon the firſt mover.

The celebrated problem of a perpetual motion conſiſts in the inventing a machine, which has the principle of its motion within itſelf. M. de la Hire has demonſtrated the impoſſibility of any ſuch machine, and finds that it amounts to this, viz. to find a body which is both heavier and lighter at the ſame time, or to find a body which is heavier than itſelf.

Animal MOTION, that which is performed by animals at the command of the mind or will.

Though all the motions of animals, whether voluntary or involuntary, are performed by means of the muſcles and nerves, yet neither theſe nor the ſubtile fluid which reſides in them are to be accounted the ultimate ſources of animal motion. They depend entirely upon the mind for thoſe motions which are properly to be accounted *animal.* All the involuntary motions, ſuch as thoſe of the blood, the heart, muſcles, organs ſubſervient to reſpiration and digeſtion, &c. are to be claſſed with thoſe of vegetables; for though no vegetables have them in ſuch perfection as animals, there are yet traces of them to be found evidently among vegetables, and that ſo remarkable, that ſome have imagined the animal and vegetable kingdoms to approach each other ſo nearly that they could ſcarce be diſtinguiſhed by a philoſophic eye. See MUSCLE.

Though the motions of animals, however, depend on the action of the mind or of the will, external objects ſeem originally to have the command of the mind itſelf; for unleſs an animal perceive ſomething, it will not be inclined to act. By means of the ideas once received, indeed, and retained in the memory, it acquires a ſelf-moving power, independent of any object preſent at the time, which is not the caſe with vegetables; for however they may act from a preſent impulſe, their motions never appear to be derived from any ſource which may not be accounted ſtrictly mechanical.

According to ſome, motion is the cauſe of ſenſation itſelf; and indeed it ſeems very probable that the motions of that ſubtle fluid, called *light* or *electricity*, in our bodies always accompany our ſenſations; but whether theſe be the *cauſe*, or only the *medium*, of ſenſe, cannot be diſcovered.

Though all animals are endowed with a power of voluntary motion, yet there is a very great variety in the degrees of that power; to determine which no certain rules can be aſſigned; neither can we, from the ſituation and manner of life of animals, derive any probable reaſon why the motion of one ſhould differ ſo very much from that of another. This difference does not ariſe from their ſize, their ferocity, their timidity, nor any other property that we can imagine. The elephant, though the ſtrongeſt land animal, is by no means the ſloweſt in its motions; the horse is much ſwifter than the bull, though there is not much difference in their ſize; a greyhound is much ſwifter than a cat, though the former be much larger, and though both live in the ſame manner, viz. by hunting. Among inſects the ſame unaccountable diverſity is obſervable. The louſe and flea are both vermine, are both nearly of the ſame ſize, and both feed on the bodies of animals; yet there is no compariſon between the ſwiftneſs of their motions: while the bug, which is much larger than either, ſeems to have a kind of medium ſwiftneſs between both.—This very remarkable circumſtance ſeems not even to depend on the range which animals are obliged to take in order to procure food for themſelves: the motion of a ſnail is ſlower than that of an earth worm; while that of many caterpillars is much quicker than either; though we can ſcarce determine which of the three has the greateſt or the leaſt extenſive range for its food.

Of all animals the ſhell fiſh move the ſloweſt, inſomuch that ſome have ſuppoſed them to be entirely deſtitute of locomotive powers; and muſcles particularly are denied to have any faculty of this kind. Every one knows that theſe animals can open and ſhut their ſhells at pleaſure; and it cannot eſcape obſervation, that in every muſcle there is a fleſhy protuberance of a much redder colour than the reſt. This has been thought to be a tongue or proboſcis, by which the animal takes in its food; but is in reality the inſtrument of its motion from place to place. This protuberance is divided into two lobes, which perform the office of feet. When the river muſcle is inclined to remove from its ſtation, it opens its ſhells, thruſts out this protuberance, and digs a furrow in the ſand; and into this furrow, by the action of the ſame protuberance, the ſhell is made to fall in a vertical poſition. It is recovered out of this into the former horizontal one, by puſhing back the ſand with the ſame tentacula, lengthening the furrow, and thus the animal continues its journey by a continual turning topſy-turvy.—Marine muſcles perform their motions in the ſame manner, and by ſimilar inſtruments. In general they are firmly attached to rocks or ſmall ſtones by threads about two inches long, which are ſpun from a glutinous ſubſtance in the protuberances already mentioned.

Other animals which inhabit bivalved ſhells, perform their motions by a kind of leg or foot; which, however, they can alter into almoſt any figure they pleaſe. By means of this leg they can not only ſink into the mud, or riſe out of it at pleaſure, but can even leap from the place where they are; and this can be done by the limpit, which people are apt to imagine one of the moſt ſluggiſh animals in nature.—When this creature is about to make a ſpring, it ſets its ſhell on edge, as if to diminiſh friction; then, ſtretching out the leg as far as poſſible, it makes it embrace a portion of the ſhell, and by a ſudden movement, ſimilar to that of a ſpring let looſe, it ſtrikes the earth with its leg, and actually leaps to a conſiderable diſtance.

The ſpout, or razor-fiſh, is ſaid to be incapable of moving forward horizontally on the ſurface; but it digs a hole ſometimes two feet deep in the ſand, in which it can aſcend or deſcend at pleaſure. The leg, by which it performs all its movements, is fleſhy, cylindrical, and pretty long; and the animal can at pleaſure make it aſſume the form of a ball. When lying on the ſurface of the ſand, and about to ſink into it, the leg is extended from the inferior end of the ſhell, and makes the extremity of it take on the form of a ſhovel, ſharp on each ſide, and terminating in a point. With this inſtrument the animal makes a hole in the ſand; after which it advances the leg ſtill farther into it, makes it aſſume the form of a hook, and with this, as a fulcrum, it obliges the ſhell to deſcend into the hole. This operation is continued until the whole ſhell be covered; and when the animal wiſhes to regain the ſurface, it makes the extremity of the leg to aſſume the form of a ball, and makes an effort to extend it. The ball, however, prevents any farther deſcent, and the reaction of the muſcular effort raiſes up the whole ſhell, which operation is continued until it reaches the ſurface; and it is ſurpriſing with what facility theſe motions are accompliſhed by an animal ſeemingly ſo little qualified to move at all. Another particularity in this fiſh is, that though it lives among ſalt water, it abhors ſalt ſo much, that when a little is thrown into its hole it inſtantly leaves it. But it is ſtill more remarkable, that if you once take hold of the ſpout-fiſh, and then allow it to retire into its hole, it cannot then be driven out by ſalt; though unleſs it be taken hold of by the hand, the application of ſalt will make it come to the ſurface as often as you pleaſe.

All other ſhell fiſh, even thoſe apparently the moſt ſluggiſh and deſtitute of any apparatus for motion, are found to be furniſhed with ſuch inſtruments as enable them to perform all thoſe movements for which they have any occaſion. Thus the ſcallop, a well-known animal inhabiting a bivalved ſhell, can both ſwim upon the ſurface of water and move upon land. When it happens to be deſerted by the tide, it opens its ſhell to the full extent, and ſhutting it again with a ſudden jerk, the reaction of the ground gives ſuch an impulſe to the whole, that it ſometimes ſprings five or ſix inches from the ground; and by a continued repetition of this action, it gradually tumbles forward until it regains the water. Its method of ſailing is ſtill more curious. Having attained the ſurface of the water by means unknown to us, it opens the ſhell, and puts one-half above water, the other with the body of the animal in it remaining below. Great numbers of them are thus frequently ſeen ſailing in company with their ſhells ſticking up above water when the weather is fine, and the wind acting upon them as ſails; but on the leaſt alarm they inſtantly ſhut their ſhells, and all ſink to the bottom together.

The oyſter has generally been ſuppoſed one of the moſt ſluggiſh animals in nature, and totally incapable of voluntary motion; but from the reſearches of the Abbé Dicquemarre, this opinion ſeems to be erroneous. The oyſter, like many other bivalved ſhell-fiſh, has a power of ſquirting water out from its body; and this property may eaſily be obſerved by putting ſome of them into a plate with as much ſea water as will cover them. The water is ejected with ſo much force, as not only to repel the approach of ordinary enemies, but to move the whole animal backwards or ſidewiſe, in a direction contrary to that in which the water was ejected. It has been alſo ſuppoſed, that oyſters are deſtitute of ſenſation; but M. Dicquemarre has ſhown, that they not only poſſeſs ſenſation, but that they are capable of deriving knowledge from experience. When removed from ſuch places as are entirely covered with the ſea, when deſtitute of experience, they open their ſhells and die in a few days; but if they happen to eſcape this danger, and the water covers them again, they will not open their ſhells again, but keep them ſhut, as if warned by experience to avoid a danger ſimilar to what they formerly underwent.

The motions of the ſea-urchin are perhaps more curious and complicated than thoſe of any other animal. It inhabits a beautiful multivalved ſhell, divided into triangular compartments, and covered with great numbers of prickles; from which laſt circumſtance it receives the name of *ſea urchin* or *ſea hedgehog*. The triangles

triangles are ſeparated from one another by regular belts, and perforated by a great number of holes, from every one of which iſſues a fleſhy horn ſimilar to that of a ſnail, and capable of moving in a ſimilar manner. The principal uſe of theſe horns ſeems to be to fix the animal to rocks or ſtones, though it likewiſe makes uſe of them in its progreſſive motion. By means of theſe horns and prickles, it is enabled to walk either on its back or its belly; but it moſt commonly makes uſe of thoſe which are near the mouth. Occaſionally it has a progreſſive motion by turning round like a wheel.

The animals called *ſea-nettles* or *meduſæ*, though extremely ſlow in their motions, are nevertheleſs evidently capable of moving at pleaſure from place to place. The variety of their figure is ſuch, that it is difficult to aſſign them any determinate figure whatever. In general, however, they reſemble a truncated cone, the baſe of which is applied to the rock to which they adhere. Their colours are various, whitiſh, brown, red or greeniſh: the mouth is very large; and when opened appears ſurrounded with filaments reſembling the horns of ſnails, which being diſpoſed in three rows around it, give the animal the appearance of a flower; and through every one of theſe the animal has the power of ſquirting the ſea water. The ſtructure of theſe animals is extremely ſingular; they conſiſting all of one organ, viz. a ſtomach. When ſearching for food, they extend their filaments, and quickly entangle any ſmall animals that come within their reach. The prey is inſtantly ſwallowed, and the mouth ſhut cloſe upon it like a purſe; in which ſtate it remains for many days before the nutritive parts are extracted. The animal, though ſcarcely an inch or an inch and a half in diameter, is nevertheleſs ſo dilatable, that it can ſwallow large whelks and muſcles, the ſhells of which are thrown out by the mouth after the nutritive parts have been exhauſted. Sometimes the ſhell is too large to be voided this way; in which caſe the body of the animal ſplits, and the ſhell is voided through the opening, which in a ſhort time heals up again. The progreſſive motion of this creature is ſo ſlow, that it reſembles that of the hour hand of a clock, and is performed by means of innumerable muſcles placed on the outſide of the body. All theſe are tubular, and filled with a fluid, which makes them project like prickles. On occaſion it can likewiſe looſen the baſe of the cone from the rock, and inverting its body, move by means of the filaments already mentioned, which ſurround the mouth; but even the motion performed in this manner is almoſt as ſlow as the other.

Some animals are capable of moving backwards, apparently with the ſame facility that they do forwards, and that by means of the ſame inſtruments which move them forward. The common houſe fly exhibits an inſtance of this, and frequently employs this retrograde motion in its ordinary courſes; though we cannot know the reaſon of its employing ſuch an extraordinary method. Another remarkable inſtance is given by Mr Smellie in the *maſon-bee*. This is one of the ſolitary ſpecies, and has its name from the mode of conſtructing its neſt with mud or mortar. Externally this neſt has no regular appearance, but at firſt ſight is taken for a quantity of dirt adhering to the wall; though the internal part be furniſhed with cells in the ſame regular manner with the neſts of other inſects of the bee kind. When this bee leaves its neſt, another frequently takes poſſeſſion of it; in which caſe a battle never fails to enſue on the return of the real proprietor. The diſpute is decided in the air; and each party endeavours to get above the other, as birds of prey are wont to do in order to give a downward blow. The undermoſt one, to avoid the ſtroke, inſtead of flying forward or laterally, always flies backward. The encounter is ſo violent, that when they ſtrike, both parties fall to the ground.

Vegetable MOTION. Though vegetables have not the power of moving from one place to another like animals, they are nevertheleſs capable of moving their different parts in ſuch a manner as would lead us to ſuſpect that they are actuated by a ſort of inſtinct. Hence many have been induced to ſuppoſe, that the animal and vegetable kingdoms are in a manner indiſtinguiſhable from one another; and that the higheſt degree of vegetable life can hardly be known from the loweſt degree of animal life. The eſſential and inſuperable diſtinction, however, between the two, is the faculty of ſenſation, and loco-motion in conſequence of it. Were it not, indeed, for the manifeſtation of ſenſe by moving from one place to another, we ſhould not be able to tell whether vegetables were poſſeſſed of ſenſation or not; but whatever motions they may be poſſeſſed of, it is certain that no vegetable has the faculty of moving from one place to another. Some have endeavoured to diſtinguiſh the two kingdoms by the digeſtion of food; alleging that plants have no proper organs, ſuch as a ſtomach, &c. for taking in and digeſting their aliment. But to this it has been replied, that the whole body of a vegetable is a ſtomach, and abſorbs its food at every pore. This, however, ſeems not to be a ſufficient anſwer. All animals take in their food at intervals, and there is not a ſingle inſtance of one which eats perpetually. The food is alſo taken into the body of the animal, and application of the parts made by means of the *internal* organization of the viſcus; but in vegetables, their whole bodies are immerſed in their food, and abſorb it by the ſurface, as animal bodies will ſometimes abſorb liquids when put into them. The roots of a tree indeed will change their direction when they meet with a ſtone, and will turn from barren into fertile ground; but this is evidently mere mechaniſm, without any proof of will or ſenſation; for the nouriſhment of the root comes not from the ſtone, but from the earth around it; and the increaſe in ſize is not owing to any expanſion of the matter which the root already contains, but to the appoſition of new matter; whence the increaſe of ſize muſt always take place in the direction from whence the nouriſhment proceeds. On this principle alſo may we explain the reaſon why the roots of a tree, after having arrived at the edge of a ditch, inſtead of ſhooting out into the air, will creep down the one ſide, along the bottom, and up the other.

In their other movements the vegetables diſcover nothing like ſenſation or deſign. They will indeed uniformly bend towards light, or towards water; but in the one caſe we muſt attribute the phenomenon to the action of the elements of light and air upon them; and in the latter, the property ſeems to be the ſame with what in other caſes we call attraction. Thus, if a root be uncovered, and a wet ſponge placed near it in a direction different from that in which the root was proceeding, it will ſoon alter its poſition, and turn towards the ſponge; and thus we may vary the direction of the root as often as we pleaſe. The efforts of a plant to turn from darkneſs or ſhade into ſunſhine are very remarkable; as in order to accompliſh this, not only the leaves will be inclined, but even the ſtems and branches twiſted. When a wet ſponge is held under the leaves of a tree, they bend down in order to touch it. If a veſſel of water be put within ſix inches of a growing cucumber, in leſs than 24 hours the latter will alter its direction; the branches will bend towards the water, and never alter their courſe until they come in contact with it. The moſt remarkable inſtance of this kind of motion, however, is, that when a pole is brought near a vine, the latter will turn towards it, and never ceaſe extending its branches till it lays hold of the ſupport.

The motions of the ſenſitive plant, and others of the ſame kind, have been conſidered as very wonderful; but it is doubtful if any of them be really more ſo than that of the vine juſt mentioned. None of theſe ſhow any kind of propenſity to move without an actual touch. A very ſlight one, indeed, makes the ſenſitive plant contract, and the whole branch, together with the leaves, bend down towards the earth.—Theſe phenomena are by ſome aſcribed to electricity. Even the motions of the *hedyſarum gyrans*, which at firſt ſight ſeem ſo much more ſurpriſing than thoſe of the ſenſitive plant, may it is ſuppoſed admit of explanation upon the ſame principle. The American plant called *dionæa muſcipula*, or *Venus's fly-trap*, is another example of very wonderful mechaniſm in vegetables, though even this does not argue any degree of ſenſation in this plant more than in others. The leaves of the dionæa are jointed, and furniſhed with two rows of prickles. A number of ſmall glands upon the ſurface ſecrete a ſweet juice which entices flies to come and ſettle upon it; but the moment theſe inſects touch the fatal ſpot, the leaves fold up, and ſqueeze them to death between the prickles. The leaves fold up in the ſame manner when the plant is touched with a ſtraw or pin. The *droſera rotundifolia* and *longifolia*, round and long-leafed ſundew, plants of our own country, not uncommon in boggy ground, poſſeſs a ſimilar ſtructure, and perform ſimilar functions.

The folding up of the leaves of certain plants in the abſence of the ſun's light, called their *ſleep*, affords another very curious inſtance of vegetable motion.—Almoſt all vegetables, indeed, undergo ſuch a remarkable change in the night, that it is difficult to know exactly how many kinds do really ſleep. They fold up their leaves in many different ways; but all agree in diſpoſing of them in ſuch a manner as to afford the beſt protection to the young ſtems, flower buds or fruit. The leaves of the tamarind tree contract round the young fruit in order to protect it from nocturnal cold; and thoſe of ſenna, glycina, and many other papilionaceous plants, diſpoſe of their leaves in the ſame manner. The leaves of the chickweed, aſclepias atriplex, &c. are diſpoſed in oppoſite pairs. In the night time they riſe perpendicularly, and join ſo cloſe at the top that the flowers are concealed by them. In like manner do the leaves protect the flowers of the ſida or althæa theophraſti, œnothera, ſolanum, and the Egyptian vetch. All theſe are erected during the night; but thoſe of the white lupine, in time of ſleep, hang down.

The flowers of plants alſo have motions peculiar to themſelves. Many of them during the night are encloſed in their calyxes. Some, particularly thoſe of the German ſpurge, geranium ſtriatum, and common whitlow graſs, when aſleep, bend towards the earth; by which means the noxious effects of rain or dew are prevented. All theſe motions have been commonly aſcribed to the ſun's rays; and Mr Smellie informs us that in ſome of the examples above mentioned the effects were evidently to be aſcribed to heat: but plants kept in a hot-houſe, where the temperature of the day and night are alike, contract their leaves, and ſleep in the ſame manner as if they were expoſed to the open air; "whence it appears (ſays he), that the ſleep of plants, is owing rather to a peculiar law, than to a quicker or ſlower motion of the juices." He ſuſpects, therefore, that as the ſleep of plants is not owing to the mere abſence of heat, it may be occaſioned by the want of light; and to aſcertain this he propoſes an experiment of throwing upon them a ſtrong artificial light. "If notwithſtanding this light (ſays he), the plants are not rouſed, but continue to ſleep as uſual, then it may be preſumed that their organs, like thoſe of animals, are not only irritable, but require the reparation of ſome invigorating influence which they have loſt while awake, by the agitations of the air and of the ſun's rays, by the act of growing, or by ſome other latent cauſe." On this, however, we muſt remark, that the throwing of artificial light upon plants cannot be attended with the ſame conſequences as that of the light of the ſun, unleſs the former were as ſtrong as the latter, which is impoſſible; and even granting that we could procure an artificial light as ſtrong as that of the ſun, a difference might be occaſioned by the different directions of the rays, thoſe of the ſun being very nearly parallel, while the rays of all artificial light diverge very greatly. If, therefore, we are to make an experiment of this kind, the rays ſhould be rendered parallel by means of a burning mirror. Here again we would be involved in a difficulty; for the rays of the ſun proceed all in one direction; but as of neceſſity we muſt employ different mirrors in our experiment, the light muſt fall upon the plant in different directions, ſo that we could not reaſonably expect the ſame reſult as when the plants are directly expoſed to the rays of the ſun.

The motion of plants, not being deducible from ſenſation, as in animals, muſt be aſcribed to that property called *irritability*; and this property is poſſeſſed *inſenſibly* by the parts of animals in a greater degree than even by the moſt irritable vegetable. The muſcular fibres will contract on the application of any ſtimulating ſubſtance, even after they are detached from the body to which they belonged. The heart of a frog will continue to beat when pricked with a pin for ſeveral hours after it is taken out of the body. The heart of a viper, or of a turtle, beats diſtinctly from 20 to 30 hours after the death of theſe animals. When the inteſtines of a dog, or any other quadruped, are ſuddenly cut into different portions, all of them crawl about like worms, and contract upon the ſlighteſt touch. The heart, inteſtines, and diaphragm, are the moſt irritable

irritable parts of animal bodies; and to diſcover whether this quality reſides in all plants, experiments ſhould be made chiefly on leaves, flowers, buds, and the tender fibres of the roots.

The motions of plants are univerſally aſcribed by our author to *irritability*, to which alſo we have aſcribed them under the article Animal. The term, however, requires an explanation; and to give this in an intelligible manner requires ſome attention. The moſt obvious compariſon is that of an electrified thread; which on the approach of any unelectrified ſubſtance, ſhows a variety of motions, equally ſurpriſing with thoſe of the parts of plants or the muſcular fibres cut out of the body. Could we ſuppoſe that the electricity of a thread might be preſerved after it was cut off from the electrifying ſubſtance, it would ſhow as much irritability as even the muſcular fibres, or portions of the inteſtines of animals. We know, from the hiſtory of the torpedo, electrical eel, &c. that there are animals in which the electric fluid acts in ſuch a manner as to produce a much more powerful effect than that of giving motion to the leaves of plants. The readineſs, therefore, with which this fluid is thrown into agitations when any ſubſtance in which it acts is touched, is without doubt the irritability in queſtion; but we have from thence no more reaſon to aſcribe ſenſation to theſe irritable bodies, than to an electrified bottle when it diſcharges itſelf, or makes a cork ball play around it.

In a paper read before the Academy of Sciences at Paris, by M. Brouſſonet, the author inclines to confound irritability and ſenſibility together. The different parts of plants (ſays he) enjoy the faculty of motion; but the motions of a vegetable are very different in their nature from thoſe of an animal: the moſt ſenſible, thoſe that are produced with moſt rapidity in plants, are always influenced by ſome ſtimulating cauſe. Irritability, which is nothing but *ſenſibility* made manifeſt by motion, is a general law to which nature has ſubjected all living beings; and it is this that continually watches over their preſervation. Being more powerful in animals than in plants, it may be often confounded in theſe laſt with phenomena that depend on a quite different cauſe. In the vegetable it is only the organ which is expoſed to the action of the ſtimulating power that moves. Irritation in particular places never produces that prompt combination of ſenſations which we obſerve in animals; in conſequence of which certain parts are put in motion without being directly affected, and which otherwiſe might have been paſſive.

“ The more perfect the organization in the different parts of animals is, the more apparent are the ſigns of irritability. The parts that come neareſt to thoſe of vegetables, and in which of conſequence the organization is moſt imperfect, are the leaſt irritable. The ſame law holds with regard to plants; but the reſult is oppoſite: the ſigns of irritability are moſt ſenſible in proportion to the analogy of the parts with thoſe of animals; and they are imperceptible in thoſe that are diſſimilar. This aſſertion is proved by what we obſerve in the organs deſtined in vegetables to perpetuate the ſpecies. Thoſe parts alone ſeem ſenſible to ſtimuli; the bark, leaves, ſtalks, and roots ſhowing no ſigns of irritability.

“ The motions eſſentially vital, which have in plants the greateſt affinity with thoſe of animals, are the courſe of the ſap, the paſſage of the air in the trachea, the different poſitions which the flowers of certain plants take at certain hours of the day, &c. But if we attend to the manner in which all theſe motions in plants are performed, we ſhall find that they preſent a greater number of modifications than the analogous motions that take place in animals. The temperature of the atmoſphere, its agitation, light, &c. have great influence on the motions of plants, by accelerating or retarding the courſe of their fluids; and, as they cannot change their place, theſe variations produce in them changes more obvious and more uniform than in animals.”

Our author now proceeds to inform us, that ſome of the motions of plants are occaſioned by the rarity of the juices in plants, and others by their abundance. Of the former kind are thoſe by which the capſules of ſome plants ſuddenly burſt with a ſpring, and throw their ſeeds to ſome diſtance. Of the other kind are the action of the ſtamina in the *parietaria*, the inflection of the peduncles of flowers, and of the piſtilla. “ Thoſe motions (ſays he) which are particularly obſerved in the organs deſtined to the reproduction of the individual, not appearing except in circumſtances that render them abſolutely neceſſary, ſeem in ſome meaſure to be the effect of a particular combination: they are, however, merely mechanical; for they are always produced in the ſame way and in the ſame circumſtances. Thus the roſe of Jericho, and the dry fruit of ſeveral ſpecies of *meſembryanthemum*, do not open but when their veſſels are full of water.

“ The ſudden diſengagement of fluids produces a kind of motion. To this cauſe we muſt attribute a great number of phenomena obſervable in the leaves of ſeveral plants, and which do not depend on irritability. The ſmall glands in each leaf of the *dionæa* are no ſooner punctured by an inſect, than it inſtantly folds up and ſeizes the animal: the puncture ſeems to operate a diſengagement of the fluid which kept the leaf expanded by filling its veſſels. This explanation is the more probable, that in the early ſtate of the vegetation of this plant, when the ſmall glands are hardly evolved, and when probably the juices do not run in ſufficient abundance, the leaves are folded up exactly as they appear when punctured by an inſect at a more advanced period. We obſerve a phenomenon ſimilar to this in both ſpecies of the *droſera* (ſun-dew), mentioned above. The mechaniſm here is very eaſily obſervable: the leaves are at firſt folded up; the juices are not yet propelled into the fine hairs with which they are covered; but after they are expanded, the preſence of the fluid is manifeſt by a drop ſeen at the extremity of each hair: it is by abſorbing this fluid that an inſect empties the veſſels of the leaf, which then folds up, and reſumes its firſt ſtate: the promptitude of the action is proportioned to the number of hairs touched by the inſect. This motion in ſome degree reſembles that which takes place in the limb of an animal kept in a ſtate of flexion by a tumor in the joint; when the matter which obſtructed the motion is diſcharged, the limb inſtantly reſumes its former poſition. The phenomena that depend on the abundance of fluids are particularly evident in plants which grow in wet ſoils; the *droſera* and *dionæa* are of this kind: and it is known by by the experiments of Meſſ. Du Fay and Du Hamel, that ſenſitive plants are particularly ſenſible when the ſun is obſcured by clouds and the air warm and moiſt. The influence of external cauſes ſometimes ſo modifies the vital motions in plants, that we would be tempted to aſcribe them to volition, like thoſe that depend entirely on that faculty in animals. If we ſet a pole in the ground near a twining plant, it always lays hold of the pole for ſupport, in whatever place we put it. The ſame thing occurs in the tendrils of the vine; which always attach themſelves to the ſupport preſented them, on whatever ſide it may be placed, provided they can reach it: but theſe motions are entirely vital: the twining plants and the tendrils direct themſelves to every quarter, and conſequently cannot fail of meeting with the bodies within their reach. Theſe motions are performed as long as the parts continue to grow; but when they ceaſe to elongate, if they have not been able to reach any body on which they can fix, they bend back upon themſelves. This and other obſervations ſhow how far the vital motions in plants may be modified by external cauſes, and how eſſentially they differ from thoſe that are the effect of volition in animals.

"Some plants appear endowed with no ſort of motion: ſome have leaves that can move in different directions: their motions are generally modified by different cauſes; but none appear ſo eminently poſſeſſed of this quality as the *hedyſarum gyrans* of Linnæus.—No part of this plant ſhows any ſigns of irritability upon application of ſtimuli: and the motion of its foliola ceaſes when the leafets are agitated by the wind.—When the ſun is warm, the little leaves of the hedyſarum are alſo immoveable; but when the weather is warm and moiſt, or when it rains, they move very freely. This motion ſeems indiſpenſably neceſſary to the plant; for it begins as ſoon as the firſt leaves unfold, and continues even during the night; but in time it grows weaker. In our ſtoves it is moſt conſiderable during the firſt year; in the ſecond, it is not very ſenſible: in its native place all the leaves have a motion never obſerved here. The moving leafets are moſt agitated while the plants are in full flower, and the proceſs of fructification goes on. The oſcillatory motion is ſo natural to it, that it not only remains for three or four days in the leafets of a branch that has been cut off and put in water, but is even continued though the branch be expoſed to the air. The leaves ſeem to perform the office of the heart in vegetables. When a plant is ſtripped of its leaves, the progreſs of vegetation is arreſted; and ſuch vegetables reſemble thoſe animals which have a periodical ſleep, induced by a diminution of the action of the heart. Many plants hardly ſhow any ſigns of motion; many ſeem alſo wholly cataleptic; which is rarely if ever found in animals. The footſtalks of the flowers of dracocephalum, a Virginian plant, preſerve themſelves in whatever poſition they are placed.

Muſcular MOTION. See MUSCLE.

MOTIVE, is ſometimes applied to that faculty of the human mind, by which we purſue good and avoid evil. Thus Hobbes diſtinguiſhes the faculties of the mind into two ſorts, the cognitive and motive.

MOTOUALIS, a ſmall nation of Syria, inhabiting to the eaſt of the country of the DRUSES, in the valley which ſeparates their mountains from thoſe of Damaſcus; of which the following account is given by Volney in his Travels, vol. ii.

The characteriſtic diſtinction between them and the other inhabitants of Syria (ſays our author) is, that they, like the Perſians, are of the ſect of Ali, while all the Turks follow that of Omar or Moaouia. This diſtinction, occaſioned by the ſchiſm which in the 36th year of the Hegira aroſe among the Arabs, reſpecting the ſucceſſors of Mahomet, is the cauſe of an irreconcilable hatred between the two parties. The ſectaries of Omar, who conſider themſelves as the only orthodox, aſſume the title of *Sonnites*, which has that ſignification, and term their adverſaries *Shiites*, that is "ſectaries of Ali." The word *Motouali* has the ſame meaning in the dialect of Syria. The followers of Ali, diſſatisfied with this name, ſubſtitute that of *Adlia*, which means "aſſertors of juſtice," literally "Juſticiarians:" a denomination which they have aſſumed in conſequence of a doctrinal point they advance in oppoſition to the Sonnite faith. A ſmall Arabic treatiſe, entitled Theological Fragments concerning the Sects and Religions of the World, has the following paſſage:

"Theſe ſectaries who pretend that God acts only on principles of juſtice, conformable to human reaſon, are called *Adlia* or *Juſticiarians.* God cannot (ſay they) command an impracticable worſhip, nor ordain impoſſible actions, nor enjoin men to perform what is beyond their ability; but wherever he requires obedience, will beſtow the power to obey. He removes the cauſe of evil, he allows us to reaſon, and impoſes only what is eaſy, not what is difficult; he makes no man reſponſible for the actions of another, nor puniſhes him for that in which he has no part; he imputes not as a crime what himſelf has created in man; nor does he require him to avoid what deſtiny has decreed.—This would be injuſtice and tyranny, of which God is incapable, from the perfection of his being." To this doctrine, which diametrically oppoſes the ſyſtem of the Sonnites, the Motoualis add certain ceremonies which increaſe their mutual averſion. They curſe Omar and Moaouia as rebels and uſurpers; and celebrate Ali and Hoſain as ſaints and martyrs. They begin their ablutions at the elbow, inſtead of the end of the finger, as is cuſtomary with the Turks; they think themſelves defiled by the touch of ſtrangers; and, contrary to the general practice of the Eaſt, neither eat nor drink out of a veſſel which has been uſed by a perſon not of their ſect, nor will they even ſit with ſuch at the ſame table.

Theſe doctrines and cuſtoms, by ſeparating the Motoualis from their neighbours, have rendered them a diſtinct ſociety. It is ſaid they have long exiſted as a nation in this country, though their name has never been mentioned by any European writer before the 18th century; it is not even to be found in the maps of D'Anville: La Roque, who left their country not a hundred years ago, gives them the name of *Amediens.* Be this as it may, in later times their wars, robberies, ſucceſſes, and various changes of fortune, have rendered them of conſequence in Syria. Till about the middle of this century, they only poſſeſſed Balbec their capital, and a few places in the valley, and Anti-Lebanon, which ſeems to have been their original country. At that period we find them under a like government with the Druzes, that is to ſay, under a number of Shaiks, with one principal chief of the family of Harfouſh. After the year 1750 they eſtabliſhed themſelves among the heights of Bekaa, and got footing in Lebanon, where they obtained lands belonging to the Maronites, almoſt as far as Beſharrai. They even incommoded them ſo much by their ravages, as to oblige the emir Youſef to attack them with open force and expel them; but on the other ſide, they advanced along the river even to the neighbourhood of Sour (Tyre). In this ſituation, Shaik Daher had the addreſs, in 1760, to attach them to his party.—The pachas of Saide and Damaſcus claimed tributes, which they had neglected paying, and complained of ſeveral robberies committed on their ſubjects by the Motoualis; they were deſirous of chaſtiſing them; but this vengeance was neither certain nor eaſy. Daher interpoſed; and by becoming ſecurity for the tribute, and promiſing to prevent any depredations, acquired allies who were able, as it is ſaid, to arm 10,000 horſemen, all reſolute and formidable troops. Shortly after they took poſſeſſion of Sour, and made this village their principal ſea port. In 1771 they were of great ſervice to Ali Bey and Daher againſt the Ottomans. But Emir Youſef having in their abſence armed the Druzes, ravaged their country. He was beſieging the caſtle of Djezin, when the Motoualis, returning from Damaſcus, received intelligence of this invaſion. At the relation of the barbarities committed by the Druzes, an advanced corps, of only 500 men, were ſo enraged, that they immediately ruſhed forward againſt the enemy, determined to periſh in taking vengeance. But the ſurpriſe and confuſion they occaſioned, and the diſcord which reigned between the two factions of Manſour and Youſef, ſo much favoured this deſperate attack, that the whole army, conſiſting of 25,000 men, was completely overthrown.

In the following year, the affairs of Daher taking a favourable turn, the zeal of the Motoualis cooled towards him, and they finally abandoned him in the cataſtrophe in which he loſt his life. But they have ſuffered for their imprudence under the adminiſtration of the pacha who ſucceeded him. Since the year 1777, Djezzar, maſter of Acre and Saide, has inceſſantly laboured to deſtroy them. His perſecution forced them in 1784 to a reconciliation with the Druzes, and to enter into an alliance with the emir Youſef. Though reduced to leſs than 700 armed men, they did more in that campaign than 15,000 or 20,000 Druzes and Maronites aſſembled at Dair-el-Kamar. They alone took the ſtrong fortreſs of Mar-Djebaa, and put to the ſword 50 or 60 Epirots who defended it. But the miſunderſtanding which prevailed among the chiefs of the Druzes having rendered abortive all their operations, the pacha has obtained poſſeſſion of the whole valley, and the city of Balbec itſelf. At this period not more than 500 families of the Motoualis remained, who took refuge in Anti-Lebanon, and the Lebanon of the Maronites; and, driven as they now are from their native ſoil, it is probable they will be totally annihilated, and even their very name become extinct.

MOTTO, in armoury, a ſhort ſentence or phraſe, carried in a ſcroll, generally under, but ſometimes over, the arms: ſometimes alluding to the bearing, ſometimes to the name of the bearer, and ſometimes containing whatever pleaſes the fancy of the deviſer.

MOVEABLE, in general, denotes any thing capable of being moved.

MOVEABLE Feaſts, are ſuch as are not always held on the ſame day of the year or month; though they be on the ſame day of the week. See FEASTS.

Thus, Eaſter is a moveable feaſt, being always held on the Sunday which falls upon or next after the firſt full moon following the 21ſt of March.

All the other moveable feaſts follow Eaſter, i. e. they keep their diſtance from it; ſo that they are fixed with reſpect thereto.

Such are Septuageſima, Sexageſima, Aſh Wedneſday, Aſcenſion day, Pentecoſt, Trinity Sunday, &c. which ſee under their proper articles, SEPTUAGESIMA, &c.

MOVEABLE Subject, in *Law*, any thing that moves itſelf, or can be moved; in contradiſtinction to immoveable or heritable ſubjects, as lands, houſes, &c.

MOVEMENT, MOTION, a term frequently uſed in the ſame ſenſe with automaton.

The moſt uſual movements for keeping time are watches and clocks: the firſt are ſuch as ſhow the parts of time, and are portable in the pocket; the ſecond, ſuch as publiſh it by ſounds, and are fixed as furniture. See HOROLOGY.

MOVEMENT, in its popular uſe among us, ſignifies all the inner works of a watch, clock, or other engine, which move, and by that motion carry on the deſign of the inſtrument.

The movement of a clock or watch is the inſide, or that part which meaſures the time, ſtrikes, &c. excluſive of the frame, caſe, dial plate, &c.

The parts common to both of theſe movements are, the main-ſpring, with its appurtenances; lying in the ſpring box, and in the middle thereof lapping about the ſpring-arbor, to which one end of it is faſtened. A-top of the ſpring-arbor is the endleſs ſcrew and its wheel; but in ſpring-clocks, this is a ratchet-wheel with its click, that ſtops it. That which the main-ſpring draws, and round which the chain or ſtring is wrapped, is called the *fuſy*; this is ordinarily taper; in large works, going with weights, it is cylindrical, and called the *barrel*. The ſmall teeth at the bottom of the fuſy or barrel, which ſtop it in winding up, is called the *ratchet*; and that which ſtops it when wound up, and is for that end driven up by the ſpring, the *garde-gut*. The wheels are various: the parts of a wheel are, the hoop or rim, the teeth, the croſs, and the collet or piece of braſs ſoldered on the arbor or ſpindle whereon the wheel is rivetted. The little wheels playing in the teeth of the larger are called *pinions*; and their teeth, which are 4, 5, 6, 8, &c. are called *leves*; the ends of the ſpindle are called *pivots*; and the guttered wheel, with iron ſpikes at bottom, wherein the line of ordinary clocks runs, the *pulley*. We need not ſay any thing of the hand, ſcrews, wedges, ſtops, &c. See WHEEL, FUSY, &c.

Perpetual MOVEMENT. See *Perpetual MOTION.*

MOUFET, THOMAS, a celebrated Engliſh phyſician, was born at London, and practiſed medicine with great reputation. Towards the latter end of his life

life he retired to the country, and died about the year 1600. This phyſician is known by a work which was begun by Edward Wotton, and printed at London in 1634, folio, with the title of *Theatrum Inſectorum*. A tranſlation of it into Engliſh was publiſhed at London in 1658, folio. Martin Liſter gives a very unfavourable opinion of this book: "As Moufet (ſays he) made uſe of Wotton, Geſner, &c. an excellent work might have been expected from him; and yet his *Theatrum* is full of confuſion, and he has made a very bad uſe of the materials with which theſe authors have furniſhed him. He is ignorant of the ſubject of which he treats, and his manner of expreſſion is altogether barbarous. Beſides this, he is extremely arrogant, to ſay no worſe; for though he has copied Aldrovandus in innumerable places, he never once mentions his name." But Ray thinks that Liſter, by expreſſing himſelf in this manner, has not done juſtice to Moufet; and he maintains that the latter has rendered an eſſential ſervice to the republic of letters.

MOUG-DEN, or **CHEN-YANG**; a city of Chineſe Tartary, and capital of the country of the Mantchews or Eaſtern Tartars. Theſe people have been at great pains to ornament it with ſeveral public edifices, and to provide it with magazines of arms and ſtorehouſes. They conſider it as the principal place of their nation; and ſince China has been under their dominion, they have eſtabliſhed the ſame tribunals here as at Peking, excepting that called *Lü-pou:* theſe tribunals are compoſed of Tartars only; their determination is final; and in all their acts they uſe the Tartar characters and language. The city is built on an eminence; a number of rivers add much to the fertility of the ſurrounding country. It may be conſidered as a double city, of which one is encloſed within the other: the interior contains the emperor's palace, hotels of the principal mandarins, ſovereign courts, and the different tribunals; the exterior is inhabited by the common people, tradeſmen, and all thoſe who by their employments or profeſſions are not obliged to lodge in the interior. The latter is almoſt a league in circumference; and the walls which encloſe both are more than three leagues round: theſe walls were entirely rebuilt in 1631, and repaired ſeveral times under the reign of Kang-hi.

MOULD, or **MOLD**, in the mechanic arts, &c. a cavity artificially cut, with a deſign to give its form or impreſſion to ſome ſofter matter applied therein. Moulds are implements of great uſe in ſculpture, foundery, &c. The workmen employed in melting the mineral or metallic ore dug out of mines, have their ſeveral moulds to receive the melted metal as it comes out of the furnace; but theſe are different according to the diverſity of metals and works. In gold mines, they have moulds for ingots; in ſilver mines, for bars; in copper and lead mines, for pigs or ſalmons; in tin mines, for pigs and ingots; and in iron mines, for ſows, chimney backs, anvils, caldrons, pots, and other large utenſils and merchandiſes of iron; which are here caſt, as it were, at firſt hand.

MOULDS of founders of large works, as ſtatues, bells, guns, and other brazen works, are of wax, ſupported within-ſide by what we call a core, and covered without-ſide with a cape or caſe. It is in the ſpace which the wax took up, which is afterwards melted away to leave it free, that the liquid metal runs, and the work is formed; being carried thither through a great number of little canals, which cover the whole mould. See FOUNDERY.

MOULDS of moneyers are frames full of ſand, wherein the plates of metal are caſt that are to ſerve for the ſtriking of ſpecies of gold and ſilver. See COINING.

A ſort of concave moulds made of clay, having within them the figures and inſcriptions of ancient Roman coins, are found in many parts of England, and ſuppoſed to have been uſed for the caſting of money. Mr Baker having been favoured with a ſight of ſome of theſe moulds found in Shropſhire, bearing the ſame types and inſcriptions with ſome of the Roman coins, gave an account of them to the Royal Society. They were found in digging of ſand, at a place called Ryton in Shropſhire, about a mile from the great Watling-ſtreet road. They are all of the ſize of the Roman denarius, and of little more than the thickneſs of our halfpenny. They are made of a ſmooth pot or brick clay, which ſeems to have been firſt well cleanſed from dirt and ſand, and well beaten or kneaded, to render it fit for taking a fair impreſſion. There were a great many of them found together, and there are of them not unfrequently found in Yorkſhire; but they do not ſeem to have been met with in any other kingdom, except that ſome have been ſaid to be once found at Lyons. They have been ſometimes found in great numbers joined together ſide by ſide, on one flat piece of clay, as if intended for the caſting of a great number of coins at once; and both theſe, and all the others that have been found, ſeem to have been of the emperor Severus. They are ſometimes found impreſſed on both ſides, and ſome have the head of Severus on one ſide and ſome well known reverſe of his on the other. They ſeem plainly to have been intended for the coinage of money, though it is not eaſy to ſay in what manner they can have been employed for that purpoſe, eſpecially thoſe which have impreſſions on both ſides, unleſs it may be ſuppoſed that they coined two pieces at the ſame time by the help of three moulds, of which this was to be the middle one. If by diſpoſing theſe into ſome ſort of iron frame or caſe, as our letter-founders do the braſs moulds for caſting their types, the melted metal could be eaſily poured into them, it would certainly be a very eaſy method of coining, as ſuch moulds require little time or expence to make, and therefore might be ſupplied with new ones as often as they happen to break.

Theſe moulds ſeem to have been burnt or baked ſufficiently to make them hard; but not ſo as to render them porous like our bricks, whereby they would have loſt their ſmooth and even ſurface, which in theſe is plainly ſo cloſe, that whatever metal ſhould be formed in them would have no appearance like the ſand-holes by which counterfeit coins and metals are uſually detected.

MOULDS of founders of ſmall works are like the frames of coiners: it is in theſe frames, which are likewiſe filled with ſand, that their ſeveral works are faſhioned; into which, when the two frames of which the mould is compoſed, are rejoined, the melted braſs is run.

MOULDS of letter-founders are partly of ſteel and partly of wood. The wood, properly ſpeaking, ſerves only to cover the real mould which is within, and to prevent the workman, who holds it in his hand, from being incommoded by the heat of the melted metal. Only one letter or type can be formed at once in each mould. See LETTER FOUNDERY.

MOULDS, in the manufacture of paper, are little frames compoſed of ſeveral braſs or iron wires, faſtened together by another wire ſtill finer. Each mould is of the bigneſs of the ſheet of paper to be made, and has a rim or ledge of wood to which the wires are faſtened. Theſe moulds are more uſually called frames or forms. See *PAPER-Making*.

MOULDS, with furnace and crucible makers, are made of wood, of the ſame form with the crucibles; that is, in form of a truncated cone: they have handles of wood to hold and turn them with, when being covered with the earth, the workman has a mind to round or flatten his veſſel.

MOULDS for leaden bullets are little iron pincers, each of whoſe branches terminates in a hemiſpherical concave, which when ſhut form an entire ſphere. In the lips or ſides where the branches meet is a little jet or hole, through which the melted lead is conveyed.

Laboratory MOULDS are made of wood, for filling and driving all ſorts of rockets and cartridges, &c.

Glaziers MOULDS. The glaziers have two kinds of moulds, both ſerving to caſt their lead: in the one they caſt the lead into long rods or canes fit to be drawn through the vice, and the grooves formed therein; this they ſometimes call ingot-mould. In the other, they mould thoſe little pieces of lead a line thick and two lines broad, faſtened to the iron bars. Theſe may be alſo caſt in the vice.

Goldſmiths MOULDS. The goldſmiths uſe the bones of the cuttle fiſh to make moulds for their ſmall works; which they do by preſſing the pattern between two bones, and leaving a jet or hole to convey the metal through, after the pattern has been taken out.

MOULD, among maſons, is a piece of hard wood or iron hollowed within ſide, anſwerable to the contours of the mouldings or cornices, &c. to be formed. This is otherwiſe *caliber*.

MOULDS, among plumbers, are the tables on which they caſt ſheets of lead. Theſe they ſometimes call ſimply *tables*. Beſides which they have other real moulds, wherewith they caſt pipes without ſoldering. See each deſcribed under PLUMBERY.

MOULDS, among the glaſs grinders, are wooden frames, whereon they make the tubes wherewith they fit their perſpectives, teleſcopes, and other optic machines. Theſe moulds are cylinders, of a length and diameter according to the uſe they are to be applied to, but always thicker at one end than the other, to facilitate the ſliding. The tubes made on theſe moulds are of two kinds; the one ſimply of paſteboard and paper; the other of thin leaves of wood joined to the paſteboard. To make theſe tubes to draw out, only the laſt or innermoſt is formed on the mould; each tube made afterwards ſerving as a mould to that which is to go over it, but without taking out the mould from the firſt. See GRINDING.

MOULDS uſed in baſket-making are very ſimple, conſiſting ordinarily of a willow or oſier turned or bent into an oval, circle, ſquare, or other figure, according to the baſkets, panniers, hampers, and other utenſils intended. On theſe moulds they make, or more properly meaſure, all their work; and accordingly they have them of all ſizes, ſhapes, &c.

MOULD, in ſhip-building, a thin flexible piece of timber, uſed by ſhipwrights as a pattern whereby to form the different curves of the timbers, and other compaſſing pieces in a ſhip's frame. There are two ſorts of theſe, viz. the bend mould and hollow mould; the former of theſe determines the convexity of the timbers, and the latter their concavity on the outſide, where they approach the heel, particularly towards the extremities of the veſſel. The figure given to the timbers by this pattern is called their *bevelling*.

MOULDS, among tallow chandlers, are of two kinds: the firſt for the common dipped candles, being the veſſel wherein the melted tallow is diſpoſed, and the wick dipped. This is of wood, of a triangular form, and ſupported on one of its angles: ſo that it has an opening of near a foot a-top: the other, uſed in the fabric of mould candles, is of braſs, pewter, or tin.—Here each candle has its ſeveral mould. See CANDLE.

MOULD, among gold-beaters, a certain number of leaves of vellum or pieces of gut, cut ſquare of a certain ſize, and laid over one another, between which they put the leaves of gold and ſilver which they beat on the marble with the hammer. See GOLD LEAF.

They have four kinds of moulds; two whereof are of vellum and two of gut; the ſmalleſt of thoſe of vellum conſiſts of 40 or 50 leaves; the largeſt contains 100: for the others, each contains 500 leaves. The moulds have all their ſeveral caſes, conſiſting of two pieces of parchment, ſerving to keep the leaves of the mould in their place, and prevent their being diſordered in beating.

MOULD, in *Agriculture*, a general name for the ſoft earthy ſubſtance with which the dry land is generally covered, and in which all kinds of vegetables take root and grow. It is far from being an homogeneous ſubſtance; being compoſed of decayed animal and vegetable matters, along with calcareous, argillaceous, and ſiliceous earths, mixed together in various proportions, and with the different degrees of moiſture, conſtituting every variety of SOIL.

MOULDINESS, is a white down or lanugo, which is produced on the ſurface of animal or vegetable matters in a ſtate of putrefaction; and which viewed through a microſcope appears like a kind of meadow, out of which ariſe herbs and flowers. See MUCOR, BOTANY *Index*.

MOULDING, any thing caſt in a mould, or that ſeems to have been ſo, though in reality it were cut with a chiſel or the axe.

MOULDINGS, in *Architecture*, projectures beyond the naked wall, column, wainſcot, &c. the aſſemblage of which forms corniches, door caſes, and other decorations of ARCHITECTURE. See that article.

MOULINET is uſed in *Mechanics*, to ſignify a roller, which being croſſed with two levers, is uſually applied to cranes, capſtans, and other ſorts of engines of the like nature to draw ropes, heave up ſtones, &c.

MOULINET is alſo a kind of turnſtile or wooden croſs, which turns horizontally upon a ſtake fixed in the ground; uſually placed in paſſages to keep out horſes, and to oblige paſſengers to go and come one by one. Theſe moulinets are often ſet near the outworks of fortified places at the ſides of the barriers, through which people paſs on foot.

MOULINS, a town of France, in the department of Allier, and containing about 16,000 inhabitants. The houſes of the Chartreux, and that of the Viſitation, are magnificent. It has a conſiderable trade in cutlery ware, and is ſeated on the river Allier, in a pleaſant fertile plain, almoſt in the middle of France, 30 miles ſouth of Nevers, and 55 north of Clermont. E. Long. 3. 25. N. Lat. 46. 34.

MOULTON, North, a town of Devonſhire, on the river Moul.

MOULTON, South, on the ſame ſtream, 182 miles from London. This, as well as the former, was anciently royal demeſne. It ſent members to parliament in the reign of Edward I. conſiſts of a mayor, 18 capital burgeſſes, a recorder, town clerk, and 2 ſerjeants at mace. Its chief manufactures are ſerges, ſhalloons, and felts; and a conſiderable market for wool.

MOULTING, or MOLTING, the falling off or change of hair, feathers, ſkins, horns, or other parts of animals, happening in ſome annually, in others only at certain ſtages of life.

The generality of animals moult in the ſpring. The moulting of a hawk is called *mewing*. The moulting of a deer is the quitting of his horns in February or March. The moulting of a ſerpent is the putting off his ſkin. See EXUVIÆ.

MOUND, a term uſed for a bank or rampart, or other fence, particularly that of earth.

MOUND, in *Heraldry*, a ball or globe with a croſs upon it, ſuch as our kings are uſually drawn with, holding it in their left hand, as they do the ſceptre in the right.

MOUNT, an elevation of earth, called alſo *mountain*. See MOUNTAIN.

MOUNT Edgecumbe, a prodigious high peak, at the entrance of Cook's ſtrait, in New Zealand, on the weſt ſide. Its height is ſuppoſed not to be much inferior to that of the Peak of Teneriffe.

MOUNT Sorrel, a town in Leiceſterſhire, ſo named from a high mount or ſolid rock adjoining to the town, of a duſky red or ſorrel-coloured ſtone, extremely hard. Of rough ſtones hewn out of this rock the town is built. It has a market on Mondays. It was noted formerly for its caſtle, and is ſeated on the river Stour, over which there is a bridge. It is 20 miles ſouth-eaſt by ſouth of Derby, and 105 north-weſt by north of London. W. Long. 1. 9. N. Lat. 52. 45.

MOUNTS of Piety, certain funds or eſtabliſhments in Italy, where money is lent out on ſome ſmall ſecurity. There were alſo mounts of piety in England, raiſed by contribution for the benefit of people ruined by the extortions of the Jews.

MOUNTAIN (*Mons*), a conſiderable eminence of land, elevated above the ſurrounding country: It is commonly full of inequalities, cavities more or leſs expoſed, and ſtrata uncovered. For the natural hiſtory of mountains, ſee MOUNTAIN, GEOLOGY *Index*.

Attraction of MOUNTAINS. This is a late diſcovery, and a very conſiderable confirmation of Sir Iſaac Newton's theory of univerſal gravity. According to the Newtonian ſyſtem, an attractive power is not only exerted between thoſe large maſſes of matter which conſtitute the ſun and planets, but likewiſe between all comparatively ſmaller bodies, and even between the ſmalleſt particles of which they are compoſed. Agreeably to this hypotheſis, a heavy body, which ought to gravitate or tend toward the centre of the earth, in a direction perpendicular to its ſurface, ſuppoſing the ſaid ſurface to be perfectly even and ſpherical, ought likewiſe, though in a leſs degree, to be attracted and tend towards a mountain placed on the earth's ſurface; ſo that a plumb line, for inſtance, of a quadrant, hanging in the neighbourhood of ſuch a mountain, ought to be drawn from a perpendicular ſituation, in conſequence of the attractive power of the quantity of matter of which it is compoſed acting in a direction different from that exerted by the whole maſs of matter in the earth, and with a proportionably inferior degree of force.

Though Sir Iſaac Newton had long ago hinted at an experiment of this kind, and had remarked, that "a mountain of an hemiſpherical figure, three miles high and ſix broad, would not, by its attraction, draw the plumb line two minutes out of the perpendicular (E):" yet no attempt to aſcertain this matter by actual experiment was made till about the year 1738; when the French academicians, particularly Meſſrs Bouguer and Condamine, who were ſent to Peru to meaſure a degree under the equator, attempted to diſcover the attractive power of Chimboraco, a mountain in the province of Quito. According to their obſervations, which were however made under circumſtances by no means favourable to an accurate ſolution of ſo nice and difficult a problem, the mountain Chimboraco exerted an attraction equal to eight ſeconds. Though this experiment was not perhaps ſufficient to prove ſatisfactorily even the reality of an attraction, much leſs the preciſe quantity of it; yet it does not appear that any ſteps had been ſince taken to repeat it.

Through the munificence of his Britannic majeſty, the Royal Society were enabled to undertake the execution of this delicate and important experiment; the aſtronomer royal was choſen to conduct it. After various inquiries, the mountain Schehallien, ſituated nearly in the centre of Scotland, was pitched upon as the moſt proper for the purpoſe that could be found in this iſland. The obſervations were made by taking the meridian zenith diſtances of different fixed ſtars, near the zenith, by means of a zenith ſector of ten feet radius; firſt on the ſouth, and afterwards on the north ſide of the hill, the greateſt length of which extended in an eaſt and weſt direction.

It is evident, that if the maſs of matter in the hill exerted any ſenſible attraction, it would cauſe the plumb-line of the ſector, through which an obſerver viewed a ſtar in the meridian, to deviate from its perpendicular ſituation, and would attract it contrariwiſe at the

---

(E) By a very eaſy calculation it is found that ſuch a mountain would attract the plumb line 1′ 18″ from the perpendicular.

the two ſtations, thereby doubling the effect. On the ſouth ſide the plummet would be drawn to the northward by the attractive power of the hill placed to the northward of it: and on the north ſide, a contrary and equal deflection of the plumb line would take place in conſequence of the attraction of the hill now to the ſouthward of it. The apparent zenith diſtances of the ſtars would be affected contrariwiſe; thoſe being increaſed at the one ſtation which were diminiſhed at the other: and the correſpondent quantities of the deflection of the plumb line would give the obſerver the ſum of the contrary attractions of the hill, acting on the plummet at the two ſtations; the half of which will of courſe indicate the attractive power of the hill.

The various operations requiſite for this experiment laſted about four months; and from them it appears that the ſum of the two contrary attractions of the mountain Schehallien, in the two temporary obſervations which were ſucceſſively fixed half way up the hill (where the effect of its attraction would be greateſt), was equal to 11″.6.—From a rough computation, founded on the known law of gravitation, and on an aſſumption that the denſity of the hill is equal to the mean denſity of the earth, it appears that the attraction of the hill ſhould amount to about the double of this quantity. From thence it was inferred that the denſity of the hill is only about half the mean denſity of the earth. It does not appear, however, that the mountain Schehallien has ever been a volcano, or is hollow; as it is extremely ſolid and denſe, and ſeemingly compoſed of an entire rock.

The inferences drawn from theſe experiments may be reduced to the following:

"1. It appears, that the mountain Schehallien exerts a ſenſible attraction; therefore, from the rules of philoſophizing, we are to conclude, that every mountain, and indeed every particle of the earth, is endued with the ſame property, in proportion to its quantity of matter.

"2. The law of the variation of this force, in the inverſe ratio of the ſquares of the diſtances, as laid down by Sir Iſaac Newton, is alſo confirmed by this experiment. For if the force of attraction of the hill had been only to that of the earth, as the matter in the hill to that of the earth, and had not been greatly increaſed by the near approach to its centre, the attraction thereof muſt have been wholly inſenſible. But now, by only ſuppoſing the mean denſity of the earth to be double to that of the hill, which ſeems very probable from other conſiderations, the attraction of the hill will be reconciled to the general law of the variation of attraction in the inverſe duplicate ratio of the diſtances, as deduced by Sir Iſaac Newton from the compariſon of the motion of the heavenly bodies with the force of gravity at the ſurface of the earth; and the analogy of nature will be preſerved.

"3. We may now, therefore, be allowed to admit this law, and to acknowledge, that the mean denſity of the earth is at leaſt double of that at the ſurface; and conſequently that the denſity of the internal parts of the earth is much greater than near the ſurface. Hence alſo, the whole quantity of matter in the earth will be at leaſt as great again, as if it had been all compoſed of matter of the ſame denſity with that at the ſurface; or will be about four or five times as great as if it were all compoſed of water.—This concluſion, Mr Maſkelyne adds, is totally contrary to the hypotheſis of ſome naturaliſts, 'who ſuppoſe the earth to be only a great hollow ſhell of matter; ſupporting itſelf from the property of an arch, with an immenſe vacuity in the midſt of it.' But were that the caſe, the attraction of mountains, and even ſmaller inequalities in the earth's ſurface would be very great, contrary to experiment, and would affect the meaſures of the degrees of the meridian much more than we find they do; and the variation of gravity, in different latitudes, in going from the equator to the poles, as found by pendulums, would not be near ſo regular as it has been found by experiment to be.

"4. As mountains are by theſe experiments found capable of producing ſenſible deflections of the plumb lines of aſtronomical inſtruments; it becomes a matter of great importance, in the menſuration of degrees in the meridian, either to chooſe places where the irregular attraction of the elevated parts may be ſmall; or where, by their ſituation, they may compenſate or counteract the effects of each other."

For meaſuring the heights of mountains, ſee BAROMETER.

Burning MOUNTAINS. See ÆTNA, HECLA, VESUVIUS; ſee alſo VOLCANO, GEOLOGY *Index*.

Marble MOUNTAINS. Of theſe there are great numbers in Egypt, from which, though immenſe quantities have been carried off for the multitude of great works erected by the ancient Egyptians; yet in the opinion of Mr Bruce, who paſſed by them in his journey to Abyſſinia, there is ſtill a ſufficient ſupply to build Rome, Athens, Corinth, Syracuſe, Memphis, Alexandria, and half a dozen more of ſuch cities.

The firſt mountain of this kind mentioned by Mr Bruce is one oppoſite to Terfowey, conſiſting partly of green marble, partly of granite, with a red bluſh upon a gray ground, and ſquare oblong ſpots. Here he ſaw a monſtrous obeliſk of marble very nearly ſquare, broken at the end, and nearly 30 feet long and 19 feet in the face. Throughout the plain there were ſcattered ſmall pieces of jaſper, with green, white, and red ſpots called in Italy *diaſpro ſanguineo*; and all the mountains upon that ſide ſeemed to conſiſt of the ſame materials. From Mr Bruce's deſcription of theſe mountains, it would appear that they are compoſed of ſerpentine, and not of calcareous marble.

Written MOUNTAIN, *Mountain of Inſcriptions*, or *Jibel-al-Mokatteb*, a ſuppoſed mountain or chain of mountains, in the wilderneſs of Sinai; on which, for a great extent of ſpace, the marble of which the mountain conſiſts is inſcribed with innumerable characters, reaching from the ground ſometimes to the height of 12 or 14 feet. Theſe were mentioned by a Greek author in the third century, and ſome of them have been copied by Pococke and other late travellers; but, after all, there is ſtill a very great uncertainty even of the *exiſtence* of ſuch mountain or mountains. The vaſt number of theſe inſcriptions, the deſert place in which they are found, and the length of time requiſite for executing the taſk, have induced a notion by no means unnatural, that they are the work of the Iſraelites during their forty years wandering in the wilderneſs. Others are of opinion that they contain nothing of any importance,

importance, but conſiſt merely of the names of travellers and the dates of their journeys.

M. Niebuhr, who viſited this country during his travels in the eaſt, made every attempt in his power, though without ſucceſs, to obtain a ſight of this celebrated mountain. On applying to ſome Greeks at Suez, they all declared that they knew nothing of the written mountain: they, however, directed him to an Arabian ſheik, who had paſſed all his lifetime in travelling between Suez and Mount Sinai; but he knew no more of it than the former. Underſtanding, however, that a conſiderable reward would be given to any perſon who would conduct them thither, this Arab directed them to another; who pretended not only to know that mountain, but all others upon which there were any inſcriptions throughout the deſert. On inquiring particularly, however, our travellers found that he was not to be depended upon; ſo that they were obliged to have recourſe to a fourth ſheik, who by his converſation convinced them that he had ſeen mountains with inſcriptions in unknown characters upon them. It does not appear, however, that this perſon was very capable, more than the reſt, of leading them to the place they ſo much wiſhed for; though he conducted them to ſome rocks upon which there were inſcriptions in unknown characters. They are moſt numerous in a narrow paſs between two mountains named *Om-er-ridſtein;* and, ſays M. Niebuhr, "the pretended Jibel-el-Mokatteb may poſſibly be in its neighbourhood." Some of theſe inſcriptions were copied by our author; but he does not look upon them to be of any conſequence. "They ſeem (ſays he) to have been executed at idle hours by travellers, who were ſatisfied with cutting the unpoliſhed rock with any pointed inſtrument, adding to their names and the date of their journeys ſome rude figures, which beſpeak the hand of a people but little ſkilled in the arts. When ſuch inſcriptions are executed with the deſign of tranſmitting to poſterity the memory of ſuch events as might afford inſtructive leſſons, greater care is generally taken in the preparation of the ſtones, and the inſcriptions are engraven with more regularity."

When N. Niebuhr arrived at laſt at the mountain to which the ſheik had promiſed to conduct him, he did not find any inſcriptions; but on climbing up to the top, he found out an Egyptian cemetery, the ſtones of which were covered with hieroglyphics. The tomb ſtones are from five to ſeven feet in length, ſome ſtanding on end and others lying flat; and "the more carefully they are examined (ſays he), the more certainly do they appear to be ſepulchral ſtones, having epitaphs inſcribed on them. In the middle of theſe ſtones is a building, of which only the walls now remain; and within it are likewiſe a great many of the ſepulchral ſtones. At one end of the building ſeems to have been a ſmall chamber, of which the roof ſtill remains. It is ſupported upon ſquare pillars; and theſe, as well as the walls of the chamber, are covered with hieroglyphic inſcriptions. Through the whole building are various buſts executed in the manner of the ancient Egyptians. The ſepulchral ſtones and the buſts are of hard and fine grained ſand ſtone." M. Niebuhr is of opinion that this cemetery was not the work of the Egyptians themſelves, but of ſome colony which came from Egypt, and had adopted the manners and cuſtoms of the people. He ſuppoſes that it might have been built by the Arabs, who had conquered Egypt under the ſhepherd kings, and adopted the Egyptian manners during their reſidence there. As it muſt have belonged to an opulent city, however, he owns that there is a great difficulty in accounting for the exiſtence of ſuch a city in the midſt of a deſert.

The tranſlator of Volney's travels aſcribes theſe inſcriptions to the pilgrims who viſit Mount Sinai. But to this, as well as to every other conjecture, there is this objection, that whether the inſcriptions be well executed or not, whether they contain matters of importance or not, they ought to have been written in a language which *ſomebody* could underſtand; but from the copies that have been taken of them by Dr Pococke and others, it does not appear that they could be explained either by him or any other perſon.

When Dr Clayton, biſhop of Clogher, viſited this part of the world about the year 1723, he expreſſed the greateſt deſire to have the matter concerning this written mountain or mountains aſcertained, and even made an offer of 500l. ſterling to any literary perſon who would undertake the journey and endeavour to decypher the inſcriptions; but no ſuch perſon has appeared, and the exiſtence of the mountains is teſtified only by the ſuperior of a convent at Cairo, who gave that mentioned in the beginning of this article. Until that part of the world, therefore, become more acceſſible to travellers, there is but little hope that we can come to any certainty in the matter. M. Niebuhr plainly, from his own accounts, had not influence enough with the Arabs to ſhow him almoſt any thing, as they refuſed to conduct him even to the ſummit of Mount Sinai.

White MOUNTAINS. See *New HAMPSHIRE.*

MOUNTAINS of the Moon, a chain of mountains in Africa, extending between Abyſſinia and Monomotapa, and ſo called from their great height.

MOUNTAINS of the Lions, alſo in Africa, divide Nigritia from Guinea, and extend as far as Ethiopia. They were ſtyled by the ancients *the mountains of God*, on account of their being greatly ſubject to thunder and lightning.

MOUNTAIN of Forty Days; a mountain of Judea, ſituated in the plain of Jericho to the north of that city. According to the abbé Mariti's deſcription, the ſummit of it is covered neither with ſhrubs, turf, nor earth; it conſiſts of a ſolid maſs of white marble, the ſurface of which is become yellow by the injuries of the air. "The path by which you aſcend to it (ſays our author) fills one with terror, as it riſes with a winding courſe between two abyſſes, which the eye dares ſcarcely behold. This path is at firſt pretty broad, but it at length becomes ſo confined, that one can with difficulty place both feet upon it at the ſame time. When we had aſcended a little higher, we found an Arab ſtretched out on the path, who made us pay a certain toll for our paſſage. Here the traveller requires courage. One of the parapets of the path being broke, we clung to the part which remained until we had reached a ſmall grotto, ſituated very commodiouſly, as it gave us an opportunity of recovering our breath. When we had reſted ourſelves a little, we purſued our courſe, which became ſtill more dangerous. Suſpended almoſt from the rock, and having before our eyes all the horror of the

the precipice, we could advance only by dragging one foot after the other; ſo that had the ſmalleſt fragments given way under us, we ſhould have been hurried to the bottom of this frightful abyſs.

"This mountain is one of the higheſt in the province, and one of its moſt ſacred places. It takes its name from the rigorous faſt which Chriſt obſerved here after having triumphed over the vanities of the world and the power of hell. In remembrance of this miracle, a chapel was formerly conſtructed on the ſummit of the mountain. It may be ſeen from the plain, but we could not approach it, as the path was almoſt entirely deſtroyed. It, however, may be acceſſible on the other ſide of the mountain, which we did not viſit. A great many ſcattered grottos are ſeen here; in one of which, according to Quareſmius, were depoſited the bodies of ſeveral anchorets, which are ſtill entire. I have heard the ſame thing aſſerted in the country, but I could never meet with any perſon who had ſeen them. Here we enjoyed the moſt beautiful proſpect imaginable. This part of the mountain of Forty Days overlooks the mountains of Arabia, the country of Gilead, the country of the Ammonites, the plains of Moab, the plain of Jericho, the river Jordan, and the whole extent of the Dead ſea. It was here that the devil ſaid to the Son of God, 'All theſe kingdoms will I give thee, if thou wilt fall down and worſhip me."

MOURNING, a particular dreſs or habit worn to ſignify grief on ſome melancholy occaſion, particularly the death of friends or of great public characters.—The modes of mourning are various in various countries; as alſo are the colours that obtain for that end. In Europe, the ordinary colour for mourning is black; in China, it is white; in Turkey, blue or violet; in Egypt, yellow; in Ethiopia, brown. White obtained formerly in Caſtile on the death of their princes. Herrera obſerves, that the laſt time it was uſed was in 1498, at the death of Prince John. Each people pretend to have their reaſons for the particular colour of their mourning: white is ſuppoſed to denote purity; yellow, that death is the end of human hopes, in regard that leaves when they fall, and flowers when they fade, become yellow: brown denotes the earth, whither the dead return; black, the privation of life, as being the privation of light: blue expreſſes the happineſs which it is hoped the deceaſed does enjoy; and purple or violet, ſorrow on the one ſide, and hope on the other, as being a mixture of black and blue.

Mourning, among the ancients, was expreſſed various ways.

Amongſt the Jews, on the death of their relations or intimate friends, grief or mourning was ſignified by weeping, tearing their clothes, ſmiting their breaſts, or tearing them with their nails, pulling or cutting off their hair and beards, walking ſoftly, i. e. barefoot, lying upon the ground, faſting, or eating upon the ground. They kept themſelves cloſe ſhut up in their houſes, covered their faces, and abſtained from all work, even reading the law, and ſaying their uſual prayers. They neither dreſſed themſelves, nor made their beds, nor ſhaved themſelves, nor cut their nails, nor went into the bath, nor ſaluted any body: ſo that ſulkineſs ſeems to have been an indication of ſorrow, and dirtineſs of diſtreſs. The time of mourning among the Jews was generally ſeven days; though this was lengthened or ſhortened according to circumſtances; but 30 days were thought ſufficient upon the ſevereſt occaſions. The different periods of the time of mourning required different degrees of grief, and different tokens of it.

The Greeks, on the death of friends, ſhowed their ſorrow by ſecluding themſelves from all gaiety, entertainments, games, public ſolemnities, the enjoyment of wine, and the delights of muſic. They ſat in gloomy and ſolitary places, ſtripped themſelves of all external ornaments, put on a coarſe black ſtuff by way of mourning, tore their hair, ſhaved their heads, rolled themſelves in the duſt and mire, ſprinkled aſhes on their heads, ſmote their breaſts with their palms, tore their faces, and frequently cried out with a lamentable voice and drawling tone, reiterating the interjection ε, ε, ε, ε; hence funeral lamentations were called Ελεγοι. If they appeared in public during the time of mourning, they had a veil thrown over their faces and heads. During the funeral proceſſion, certain perſons called εξαρχοι θρηνων, marched before, and ſung melancholy ſtrains called ογοΦυρμοι Ιαλεμοι, Αινοι, and Αιλενοι. Theſe vocal mourners ſung thrice during the proceſſion round the pile and round the grave. Flutes were alſo uſed to heighten the ſolemnity. At the funerals of ſoldiers, their fellow ſoldiers who attended, as a teſtimony of their affliction, held their ſhields, their ſpears, and the reſt of their armour, inverted.

The tokens of private grief among the Romans were the ſame as thoſe already obſerved as cuſtomary among the Greeks. Black or dark brown were the colours of the mourning habits worn by the men; they were alſo common to the women. The mourning of the emperors at firſt was black. In the time of Auguſtus, the women wore white veils, and the reſt of their dreſs black. From the time of Domitian they wore nothing but white habits, without any ornaments of gold, jewels, or pearls. The men let their hair and beards grow, and wore no wreaths of flowers on their heads while the days of mourning continued. The longeſt time of mourning was ten months: this was Numa's eſtabliſhment, and took in his whole year. For a widow to marry during this time was infamous. Mourning was not uſed for children who died under three years of age. From this age to ten they mourned as many months as the child was years old. A remarkable victory, or other happy event, occaſioned the ſhortening of the time of mourning: The birth of a child, or the attainment of any remarkable honour in the family, certain feaſts in honour of the gods, or the conſecration of a temple, had the ſame effect. After the battle of Cannæ, the commonwealth decreed that mourning ſhould not be worn for more than 30 days, that the loſs might be forgotten as ſoon as poſſible. When public magiſtrates died, or perſons of great note, alſo when any remarkable calamity happened, all public meetings were intermitted, the ſchools of exerciſe, baths, ſhops, temples, and all places of concourſe were ſhut up, and the whole city put on a face of ſorrow; the ſenators laid aſide the *laticlave*, and the conſuls ſat in a lower ſeat than ordinary. This was the cuſtom of Athens alſo, and was obſerved upon the death of Socrates not long after he had been ſentenced to death by their judges.

Præficæ, or mourning women, (by the Greeks called θρηνων εξαρχοι), went about the ſtreets: this was cuſtomary

mary among the Jews as well as the Greeks and Romans, (Jerem. ix. 17.)

MOUSE. See Mus, Mammalia *Index*.

Mouse-Ear. See Hieracium, } Botany *Index*.
Mouse-Tail. See Myosurus, }
Dor-Mouse. See Myoxus, } Mammalia *Index*.
Shrew-Mouse. See Sorex, }

MOUSELLE, the name of an Eaſt Indian tree, with white tubular flowers, which fall off every day in great plenty. They are of a ſweet agreeable ſmell, and the Gentoos are very fond of wearing them, ſtringing and hanging them about their necks and arms. The fruit is a pale red cherry, of the ſhape and ſize of our white heart cherry, but the fooſtalk is not quite ſo long. This fruit has a ſtone in it, containing a bitter oily kernel. The Indians rub with this oil any part ſtung by a ſcorpion or bitten by a centipede, which it ſoon cures. The crows are very fond of the fruit.

MOUSUL, or Mosul, a large city of Turkey in Aſia, and capital of a beglerbegate, ſtands on the weſt bank of the Tigris, in the latitude, according to Mr Ives's obſervation, of 36° 30′ north. It is ſurrounded with ſtone walls, but has many of its ſtreets lying waſte. Tavernier ſpeaks of it as a ruined place, with only two blind markets and a ſorry caſtle; yet, he ſays, that it is much frequented by merchants, and that its baſha commands 3000 men. There is a bridge of boats over the Tigris; and the city is a thoroughfare from Perſia to Syria, which makes it a place of trade, and which is more augmented by a conſtant traffic from this place to Bagdad. The country on this ſide the river is ſandy and barren; but on the oppoſite ſide it is exceedingly fruitful, yielding good crops of corn and fruit in abundance. Mr Ives ſays it was the beſt built city he had ſeen in Turkey; but had nothing in it to attract the notice of an European. It was beſieged for near ſix months by Nadir Shah without ſucceſs. Breaches were frequently made in the walls, and aſſaults continued for three days ſucceſſively; but the aſſailants were conſtantly repulſed, and the breaches made in the day time repaired during the night. The beſieged had unanimouſly reſolved to die rather than to ſubmit. The Turks declared, that ſhould the place be forced to ſurrender, they were determined to put to death all their wives and daughters firſt, that they might not fall into the vile hands of the abhorred Perſians. The place was therefore defended with uncommon bravery; even the women and children exerted themſelves with the greateſt alacrity. The Chriſtians behaved in ſuch a manner as to gain the eſteem and admiration of the other inhabitants; and ſome of their churches being demoliſhed, they were afterwards repaired at the expence of government.

In this city there are a great many moſques, the largeſt and moſt ſtately of which is ornamented on the top with green tiles. At the doors of theſe houſes there are uſually inſcriptions in gilt letters, declaring the awfulneſs of the building, as being the houſe of God. One of them has a minaret which bends like thoſe of Bagdad. Some of the moſt bigotted Turks ſay, that Mahomet ſaluted this minaret as he paſſed; on which it bent its head in reverence to the prophet, and ever after continued in that ſituation. The manufacture of this city is *muſſolen* (muſlin), which is made very ſtrong and pretty fine. In the year 1757, this city and the country adjacent were viſited by a dreadful famine, owing to the preceding hard winter, and innumerable multitudes of locuſts, by which the fruits of the earth were deſtroyed. When Mr Ives was there in 1758, the country was comparatively depopulated. Almoſt all the brute creation had been deſtroyed for the ſubſiſtence of man. During the famine, the people had eaten dogs, and every kind of animal which is held in abhorrence at any other time, not ſparing even their own children; and the dead bodies lay in the ſtreets for want of people to bury them. Their fruit trees were alſo deſtroyed by the froſt; ſo that when our author was there ſcarcely any fruit could be had. The neighbouring mountains afford ſilver mines; and they would yield much quickſilver if the Turks had either the ſkill or inclination to work them to advantage. Lanza ſays, that ſome time ago an Engliſhman who travelled through this country got two or three bottles of it, which he preſented to the baſha as a ſpecimen of what might be done in that way: but no farther attempt was made. Here alſo are ſome lead mines, which ſupply as much of that metal as furniſhes them with bullets and ſome neceſſary utenſils.

MOU-TAN or Peony Shrub of China: alſo called *hoa-ouang*, or "the king of flowers," and *peleang-kin*, "an hundred ounces of gold," in alluſion to the exceſſive price given formerly by ſome of the virtuoſi for certain ſpecies of this plant. The mou-tan ſeems to claim pre-eminence, not only on account of the ſplendour and number of its flowers, and of the ſweet odour which they diffuſe around, but alſo on account of the multitude of leaves which compoſe them, and of the beautiful golden ſpots with which they are interſperſed. This plant, which is of a ſhrubby nature, ſhoots forth a number of branches, which form a top almoſt as large as thoſe of the fineſt orange trees.

MOUTH, in *Anatomy*, a part of the face, conſiſting of the lips, the gums, the inſides of the cheeks, the palate, the ſalival glands, the os hyoides, the uvula, and the tonſils; which ſee under the article Anatomy.

Mr Derham obſerves, that the mouth in the ſeveral ſpecies of animals is nicely adapted to the uſes of ſuch a part, and well ſized and ſhaped for the formation of ſpeech, the gathering and receiving of food, the catching of prey, &c. In ſome creatures it is wide and large, in others little and narrow: in ſome it is formed with a deep inciſure into the head, for the better catching and holding of prey, and more eaſy comminution of hard, large, and troubleſome food; and in others with a ſhorter inciſure, for the gathering and holding of herbaceous food. In birds it is neatly ſhaped for piercing the air; hard and horny, to ſupply the want of teeth; hooked, in the rapacious kind, to catch and hold their prey; long and ſlender in thoſe that have their food to grope for in mooriſh places; and broad and long in thoſe that ſearch for it in the mud. Nor is the mouth leſs remarkable in inſects; in ſome it is forcipated, to catch, hold, and tear the prey; in others aculeated, to pierce and wound animals, and ſuck their blood; in others, ſtrongly rigid, with jaws and teeth, to gnaw and ſcrape out their food, carry burdens, perforate the earth, nay the hardeſt wood, and even ſtones themſelves, for houſes and neſts for their young.

MOWEE, one of the Sandwich iſlands, diſcovered by Captain Cook, is 162 miles in circumference. A low iſthmus divides it into two circular peninſulas, of which the eaſtern is double the ſize of the weſtern. The mountains in both riſe to a great height, and may be ſeen at the diſtance of more than 30 leagues. The northern ſhores, like thoſe of Owhyhee, afford no ſoundings, and the country preſents the ſame appearance of verdure and fertility. The number of inhabitants is computed at about 65,000. W. Long. 175. 56. N. Lat. 20. 53.

MOXA, or Mugwort of China, is a ſoft lanuginous ſubſtance, prepared in Japan from the young leaves of a ſpecies of ARTEMISIA, by beating them together when thoroughly dried, and rubbing them betwixt the hands till only the fine fibres are left. The down on the leaves of mullein, cotton, hemp, &c. anſwers the ſame purpoſe.

In the Eaſtern countries it is uſed by burning it on the ſkin: a little cone of the moxa is laid upon the part, previouſly moiſtened, and ſet on fire at the top; it burns down with a temperate glowing heat, and produces a dark coloured ſpot, the exulceration of which is promoted by applying a little garlic; the ulcer is left to diſcharge, or is ſoon healed, according to the intention in uſing the moxa.

MOYRA. See Moira.

MUCILAGE, in *Pharmacy*, is in general any viſcid or glutinous liquor.

Mucilage alſo imports the liquor which principally ſerves to moiſten the ligaments and cartilages of the articulations, and is ſupplied by the mucilaginous glands.

MUCOR, in *Botany*, a genus of the order of fungi, belonging to the cryptogamia claſs of plants. See Botany *Index*.

MUCUS, a mucilaginous liquor ſecreted by certain glands, and ſerving to lubricate many of the internal cavities of the body. In its natural ſtate it is generally limpid and colourleſs; but, from certain cauſes, aſſumes a thick conſiſtence and a whitiſh colour like pus. For the diſtinguiſhing characters between pus and mucus, ſee Chemistry, N° 2769.

MUCK, or Running a Muck, is a practice that has prevailed time immemorial in Batavia. To run a muck, in the original ſenſe of the word, is to get intoxicated with opium, and then ruſh into the ſtreet with a drawn weapon, and kill any one that comes in the way, till the party is himſelf either killed or taken priſoner. If the officer take one of theſe *amocks* or *mohawks* (as they have been called by an eaſy corruption) alive, he has a conſiderable reward; and the unhappy wretch is always broken alive on the wheel: but ſuch is the fury of their deſperation, that three out of four are neceſſarily deſtroyed in attempting to ſecure them.

MUD-iguana. See Muræna, Ichthyology *Index*.

MUFFLE, in *Chemiſtry*, a veſſel employed in ſome metallurgic operations. In figure it repreſents an oblong arch or vault, the hinder part of which is cloſed by a ſemicircular plane, and the lower part or floor of which is a rectangular plane. It is a little oven that is placed horizontally in aſſay and enamelling furnaces, ſo that its open ſide correſponds with the door of the fire-place of the furnace. Under this arched oven ſmall cupels or crucibles are placed; and the ſubſtances contained are thus expoſed to intenſe heat without contact of fuel, ſmoke, or aſhes.

MUFTI, the chief of the eccleſiaſtical order, or primate of the Muſſulman religion. The authority of the mufti is very great in the Ottoman empire; for even the ſultan himſelf, if he would preſerve any appearance of religion, cannot, without hearing his opinion, put any perſon to death, or ſo much as inflict any corporal puniſhment. In all actions, eſpecially criminal ones, his opinion is required, by giving him a writing in which the caſe is ſtated under feigned names; which he ſubſcribes with the words, *He ſhall*, or *ſhall not, be puniſhed*. Such outward honour is paid to the mufti, that the grand ſignior himſelf riſes up to him, and advances ſeven ſteps to meet him when he comes into his preſence. He alone has the honour of kiſſing the ſultan's left ſhoulder, whilſt the prime vizier kiſſes only the hem of his garment. When the grand ſignior addreſſes any writing to the mufti, he gives him the following titles: *To the Eſad, the wiſeſt of the wiſe, inſtructed in all knowledge, the moſt excellent of excellents, abſtaining from things unlawful, the ſpring of virtue and of true ſcience, heir of the prophetic doctrines, reſolver of the problems of faith, revealer of the orthodox articles, key of the treaſures of truth, the light to the doubtful allegories, ſtrengthened with the grace of the ſupreme Legiſlator of mankind, may the Moſt High God perpetuate thy virtues!* The election of the mufti is ſolely in the grand ſignior, who preſents him with a veſt of rich ſables, &c. If he is convicted of treaſon or any great crime, he is put into a mortar kept for that purpoſe in the Seven Towers at Conſtantinople, and pounded to death.

MUGGLETONIANS, a religious ſect which aroſe in England about the year 1657; ſo denominated from their leader Lodowick Muggleton, a journeyman taylor, who, with his aſſociate Reeves, ſet up for great prophets, pretending, as it is ſaid, to have an abſolute power of ſaving and damning whom they pleaſed; and giving out that they were the two laſt witneſſes of God that ſhould appear before the end of the world.

MUGIL, the Mullet, a genus of fiſhes belonging to the order of abdominales. See Ichthyology *Index*.

MUGWORT, a ſpecies of Artemisia; which ſee, Botany *Index*.

MUID, a large meaſure in uſe among the French, for things dry. The muid is no real veſſel uſed as a meaſure, but an eſtimation of ſeveral other meaſures; as the ſeptier, mine, minot, buſhel, &c.

Muid, is alſo one of the nine caſks, or regular veſſels uſed in France, to put wine and other liquors in. The muid of wine is divided into two demi-muids, four quarter-muids, and eight half-quarter muids, containing 36 ſeptiers.

MULATTO, a name given in the Indies to thoſe who are begotten by a negro man on an Indian or white woman, or by an Indian or white man on a negro woman.

MULBERRY. See Morus, Botany *Index*.

Mulberry-Cyder, a name given by the people of Devonſhire, and ſome other parts of England, to a ſort

ſort of cyder rendered very palatable by an admixture of mulberry juice in the making; they chooſe for this purpoſe the ripeſt and blackeſt mulberries, and preſſing out their juice, and mixing it with a full bodied cyder at the time of the grinding and preſſing, give juſt ſo much of it as adds a perceptible flavour. It is very worthy the attention of people who live in other countries, where ſtrong and good cyder is made, that this renders it a ſort of wine much more agreeable than any other Engliſh liquor, and might be brought into general uſe, to the great advantage of the dealer. The colour of this liquor reſembles that of the brighteſt red wine, and the flavour of the mulberry never goes off. Phil. Tranſ. N° 133.

MULCT, a fine of money laid upon a man who has committed ſome fault or miſdemeanour.

MULE, a mongrel kind of quadruped, uſually generated between an aſs and a mare, and ſometimes between a horſe and a ſhe aſs; but the ſignification of the word is commonly extended to every kind of animal produced by a mixture of two different ſpecies. See MAMMALIA *Index*.

MULES, among gardeners, denote a ſort of vegetable monſters produced by putting the farina fœcundans of one ſpecies of plant into the piſtil or utricle of another.

The carnation and ſweet-william being ſomewhat alike in their parts, particularly their flowers, the farina of the one will impregnate the other, and the ſeed ſo enlivened will produce a plant differing from either. An inſtance of this we firſt had in Mr Fairchild's garden at Hoxton; where a plant is ſeen neither ſweet-william nor carnation, but reſembling both equally: this was raiſed from the ſeed of a carnation that had been impregnated by the farina of the ſweet-william. Theſe couplings being not unlike thoſe of the mare with the aſs, which produce the mule, the ſame name is given them; and they are, like the others, incapable of multiplying their ſpecies.

This furniſhes a hint for altering the property and taſte of any fruit, by impregnating one tree with the farina of another of the ſame claſs; *e. gr.* a codlin with a pear-main, which will occaſion the codlin ſo impregnated to laſt a longer time than uſual, and to be of a ſharper taſte.

MULHAUSEN, an imperial and Hanſeatic town of Germany, in Upper Saxony, and in Thuringia, under the protection of the elector of Saxony; ſeated in a fertile country, on the river Unſtrutht, 15 miles north-eaſt of Eiſenach, and 45 eaſt by ſouth of Caſſel. E. Long. 10. 49. N. Lat. 51. 13.

MULHAUSEN, a conſiderable town of Germany, in Alſace, and capital of a republic in alliance with the Swiſs. It is populous, well built, and adorned with handſome public ſtructures; ſeated in a pleaſant fertile country, on an iſland formed by the river Ill, 15 miles north-weſt of Baſle, and 20 eaſt of Befort. E. Long. 7. 24. N. Lat. 47. 48.

MULIER, in *Law*, ſignifies the lawful iſſue born in wedlock, though begotten before. The mulier is preferred to an older brother born out of matrimony; as for inſtance, if a man has a ſon by a woman before marriage, which iſſue is a baſtard, and afterwards marries the mother of the baſtard, and they have another ſon, this ſecond ſon is mulier and lawful, and ſhall be heir of the father; but the other can be heir to no perſon *. By the civil law, where a man has iſſue by a woman, if after that he marries her, the iſſue is mulier.

MULL, one of the Weſtern iſlands of Scotland, about 25 miles long, and as much in breadth. It is in general rocky and barren, not producing a ſufficient quantity of corn for the inhabitants; but a great number of cattle are annually exported, which with the fiſhings and a conſiderable quantity of kelp are the only articles of commerce. It is deeply indented with bays and creeks, forming in ſeveral parts good natural harbours. There are no villages except Tobermorey, near the northern point of the iſland, where a fiſhing ſtation has been fixed. The iſland was originally part of the dominions of the Lords of the Iſles; but in after times it became a part of the poſſeſſions of the ancient family of Macleans, who ſtill retain a conſiderable part. The duke of Argyll is alſo a conſiderable proprietor. The ruins of ſeveral ancient caſtles are ſeen on this iſland. The population of Mull, in 1795, amounted to about 8000 perſons.

MULL of Cantyre. See CANTYRE.

MULL of Galloway. See GALLOWAY.

MULLEIN. See VERBASCUM, BOTANY *Index*.

MULLER, or REGIOMONTANUS, JOHN, a celebrated aſtronomer of the 15th century, was born at Koningſhoven in Franconia in 1436, and acquired great reputation by publiſhing an abridgement of Ptolemy's Almageſt, which had been begun by Purback. He went to Rome to perfect himſelf in the Greek tongue, and to ſee the Cardinal Baſſarion; but finding ſome faults in the Latin tranſlation of George de Trebizond, that tranſlator's ſon aſſaſſinated him in a ſecond journey he made to Rome in 1476, where Pope Sixtus IV. had provided for him the archbiſhopric of Ratiſbon, and had ſent for him to reform the calendar. Others ſay that he died of the plague.

MULLER, or *Mullar*, denotes a ſtone flat and even at bottom, but round a-top; uſed for grinding of matters on a marble.—The apothecaries uſe mullers to prepare many of their teſtaceous powders; and painters for their colours, either dry or in oil.

MULLER is an inſtrument uſed by the glaſs-grinders; being a piece of wood, to one end whereof is cemented the glaſs to be ground, whether convex in a baſon, or convave in a ſphere or bowl.—The muller is ordinarily about ſix inches long, turned round: the cement uſed is compoſed of aſhes and pitch. See GRINDING.

MULLERAS, a town of Germany, in the circle of Upper Saxony, and marquiſate of Brandenburg, ſeated 38 miles ſouth of Berlin, upon a canal which joins the Oder and the Spree. This canal is 15 miles in length, 10 yards in breadth, and ſeven feet in depth. It was eight years in making; and ſince that time the cities of Hamburg and Breſlaw have carried on great trade by water. E. Long. 14. 50. N. Lat. 52. 21.

MULLET. See MUGIL, ICHTHYOLOGY *Index*.

MULLET, or *Mollet*, in *Heraldry*, a bearing in form of the rowel of a ſpur, which it originally repreſented.

MULLINGAR, the county town of Weſtmeath, and province of Leinſter, in Ireland, 38 miles from

---

* See the article *Baſtard*.

Dublin. N. Lat. 53. 30. W. Long. 7. 50. Within a few miles of it are the ruins of the church, and alſo thoſe of a caſtle. It is ſituated on the river Feyle. It holds a great wool fair, and is a place of good trade. In 1227, the priory of St Mary, formerly known by the name of *The Houſe of God of Mullingar*, was founded here by Ralph de Petyt biſhop of Meath, for regular canons of the order of St Auguſtin. A Dominican friary was alſo founded here in 1237 by the family of Nugent; ſome ruins of which ſtill remain. In 1622, the friars of Multifarnham began to erect a houſe there for friars of the order of St Francis, but it was never completed.

MULLUS, the SURMULLET, a genus of fiſhes belonging to the order of thoracici. See ICHTHYOLOGY *Index*.

MULTIPLE, in *Arithmetic*, a number which comprehends ſome other ſeveral times; thus 6 is a multiple of 2, and 12 is a multiple of 6, 4, and 3; comprehending the firſt twice, the ſecond thrice, &c.

ACTION of MULTIPLEPOINDING, in *Scots Law*. See LAW, N° clxxxiii. 24.

MULTIPLICAND, in *Arithmetic*, the number to be multiplied by another. See ARITHMETIC.

MULTIPLICATION, in general, the act of increaſing the number of any thing.

MULTIPLICATION, in *Arithmetic*, is a rule by which any given number may be ſpeedily increaſed, according to any propoſed number of times. See ARITHMETIC.

MULTIPLICATION, in *Algebra*. See ALGEBRA.

MULTIPLICATOR, or MULTIPLIER, in *Arithmetic*, the number by which any other is multiplied, or the number of times it is ſuppoſed to be taken.

MULTIPLICATUS FLOS, a luxuriant flower, whoſe petals are multiplied ſo as to exclude a part or the whole of the ſtamina.

MULTIPLYING GLASS, in *Optics*, a glaſs wherewith objects appear increaſed in number. See OPTICS.

MULTURE in *Scots Law*, a certain ſtipulated quantity of meal given as payment to the proprietor or tackſman of a mill for grinding the corn: and all corn ground on farms thirled to the mill is obliged to pay multure whether the corn be ground at that mill or elſewhere.

MULVIA, a river of Barbary in Africa, which riſes in the mountains of Atlas, and divides the empire of Morocco from that of Algiers, and then falls into the Mediterranean, to the weſtward of Marſalquiver.

MUM, a kind of malt liquor much drunk in Germany, and chiefly brought from Brunſwick, which is the place of moſt note for making it. The proceſs of brewing mum, as recorded in the townhouſe of that city, is as follows: Take 63 gallons of water that has been boiled till one third part is conſumed, and brew it with ſeven buſhels of wheaten malt, one buſhel of oat meal, and one buſhel of ground beans. When it is tunned, the hogſhead muſt not be filled too full at firſt: as ſoon as it begins to work, put into it three pounds of the inner rind of fir, one pound of the tops of fir and beech, three handfuls of carduus benedictus, a handful or two of the flower of roſa ſolis: add burnet, betony, marjoram, avens, pennyroyal, and wild thyme, of each a handful and a half; of elder flowers, two handfuls or more; ſeeds of cardamom bruiſed, 30 ounces; barberries bruiſed, one ounce: when the liquor has worked a while, put the herbs and ſeeds into the veſſel; and, after they are added, let it work over as little as poſſible; then fill it up: laſtly, when it is ſtopped, put into the hogſhead ten new-laid eggs unbroken; ſtop it up cloſe, and uſe it at two years end. The Engliſh brewers, inſtead of the inner rind of fir, uſe cardamom, ginger, and ſaſſafras; and alſo add elecampane, madder, and red ſanders.

MUMMIUS, L. a Roman conſul ſent againſt the Achæans, whom he conquered B. C. 147. He deſtroyed Corinth, Thebes, and Chalcis, by order of the ſenate, and obtained the ſurname of *Achaicus* from his victories. He did not enrich himſelf with the ſpoils of the enemy, but returned home without any increaſe of fortune. He was ſo little acquainted with the value of the paintings and works of the moſt celebrated artiſts of Greece which were found in the plunder of Corinth, that he ſaid to thoſe who conveyed them to Rome, that if they loſt or injured them, they ſhould makes others in their ſtead.

MUMMY, a body embalmed or dried, in the manner uſed by the ancient Egyptians; or the compoſition with which it is embalmed. There are two kinds of bodies denominated *mummies*. The firſt are only carcaſes dried by the heat of the ſun, and by that means kept from putrefaction: theſe are frequently found in the ſands of Libya. Some imagine, that theſe are the bodies of deceaſed people buried there on purpoſe to keep them entire without embalming; others think they are the carcaſes of travellers who have been overwhelmed by the clouds of ſand raiſed by the hurricanes frequent in thoſe deſerts. The ſecond kind of mummies are bodies taken out of the catacombs near Cairo, in which the Egyptians depoſited their dead after embalming. See EMBALMING.

We have two different ſubſtances preſerved for medicinal uſe under the name of *mummy*, though both in ſome degree of the ſame origin. The one is the dried and preſerved fleſh of human bodies, embalmed with myrrh and ſpices; the other is the liquor running from ſuch mummies, when newly prepared, or when affected by great heat or damps. The latter is ſometimes in a liquid, ſometimes of a ſolid form, as it is preſerved in vials well ſtopped, or ſuffered to dry and harden in the air. The firſt kind of mummy is brought to us in large pieces, of a lax and friable texture, light and ſpongy, of a blackiſh brown colour, and often damp and clammy on the ſurface: it is of a ſtrong but diſagreeable ſmell. The ſecond kind of mummy, in its liquid ſtate, is a thick, opaque, and viſcous fluid, of a blackiſh colour, but not diſagreeable ſmell. In its indurated ſtate, it is a dry ſolid ſubſtance, of a fine ſhining black colour, and cloſe texture, eaſily broken, and of a good ſmell; very inflammable, and yielding a ſcent of myrrh and aromatic ingredients while burning. This, if we cannot be content without medicines from our own bodies, ought to be the mummy uſed in the ſhops; but it is very ſcarce and dear; while the other is ſo cheap, that it will always be moſt in uſe.

All theſe kinds of mummies are brought from Egypt. But we are not to imagine, that any body breaks up the real Egyptain mummies, to ſell them in pieces to the druggiſts, as they make a much better market of them in Europe whole, when they can contrive to get them. What our druggiſts are ſupplied with, is the fleſh of executed criminals, or of any other bodies the Jews can get, who fill them with the common bitumen, ſo plentiful in that part of the world; and adding a little aloes, and two or three other cheap ingredients, ſend them to be baked in an oven, till the juices are exhaled, and the embalming matter has penetrated ſo thoroughly that the fleſh will keep and bear tranſporting into Europe. Mummy has been eſteemed reſolvent and balſamic: but whatever virtues have been attributed to it, ſeem to be ſuch as depend more upon the ingredients uſed in preparing the fleſh than in the fleſh itſelf; and it would ſurely be better to give thoſe ingredients without ſo ſhocking an addition.

There are found in Poland a kind of natural mummies, or human bodies preſerved without the aſſiſtance of art. Theſe lie in conſiderable numbers in ſome of the vaſt caverns in that country. They are dried with the fleſh and ſkin ſhrunk up almoſt cloſe to the bones, and are of a blackiſh colour. In the wars which ſeveral ages ago laid waſte that country, it was common for parties of the weaker ſide to retire into theſe caves, where their enemies, if they found them out, ſuffocated them by burning ſtraw, &c. at the mouth of the cavern, and then left the bodies; which, being out of the way of injuries from common accidents, have lain there ever ſince.

Mummy, among gardeners, a kind of wax uſed in grafting and planting the roots of trees, made in the following manner: Take one pound of black pitch, and a quarter of a pound of turpentine; put them together into an earthen pot, and ſet them on fire in the open air, holding ſomething in your hand to cover and quench the mixture in time, which is to be alternately lighted and quenched till all the nitrous and volatile parts be evaporated. To this a little common wax is to be added; and the compoſition is then to be ſet by for uſe.

MUMPS. See Medicine *Index*.

MUNDA, an ancient town of Spain, in the kingdom of Granada, ſeated on the declivity of a hill, at the bottom of which runs a river. W. Long. 4. 13. N. Lat. 48. 15.

This city was anciently famous for a victory gained by Cæſar over the two ſons of Pompey, who had collected an army in Spain after the defeat of their father at Pharſalia. See (*Hiſtory of*) Rome.

The Pompeys poſted their army advantageouſly on a riſing ground, whereof one ſide was defended by the city of Munda, and the other by a ſmall river which watered the plain, and by a marſh: ſo that the enemy could not attack them but in front. Cæſar likewiſe drew up his troops with great art, and having advanced a little way from his camp, ordered them to halt, expecting the enemy would abandon their advantageous poſt, and come to meet him. But as they did not ſtir, Cæſar made as if he intended to fortify himſelf in that poſt; which induced the young general, who looked upon this as a ſign of fear, to advance into the plain, and attack the enemy before they could ſecure themſelves with any works. Pompey's army was by far the moſt numerous: for it conſiſted of 13 legions, 6000 horſe, and an incredible number of auxiliaries, among whom were all the forces of Bocchus king of Mauritania, commanded by his two ſons, both youths of great valour and bravery. Cæſar had 80 cohorts, three legions, to wit, the third, the fifth, and the tenth, and a body of 8000 horſe. As the enemy drew near, Cæſar betrayed a great deal of uneaſineſs and concern, as if he were doubtful of the ſucceſs, knowing he was to engage men no way inferior in valour and experience to his own, and commanded by officers who had on many occaſions given ſignal proofs of their bravery and conduct. Cneius, the elder of the two brothers, was generally looked upon as an able commander; and Labienus, who had revolted, eſteemed ſcarce inferior to himſelf.

However, the dictator, deſirous to put an end to the civil war, either by his own death or that of his rivals, gave the ſignal for the battle, and fell upon the enemy with his uſual vigour and reſolution. At the firſt onſet, which was dreadful, the auxiliaries on both ſides betook themſelves to flight, leaving the Romans to decide their quarrel by themſelves. Then the legionaries engaged with a fury hardly to be expreſſed; Cæſar's men being encouraged by the hopes of putting an end to all their labours by this battle; and thoſe of Pompey exerting themſelves out of neceſſity and deſpair, ſince moſt of them expected no quarter, as having been formerly pardoned. Never was victory more obſtinately diſputed. Cæſar's men, who had been always uſed to conquer, found themſelves ſo vigorouſly charged by the enemy's legionaries, that they began to give ground; and though they did not turn their backs, yet it was manifeſt that ſhame alone kept them in their poſts. All authors agree, that Cæſar had never been in ſo great danger; and he himſelf, when he came back to his camp, told his friends, that he had often fought for victory, but this was the firſt time he had ever fought for life. Thinking himſelf abandoned by fortune, which had hitherto favoured him, he had ſome thoughts of ſtabbing himſelf with his own ſword, and by a voluntary death preventing the diſgrace of a defeat: but returning ſoon to himſelf, and concluding it would be more to his reputation to fall by the enemy's hand at the head of his troops, than, in a fit of deſpair, by his own, he diſmounted from his horſe, and ſnatching a buckler from one of his legionaries, he threw himſelf like a man in deſpair into the midſt of the enemy; crying out to his men, *Are you not aſhamed to deliver your general into the hands of boys?* At theſe words, the ſoldiers of the tenth legion, animated by the example of their general, fell upon the enemy with freſh vigour, and made a dreadful havock of them. But in ſpite of their utmoſt efforts, Pompey's men ſtill kept their ground, and, though greatly fatigued, returned to the charge with equal vigour. Then the Cæſareans began to deſpair of victory; and the dictator, running through the ranks of his diſheartened legionaries, had much ado to keep them together. The battle had already laſted from the riſing to the ſetting of the ſun, without any conſiderable advantage on either ſide.

At length a mere accident decided the diſpute in favour of the dictator. Bogud, a petty king of Mauritania, had joined Cæſar ſoon after his arrival in Spain, with ſome ſquadrons of Numidian horſe; but, in the very beginning of the battle, being terrified at the ſhouting of the ſoldiers, intermingled with groans, and the claſhing of their arms, he had abandoned his poſt, and retired with the auxiliaries under his command to a riſing ground at a ſmall diſtance from the enemy's camp. There he continued the whole day an idle ſpectator of the battle that was fought in the plain. But towards the evening, partly out of ſhame and partly out of compaſſion for his friend Cæſar, he reſolved to fall upon Pompey's camp; and accordingly flew thither with all the forces he had with him. Labienus, appriſed of his deſign, haſtened after him to the defence of the camp; which Cæſar obſerving, cried to his legionaries, *Courage, fellow ſoldiers! the victory at length is ours; Labienus flies.* This artifice had the deſired effect: Cæſar's men, believing that Labienus was truly fled, made a laſt effort, and charged the wing he commanded ſo briſkly, that after a moſt obſtinate diſpute they put them to flight.

Though the enemy's left wing was thus entirely defeated, the right wing, where the elder Pompey commanded, ſtill kept their ground for ſome time. Pompey diſmounting from his horſe, fought on foot like a private man in the firſt line, till moſt of his legionaries being killed, he was forced to ſave himſelf by flight from falling into the enemy's hands. Part of his troops fled back to their camp, and part took ſhelter in the city of Munda. The camp was immediately attacked, and taken ſword in hand; and as for the city, Cæſar, without loſs of time, drew a line of circumvallation round it. This victory was gained on the 16th of the kalends of April, i. e. according to our way of counting, on the 17th day of March, when the Dionyſian feſtival, or the Liberalia, were celebrated at Rome; the very day, as Plutarch obſerves, in which Pompey the Great, four years before, had ſet out for the war. In this action Pompey loſt 30,000 men; among whom were the famous Labienus, Attius Varus, and 3000 Roman knights. Seventeen officers of diſtinction were taken, and all the enemy's eagles and enſigns, together with Pompey's faſces, which he had aſſumed as governor of Spain. On Cæſar's ſide, only 1000 men were killed and 500 wounded.

MUNDIC, or Marcasite, an old name for pyrites of copper or iron. See *Ores of Copper and Iron*, Mineralogy *Index*.

MUNDINGOES, the name of a people who live on the ſides of the river Gambia in Africa, and who are of a jet black colour, ſtrong, and well made. They have a prieſt ſent over every year from one of the Cape de Verd iſlands to chriſten and marry.

MUNDUS patens, the open world, in Roman antiquity, a ſolemnity performed in a ſmall temple, of a round form like the world, dedicated to *Dis* and the reſt of the infernal gods. This temple was opened but three times in the year, viz. the 24th of Auguſt, the 4th of October, and the 7th of November. During theſe days, the Romans believed hell was open; on theſe days therefore they never offered battle, liſted ſoldiers, put to ſea, or married.

MUNICH, a town of Germany, capital of the whole duchy of Bavaria, and the reſidence of the elector. It ſtands on the Iſer, 70 miles ſouth of Ratiſbon and 214 weſt of Vienna, being one of the moſt pleaſant and populous cities of Germany for its bigneſs. The number of the inhabitants is ſaid to be about 40,000. Having been built at firſt on a ſpot of ground belonging to a convent, it had from thence in German the name of *Munchen*, i. e. *Monk's town*, and a monk for its arms. The elector's palace here is a very grand ſtructure, conſiſting of ſeveral courts, furniſhed and adorned in the moſt magnificent manner, with tapeſtry, gilding, ſculpture, ſtatues, and paintings. It contains an amazing collection of jewels, antiquities, and curioſities. The great hall is 118 feet long and 52 broad; and the ſtaircaſe leading to it, from top to bottom of marble and gold. In the hall of antiquities are 354 buſts and ſtatues of jaſper and porphyry, braſs and marble. In this palace is a library, containing a vaſt collection of books, and many valuable manuſcripts, in moſt languages, ancient and modern; and a chamber of rarities, among which is the picture of a bravo or aſſaſſin, who is ſaid to have committed 345 murders with his own hand, and to have been accomplice in, or privy to, 400 more. The treaſury in the chapel contains alſo a vaſt number of pictures, precious ſtones, medals, veſſels of gold and ſilver, &c. Among other curioſities, here is a cherry ſtone with 140 heads diſtinctly engraved upon it. The gardens of the palace are alſo very fine, and it is ſaid a ſecret paſſage leads from it to all the churches and convents in the town. There is a great number of other fine buildings in this city, public and private, particularly the riding houſe, town houſe, opera room, the Jeſuits college, the large edifice for tournaments, the churches, convents, fountains, &c. Its manufactures are thoſe of ſilk, particularly velvet, woollen cloths, and tapeſtry; and it has two annual fairs, at which great quantities of ſalt, wine, &c. are ſold. The ſtreets are broad and regular; and moſt of the houſes well built, and painted on the outſide. The market place is extremely beautiful. Not far from Munich are four other palaces, with fine gardens, belonging to the elector, viz. thoſe of Sleiſheim, Nymphenburg, Dauchau, and Starenberg. The firſt and laſt are about three leagues from the capital; the ſecond about half a league; and the third about two, at a market town of the ſame name. It was unſucceſsfully attacked by the French in 1796.

Munich, *Count de*, was the favourite of the czarina Ann, and was concerned in all the events of her reign. Being appointed general of her armies, he gained great advantages over the Crim Tartars, beat the Turks, A. D. 1739, in an engagement near Choczim, and took that city together with Jaſſi the capital of Moldavia. He was afterwards prime miniſter to the czar Iwan VI. but in a ſhort time after he was accuſed of employing the power which his office conferred on him to gratify his own ambition and private reſentment. The empreſs Elizabeth brought him to trial, and he was condemned to loſe his life, A. D. 1742. This ſentence was mitigated to baniſhment into Siberia, whither many of the victims of his power had been exiled. He was recalled by Peter III. A. D. 1762, and declared field marſhal. Upon the death of this prince, the empreſs Catharine II. appointed him director general of the ports of the Baltic. He died on the 8th of October 1767, at the age of 84.

MUNICIPAL, in the Roman civil law, an epithet which ſignifies inveſted with the rights and privileges of Roman citizens. See Municipium.

MUNICIPAL, among us, is applied to the laws that obtain in any particular city or province. And thoſe are called *municipal officers* who are elected to defend the intereſts of cities, to maintain their rights and privileges, and to preſerve order and harmony among the citizens; ſuch as mayors, ſheriffs, conſuls, &c.

MUNICIPES, an appellation given by the Romans to the inhabitants of the *municipia* or municipal cities. See MUNICIPIUM.

MUNICIPIUM, in Roman antiquity, a corporation borough, or enfranchiſed city or town, where the inhabitants enjoyed their own laws and cuſtoms, and at the ſame time were honoured with the privileges of Roman citizens; but then this privilege generally reached no further than the bare title. Some indeed, by particular merit, obtained the liberty of votes, which occaſioned that diſtinction of *muncipium ſine ſuffragio*, and *municipium cum ſuffragio*.—The inhabitants of the *municipium ſine ſuffragio* were called barely *Romani*, but thoſe of the *municipium cum ſuffragio* were called *cives Romani*.

The difference between proper citizens of Rome and the inhabitants of the municipium may be thus expreſſed. The proper citizens of Rome were, 1. Regiſtered in the cenſus; 2. Had the right of ſuffrage and of bearing honours; 3. Were aſſeſſed in the poll-tax; 4. Served in the legions; 5. Uſed the Roman laws and religion; 6. Were called *Quirites* and *populus Romanus*: Whereas the municipes enjoyed the three firſt of theſe privileges, but were denied the three laſt.

MUNITION, the proviſions with which a place is furniſhed in order for defence; or that which follows a camp for its ſubſiſtence.

MUNITION Ships, are thoſe that have ſtores on board in order to ſupply a fleet of men of war at ſea. In an engagement, all the munition ſhips and victuallers attending the fleet take their ſtation in the rear of all the reſt; they are not to engage in the fight, but to attend to ſuch directions as are ſent to them by the admiral.

MUNSTER, in Latin *Monomia*, and in Iriſh *Moun*, the moſt ſoutherly province of Ireland; bounded on the north by Leinſter and Connaught, and on the eaſt, weſt, and ſouth, by the ocean. It contains the counties of Cork, Clare, Kerry, Limerick, Tipperary, and Waterford; and 3,289,932 Iriſh plantation acres, 740 pariſhes, 63 baronies, and 26 boroughs. It is about 125 miles long and 120 broad; and its principal town is Cork. Its ancient name was *Mumhan*; and in latter ages it was divided into *Deſmond* or South Munſter, *Ormond* or Eaſt Munſter, and *Thomond* or North Munſter. It lies between 51. 15. and 53. 0. N. Lat. and 7. 10. and 10. 40. W. Long.

MUNSTER, a territory of Germany in the circle of Weſtphalia; bounded on the north by Embden and Oldenburg, on the ſouth by the county of Mark and duchy of Weſtphalia, on the weſt by the county of Bentheim and the United Provinces, and on the eaſt by the biſhoprics of Oſnaburgh and Paderborn together with the county of Ravenſberg. It is the largeſt of all the Weſtphalian biſhoprics, being in length about 80 miles, and in breadth from 20 to 60. It is divided into 13 bailiwicks: and though in general but a barren country, has ſome fruitful plains, with woods, and quarries of ſtone. The inhabitants, excepting a few of the nobility and gentry, are all Roman Catholics; though Lutheraniſm had once a conſiderable footing here. The biſhop, who is generally alſo elector of Cologne, has a revenue from hence of about 70,000 pounds, and can maintain 8000 men. In conſequence of an unjuſt cuſtom, unknown in the reſt of the empire, he is heir to all ſtrangers who die in the country without children. In the matricula he is rated at 30 foot and 118 horſe; or 832 florins monthly in lieu of them. His chapter conſiſts of 40 canons, who are all noble.

MUNSTER, a city of Germany, capital of a biſhopric of the ſame name and of all Weſtphalia, ſtands at the conflux of the river Aa with the Ems, in E. Long. 7. 49. N. Lat. 52. 0. It is of a circular form, large, and well fortified both by nature and art. It has a fine citadel called the *Brille*, erected by a biſhop named *Bernard van Galen* in order to awe the burghers. The dean and chapter now elect the biſhop; but till the beginning of the 13th century he was nominated by the emperor. This city has been rendered famous by three remarkable tranſactions. 1. By the peace concluded here in 1648, which put an end to the war of 30 years; occaſioned by the perſecuting ſpirit of bigotted Papiſts, who choſe rather to plunge their country into all the calamities of war than allow liberty of conſcience to the Proteſtants. By this peace, however, they conſented, much againſt their inclinations, to grant them a toleration. 2. By the diſorders and diſturbances occaſioned here in 1553, by a parcel of enthuſiaſts, headed by a taylor, called *John of Leyden* from the place of his birth, who turned out the magiſtrates, and took poſſeſſion of the city, where they perpetrated the moſt horrid villanies and cruelties. 3. For the noble, though unſucceſsful, efforts it made in defence of its liberties againſt the tyranny and oppreſſion of the above mentioned turbulent and bloody-minded biſhop, Bernard van Galen. In this city are a great number of convents and other religious houſes, many of them ſtately piles, and ſurrounded with beautiful gardens.

MUNYCHIA, or *Munichius Portus*, in *Ancient Geography*, a village and port of Athens, nearer to the city, fortified in the ſame manner as the Piræus, to the eaſt of which it lay, or between it and the promontory Sunium, at the mouth of the Iliſſus. Strabo ſays it was an eminence in form of a peninſula, at the foot of which ſtood three harbours, anciently encompaſſed with a wall, taking within its extent the Piræus and other harbours full of docks, with the temple of Diana Munychia; taking its name from *Mynichus*, the founder of the temple.

MUNYCHIA, an anniverſary ſolemnity obſerved at Athens, in honour of Diana, on the 16th of the month Munychion. Cakes were offered on the occaſion, called αμφιφωντες.

MUNYCHION, the tenth month of the Athenian year, containing 29 days, and anſwering to the latter part of our March and the beginning of April. It was ſo called from the feſtival Munychia, which was obſerved in this month. See MONTH and MUNYCHIA.

MUPHTI. See MUFTI.

MURÆNA, or EEL; a genus of fiſhes, belonging to the order of apodes. See ICHTHYOLOGY *Index*.

MURAL, ſomething belonging to a wall, which the Latins call *murus*.

MURAL Crown, among the ancient Romans. See CROWN.

MURAL arch, is a wall, or walled arch, placed exactly in the plane of the meridian, i. e. upon the meridian line, for the fixing of a large quadrant, ſextant, or other inſtrument, to obſerve the meridian altitudes, &c. of the heavenly bodies.

Tycho Brahe was the firſt who uſed a mural arch in his obſervations; after him Hevelius, Mr Flamſtead, De la Hire, &c. uſed the ſame means. See ASTRONOMY.

MURANUM, in *Ancient Geography*, a town on the confines of Lucania. Now *Morano;* a citadel in Calabria Citra, at the ſprings of the Sybaris, midway between the Sinus Tarentinus to the eaſt, and the Tuſcan ſea to the weſt. Suppoſed to have ariſen from the ruins of Syphæum, a town of the Bruttii mentioned by Livy.

MURATORI, LEWIS ANTHONY, a learned and celebrated Italian writer, born at Vignoles, in the territory of Bologna, in 1672. He early diſcovered an extreme fondneſs for the learned languages and ſciences; and this was ſeconded by an excellent education. After having completed his firſt ſtudies, he embraced the ſtate of an eccleſiaſtic; and applied himſelf to polite literature, philoſophy, theology, civil law, antiquities, and other ſciences; by which means he became in a manner univerſally learned. He was ſcarcely 22 years of age when he was made librarian of the Ambroſian library at Milan. In 1700 the duke of Modena, his ſovereign, recalled him, and made him his librarian, and keeper of the archives of his duchy. Muratori diſcharged this double employment during the reſt of his life, and had no other benefice than the provoſtſhip of Santa Maria del Pompoſa. The principal of his works are,—1. *Anecdota*, or a collection of pieces taken from the Ambroſian library, 2 vols 4to, with learned notes and diſſertations. 2. A treatiſe on the perfection of the Italian poetry, 2 vols 4to. 3. *Anecdota Græca*, 3 vols 4to. 4. A genealogical hiſtory of the houſe of Modena, 2 vols folio. 5. An excellent collection of the writers of the Italian hiſtory, 27 vols folio, with learned notes. 6. Another collection, under the title of *Antiquitates Italicæ*. 7. A collection of ancient inſcriptions, under the title of *Novus Theſaurus*, 6 vols folio. 8. The annals of Italy, 12 vols 4to, in Italian, &c. 9. Letters, diſſertations, Italian poems, &c.

MURCIA, the Pagan goddeſs of idleneſs. The name is taken from *murcus* or *murcidus*, an obſolete word, ſignifying a dull, ſlothful, or lazy perſon.—The ſtatues of this goddeſs were always covered with duſt and moſs, to expreſs her idleneſs and negligence. She had a temple in Rome, at the foot of the Aventine mount.

MURCIA, a kingdom in Spain, bounded on the north by New Caſtile, on the eaſt by the kingdom of Valencia, on the weſt by Andaluſia and Granada, and on the ſouth by the Mediterranean ſea. It is about 62 miles in length, and 58 in breadth; and its principal river is the Segura. The ſoil is dry, becauſe it ſeldom rains, and therefore it produces little corn or wine; but there is plenty of oranges, citrons, lemons, olives, almonds, mulberries, rice, pulſe, and ſugar. It has alſo a great deal of ſilk. It was taken from the Moors in 1265. The air is very healthful.

MURCIA, a large, handſome, and populous town of Spain, capital of a kingdom of the ſame name. It is a biſhop's ſee, and contains ſix pariſhes. The cathedral is a moſt ſuperb edifice, with the ſtairs of the ſteeple ſo contrived that a man may ride up to the top, either on horſeback or in a coach. It is ſituated in a pleaſant plain, which abounds in fine gardens about the city, and in which are the beſt fruits in Spain. It is ſeated on the river Segura, in W. Long. 8. 36. N. Lat. 37. 48.

MURDER, or MURTHER, the act of killing another with violence and injuſtice. The word comes from the Saxon *morth*, "death;" which ſome will have to ſignify a violent death; whence the barbarous Latin *murdrum* and *modrum*.

Among the number of popular errors, is the notion which has obtained, that the dead body would bleed in the preſence or upon the touch of the murderer.

The crime of murder is puniſhed with death in almoſt all nations.

MURDER, or *Murther*, in *Law*, is thus defined, or rather deſcribed, by Sir Edward Coke: "When a perſon, of ſound memory and diſcretion, unlawfully killeth any reaſonable creature in being, and under the king's peace, with malice aforethought, either expreſs or implied." The beſt way of examining the nature of this crime will be by conſidering the ſeveral branches of this definition.

1. It muſt be committed by a perſon *of ſound memory and diſcretion:* for lunatics or infants are incapable of committing any crime; unleſs in ſuch caſes where they ſhow a conſciouſneſs of doing wrong, and of courſe a diſcretion or diſcernment between good and evil.

2. Next, it happens when a perſon of ſuch ſound diſcretion *unlawfully killeth*. The unlawfulneſs ariſes from the killing without warrant or excuſe: and there muſt alſo be an actual killing to conſtitute murder; for a bare aſſault, with intent to kill, is only a great miſdemeanor, though formerly it was held to be murder. The killing may be by poiſoning, ſtriking, ſtarving, drowning, and a thouſand other forms of death, by which human nature may be overcome. Of theſe the moſt deteſtable of all is poiſon; becauſe it can of all others be the leaſt prevented, either by manhood or forethought. And therefore, by the ſtat. 22 Hen. VIII. c. 9. it was made treaſon, and a more grievous and lingering kind of death was inflicted on it than the common law allowed; namely, *boiling to death:* but this act did not live long, being repealed by 1 Edw. VI. c. 12. There was alſo, by the ancient common law, one ſpecies of killing held to be murder, which may be dubious at this day, as there hath not been an inſtance wherein it has been held to be murder for many ages paſt, viz. bearing falſe witneſs againſt another, with an expreſs premeditated deſign to take away his life, ſo as the innocent perſon be condemned and executed. The Gothic laws puniſhed in this caſe both the judge, the witneſſes, and the proſecutor; and, among the Romans, the *lex Cornelia de ſicariis*, puniſhed the falſe witneſſes with death, as being guilty of a ſpecies of aſſaſſination. And there is no doubt but this is equally murder *in foro*

conſcientiæ as killing with a ſword; though the modern law (to avoid the danger of deterring witneſſes from giving evidence upon capital proſecutions, if it muſt be at the peril of their own lives) has not yet puniſhed it as ſuch. If a man, however, do ſuch an act, of which the probable conſequence may be, and eventually is, death; ſuch killing may be murder, although no ſtroke be ſtruck by himſelf, and no killing may be primarily intended: as was the caſe of the unnatural ſon who expoſed his ſick father to the air againſt his will, by reaſon whereof he died; and of the harlot, who laid her child under leaves in an orchard, where a kite ſtruck and killed it. So too, if a man have a beaſt that is uſed to do miſchief; and he, knowing it, *ſuffers* it to go abroad, and it kills a man; even this is manſlaughter in the owner; but if he have purpoſely *turned it looſe*, though barely to frighten people, and make what is called *ſport*, it is with us (as in the Jewiſh law) as much murder as if he had incited a bear or dog to worry them. If a phyſician or ſurgeon give his patient a potion or plaſter to cure him, which, contrary to expectation, kills him, this is neither murder nor manſlaughter, but miſadventure; and he ſhall not be puniſhed criminally, however liable he might formerly have been to a civil action for neglect or ignorance; but it hath been holden, that if it be not a *regular* phyſician or ſurgeon who adminiſters the medicine, or performs the operation, it is manſlaughter at the leaſt. Yet Sir Matthew Hale very juſtly queſtions the law of this determination; ſince phyſic and ſalves were in uſe before licenſed phyſicians and ſurgeons: wherefore he treats this doctrine as apocryphal, and fitted only to gratify and flatter licentiates and doctors in phyſic; though it may be of uſe to make people cautious and wary how they meddle too much in ſo dangerous an employment. In order alſo to make the killing murder, it is requiſite that the party die within a year and a day after the ſtroke received, or cauſe of death adminiſtered; in the computation of which the whole day upon which the hurt was done ſhall be reckoned the firſt.

3. Farther: The perſon killed muſt be "*a reaſonable creature in being, and under the king's peace*," at the time of the killing. Therefore to kill an alien, a Jew, or an outlaw, who are all under the king's peace or protection, is as much murder as to kill the moſt regular-born Engliſhman; except he be an alien-enemy, in the time of war. To kill a child in its mother's womb, is now no murder, but a great miſpriſion; but if the child be born alive, and dieth by reaſon of the potion or bruiſes it received in the womb, it ſeems, by the better opinion, to be murder in ſuch as adminiſtered or gave them. As to the murder of baſtard children, ſee BASTARD.

4. Laſtly, The killing muſt be committed "*with malice aforethought*," to make it the crime of murder. This is the grand criterion which now diſtinguiſhes murder from other killing: and this malice prepenſe, *malitia præcogitata*, is not ſo properly ſpite or malevolence to the deceaſed in particular, as any evil deſign in general; the dictate of a wicked, depraved, and malignant heart; *un diſpoſition à faire une mal choſe*: and it may be either *expreſs*, or *implied*, in law. Expreſs malice is when one, with a ſedate deliberate mind and formed deſign, doth kill another, which formed deſign is evidenced by external circumſtances diſcovering that inward intention; as lying in wait, antecedent menaces, former grudges, and concerted ſchemes to do him ſome bodily harm. This takes in the caſe of deliberate duelling, where both parties meet avowedly with an intent to murder: thinking it their duty, as gentlemen, and claiming it as their right, to wanton with their own lives and thoſe of their fellow creatures; without any warrant or authority from any power either divine or human, but in direct contradiction to the laws both of God and man; and therefore the law has juſtly fixed the crime and puniſhment of murder on them, and on their ſeconds alſo. Yet it requires ſuch a degree of paſſive valour to combat the dread of even undeſerved contempt, ariſing from the falſe notions of honour too generally received in Europe, that the ſtrongeſt prohibitions and penalties of the law will never be entirely effectual to eradicate this unhappy cuſtom, till a method be found out of compelling the original aggreſſor to make ſome other ſatisfaction to the affronted party, which the world ſhall eſteem equally reputable as that which is now given at the hazard of the life and fortune, as well of the perſon inſulted, as of him who has given the inſult. Alſo, if even upon a ſudden provocation one beats another, in a cruel and unuſual manner, ſo that he dies, though he did not intend his death, yet he is guilty of murder by expreſs malice; i. e. by an expreſs evil deſign, the genuine ſenſe of *malitia*: As when a park-keeper tied a boy that was ſtealing wood to a horſe's tail, and dragged him along the park; when a maſter corrected his ſervant with an iron bar, and a ſchoolmaſter ſtamped on his ſcholar's belly, ſo that each of the ſufferers died; theſe were juſtly held to be murders, becauſe the correction being exceſſive, and ſuch as could not proceed but from a bad heart, it was equivalent to a deliberate act of ſlaughter. Neither ſhall he be guilty of a leſs crime who kills another in conſequence of ſuch a wilful act as ſhows him to be an enemy to all mankind in general; as going deliberately, and with an intent to do miſchief, upon a horſe uſed to ſtrike, or coolly diſcharging a gun among a multitude of people. So if a man reſolves to kill the next man he meets, and does kill him, it is murder, although he knew him not; for this is univerſal malice. And if two or more come together to do an unlawful act againſt the king's peace, of which the probable conſequence might be bloodſhed; as to beat a man, to commit a riot, or to rob a park, and one of them kills a man; it is murder in them all, becauſe of the unlawful act, the *malitia præcogitata*, or evil intended beforehand.

Alſo in many caſes where no malice is expreſſed, the law will imply it: as, where a man wilfully poiſons another, in ſuch a deliberate act the law preſumes malice, though no particular enmity can be proved. And if a man kills another ſuddenly, without any, or without a conſiderable provocation, the law implies malice; for no perſon, unleſs of an abandoned heart, would be guilty of ſuch an act upon a ſlight or no apparent cauſe. No affront, by words or geſtures only, is a ſufficient provocation, ſo as to excuſe or extenuate ſuch acts of violence as manifeſtly endanger the life of another. But if the perſon ſo provoked had unfortunately killed the other, by beating him in ſuch a manner as ſhowed only an intent to chaſtiſe and not to kill him, the law ſo far conſiders the provocation of contumelious behaviour, as to adjudge it only manſlaughter, and not murder. In like manner, if one kills an officer of juſtice, either civil or criminal, in the execution of his duty, or any of his aſſiſtants endeavouring to conſerve the peace, or any private perſon endeavouring to ſuppreſs an affray or apprehend a felon, knowing his authority or the intention with which he interpoſes, the law will imply malice, and the killer ſhall be guilty of murder. And if one intends to do another felony, and undeſignedly kills a man, this is alſo murder. Thus if one ſhoots at A, and miſſes him, but kills B, this is murder; becauſe of the previous felonious intent, which the law transfers from one to the other. The ſame is the caſe, where one lays poiſon for A, and B, againſt whom the priſoner had no malicious intent, takes it, and it kills him, this is likewiſe murder. So alſo, if one give a woman with child a medicine to procure abortion, and it operates ſo violently as to kill the woman, this is murder in the perſon who gave it. It were endleſs to go through all the caſes of homicide, which have been adjudged, either expreſsly or impliedly, malicious: theſe therefore may ſuffice as a ſpecimen; and we may take it for a general rule, that all homicide is malicious, and of courſe amounts to murder, unleſs where juſtified by the command or permiſſion of the law; excuſed on a principle of accident or ſelf-preſervation; or alleviated into manſlaughter, by being either the involuntary conſequence of ſome act, not ſtrictly lawful, or (if voluntary) occaſioned by ſome ſudden and ſufficiently violent provocation. And all theſe circumſtances of juſtification, excuſe, or alleviation, it is incumbent upon the priſoner to make out, to the ſatisfaction of the court and jury, the latter of whom are to decide whether the circumſtances alleged are proved to have actually exiſted; the former, how far they extend to take away or mitigate the guilt. For all homicide is preſumed to be malicious, until the contrary appeareth upon evidence.

The puniſhment of murder, and that of man-ſlaughter, were formerly one and the ſame; both having the benefit of clergy; ſo that none but unlearned perſons, who leaſt knew the guilt of it, were put to death for this enormous crime. But now, by ſeveral ſtatutes, the benefit of clergy is taken away from murderers through malice prepenſe, their abettors, procurers, and counſellors. In atrocious caſes it was frequently uſual for the court to direct the murderer, after execution, to be hung upon a gibbet in chains near the place where the fact was committed; but this was no part of the legal judgment; and the like is ſtill ſometimes practiſed in the caſe of notorious thieves. This, being quite contrary to the expreſs command of the Moſaical law, ſeems to have been borrowed from the civil law; which, beſides the terror of the example, gives alſo another reaſon for this practice, viz. that it is a comfortable ſight to the relations and friends of the deceaſed. But now, in England, it is enacted by ſtatute 25 Geo. II. c. 37. that the judges, before whom any perſon is found guilty of wilful murder, ſhall pronounce ſentence immediately after conviction, unleſs he ſees cauſe to poſtpone it; and ſhall in paſſing ſentence direct him to be executed on the next day but one (unleſs the ſame ſhall be Sunday, and then on the Monday following), and that his body be delivered to the ſurgeons to be diſſected and anatomized; and that the judge may direct his body to be afterwards hung in chains, but in nowiſe to be buried without diſſection. And, during the ſhort but awful interval between ſentence and execution, the priſoner ſhall be kept alone, and ſuſtained with only bread and water. But a power is allowed to the judge, upon good and ſufficient cauſe, to reſpite the execution, and relax the other reſtraints of this act. See farther, PARRICIDE, and *PETIT Treaſon*.

MURDERERS, or *Murdering Pieces*, in a ſhip, are ſmall pieces of ordnance, either of braſs or iron, which have chambers put in at their breeches. They are uſed at the bulk-heads of the fore-caſtle, half-deck, or ſteerage, in order to clear the deck, on the ſhip's being boarded by an enemy.

MURENA. See MURÆNA, ICHTHYOLOGY *Index*.

MURENGERS, two officers of great antiquity in the city of Cheſter, annually choſen out of the aldermen, to ſee the walls kept in repair, and to receive a certain toll for that purpoſe.

MUREX, a genus of animals belonging to the order of vermes teſtacea. See CONCHOLOGY *Index*.

MUREX, a caltrap or iron inſtrument, with ſharp points projecting in every direction, uſed by the Romans as a defence againſt the enemy's horſe; ſo called, probably from ſome reſemblance to the ſpines on the ſhell of the murex.

MURGI, or MURGIS, in *Ancient Geography*, the laſt town of Bætica, next the Tarraconenſis: the Urce of Ptolemy. Now *Muxara*, a port-town of Granada, on the Mediterranean. W. Long. 1° 50′. N. Lat. 37° 6′.

MURIA, the Latin name of common ſalt. See SODA, *Muriate of*, CHEMISTRY *Index*.

MURIATIC ACID. See CHEMISTRY *Index*. This acid, according to the views of Sir H. Davy, is compoſed of chlorine (the oxymuriatic acid of all chemiſts formerly, and of ſome ſtill) and hydrogen.

MURINA, or MURINES, a delicious ſweet wine, medicated with ſpices, and the uſual drink of the ladies of antiquity.

MURRAIN, or GARGLE, a contagious diſeaſe among cattle. See FARRIERY *Index*.

MURRAY, or MORAY, the name of a diſtrict in the north of Scotland, which, in a former diviſion of the kingdom, was denominated a province. This diſtrict includes the counties of Banff, Elgin and Nairn. The county of Elgin, the middle diviſion of this diſtrict, is ſtill known by the name of Morayſhire.

MURRHINE, MURRHINUS, *Μοῤῥινος*, in antiquity, an appellation given to a delicate ſort of ware brought from the eaſt, whereof cups and vaſes were made, which added not a little to the ſplendour of the Roman banquets. Critics are divided concerning the matter of the pocula or vaſa murrhina, murrina, or murrea. Some will have them to have been the ſame with our porcelain or china ware. The generality held them to have been made of ſome precious kind of ſtone, which was found chiefly, as Pliny tells us, in Parthia, but more eſpecially in Carmania. Arrian tells us, that there was a great quantity of them made at Dioſpolis in Egypt. This he calls another ſort of murrhina work; and it is evident, from all accounts, that the murrhina of Dioſpolis was a ſort of glaſs ware, made in imitation of the porcelain or murrha of India. There is ſome difference in the accounts given by Pliny and Martial of the murrhina vaſa. The firſt author ſays, that they would not bear hot liquors, but that only cold ones were drank out of them. The latter, on the other hand, tells us, that they bore hot liquors very well. If we credit Pliny's account, their porcelain was much inferior to our's in this particular. Some conjecture them to have been of agate, others of onyx, others of coral. Baronius, doubtleſs, was fartheſt out of the way, when he took them to be made of myrrh, congealed and hardened. Some have ſuppoſed theſe veſſels to be made of cryſtal, but this is contrary to the account of all the ancients. The Greeks had the words κρυϛαλλος, for cryſtal, and σμυρνη for myrrh, very common among them; and therefore if theſe veſſels had been made of either of theſe ſubſtances, they would in ſome places have called them ſmyrna or cryſtalline. On the contrary, the moſt correct among them call them murrhina or morrina. The cups made of cryſtal, which were alſo in uſe at thoſe times were called cryſtallina, and theſe murrhina or murrhæa, by way of keeping up the diſtinction; and Martial tells us, that the ſtone they were made of was ſpotted or variegated, calling them pocula maculoſæ murræ. And Statius mentions the cryſtalline and murrhine cups in the ſame ſentence, but as different things, not the ſame. Arrian mentions alſo the λιθος μορρια; which his interpreters cenſure as an error of the copies, and would alter into myrrha, the name of the gum myrrh.

Pompey is recorded as the firſt who brought theſe murrhine veſſels out of the eaſt, which he exhibited in his triumph, and dedicated to Jupiter Capitolinus. But private perſons were not long without them. So fond in effect did the Roman gentry grow of them, that a cup which held three ſextaries was ſold for 70 talents. T. Petronius, before his death, to ſpite Nero (or as Pliny expreſſes it, *ut menſam ejus exhæredaret*, to diſinherit his table), broke a baſon, *trulla murrhina*, valued at 300 talents, on which that emperor had ſet his heart.

MUS, a genus of quadrupeds belonging to the order of *Glires*. See MAMMALIA *Index*.

MUSA, the PLANTAIN-TREE; a genus of plants belonging to the polyandria claſs, and in the natural method ranking under the eighth order, *Scitamineæ*. See BOTANY *Index*.

MUSÆUS, an ancient Greek poet, was, according to Plato and Diodorus Siculus, an Athenian, the ſon of Orpheus, and chief of the Eleuſinian myſteries inſtituted at Athens in honour of Ceres: or, according to others, he was only the diſciple of Orpheus; but from the great reſemblance which there was between his character and talents and thoſe of his maſter, by giving a ſtronger outline to the figure he was called his *ſon*, as thoſe were ſtyled the *children of Apollo* who cultivated the arts of which he was the tutelar god.

Burney's History of Muſic.

Muſæus is allowed to have been one of the firſt poets who verſified the oracles. He is placed in the Arundelian marbles, epoch 15. 1426 B. C. at which time his hymns are there ſaid to have been received in the celebration of the Eleuſinian myſteries. Laertius tells us, that Muſæus not only compoſed a theogony, but formed a ſphere for the uſe of his companions; yet as this honour is generally given to Chiron, it is more natural to ſuppoſe, with Sir Iſaac Newton, that he enlarged it with the addition of ſeveral conſtellations after the conqueſt of the golden fleece. The ſphere itſelf ſhows that it was delineated after the Argonautic expedition, which is deſcribed in the aſteriſms, together with ſeveral other more ancient hiſtories of the Greeks, and without any thing later; for the ſhip Argo was the firſt long veſſel which they had built: hitherto they had uſed round ſhips of burthen, and kept within ſight of the ſhore; but now, by the dictates of the oracle, and conſent of the princes of Greece, the flower of that country ſail rapidly through the deep, and guide their ſhip by the ſtars.

Muſæus is celebrated by Virgil in the character of hierophant, or prieſt of Ceres, at the head of the moſt illuſtrious mortals who have merited a place in Elyſium. Here he is made the conductor of Æneas to the receſs where he meets the ſhade of his father Anchiſes.

A hill near the citadel of Athens was called *Muſæum*, according to Pauſanias, from Muſæus, who uſed to retire thither to meditate and compoſe his religious hymns; at which place he was afterwards buried. The works which went under his name, like thoſe of Orpheus, were by many attributed to Onomacritus. Nothing remains of this poet now, nor were any of his writings extant in the time of Pauſanias, except a hymn to Ceres, which he made for the Lycomides. And as theſe hymns were likewiſe ſet to muſic, and ſung in the myſteries by Muſæus himſelf in the character of prieſt, he thence perhaps acquired from future times the title of *muſician*, as well as of *poet;* the performance of ſacred muſic being probably at firſt confined to the prieſthood in theſe celebrations, as it had been before in Egypt, whence they originated. However, he is not enumerated among ancient muſicians by Plutarch; nor does it appear that he merited the title of *ſon* and *ſucceſſor to Orpheus* for his muſical abilities, ſo much as for his poetry, piety, and profound knowledge in religious myſteries.

MUSCA, the FLY; a genus of inſects belonging to the order of diptera. See ENTOMOLOGY *Index*.

MUSCA, a name given to ſuch perſons among the Romans as officiouſly thruſt themſelves into the company of their ſuperiors and thoſe who deſpiſed them, by finding means of getting admittance to entertainments without invitation, and without a welcome: So that *muſcæ* were the ſame as paraſites, who were frequently by the Greeks termed Μυιαι. See PARASITE.

MUSCADINE, a rich wine, of the growth of Provence, Languedoc, Cividad, &c.—The word is ſuppoſed to be derived from *muſk;* the wine being ſuppoſed to have a little of the ſmell of that perfume; others from *muſca*, "a fly," becauſe the flies are extremely fond of its grapes; as the Latins had their *vinum apianum*, ſo called *ab apibus*, from the bees which fed on it.

The proceſs for making muſcadine at Frontignac, is the following: The muſcadine grapes are allowed to be half dried on the vine; and as ſoon as they are gathered, they are trod and preſſed, and the liquor is tunned, without letting it ſtand to ferment in the fat; the lee which remains is ſuppoſed to produce the peculiar flavour of this wine.

MUSCHENBROECK, PETER DE, a very diſtinguiſhed natural philoſopher and mathematician, was born

born at Utrecht a little before 1700. He was firſt profeſſor in his own univerſity, and afterwards invited to the chair at Leyden, where he died full of reputation and honours in 1761. He was a member of ſeveral academies; particularly the Academy of Sciences at Paris. He was the author of ſeveral works in Latin, which are frequently referred to, and all of which diſcover great penetration and exactneſs of the ſubjects of which he treats. He was alſo conſummate in the knowledge of law.

MUSCI, Mosses, one of the orders of the claſs cryptogamia; which ſee, Botany *Index*.—The ancients took the moſs of trees to be the effect of a diſorder or diſcompoſure of the texture of the bark; or at moſt a kind of little filaments ariſing from the bark: but the moderns find, by more accurate obſervation, that moſſes are real diſtinct plants, whoſe ſeed, being extremely ſmall, is encloſed in little capſules; which burſting of themſelves, the ſeed is carried off by the winds; till, falling into the inequalities of the bark of trees, it is there ſtopped, takes root, and feeds at the expence of the tree, as mouldineſs does on bread, &c.

MUSCLE, or Mussel. See Mytulus, Conchology *Index*.

MUSCOVY. See Russia.

Muscovy Glaſs, or Glimmer. See Mica, Mineralogy *Index*.

MUSCULUS, a military machine, made uſe of by the Romans to cover and protect the ſoldiers while they approached and undermined the walls of beſieged places, or filled the ditches. It ſeems to have reſembled the teſtudo in form, but was ſmaller in ſize. See Testudo.

MUSEIA, were Grecian feſtivals in honour of the Muſes, celebrated with games every fifth year, particularly by the Theſpians. The Macedonians alſo obſerved a feſtival of the ſame name in honour of Jupiter and the Muſes, which laſted for nine days, and was celebrated with ſtage plays, ſongs, and poetical compoſitions.

MUSES, certain fabulous deities among the Pagans, ſuppoſed to preſide over the arts and ſciences: for this reaſon it is uſual for the poets, at the beginning of a poem, to invoke theſe goddeſſes to their aid.

The Muſes were originally only ſingers and muſicians in the ſervice of Oſiris, or the great Egyptian Bacchus, under the inſtruction and guidance of his ſon Orus; but in ſucceeding times they were called the *daughters of Jupiter and Mnemoſyne* or *Memory*.

Theſe are the only pagan divinities whoſe worſhip has been continued through all ſucceeding changes in the religion and ſentiments of mankind. Profeſſors of every liberal art in all the countries of Europe ſtill revere them; particularly the poets, who ſeldom undertake the ſlighteſt work without invoking their aid.

Sir Iſaac Newton tells us, that the ſinging women of Oſiris were celebrated in Thrace by the name of the *Muſes*; and that the daughters of Pierius, a Thracian, imitating them, were celebrated by the ſame name.

Diodorus Siculus informs us, that Alcman of Meſſene, a lyric poet who flouriſhed in the 27th Olympiad, 670 years B. C. makes them the daughters of Uranus and Terra. It has been aſſerted by ſome ancient writers, that at firſt they were only three in number; but Homer, Heſiod, and other profound mythologiſts, admit of nine (A).

In his hymn to Apollo, Homer ſays,

> ——By turns the *nine* delight to ſing.

And Heſiod, in his Theogony, names them all.—They are ſaid ſeverally to preſide over ſome art or ſcience, as muſic, poetry, dancing, aſtronomy. By ſome they are called *virgins*, becauſe the virtues of education appear unalterable: they are called *muſes* from a Greek word which ſignifies to explain myſteries, becauſe they have taught things the moſt curious and important to know, and which are above the comprehenſion of vulgar minds. Each of their names is ſaid to include ſome particular allegory; *Clio*, for inſtance, has been thus called, becauſe thoſe who are praiſed in verſe acquire immortal fame; *Euterpe*, on account of the pleaſure accruing to thoſe who hear learned poetry; *Thalia* implies for ever flouriſhing; *Melpomene*, that her melody inſinuates itſelf into the inmoſt receſſes of the ſoul; *Terpſichore* marks the pleaſure which thoſe receive who are verſed in the liberal arts; *Erato* ſeems to indicate, that the learned command the eſteem and friendſhip of all mankind; *Polyhymnia*, that many poets are become immortal by the number of hymns which they have addreſſed to the gods; *Urania*, that thoſe whom ſhe inſtructs elevate their contemplations and celebrity to the heavens and the ſtars; and laſtly, the exquiſite voice of *Calliope* has acquired her that appellation, as the inventreſs and guardian of eloquence and rhetoric.

Burney's Hiſt. of Muſic.

An epigram of Callimachus gives the attributes of the Muſes in as many lines.

> *Calliope* the deeds of heroes ſings;
> Great *Clio* ſweeps to hiſtory the ſtrings;
> *Euterpe* teaches mimes their ſilent ſhow;
> *Melpomene* preſides o'er ſcenes of wo;
> *Terpſichore* the flute's ſoft pow'r diſplays;
> And *Erato* gives hymns the gods to praiſe;
> *Polymnia's* ſkill inſpires melodious ſtrains;
> *Urania* wiſe, the ſtarry courſe explains;
> And gay *Thalia's* glaſs points out where folly reigns.

This epigram does not, however, exactly correſpond with the ideas of other poets, or of the ancient painters, in characterizing the attributes of the Muſes. The ancients had numberleſs ingenious and fanciful ideas concerning the muſes, which we have not room to recite. —"It ſeems (ſays the abbé Barthelemi †) as if the firſt poets, enchanted with the beauties of nature, occaſionally were led to invoke the nymphs of the woods, hills, and fountains; and that yielding to the prevailing taſte for allegory, they gave them names relative to the influence

† *Travels of Anacharſis*, vol. iii. p. 261.

(A) It has been ſaid, that when the citizens of Sicyon directed three ſkilful ſtatuaries to make each of them ſtatues of the three Muſes, they were all ſo well executed, that they did not know which to chooſe, but erected all the nine, and that Heſiod and Homer only gave them names.

fluence they might be ſuppoſed to have over the productions of the mind. At firſt three Muſes only were admitted, Melcte, Mneme, and Aœde: that is to ſay, the meditation or reflection neceſſary to ſtudy; memory, which records illuſtrious deeds; and ſong, which accompanies their recital. In proportion as improvement was made in the art of verſification, its characters and effects were perſonified, the number of the Muſes increaſed, and the names they now received referred to the charms of poety, its celeſtial origin, the beauty of its language, the pleaſure and gaiety it inſpires, the ſong and dance which add to it new charms, and the glory with which it is crowned. Afterwards were aſſociated with them the Graces, whoſe employment it is to embelliſh poetry, and Love who is ſo frequently its object. Theſe ideas took birth in a barbarous country, in Thrace, where Orpheus, Linus, and their diſciples, ſuddenly appeared in the midſt of ignorance. The Muſes were honoured there on the Pierian mount; and extending their dominion, ſucceſſively took their ſtations on Pindus, Parnaſſus, Helicon, and all thoſe ſolitary places where the painters of nature, ſurrounded by the moſt pleaſing images, experience the divine glow of inſpiration."

Pythagoras, and afterwards Plato, make the Muſes the ſoul of the planets in our ſyſtem; from whence the imaginary muſic of the ſpheres.

MUSEUM, a name which originally ſignified a part of the palace of Alexandria, which took up at leaſt one-fourth of the city. This quarter was called the *muſeum*, on account of its being ſet apart for the Muſes and the ſtudy of the ſciences. Here were lodged and entertained the men of learning; who were divided into many companies or colleges, according to the ſciences of which they were the profeſſors; and to each of theſe houſes or colleges was allotted a handſome revenue. The foundation of this eſtabliſhment is attributed to Ptolemy Philadelphus, who here placed his library. Hence the word *muſeum* is now applied to any place ſet apart as a repoſitory for things that have an immediate relation to the arts.

The muſeum at Oxford, called the *Aſhmolean muſeum*, is a noble pile of bulding, erected at the expence of the univerſity, at the weſt end of the theatre, at which ſide it has a magnificent portal, ſuſtained by pillars of the Corinthian order. The front, which is to the ſtreet, extends about 60 feet, where there is this inſcription over the entrance in gilt characters, *Muſeum Aſhmoleanum, ſchola naturalis hiſtoriæ, officina chymica.* It was begun in 1679, and finiſhed in 1683, when a valuable collection of curioſities was preſented to the univerſity by Elias Aſhmole, Eſq. which were the ſame day repoſited there: ſeveral acceſſions have been ſince made to the muſeum; among which are hieroglyphics, and other Egyptian antiquities, an entire mummy, Roman antiquities, altars, medals, lamps, &c. and a variety of natural curioſities.

For an account of the Britiſh muſeum, ſee LONDON, N° 146.

MUSHROOM. See FUNGI, BOTANY *Index*.

To try the quality of muſhrooms:—Take an onion, and ſtrip the outer ſkin, and boil it with your muſhrooms: if the onion become blue or black, there are certainly dangerous ones amongſt them; if it remain white, they are good.

MUSIC;

Definition. THE art of combining ſounds in a manner agreeable to the ear. This combination may be either ſimultaneous or ſucceſſive: in the firſt caſe, it conſtitutes harmony; in the laſt, melody. But though the ſame ſounds, or intervals of ſound, which give pleaſure when heard in ſucceſſion, will not always produce the ſame effect in harmony; yet the principles which conſtitute the ſimpler and more perfect kinds of harmony, are almoſt, if not entirely, the ſame with thoſe of melody. By *perfect harmony*, we do not here mean that plenitude, thoſe complex modifications of harmonic ſound, which are admired in practice; but that harmony which is called *perfect* by theoricians and artiſts; that harmony which reſults from the coaleſcence of ſimultaneous ſounds produced by vibrations in the proportions of thirds, fifths, and octaves, or their duplicates.

The principles upon which theſe various combinations of ſound are founded, and by which they are regulated, conſtitute a ſcience, which is not only extenſive but profound, when we would inveſtigate the principles from whence theſe happy modifications of ſound reſult, and by which they are determined; or when we would explore the ſenſations, whether mental or corporeal, with which they affect us. The ancient definitions of muſic are not proportioned in their extent to our preſent ideas of that art; but M. Rouſſeau betrays a temerity highly inconſiſtent with the philoſophical character, when from thence he infers, that their ideas were vague and undetermined. Every ſoul ſuſceptible of refinement and delicacy in taſte or ſentiment, muſt be conſcious that there is a muſic in action as well as in ſound; and that the ideas of beauty and decorum, of harmony and ſymmetry, are, if we may uſe the expreſſion, equally conſtituent of viſible as of audible muſic. Thoſe illuſtrious minds, whoſe comprehenſive proſpects in every ſcience where taſte and propriety prevail took in nature at a ſingle glance, would behold with contempt and ridicule thoſe narrow and microſcopic views of which alone their ſucceſſors in philoſophy have diſcovered themſelves capacious. With theſe definitions, however, we are leſs concerned, as they bear no proportion to the ideas which are now entertained of muſic. Nor can we follow M. Rouſſeau, from whatever venerable ſources his authority may be derived, in adopting his Egyptian etymology for the word *muſic*. The eſtabliſhed derivation from *Muſa* could only be queſtioned by a paradoxical genius. That muſic had been practiſed in Egypt before it was known as an art in Greece, is indeed a fact which cannot be queſtioned; but it does not thence follow that the Greeks had borrowed the name as well as the art from Egypt. If the art of muſic be ſo natural to man that vocal melody is practiſed wherever articulate ſounds are uſed, there can be little reaſon for deducing the idea of muſic from the whiſtling of winds through the reeds that grew on the river Nile. And indeed, when we reflect with how eaſy a tranſition we may paſs from the accents of ſpeaking to diatonic ſounds; when we obſerve how early children adapt the language of their amuſements to meaſure and melody, however rude; when we conſider how early and univerſally theſe practices take place—there is no avoiding the concluſion, that the idea of muſic is connatural to man, and implied in the original principles of his conſtitution. We have already ſaid, that the principles on which it is founded, and the rules by which it is conducted, conſtitute a ſcience. The ſame maxims when applied to practice form an art: hence its firſt and moſt capital diviſion is into *ſpeculative* and *practical* muſic.

Speculative muſic is, if we may be permitted to uſe the expreſſion, the knowledge of the nature and uſe of thoſe materials which compoſe it, or, in other words, of all the different relations between the high and low, between the harſh and the ſweet, between the ſwift and the ſlow, between the ſtrong and the weak, of which ſounds are ſuſceptible: relations which, comprehending all the poſſible combinations of muſic and ſounds, ſeem likewiſe to comprehend all the cauſes of the impreſſions which their ſucceſſion can make upon the ear and upon the ſoul.

Practical muſic is the art of applying and reducing to practice thoſe principles which reſult from the theory of agreeable ſounds, whether ſimultaneous or ſucceſſive; or, in other words, to conduct and arrange ſounds according to the proportions reſulting from conſonance, from duration and ſucceſſion, in ſuch a manner as to produce upon the ear the effect which the compoſer intends. This is the art which we call *compoſition* *. With reſpect to the actual production of ſounds by voices or inſtruments, which is called *execution*, this department is merely mechanical and operative: which, only preſuppoſing the powers of ſounding the intervals true, of exactly proportioning their degrees of duration, of elevating or depreſſing ſounds according to thoſe gradations which are preſcribed by the tone, and to the value required by the time, demands no other knowledge but a familiar acquaintance with the characters uſed in muſic, and a habit of expreſſing them with promptitude and facility.

* See *Compoſition*.

Speculative muſic is likewiſe divided into two departments; viz. the knowledge of the proportions of ſounds or their intervals, and that of their relative durations; that is to ſay, of meaſure and of time.

The firſt is what among the ancients ſeems to have been called *harmonical* muſic. It ſhows in what the nature of air or melody conſiſts; and diſcovers what is conſonant or diſcordant, agreeable or diſagreeable, in the modulation. It diſcovers, in a word, the effects which ſounds produce on the ear by their nature, by their force, and by their intervals; which is equally applicable to their conſonance and their ſucceſſion.

The ſecond has been called *rhythmical*, becauſe it treats of ſounds with regard to their time and quantity. It contains the explication of their continuance, of their proportions, of their meaſures, whether long or ſhort, quick or ſlow, of the different modes of time and the parts into which they are divided, that to theſe the ſucceſſion of ſounds may be conformed.

Practical muſic is likewiſe divided into two departments, which correſpond to the two preceding.

That which anſwers to *harmonical* muſic, and which the ancients called *melopée*, teaches the rules for combining and varying the intervals, whether conſonant or diſſonant, in an agreeable and harmonious manner.

The ſecond, which anſwers to the *rhythmical* muſic, and which they called *rhythmopée*, contains the rules for applying the different modes of time, for underſtanding the feet by which verſes were ſcanned, and the diverſities of meaſure; in a word, for the practice of the rhythmus.

Muſic is at preſent divided more ſimply into *melody* and *harmony*; for ſince the introduction of *harmony*, the proportion between the length and ſhortneſs of ſounds, or even that between the diſtance of returning cadences, are of leſs conſequence amongſt us. For it often happens in modern languages, that the verſes aſſume their meaſures from the muſical air, and almoſt entirely loſe the ſmall ſhare of proportion and quantity which in themſelves they poſſeſs.

By melody the ſucceſſions of ſound are regulated in ſuch a manner as to produce pleaſing airs. See MELODY.

Harmony conſiſts in uniting to each of the ſounds, in a regular ſucceſſion, two or more different ſounds, which ſimultaneouſly ſtriking the ear ſoothe it by their concurrence. See HARMONY.

Muſic, according to Rouſſeau, may be, and perhaps likewiſe ought to be, divided into the *phyſical* and the *imitative*. The firſt is limited to the mere mechaniſm of ſounds, and reaches no farther than the external ſenſes, without carrying its impreſſions to the heart, and can produce nothing but corporeal ſenſations more or leſs agreeable. Such is the muſic of ſongs, of hymns, of all the airs which only conſiſt in combinations of melodious ſounds, and in general all muſic which is merely harmonious.

It may, however, be queſtioned, whether every ſound, even to the moſt ſimple, is not either by nature or by early and confirmed aſſociation, *imitative*. If we may truſt our own feelings, there is no ſuch thing in nature as muſic which gives mechanical pleaſure alone. For if ſo, it muſt give ſuch pleaſure as we receive from taſtes, from odours, or from other grateful titillations; but we abſolutely deny that there are any muſical ſenſations or pleaſures in the ſmalleſt degree analogous to theſe. Let any piece of muſic be reſolved into its elementary parts and their proportions, it will then eaſily appear from this analyſis, that ſenſe is no more than the vehicle of ſuch perceptions, and that mind alone can be ſuſceptible of them. It may indeed happen, from the number of the performers and the complication of the harmony, that meaning and ſentiment may be loſt in the multiplicity of ſounds; but this, though it may be harmony, loſes the name of *muſic*.

The ſecond department of this diviſion, by lively and accentuated inflections, and by ſounds which may be ſaid to ſpeak, expreſſes all the paſſions, paints every poſſible picture, reflects every object, ſubjects the whole of nature to its ſkilful imitations, and impreſſes even on the heart and ſoul of man ſentiments proper to affect them in the moſt ſenſible manner. This, continues he, which is the genuine lyric and theatrical muſic, was what gave double charms and energy to ancient poetry; this is what, in our days, we exert ourſelves in applying to the drama, and what our ſingers execute on the ſtage. It is in this muſic alone, and not in harmonics or the reſonance of nature, that we muſt expect to find accounts of thoſe prodigious effects which it formerly produced.

But, with M. Rouſſeau's permiſſion, all muſic which is not in ſome degree characteriſed by theſe pathetic and imitative powers, deſerves no better name than that of a *muſical jargon*, and can only be effectuated by ſuch a complication and intricacy of harmony, as may confound, but cannot entertain the audience. This character, therefore, ought to be added as eſſential to the definition of muſic; and it muſt be attributed to our neglect of this alone, whilſt our whole attention is beſtowed on harmony and execution, that the beſt performances of our artiſts and compoſers are heard with liſtleſs indifference and oſcitation, nor ever can conciliate any admirers, but ſuch as are induced, by pedantry and affectation, to pretend what they do not feel. Still may the curſe of indifference and inattention purſue and harrow up the ſouls of every compoſer or performer, who pretends to regale our ears with this muſical legerdemain, till the grin of ſcorn, or the hiſs of infamy, teach them to correct this depravity of taſte, and entertain us with the voice of nature!

Whilſt moral effects are ſought in the natural effects of ſound alone, the ſcrutiny will be vain, and diſputes will be maintained without being underſtood: but ſounds as repreſentatives of objects, whether by nature or aſſociation, introduce new ſcenes to the fancy and new feelings to the heart; not from their mechanical powers, but from the connection eſtabliſhed by the Author of our frame between ſounds and the object which either by natural reſemblance or unavoidable aſſociation they are made to repreſent.

It would ſeem that muſic was one of thoſe arts which were firſt diſcovered: and that vocal was prior to inſtrumental muſic, if in the earlieſt ages there was any muſic which could be ſaid to be purely inſtrumental. For it is more than probable, that muſic was originally formed to be the vehicle of poetry; and of conſequence, though the voice might be ſupported and accompanied by inſtruments, yet muſic was never intended for inſtruments alone.

We are told by ancient authors, that all the laws, whether human or divine, exhortations to virtue, the knowledge of the characters and actions of gods and heroes, the lives and atchievements of illuſtrious men, were written in verſe, and ſung publicly by a quire to the ſound of inſtruments; and it appears from the Scriptures, that ſuch from the earlieſt times was the cuſtom among the Iſraelites. Nor was it poſſible to find means more efficacious for impreſſing on the mind of man the principles of morals, and inſpiring the love of virtue. Perhaps, however, this was not the reſult of a premeditated plan; but inſpired by ſublime ſentiments and elevation of thought, which in accents that were ſuited and proportioned to their celeſtial nature endeavoured to find a language worthy of themſelves and expreſſive of their grandeur.

It merits attention, that the ancients were duly ſenſible of the value and importance of this divine art, not only as a ſymbol of that univerſal order and ſymmetry which prevails through the whole frame of material and intelligent nature, but as productive of the moſt momentous effects both in moral and political life. Plato and Ariſtotle, who diſagreed almoſt in every other maxim of politics, are unanimous in their approbation of muſic, as an efficacious inſtrument in the formation of the public character and in conducting the ſtate; and it was the general opinion, that whilſt the gymnaſtic exerciſes rendered the conſtitution robuſt and hardy, muſic humaniſed the character, and ſoftened thoſe habits of roughneſs and ferocity by which men might otherwiſe have degenerated into ſavages. The gradations by which voices were exerted and tuned, by which the invention of one inſtrument ſucceeded to another, or by which the principles of muſic were collected and methodiſed in ſuch a manner as to give it the form of an art and the dignity of a ſcience, are topics ſo fruitful of conjecture and ſo void of certainty, that we muſt leave them to employ minds more ſpeculative and inventions more prolific than ours, or transfer them to the *Hiſtory* of muſic as a more proper place for ſuch diſquiſitions. For the amuſement of the curious, Rouſſeau in his *Muſical Dictionary*, Plates C and N, has tranſcribed ſome fragments of Grecian, Perſian, American, Chineſe, and Swiſs muſic, with which performers may entertain themſelves at leiſure. When they have tried the pieces, it is imagined they will be leſs ſanguinely fond than that author of aſcribing the power of muſic to its affinity with the national accents where it is compoſed. This may doubtleſs have its influence; but there are other cauſes more permanent and leſs arbitrary to which it owes its moſt powerful and univerſal charms.

The muſic now moſt generally celebrated and practiſed is that of the Italians, or their ſucceſsful imitators. The Engliſh, from the invaſion of the Saxons, to that more late though lucid era in which they imbibed the art and copied the manner of the Italians, had a muſic which neither pleaſed the ſoul nor charmed the ear. The primitive muſic of the French deſerves no higher panegyric. Of all the barbarous nations, the Scots and Iriſh ſeem to have poſſeſſed the moſt affecting original muſic. The firſt conſiſts of a melody characteriſed by tenderneſs: It melts the ſoul to a pleaſing penſive languor. The other is the native expreſſion of grief and melancholy. Taſſoni informs us, that in his time a prince from Scotland had imported into Italy a lamentable kind of muſic from his own country; and that he himſelf had compoſed pieces in the ſame ſpirit. From this expreſſive though laconic deſcription, we learn that the character of our national muſic was even then eſtabliſhed; yet ſo groſs is our ignorance and credulity, that we aſcribe the beſt and moſt impaſſioned airs which are extant among us to David Rizzio; as if an Italian lutaniſt, who had lived ſo ſhort a time in Scotland, could, at once, as it were by inſpiration, have imbibed a ſpirit and compoſed in a manner ſo different from his own. It is yet more ſurpriſing that Geminiani ſhould have entertained and publiſhed the ſame prejudice, upon the miſerable authority of popular tradition alone; for the fact is authenticated by no better credentials. The primitive muſic of the Scots may be divided into the *martial*, the *paſtoral*, and the *feſtive*. The *firſt* conſiſts either

either in marches, which were played before the chieftains, in imitation of the battles which they fought, or in lamentations for the cataſtrophes of war and the extinction of families. Theſe wild effuſions of natural melody preſerve ſeveral of the rules preſcribed for compoſition. The ſtrains, though rude and untutored, are frequently terrible or mournful in a very high degree. The port or march is ſometimes in common, ſometimes in treble time; regular in its meaſures, and exact in the diſtance between its returning cadences; moſt frequently, though not always, loud and briſk. The *pibroch*, or imitation of battles, is wild, and abrupt in its tranſitions from interval to interval and from key to key; various and deſultory in its movements; frequently irregular in the return of its cadences; and in ſhort, through the whole, ſeems inſpired with ſuch fury and enthuſiaſm, that the hearer is irreſiſtibly infected with all the rage of precipitate courage, notwithſtanding the rudeneſs of the accents by which it is kindled. To this the *paſtoral* forms a ſtriking contraſt. Its accents are plaintive, yet ſoothing; its harmony generally flat; its modulations natural and agreeable; its rhythmus ſimple and regular; its returning cadences at equal diſtance; its tranſitions from one concinnous interval to another, at leaſt for the moſt part; its movements ſlow, and may be either in common or treble time. It ſcarcely admits of any other harmony than that of a ſimple baſs. A greater number of parts would cover the air, and deſtroy the melody. To this we ſhall add what has been ſaid upon the ſame ſubject by Dr Franklin. Writing to Lord K———, he proceeds thus:

"Give me leave, on this occaſion, to extend a little the ſenſe of your poſition, 'That melody and harmony are ſeparately agreeable, and in union delightful;' and to give it as my opinion, that the reaſon why the Scotch tunes have lived ſo long, and will probably live for ever (if they eſcape being ſtifled in modern affected ornament), is merely this, that they are really compoſitions of melody and harmony united, or rather that their melody is harmony. I mean, the ſimple tunes ſung by a ſingle voice. As this will appear paradoxical, I muſt explain my meaning. In common acceptation, indeed, only an agreeable *ſucceſſion* of ſounds is called *melody;* and only the *coexiſtence* of agreeable ſounds *harmony.* But ſince the memory is capable of retaining for ſome moments a perfect idea of the pitch of a paſt ſound, ſo as to compare it with the pitch of a ſucceeding ſound, and judge truly of their agreement or diſagreement, there may and does ariſe from thence a ſenſe of a harmony between the preſent and paſt ſounds, equally pleaſing with that between two preſent ſounds. Now the conſtruction of the old Scotch tunes is this, that almoſt every ſucceeding emphatical note is a third, a fifth, an octave, or in ſhort ſome note that is in concord with the preceding note. Thirds are chiefly uſed, which are very pleaſing concords. I uſe the word *emphatical,* to diſtinguiſh thoſe notes which have a ſtreſs laid on them in ſinging the tune, from the lighter connecting notes that ſerve merely, like grammar-articles in common ſpeech, to tack the whole together.

"That we have a moſt perfect idea of a ſound juſt paſt, I might appeal to all acquainted with muſic, who know how eaſy it is to repeat a ſound in the ſame pitch with one juſt heard. In tuning an inſtrument, a good ear can as eaſily determine that two ſtrings are in uniſon by ſounding them ſeparately, as by ſounding them together; their diſagreement is alſo as eaſily, I believe I may ſay more eaſily and better diſtinguiſhed when ſounded ſeparately; for when ſounded together, though you know by the beating that one is higher than the other, you cannot tell which it is. I have aſcribed to memory the ability of comparing the pitch of a preſent tone with that of one paſt. But if there ſhould be, as poſſibly there may be, ſomething in the ear ſimilar to what we find in the eye, that ability would not be entirely owing to memory. Poſſibly the vibrations given to the auditory nerves by a particular ſound may actually continue for ſome time after the cauſe of theſe vibrations is paſt, and the agreement or diſagreement of a ſubſequent ſound become by compariſon with them more diſcernible. For the impreſſion made on the viſual nerves by a luminous object will continue for 20 or 30 ſeconds."

After ſome experiments to prove the permanency of viſible impreſſions, he continues thus:

"Farther, when we conſider by whom theſe ancient tunes were compoſed, and how they were firſt performed, we ſhall ſee that ſuch harmonical ſucceſſion of ſounds was natural, and even neceſſary in their conſtruction. They were compoſed by the minſtrels of thoſe days, to be played on the harp accompanied by the voice. The harp was ſtrung with wire, which gives a ſound of long continuance; and had no contrivance like that of the modern harpſichord, by which the ſound of the preceding note can be ſtopt the moment a ſucceeding note begins. To avoid actual diſcord, it was therefore neceſſary that the ſucceeding emphatic note ſhould be a chord with the preceding, as their ſounds muſt exiſt at the ſame time. Hence aroſe that beauty in thoſe tunes that has ſo long pleaſed, and will pleaſe for ever, though men ſcarce know why. That they were originally compoſed for the harp, and of the moſt ſimple kind, I mean a harp without any half-notes but thoſe in the natural ſcale, and with no more than two octaves of ſtrings, from C to C, I conjecture from another circumſtance; which is, that not one of theſe tunes really ancient, has a ſingle artificial half-note in it; and that in tunes where it is moſt convenient for the voice to uſe the middle notes of the harp, and place the key in F, there the B, which if uſed ſhould be a B flat, is always omitted, by paſſing over it with a third. The connoiſſeurs in modern muſic will ſay I have no taſte; but I cannot help adding, that I believe our anceſtors, in having a good ſong, diſtinctly articulated, ſung to one of thoſe tunes, and accompanied by the harp, felt more real pleaſure than is communicated by the generality of modern operas, excluſive of that ariſing from the ſcenery and dancing. Moſt tunes of late compoſition, not having this natural harmony united with their melody, have recourſe to the artificial harmony of a baſs, and other accompanying parts. This ſupport, in my opinion, the old tunes do not need, and are rather confuſed than aided by it. Whoever has heard *James Oſwald* play them on his violincello, will be leſs inclined to diſpute this with me. I have more than once ſeen tears of pleaſure in the eyes of his auditors: and yet I think, even *his* playing thoſe tunes would

would pleaſe more if he gave them leſs modern ornament."

As theſe obſervations are for the moſt part true, and always ingenious, we need no other apology for quoting them at length. It is only proper to remark, that the tranſition in Scots muſic by conſonant intervals, does not ſeem, as Dr Franklin imagines, to ariſe from the nature of the inſtruments upon which they played. It is more than probable, that the ancient Britiſh harp was not ſtrung with wire, but with the ſame materials as the Welſh harps at preſent. Theſe ſtrings have not the ſame permanency of tone as metal; ſo that the ſound of a preceding emphatic note muſt have expired before the ſubſequent accented note could be introduced. Beſides, they who are acquainted with the manœuvre of the Iriſh harp, know well that there is a method of diſcontinuing ſounds no leſs eaſy and effectual than upon the harpſichord. When the performer finds it proper to interrupt a note, he has no more to do but return his finger gently upon the ſtring immediately ſtruck, which effectually ſtops its vibration.

That ſpecies of Scots muſic which we have diſtinguiſhed by the name of *feſtive* ſeems now limited to reels and country-dances. Theſe may be either in common or treble time. They moſt frequently conſiſt of two ſtrains: each of theſe contains eight or twelve bars. They are truly rhythmical; but the mirth which they excite ſeems rather to be inſpired by the vivacity of the movement, than either by the force or variety of the melody. They poſſeſs a manœuvre and expreſſion peculiar to themſelves, which it is impoſſible to deſcribe, and which can only be exhibited by good performers.

Having thus far purſued the general idea of muſic, we ſhall, after the hiſtory, give a more particular detail of the ſcience.

HISTORY OF MUSIC.

o accu-
ate ac-
ounts of
he ſtate of
uſic in
he earlier
ges of the
orld.

MUSIC is capable of ſo infinite a variety, ſo greatly does the moſt ſimple differ from the moſt complex, and ſo multiplied are the degrees between theſe two extremes, that in no age could the incidents reſpecting that faſcinating art have been few or unintereſting. But, that accounts of theſe incidents ſhould have been handed down to us, ſcanty and imperfect, is no matter of ſurpriſe, when we recollect that the hiſtory of muſic is the hiſtory only of ſounds, of which writing is a very inadequate medium; and that men would long employ themſelves in the pleaſing exerciſe of cultivating muſic before they poſſeſſed either the ability or the inclination to record their exertions.

No accurate traces, therefore, of the actual ſtate of muſic, in the earlier ages of the world, can be diſcerned. Our ideas on the ſubject have no foundation firmer than conjecture and analogy.

It is probable, that among all barbarous nations ſome degree of ſimilarity is diſcernible in the ſtyle of their muſic. Neither will much difference appear during the firſt dawnings of civilization. But in the more advanced periods of ſociety, when the powers of the human mind are permitted without obſtacle to exert their native activity and tendency to invention, and are at the ſame time affected by the infinite variety of circumſtances and ſituations which before had no exiſtence, and which in one caſe accelerate, and in another retard; then that ſimilarity, once ſo diſtinguiſhable, gives place to the endleſs diverſity of which the ſubject is capable.

uſic not
e inven-
on of any
e man.

The practice of muſic being univerſal in all ages and all nations, it would be abſurd to attribute the invention of the art to any one man. It muſt have ſuffered a regular progreſſion, through infancy, childhood, and youth, before it could arrive at maturity. The firſt attempts muſt have been rude and artleſs. Perhaps the firſt flute was a reed of the lake.

No nation has been able to produce proofs of antiquity ſo indiſputable as the Egyptians. It would be vain, therefore, to attempt tracing muſic higher than the hiſtory of Egypt.

gyptian
uſic.

By comparing the accounts of Diodorus Siculus and of Plato, there is reaſon to ſuppoſe, that in very ancient times the ſtudy of muſic in Egypt was confined to the prieſthood, who uſed it only on religious and ſolemn occaſions; that, as well as ſculpture, it was circumſcribed by law; that it was eſteemed ſacred, and forbidden to be employed on light or common occaſions; and that innovation in it was prohibited: But what the ſtyle or relative excellence of this very ancient muſic was, there are no traces by which we can form an accurate judgment. After the reigns of the Pharaohs, the Egyptians fell by turns under the dominion of the Ethiopians, the Perſians, the Greeks, and the Romans. By ſuch revolutions, the manners and amuſements of the people, as well as their form of government, muſt have been changed. In the age of the Ptolemies, the muſical games and conteſts inſtituted by thoſe monarchs were of Greek origin, and the muſicians who performed were chiefly Greek.

The moſt ancient monuments of human art and induſtry, at preſent extant at Rome, are the obeliſks brought thither from Egypt, two of which are ſaid to have been erected by Seſoſtris at Heliopolis, about 400 years before the ſiege of Troy. Theſe were by the order of Auguſtus brought to Rome after the conqueſt of Egypt. One of them called *guglia rotta*, or the broken pillar, which during the ſacking of the city in 1527 was thrown down and broken, ſtill lies in the Campus Martius. On it is ſeen the figure of a muſical inſtrument of two ſtrings, and with a neck. It reſembles much the calaſcione ſtill uſed in the kingdom of Naples.

An Egyptian muſical inſtrument.

This curious relick of antiquity is mentioned, becauſe it affords better evidence than, on the ſubject of ancient muſic, is uſually to be met with, that the Egyptians, at ſo very early a period of their hiſtory, had advanced to a conſiderable degree of excellence in the cultivation of the arts. By means of its neck, this inſtrument was capable, with only two ſtrings, of producing a great number of notes. Theſe two ſtrings, if tuned fourths to each other, would furniſh that ſeries of ſounds called by the ancients *heptachord*, which

which conſiſts of a conjunct tetrachord as B, C, D, E; E, F, G, A; if tuned fifths, they would produce an octave, or two disjunct tetrachords. The calaſcione is tuned in this laſt manner. The annals of no nation other than Egypt, for many ages after the period of the obeliſk at Heliopolis, exhibit the veſtige of any contrivance to ſhorten ſtrings during performance by a neck or finger-board. Father Montfaucon obſerves, that after examining 500 ancient lyres, harps, and citharas, he could diſcover no ſuch thing.

Egypt indeed ſeems to have been the ſource of human intelligence, and the favourite reſidence of genius and invention. From that celebrated country did the Greeks derive their knowledge of the firſt elements of thoſe arts and ſciences in which they afterwards ſo eminently excelled. From Greece again did the Romans borrow their attainments in the ſame purſuits. And from the records of thoſe different nations have the moderns been enabled to accompliſh ſo wonderful an improvement in literature.

The Egyptian Hermes the inventor of the lyre.

The Hermes or Mercury of the Egyptians, ſirnamed *Triſmegiſtus*, or *thrice illuſtrious*, who was, according to Sir Iſaac Newton, the ſecretary of Oſiris, is celebrated as the inventor of muſic. It has already been obſerved, that no one perſon ought ſtrictly to be called the inventor of an art which ſeems to be natural to, and coeval with, the human ſpecies; but the Egyptian Mercury is without doubt entitled to the praiſe of having made ſtriking improvements in muſic, as well as of having advanced in various reſpects the civilization of the people, whoſe government was chiefly committed to his charge. The account given by Apollodorus of the manner in which he accidentally invented the lyre, is at once entertaining and probable. "The Nile (ſays Apollodorus), after having overflowed the whole country of Egypt, when it returned within its natural bounds, left on the ſhore a great number of dead animals of various kinds, and among the reſt a tortoiſe; the fleſh of which being dried and waſted by the ſun, nothing remained within the ſhell but nerves and cartilages, and theſe being braced and contracted by the drying heat became ſonorous. Mercury, walking along the banks of the Nile, happened to ſtrike his foot againſt this ſhell; and was ſo pleaſed with the ſound produced, that the idea of a lyre ſtarted into his imagination. He conſtructed the inſtrument in the form of a tortoiſe, and ſtrung it with the dried ſinews of dead animals."

How beautiful to conceive the energetic powers of the human mind in the early ages of the world, exploring the yet undiſcovered capabilities of nature, and directed to the inexhauſtible ſtore by the finger of God in the form of accident!

The ſingle flute of the Egyptians.

The monaulos, or ſingle flute, called by the Egyptians photinx, was probably one of the moſt ancient inſtruments uſed either by them or any other nation. From various remains of ancient ſculpture, it appears to have been ſhaped like a bull's horn, and was at firſt, it may be ſuppoſed, no other than the horn itſelf.—Before the invention of flutes, as no other inſtrument except thoſe of percuſſion were known, muſic muſt have been little more than metrical. When the art of refining and lengthening ſounds was firſt diſcovered, the power of muſic over mankind, from the agreeable ſurpriſe occaſioned by ſoft and extended notes, was probably irreſiſtible. At a time when all the reſt of the world was involved in ſavage ignorance, the Egyptians were poſſeſſed of muſical inſtruments capable of much variety and expreſſion.—Of this the aſtoniſhing remains of the city Thebes ſtill ſubſiſting afford ample evidence. In a letter from Mr Bruce, ingroſſed in Dr Burney's hiſtory of Muſic, there is given a particular deſcription of the Theban harp, an inſtrument of extenſive compaſs, and exquiſite elegance of form. It is accompanied with a drawing taken from the ruins of an ancient ſepulchre at Thebes, ſuppoſed by Mr Bruce to be that of the father of Seſoſtris.

The Theban harp of Egypt.

On the ſubject of this harp, Mr Bruce makes the following ſtriking obſervation. It overturns all the accounts of the earlieſt ſtate of ancient muſic and inſtruments in Egypt, and is altogether, in its form, ornaments, and compaſs, an inconteſtable proof, ſtronger than a thouſand Greek quotations, that geometry, drawing, mechanics, and muſic, were at the greateſt perfection when this harp was made; and that what we think in Egypt was the invention of arts was only the beginning of the æra of their reſtoration."

Indeed, when the beauty and powers of this harp, along with the very great antiquity of the painting which repreſents it, are conſidered, ſuch an opinion as that which Mr Bruce hints at, does not ſeem to be devoid of probability.

It cannot be doubted that during the reigns of the Ptolemies, who were voluptuous princes, muſic muſt have been much cultivated and encouraged. The father of Cleopatra, who was the laſt of that race of kings, derived his title of auletes, or flute-player, from his exceſſive attachment to the flute. Like Nero, he uſed to array himſelf in the dreſs of a tibicen, and exhibit his performance in the public muſical conteſts.

Some authors, particularly Am. Marcellinus and M. Pau, refuſe to the Egyptians, at any period of their hiſtory, any muſical genius, or any excellence in the art; but the arguments uſed to ſupport this opinion ſeem to be inconcluſive, and the evidences of the oppoſite deciſion appear to be inconteſtable.

Hebrew muſic

The ſacred Scriptures afford almoſt the only materials from which any knowledge of Hebrew muſic can be drawn. In the rapid ſketch, therefore, of ancient muſic which we mean to exhibit, a very few obſervations are all which can properly be given to that department of our ſubject.

Moſes, who led the Iſraelites out of Egypt, was educated by Pharaoh's daughter in all the literature and elegant arts cultivated in that country. It is probable, therefore, that the taſte and ſtyle of Egyptian muſic would be infuſed in ſome degree into that of the Hebrews. Muſic appears to have been interwoven through the whole tiſſue of religious ceremony in Paleſtine. The prieſthood ſeem to have been muſicians hereditarily and by office. The prophets appear to have accompanied their inſpired effuſions with muſic; and every prophet, like the preſent improviſatori of Italy, ſeems to have been accompanied by a muſical inſtrument.

Muſic, vocal and inſtrumental, conſtituted a great part of the funeral ceremonies of the Jews. The pomp and expence uſed on theſe occaſions advanced by degrees to an exceſſive extent. The number of flute-players in the proceſſions amounted ſometimes to ſeveral hundreds, and the attendance of the gueſts continued frequently for 30 days *.

Joſephus, b. iii. c. 9.

The Hebrew language abounds with conſonants, and has ſo few vowels, that in the original alphabet they had no characters. It muſt, therefore, have been harſh and unfavourable to muſic. Their inſtruments of muſic were chiefly thoſe of percuſſion; ſo that, both on account of the language and the inſtruments, the muſic muſt have been coarſe and noiſy. The vaſt numbers of performers too, whom it was the taſte of the Hebrews to collect together, could with ſuch a language and ſuch inſtruments produce nothing but clamour and jargon. According to Joſephus, there were 200,000 muſicians at the dedication of Solomon's temple. Such are the circumſtances from which only an idea of Hebrew muſic can be formed; for the Jews, neither ancient nor modern, have ever had any characters peculiar to muſic; and the melodies uſed in their religious ceremonies have at all times been entirely traditional.

oarſe and oiſy.

Grecian muſic.

Cadmus, with the Phœnician colony which he led into Greece, imported at the ſame time various arts into that country. By the aſſiſtance of his Phœnician artificers, that chief diſcovered gold in Thrace and copper at Thebes. At Thebes that metal is ſtill termed *cadmia.* Of theſe materials, and of iron, they formed to themſelves armour and inſtruments of war. Theſe they ſtruck againſt each other during their dances at ſacrifices, by which they firſt obtained the idea of muſic. Such is the account given of the origin of that ſpecies of muſic in Greece produced by inſtruments of percuſſion. The invention of wind inſtruments in Greece is attributed to Minerva; and to the Grecian Mercury is aſſigned, by the poets and hiſtorians of that country, the honour of many diſcoveries probably due to the Egyptian Hermes, particularly the invention of ſtringed inſtruments. The lyre of the Egyptian Mercury had only three ſtrings; that of the Grecian ſeven: The laſt was perhaps no more than an improvement on the other. When the Greeks deified a prince or hero of their own country, they uſually aſſigned him an Egyptian name, and with the name beſtowed on their new divinity all the actions, attributes, and rites of the original.

The Grecian lyre, although ſaid to have been invented by Mercury, was cultivated principally by Apollo, who firſt played upon it with method, and accompanied it with the voice. The celebrated conteſt between him and Marſyas is mentioned by various authors; in which, by conjoining the voice with his lyre (a combination never before attempted), his muſic was declared ſuperior to the flute of Marſyas. The progreſs of the lyre, according to Diodorus Siculus, is the following. "The muſes added to the Grecian lyre the ſtring called *meſe;* Linus that of lichanos; and Orpheus and Thamyras thoſe ſtrings which are named hypate and parhypate." It has been already mentioned, that the lyre invented by the Egyptian Mercury had but three ſtrings. By putting theſe circumſtances together, we may perhaps acquire ſome knowledge of the progreſs of muſic, or at leaſt of the extenſion of its ſcale in the higheſt antiquity. *Meſe,* in the Greek muſic, is the fourth ſound of the ſecond tetrachord of the great ſyſtem, and firſt tetrachord invented by the ancients, anſwering to our A, on the fifth line in the baſe. If this ſound then was added to the former three, it proves that the moſt ancient tetrachord was that from E in the baſe to A; and that the three original ſtrings in the Mercurian and Apollonian lyre were tuned E, F, G, which the Greeks call *hypate meſon, parhypate meſon,* and *meſon diatonos:* The addition, therefore, of *meſe* to theſe, completed the firſt and moſt ancient tetrachord E, F, G, A. The ſtring lichanos again being added to theſe, and anſwering to our D on the third line in the baſe, extended the compaſs downwards, and gave the ancient lyre a regular ſeries of five ſounds. The two ſtrings hypate and parhypate, correſponding with our B and C in the baſe, completed the heptachord or ſeven ſounds b, c, d, e, f, g, a; a compaſs which received no addition till after the days of Pindar.

Progreſs of the Grecian lyre.

It might perhaps be expected, that in a hiſtory of Greek muſic ſomething ought to be ſaid concerning the muſes, Apollo, Bacchus, and the other gods and demi-gods, who in the mythology of that country appear to have promoted and improved the art. But ſuch a diſcuſſion would be too diffuſive, and involve too much foreign matter for the plan we have choſen to adopt. We cannot avoid, however, making a few obſervations on the poems of Homer, in ſo far as connected with our ſubject. It has been imagined, with much appearance of probability, that the occupation of the firſt poets and muſicians of Greece reſembled that of the Celtic and German bards and the ſcalds of Iceland and Scandinavia. They ſung their poems in the ſtreets of the cities and in the palaces of princes. They were treated with high reſpect, and regarded as inſpired perſons. Such was the employment of Homer. His poems, ſo juſtly celebrated, exhibit the moſt authentic picture that can be found in the annals of antiquity, although perhaps ſomewhat highly coloured, of the times of which he wrote and in which he lived. Muſic is always named throughout the Iliad and Odyſſey with rapture; but as in theſe poems no mention is made of inſtrumental muſic unaccompanied with poetry and ſinging, a conſiderable ſhare no doubt of the poet's praiſes is to be attributed to the poetry. The inſtruments moſt frequently named are the lyre, the flute, and the ſyrinx. The trumpet appears not to have been known at the ſiege of Troy, although it had come to be in uſe in the days of Homer himſelf. From the time of Homer till that of Sappho, there is almoſt a total blank in literature. Only a few fragments remain of the works of thoſe poets and muſicians whoſe names are preſerved as having flouriſhed between thoſe periods (A). During the century which elapſed between the days of Sappho and thoſe of Anacreon, no literary productions are preſerved entire.—From

Occupation of the firſt poets and muſicians in Greece.

(A) Heſiod lived ſo near to Homer, that it has been diſputed which of them is the moſt ancient. It is now, we believe, univerſally admitted, that the palm of antiquity is due to Homer; but we conſider them as having both flouriſhed in the ſame era.

From Anacreon to Pindar there is another chaſm of near a century. Subſequent to this time, the works ſtill extant of the three great tragic poets, Æſchylus, Sophocles, and Euripides, together with thoſe of Plato, Ariſtotle, Ariſtoxenus, Euclid, Theocritus, Callimachus, Polybius, and many others, produced all within a ſpace leſs than 300 years, diſtinguiſh this illuſtrious and uncommon period as that in which the whole powers of genius ſeem to have been exerted to illuminate and inſtruct mankind in future ages. Then it was that eloquence, poetry, *muſic*, architecture, hiſtory, painting, ſculpture, like the ſpontaneous bloſſoms of nature, flouriſhed without the appearance of labour or of art.

The poets, as well epic as lyric and elegiac, were all likewiſe muſicians; ſo ſtrictly connected were muſic and poetry for many ages. It would afford amuſement to collect the biographical anecdotes of theſe favourites of genius, and to aſſign to each the reſpective improvements made by him in muſic and poetry; but our limits do not admit of ſo extenſive a diſquiſition; for which, therefore, reference muſt be made to the editors and commentators of theſe authors, and to the voluminous hiſtories of muſic lately publiſhed.

The invention of muſical characters.

The invention of notation and muſical characters marked a diſtinguiſhed æra in the progreſs of muſic. There are a diverſity of accounts reſpecting the perſon to whom the honour of that invention is due; but the evidences ſeem to preponderate in favour of Terpander, a celebrated poet and muſician, to whoſe genius muſic is much indebted. He flouriſhed about the 27th Olympiad, or 671 years before Chriſt.

Before that valuable diſcovery, muſic being entirely traditional, muſt have depended much on the memory and taſte of the performer.

Vociferous muſic of the Greeks.

There is an incident mentioned in the accounts handed down to us of the Olympic games, which may ſerve in ſome degree to mark the character of muſic at the time in which it happened. Lucian relates that a young flute-player named Harmonides, at his firſt public appearance in theſe games, began a ſolo with ſo violent a blaſt, on purpoſe to *ſurpriſe* and *elevate* the audience, that he *breathed his laſt breath into his flute*, and died on the ſpot. When to this anecdote, wonderful to us, and almoſt incredible, is added that circumſtance, that the trumpet-players at theſe public exhibitions expreſſed an exceſs of joy when they found their exertions had neither rent their cheeks nor burſt their blood-veſſels, ſome idea may be formed of the noiſy and vociferous ſtyle of muſic which then pleaſed; and from ſuch facts only can any opinion be obtained of the actual ſtate of ancient muſic.

In whatever *manner* the flute was played on, there is no doubt that it was long in Greece an inſtrument of high favour, and that the flute-players were held in much eſtimation. The flute uſed by Iſmenias, a celebrated Theban muſician, coſt at Corinth three talents, or 581l. 5s. If, ſays Xenophon, a bad flute-player would paſs for a good one, he muſt, like the *great flute-players*, expend large ſums on *rich furniture*, and appear in public *with a great retinue of ſervants*.

Extravagance of the ancients with reſpect to muſic.

The ancients, it appears, were not leſs extravagant in gratifying the miniſters of their pleaſures than ourſelves. Amœbæus, a harper, was paid an Attic talent, or 193l. 15s. per day for his performance (B).

It is proper to add, that the celebrated muſicians of Greece who performed in public were of *both* ſexes; and that the beautiful Lamia, who was taken captive by Demetrius, in the ſea engagement in which he vanquiſhed Ptolemy Soter, and who herſelf captivated her conqueror, was a public performer, as well as were many other elevated female ſpirits, who are recorded by ancient authors in terms of admiration, and of whom, did our limits here admit of biography, we would treat with pleaſure. The philoſophers of Greece, whoſe capacious minds graſped every other object of human intelligence, were not inattentive to the theory of muſic, or the philoſophy of ſound. This department of ſcience became the ſource of various ſects, and of much diverſity of opinion.—The founders of the moſt diſtinguiſhed ſects were Pythagoras and Ariſtoxenus.

Roman muſic.

Like every other people, the Romans, from their firſt origin as a nation, were poſſeſſed of a ſpecies of muſic which might be diſtinguiſhed as their own. It appears to have been rude and coarſe, and probably was a variation of the muſic in uſe among the Etruſcans and other tribes around them in Italy; but as ſoon as they began to open a communication with Greece, from that country, with their arts and philoſophy, they borrowed alſo their muſic and muſical inſtruments. No account, therefore, of Roman muſic is to be expected that would not be a repetition of what has been ſaid on the ſubject of the muſic of Greece.

Vanity of Nero with reſpect to muſic.

The exceſſive vanity of Nero with reſpect to muſic, diſplayed in his public contentions for ſuperiority with the moſt celebrated profeſſors of the art in Greece and Rome, is known to every one converſant in the hiſtory of Rome. The ſolicitude with which that deteſtable tyrant attended to his voice is curious, and will throw ſome light on the practices of ſingers in ancient times. He was in uſe to lie on his back, with a thin plate of lead on his ſtomach. He took frequent emetics and cathartics, abſtained from all kinds of fruits and ſuch meats as were held to be prejudicial to ſinging. Apprehenſive of injuring his voice, he at length deſiſted from haranguing the ſoldiery and the ſenate; and after his return from Greece eſtabliſhed an officer (Phonaſcus) to regulate his tones in ſpeaking.

Sacred muſic

Moſt nations have conſented in introducing muſic into their religious ceremonies. That art was early admitted into the rites of the Egyptians and Hebrews; and that it conſtituted a conſiderable part of the Grecian and Roman religious ſervice, appears from the writings of many ancient authors. The ſame pleaſing art ſoon obtained an introduction into the Chriſtian church, as the Acts of the Apoſtles diſcover in many paſſages. There remain no ſpecimens of the muſic employed in the worſhip of the primitive Chriſtians; but probably it was at firſt the ſame with that uſed in the Pagan rites of the Greeks and Romans. The practice

---

(B) Roſcius gained 500 ſeſtertia, or 4036l. 9s. 2d. ſterling.

practice of chanting the pſalms was introduced into the weſtern churches by St Ambroſe, about 350 years after Chriſt. In the year 600, the method of chanting was improved by St Gregory the Great. The Ambroſian chant contained four modes. In the Gregorian the number was doubled. So early as the age of Conſtantine the Great, prior to either of the periods laſt mentioned, when the Chriſtian religion firſt obtained the countenance of power, inſtrumental muſic came to be introduced into the ſervice of the church.

troduced to the nglish urch.

In England, according to Biſhop Stillingfleet, muſic was employed in the church ſervice, firſt by St Auguſtine, and afterwards much improved by St Dunſtan, who was himſelf an eminent muſician, and who is ſaid to have firſt furniſhed the Engliſh churches and convents with the organ. The organ, the moſt majeſtic of all inſtruments, ſeems to have been an improvement of the hydraulican or water organ of the Greeks.— The firſt organ ſeen in France was ſent from Conſtantinople in 757, as a preſent to King Pepin from the emperor Conſtantine Copronymus VI. In Italy, Germany, and England, that inſtrument became frequent during the 10th century.

The great mprovements in muſic had their origin n Italy.

During the dark ages no work of genius or taſte in any department of ſcience ſeems to have been produced in any part of Europe; and except in Italy, where the cultivation of muſic was rather more the object of attention, that art was neglected equally with all others. There has always been obſerved a correſpondence in every country between the progreſs of muſic and the cultivation of other arts and ſciences. In the middle ages, therefore, when the moſt fertile provinces of Europe were occupied by the Goths, Huns, Vandals, and other barbarous tribes, whoſe language was as harſh as their manners were ſavage, little perfection and no improvement of muſic is to be looked for. Literature, arts, and refinements, were encouraged more early at the courts of the Roman pontiffs than in any other country; and owing to that circumſtance it is, that the ſcale, the counterpoint, the beſt melodies, the dramas religious and ſecular, the chief graces and elegancies of modern muſic, have derived their origin from Italy. In modern times, Italy has been to the reſt of Europe what ancient Greece was to Rome. The Italians have aided the civilization of their conquerors, and enlightened the minds of thoſe whoſe ſuperior proweſs had enſlaved them.

Counterpoint.

Having mentioned counterpoint, it would be improper not to make one or two obſervations on an invention which is ſuppoſed to have been the ſource of great innovation in the practice of muſic. Counterpoint, or muſic in parts, ſeems to be an invention purely modern. The term harmony meant in the language of antiquity what is now underſtood by melody. Guido, a monk of Arezzo in Tuſcany, is, in the general opinion, ſuppoſed to have entertained the firſt idea of counterpoint about the year 1022: an art which, ſince his time, has experienced gradual and imperceptible improvements, far exceeding the powers or comprehenſion of any one individual. The term *counterpoint*, or *contra punctum*, denotes its own etymology and import. Muſical notation was at one time performed by ſmall points; and the preſent mode is only an improvement of that practice. Counterpoint, therefore, denotes the notation of harmony or muſic in parts, by points oppoſite to each other. The improvements of this important acquiſition to the art of muſic kept pace at firſt with thoſe of the organ; an inſtrument admirably adapted to harmony: And both the one and the other were till the 13th century employed chiefly in ſacred muſic. It was at this period that ſacred muſic began to be cultivated.

The invention of the time-table.

Before the invention of characters for time, muſic in parts muſt have conſiſted entirely of *ſimple counterpoint*, or note againſt note, as is ſtill practiſed in pſalmody. But the happy diſcovery of a time-table extended infinitely the powers of combined ſounds. The ancients had no other reſource to denote time and movement in muſic except two characters (— ◡), equivalent to a long and a ſhort ſyllable. But time is of ſuch importance in muſic, that it can impart meaning and energy to the repetition of the ſame ſound. Without it variety of tones has no effect with reſpect to gravity and acuteneſs. The invention of the time-table is attributed by almoſt all the writers on muſic of the laſt and preſent century to John de Muris, who flouriſhed about the year 1330. But in a manuſcript of John de Muris himſelf, bequeathed to the Vatican library by the Queen of Sweden, that honour ſeems to be yielded to Magiſter Franco, who appears to have been alive as late at leaſt as 1083. John de Muris, however, who there is ſome cauſe to believe was an Engliſhman, though not the inventor of the *cantus menſurabilis*, did certainly by his numerous writings greatly improve it. His tract on the *Art of Counterpoint* is the moſt clear and uſeful eſſay on the ſubject of which thoſe times can boaſt.

Troubadours.

In the 11th century, during the firſt cruſade, Europe began to emerge from the barbarous ſtupidity and ignorance which had long overwhelmed it. While its inhabitants were exerciſing in Aſia every ſpecies of rapine and pious cruelty, art, ingenuity, and reaſon, inſenſibly civilized and ſoftened their minds. Then it was that the poets and ſongſters, known by the name of *Troubadours*, who firſt appeared in Provence, inſtituted a new profeſſion; which obtained the patronage of the count of Poictou, and many other princes and barons, who had themſelves cultivated muſic and poetry with ſucceſs. At the courts of their munificent patrons the troubadours were treated with reſpect. The ladies, whoſe charms they celebrated, gave them the moſt generous and flattering reception. The ſucceſs of ſome inſpired others with hopes, and excited exertions in the exerciſe of their art; impelling them towards perfection with a rapidity which the united force alone of emulation and emolument could occaſion. Theſe founders of modern verſification, conſtructing their ſongs on plans of their own, claſſical authority, either through ignorance or deſign, was entirely diſregarded. It does not appear, however, during the cultivation and favour of Provençal literature, that any one troubadour ſo far outſtripped the reſt as to become a model of imitation. The progreſs of taſte muſt ever be impeded by the ignorance and caprice of thoſe who cultivate an art without ſcience or principles.

During almoſt two centuries after the arrangement of the ſcale attributed to Guido, and the invention of the time-table aſcribed to Franco, no remains of ſecular muſic can be diſcovered, except thoſe of the troubadours or Provençal poets. In the ſimple tunes of theſe bards no time indeed is marked, and but little variety of notation appears: It is not difficult, however, to diſcover in them the germs of the future melodies, as well as the poetry of France and Italy. Had the poetry and muſic of the troubadours been treated of in an agreeable manner by the writers who have choſen that ſubject, it would have been diſcovered to be worthy of attention; the poetry, as intereſting to literature; the melody to which it was ſung, as curious to the muſical hiſtorian.

Almoſt every ſpecies of Italian poetry is derived from the Provençals. *Air*, the moſt captivating part of ſecular vocal muſic, ſeems to have had the ſame origin. The moſt ancient ſtrains that have been ſpared by time, are ſuch as were ſet to the ſongs of the troubadours. The Provençal language began to be in favour with poets about the end of the 10th century. In the 12th it became the general vehicle, not only of poetry, but of proſe, to all who were ignorant of Latin. And theſe were not the laity only. At this period *violars*, or performers on the vielle or viol, *juglars* or flute-players, *muſars* or players on other inſtruments, and *comics* or comedians, abounded all over Europe. This ſwarm of poet-muſicians, who were formerly comprehended in France under the general title of *jongleurs*, travelled from province to province, ſinging their verſes at the courts of princes. They were rewarded with clothes, horſes, arms, and money. Jongleurs or muſicians were employed often to ſing the verſes of troubadours, who themſelves happened to be deficient in voice or ignorant of muſic. The term *troubadour*, therefore, implies poetry as well as muſic. The jongleurs, menetriers, ſtrollers, or minſtrels, were frequently muſicians, without any pretenſions to poetry. Theſe laſt have been common at all times; but the troubadour or bard has diſtinguiſhed a particular profeſſion, either in ancient or modern times, only during the early dawnings of literature.

In the 13th century the ſongs were on various ſubjects; moral, merry, amorous: and at that time melody ſeems to have been little more than plain ſong or chanting. The notes were ſquare, and written on four lines only like thoſe of the Romiſh church in the cliff C, and without any marks for time. The movement and embelliſhments of the air depended on the abilities of the ſinger. Since that time, by the cultivation of the voice modern muſic has been much extended, for it was not till towards the end of St Lewis's reign that the fifth line began to be added to the ſtave. The ſinger always accompanied himſelf with an inſtrument in uniſon.

The harp the favourite inſtrument of the Troubadours.

As the lyre is the favourite inſtrument in Grecian poetry, ſo the harp held the ſame place in the eſtimation of the poets who flouriſhed in the period of which we at preſent ſpeak. A poet of the 14th century, Machau, wrote a poem on the ſubject of the harp alone; in which he aſſigns to each of its 25 ſtrings an allegorical name; calling one *liberality*, another *wealth*, &c.

The viol or violin.

The inſtrument which frequently accompanied, and indeed diſputed the pre-eminence with the harp, was the viol. Till the 16th century this inſtrument was furniſhed with frets; after that period it was reduced to four ſtrings: and ſtill under the denomination of *violin* holds the firſt place among the treble inſtruments. The viol was played with a bow, and differed entirely from the vielle, the tones of which were produced by the friction of a wheel: The wheel performed the part of a bow.

Britiſh harpers were famous long before the conqueſt. The bounty of William of Normandy to his *joculator* or bard is recorded in the Doomſday book. The harp ſeems to have been the favourite inſtrument in Britain for many ages, under the Britiſh, Saxon, Daniſh, and Norman kings. The *fiddle*, however, is mentioned ſo early as 1200 in the legendary life of St Chriſtopher. The ancient privileges of the minſtrels at the fairs of Cheſter are well known in the hiſtory of England.

The extirpation of the bards of Wales by Edward I. is likewiſe too familiar an incident to be particularly mentioned here. His perſecuting ſpirit, however, ſeems to have been limited to that principality; for we learn; that at the ceremony of knighting his ſon, a *multitude of minſtrels* attended.

In 1315, during the reign of Edward II. ſuch extenſive privileges were claimed by the minſtrels, and ſo many diſſolute perſons aſſumed that character, that it became neceſſary to reſtrain them by expreſs laws.

St Cecilia.

The father of our genuine poetry, who in the 14th century enlarged our vocabulary, poliſhed our numbers, and with acquiſitions from France and Italy augmented our ſtore of knowledge (Chaucer), entitles one of his poems The Hiſtory of St Cecilia; and the celebrated patroneſs of muſic muſt no doubt be mentioned in a hiſtory of the art. Neither in Chaucer, however, nor in any of the hiſtories or legendary accounts of this ſaint, does any thing appear to authorize the religious veneration paid to her by the votaries of muſic; nor is it eaſy to diſcover whence it has ariſen.

Origin of the degree of Mus. D.

As an incident relative to the period of which we ſpeak, it may be mentioned, that, according to Spelman, the appellation of *Doctor* was not among the degrees granted to graduates in England ſooner than the reign of King John, about 1207; although, in Wood's hiſtory of Oxford, that degree is ſaid to have been conferred, even in muſic, in the reign of Henry II. It is known that the title was created on the continent in the 12th century; and as, during the middle ages, muſic was always ranked among the ſeven liberal arts, it is likely that the degree was extended to it.

After the invention of printing, an art which has tended to diſſeminate knowledge with wonderful rapidity among mankind, muſic, and particularly counterpoint, became an object of high importance. The names of the moſt eminent compoſers who flouriſhed in England, from that time to the Reformation, were, Fairfax, William of Newark, Sheryngham, Turges, Baniſter, Tudor, Taverner, Tye, Johnſon, Parſons; to whom may be added John Marbeck, who ſet the whole Engliſh cathedral ſervice to muſic.

Scottiſh muſic.

Before this period Scottiſh muſic had advanced to a high degree of perfection. James I. was a great compoſer of airs to his own verſes; and may be conſidered

dered as the father of that plaintive melody which in Scotch tunes is ſo pleaſing to a taſte not vitiated by modern affectation. Beſides the teſtimony of *Fordun* and *Major*, who may be ſuſpected of being under the influence of national prejudice, we have that of Aleſſandro Teſſani, to the muſical ſkill of that accompliſhed prince. "Among us moderns (ſays this foreigner) we may reckon *James king of Scotland*, who not only compoſed many ſacred pieces of vocal muſic, but alſo of himſelf *invented a new kind of muſic, plaintive and melancholy, different from all others*; in which he has *been imitated* by Carlo Geſueldo prince of Venoſa, who in our age has improved muſic with new and admirable inventions."

Under ſuch a genius in poetry and muſic as King James I. it cannot be doubted that the national muſic muſt have been greatly improved. We have ſeen that he compoſed ſeveral anthems, or vocal pieces of *ſacred muſic*, which ſhows that his knowledge of the ſcience muſt have been very conſiderable. It is likewiſe known, that organs were by him introduced into the cathedrals and abbeys of Scotland, and choir-ſervice brought to ſuch a degree of perfection, as to fall little ſhort of that eſtabliſhed in any country of Europe.—By an able and ingenious antiquary * the great era of muſic, as of poetry, in Scotland, is ſuppoſed to have been from the beginning of the reign of James I. down to the end of the reign of James V. During that period flouriſhed *Gavin Douglas* biſhop of Dunkeld, *Ballenden* archdeacon of Murray, *Dunbar*, *Henryſon*, *Scott*, *Montgomery*, *Sir David Lindſey*, and many others, whoſe fine poems have been preſerved in Banatyne's Collection, and of which ſeveral have been publiſhed by Allan Ramſay in his *Evergreen*.

*See *Tyt-*
r's Diſ-
rtation
the
otch Mu-
, vol. i. of
e Tranſ-
tions of
e Society
Antiqua-
es in Scot-
nd.

Before the Reformation, as there was but one religion, there was but one kind of ſacred muſic in Europe, plain chant, and the deſcant built upon it.—That muſic likewiſe was applied to one language only, the Latin. On that account, the compoſitions of Italy, France, Spain, Germany, Flanders, and England, kept pace in a great degree with each other in ſtyle and excellence. All the arts ſeem to have been the companions, if not the produce, of ſucceſsful commerce: they appeared firſt in Italy, then in the Hanſeatic towns, next in the Netherlands; and during the 16th century, when commerce became general in every part of Europe.

the 16th
entury
uſic an
diſpen-
ble part
educa-
on.

In the 16th century muſic was an indiſpenſable part of polite education: All the princes of Europe were inſtructed in that art. There is a collection preſerved in manuſcript called *Queen Elizabeth's Virginal Book*. If her majeſty was able to execute any of the pieces in that book, ſhe muſt have been a great player; a month's practice would not be ſufficient for any maſter now in Europe to enable him to play one of them to the end. *Tallis*, ſingularly profound in muſical compoſition, and *Bird* his admirable ſcholar, were two of the authors of this famous collection.

During the reign of Elizabeth, the genius and learning of the Britiſh muſicians were not inferior to any on the continent; an obſervation ſcarcely applicable at any other period of the hiſtory of this country. Sacred muſic was the principal object to ſtudy all over Europe.

Eminent muſicians in Italy during the 16th century.

The moſt eminent muſical theoriſts of Italy, who flouriſhed in the 16th century, were, Franchinus Gaſicrius, or Gafforio of Lode, Pietro Aaron of Florence, Lodovico Fogliano, Giov. Spatro, Giov. Maria da Terentio Lanfranco, Steffano Uanneo, Anton. Franciſco Done, Luigi Dentice, Nicolo Vicentino, and Gioſeffo Zarlino, the moſt general, voluminous, and celebrated theoriſt of that period, Vincentio Galilei, a Florentine nobleman, and father of the great Galileo Galilei, Maria Artuſe of Bologna, Oraſeo Tegrini, Pietro Pontio, and Lodovico Zacconi.

The principal Roman authors were, Giovanni Anmuccia, Giovanni Pierluigi da Paleſtrina, juſtly celebrated, Ruggiero Giovanelli, Luca Marenzio, who brought to perfection madrigals, the moſt cheerful ſpecies of ſecular muſic.

Of the Venetians, Adrian Willaeri is allowed to be at the head.

At the head of the Neapolitans is deſervedly placed Rocco Rodio.

At Naples, too, the illuſtrious dilettante, Don Carlo Geſualdo prince of Venoſa, is highly celebrated. He ſeems, however, to have owed much of his fame to his high rank.

Lombardy might alſo furniſh an ample liſt of eminent muſicians during the 16th century, of whom, however, our limits will not admit of a particular enumeration:—The chief of them were, Conſtanzo Porta, Gaſtoldi, Biſſi, Cima, Vecchi, and Monteverde.

At Bologna, beſides Artuſi already mentioned, Andrea Rota of the ſame city appears to have been an admirable contrapunctiſt.

Franciſco Corteccia, a celebrated organiſt and compoſer, and Aleſſandro Strigglio, a lutaniſt and voluminous compoſer, were the moſt eminent Florentines.

In Germany.

The inhabitants of the extenſive empire of Germany have long made muſic a part of general education.—They hold the place, next to Italy, among the moſt ſucceſsful cultivators of the art. During the 16th century, their moſt eminent compoſers of muſic and writers on the ſubject were, Geo. Reiſchius, Michael Roſwick, Andreas Ornithorparchus, Paul Hofhaimer, Luſpeinius, Henry Loris or Lorit, Faber, Fink, Hoſman, and many others whom it would be tedious to mention; and for a particular account of whoſe treatiſes and compoſitions we muſt refer to more voluminous hiſtories of muſic.

In France.

In France, during, the 16th century, no art except the art of war made much progreſs in improvement.—Ronſard, Baif, Goudimel, Claud le Jeune, Caurroy, and Maudit, are the chief French muſicians of that period.

Spain.

In Spain, muſic was early received into the circle of ſciences in the univerſities. The muſical profeſſorſhip at Salamanca was founded and endowed by Alfonzo the Wiſe, king of Caſtile.

One of the moſt celebrated of the Spaniſh muſicians was Francis Salinas, who had been blind from his infancy. He was a native of Burgos.

D. Criſtofero Morales, and Tomaſo Lodovico da Vittorio, deſerve likewiſe to be mentioned; and to mention them is all we can attempt; the purpoſe of which is, to excite more minute inquiry by thoſe who may chooſe to inveſtigate the ſubject particularly.

The Netherlands.

The Netherlands, likewiſe, during the period of which we have been ſpeaking, produced eminent compoſers; of of whom we may mention Verletot, Gombert, Arkadelt, Berchem, Richefort or Ricciafort, Crequilon Le Cock or Le Coq, Canis, Jacob Clemens Non Papa, Pierre Manchicourt, Baſton, Kerl, Rore, Orlandi di Laſſo, and his ſons Ferdinand and Rodolph.

Muſical compoſers in England during the 17th century.

In the 17th century, the muſical writers and compoſers who acquired fame in England, were, Dr Nathanael Giles, Thomas Tomkins, and his ſon of the ſame name; Elway Bevin, Orlando Gibbons, Dr William Child, Adrian Batten, Martin Pierſon, William Lawes, Henry Lawes, Dr John Wilſon, John Hilton, John Playford, Captain Henry Cook, Pelham Humphrey, John Blow, William Turner, Dr Chriſtopher Gibbons, Benjamin Rogers, and Henry Purcell. Of theſe, Orlando Gibbons, Pelham Humphrey, and Henry Purcell, far excelled the reſt.

About the end of the reign of James I. a muſic lecture or profeſſorſhip was founded in the univerſity of Oxford by Dr William Hychin.

In the reign of Charles I. a charter was granted to the muſicians of Weſtminſter, incorporating them, as the king's muſicians, into a body politic, with powers to proſecute and fine all who, except themſelves, ſhould "attempt to make any benefit or advantage of muſic in England or Wales;" powers which in the ſubſequent reign were put in execution.

About the end of the reign of Charles II. a paſſion ſeems to have been excited in England for the violin, and for pieces expreſsly compoſed for it, in the Italian manner (B). Prior to 1600, there was little other muſic except maſſes and madrigals, the two principal diviſions of ſacred and ſecular muſic; but from that time to the preſent, dramatic muſic becomes the chief object of attention. The muſic of the church and of the chamber continued indeed to be cultivated in Italy with diligence, and in a learned and elaborate ſtyle, till near the middle of the century; yet a revolution in favour of melody and expreſſion was preparing, even in ſacred muſic, by the ſucceſs of dramatic compoſition, conſiſting of recitation and melodies for a ſingle voice. Such melodies began now to be preferred to muſic of many parts; in which canons, fugues, and full harmony, had been the productions which chiefly employed the maſter's ſtudy and the hearer's attention.

Mean ſtate of the opera in the beginning of the 18th century.

So late as the beginning of the 18th century, according to Riccoboni, the performers in the operas of Germany, particularly at Hamburg, "were all tradeſmen or handicrafts. Your ſhoemaker (ſays he) was often the firſt performer on the ſtage; and you might have bought fruit and ſweetmeats of the ſame girls, whom the night before you had ſeen in the characters of Armida or Semiramis. Soon, however, the German opera aroſe to a more reſpectable ſituation; and even during the 17th century many eminent compoſers flouriſhed in that country."

State of muſic in France in the 17th century.

The liſt of great muſicians which France produced during the early part of the ſame century is not numerous. Muſic ſeems to have been but little cultivated in that country, till the operas of Lulli, under the powerful patronage of Louis XIV. excited public attention.

The favourite ſinging-maſter and compoſer of France, about the middle of the 17th century, was Michael Lambert. John Baptiſt Lulli, ſoon after this time, roſe from the rank of a menial ſervant to fame, opulence, and nobility, by his ſkill in muſical compoſitions. The celebrated ſinger La Rochois was taught ſinging and acting by Lulli.

Curious anecdotes of a French ſinger.

La Maupin the ſucceſſor of La Rochois, on account of her extraordinary character and romantic adventures, deſerves to be mentioned. She eloped from her huſband with a fencing-maſter, of whom ſhe learnt the ſmall ſword. She became an excellent fencer. At Marſeilles ſhe entertained a ſtrange attachment to a young lady, who was ſeized with a whimſical fondneſs in return, on account of which the latter was confined in a convent. La Maupin obtained admiſſion into the ſame convent as a novice. She ſet fire to the building, and in the confuſion carried off her favourite. At Paris when ſhe appeared on the ſtage in 1695, Dumeni a ſinger having affronted her, ſhe put on men's clothes, and inſiſted on his drawing his ſword and fighting her. When he refuſed, ſhe caned him, and took from him his watch and ſnuff-box as trophies of her victory. At a ball given by Monſieur brother of Louis XIV. ſhe again put on men's clothes; and having behaved impertinently to a lady, three of the lady's friends, ſuppoſing La Maupin to be a man, called her out. She killed them all; and returning coolly to the ball, told the ſtory to Monſieur, who obtained her pardon. She became afterwards miſtreſs to the elector of Bavaria. This prince quitting her for the counteſs of Arcos, ſent her by the count, huſband of that lady, a purſe of 40,000 livres. She threw it at the count's head, telling him, it was a recompenſe worthy of ſuch meanneſs as he diſplayed. At laſt, ſeized with a fit of devotion, ſhe recalled her huſband, and ſpent the remainder of her life in piety. She died in 1707 at the age only of 34.

Chief compoſers for the church in England.

The Engliſh muſician whom we laſt mentioned was the celebrated Purcell. After his time the chief compoſers for the church were Clarke, Dr Holden, Dr Creyghton, Tucker, Aldrich, Golwin, Weldon, Dr Crofts, Dr Greene, Boyce, and Nares; to whom may be added John Stanley, who attained high proficiency in muſic, although from two years old totally deprived of ſight.

The annals of modern muſic have hitherto furniſhed no event ſo important to the progreſs of the art as the invention of recitative or dramatic melody; a ſtyle of muſic which reſembles the manner of the ancient rhapſodiſts.

Firſt muſical drama.

The *Orfeo* of Politian was the firſt attempt at muſical drama. It was afterwards perfected by Metaſtaſio. No muſical dramas ſimilar to thoſe afterwards known

---

(B) The moſt celebrated violin players of Italy, from the 16th century to the preſent time, have been Farina, M. Angelo Roſſi, Baſſani the violin-maſter of Corelli, the admirable Angelico Corelli himſelf, Torelli, Alberti, Albenoni, Teſſarini, Vivaldi, Geminiani one of the moſt diſtinguiſhed of Corelli's ſcholars, Tartini, Veracini, Barbella, Locatelli, Ferrari, Martini, Boccherini, and Giardini.

known by the names of *opera* and *oratorio*, had exiſtence in Italy before the beginning of the 17th century. It was about the 1600, or a little before that time, that eunuchs were firſt employed for ſinging in Italy.

irſt ſing- ig eu- uchs.

There ſeem to have been no *ſinging* eunuchs in ancient times, unleſs the galli or archigalli, prieſts of Cybele, were ſuch. Caſtration has, however, at all times been practiſed in eaſtern countries, for the purpoſe of furniſhing to tyrannic jealouſy guards of female chaſtity; but never, ſo far as modern writers on the ſubject have diſcovered, merely to preſerve the voice, till about the end of the 16th century.

At Rome, the firſt public theatre opened for the exhibition of muſical dramas, in modern times, was *il Torre de Nona*, where in 1671 Giaſone was performed. In 1679, the opera of *Dou è Amore*, ſet by the famous organiſt Bernardo Paſquini, was repreſented at *Nilla Sala de Signori Capranica;* a theatre which ſtill ſubſiſts. In the year 1680, *L'Oneſta negl' Amore* was exhibited; the firſt dramatic compoſition of the elegant, profound, and original Aleſſandro Scarlatti.

The inhabitants of Venice have cultivated and encouraged the muſical drama with more zeal and diligence than the reſt of Italy, during the end of the laſt and beginning of the preſent century; yet the opera was not eſtabliſhed in Venice before the year 1637. In that year the firſt regular drama was performed. It was Andromeda.

Opera of Berenice.

In 1680 the opera of Berenice was exhibited at Padua with ſuch aſtoniſhing ſplendour as to merit notice. There were choruſes of 100 virgins, 100 ſoldiers, 100 horſemen in iron armour, 40 cornets of horſe, 6 trumpeters on horſeback, 6 drummers, 6 enſigns, 6 ſackbuts, 6 great flutes, 6 minſtrels playing on Turkiſh inſtruments, 6 others on octave flutes, 6 pages, 3 ſergeants, 6 cymbaliſts. There were 12 huntſmen, 12 grooms, 6 coachmen for the triumph; 6 others for the proceſſion; 2 lions led by two Turks, 2 elephants by two others, Berenice's triumphal car drawn by 4 horſes, 6 other cars with priſoners and ſpoils drawn by 12 horſes, 6 coaches. Among the ſcenes and repreſentations in the firſt act were, a vaſt plain with two triumphal arches, another plain with pavilions and tents, and a foreſt for the chaſe. In act third, the royal dreſſing room completely furniſhed, ſtables with 100 live horſes, portico adorned with tapeſtry, and a ſtupendous palace in perſpective. At the end of the firſt act were repreſentations of every kind of chaſe, wild boar, ſtag, deer, bears. At the end of the third act, an enormous globe, deſcending as from the ſky, divided itſelf into other globes ſuſpended in the air, and ornamented with emblematical figures of time, fame, honour, &c.

Early in the laſt century, machinery and decoration uſurped the importance due to poetry and muſic in ſuch exhibitions.

Few inſtances occur of muſical dramas at Naples till the beginning of the preſent century. Before the time of the elder Scarlatti, it ſeems as if Naples had been leſs fertile in great contrapuntiſts, and leſs diligent in the cultivation of dramatic muſic, than any other ſtate of Italy. Since that time all the reſt of Europe has been furniſhed with compoſers and performers from that city.

French and Engliſh opera.

The word *opera* ſeems to have been familiar to Engliſh poets from the beginning of the laſt century. *Stilo recitativo*, a recent innovation even in Italy, is mentioned by Ben Johnſon ſo early as 1617. From this time it was uſed in maſques, occaſionally in plays, and in cantatas, before a regular drama wholly ſet to muſic was attempted. By the united abilities of Quinault and Lulli, the opera in France had ariſen to high favour. This circumſtance afforded encouragement to ſeveral attempts at dramatic muſic in England by Sir William D'Avenant and others, before the muſic, language, or performers of Italy were employed on our ſtage. Pieces, ſtyled *dramatic operas*, preceded the Italian opera on the ſtage of England. Theſe were written in Engliſh, and exhibited with a profuſe decoration of ſcenery and habits, and with the beſt ſingers and dancers that could be procured: Pſyche and Circe are entertainments of this kind: The Tempeſt and Macbeth were acted with the ſame accompaniments.

During the 17th century, whatever attempts were made in muſical drama, the language ſung was always Engliſh. About the end of that century, however, Italian ſinging began to be encouraged, and vocal as well as inſtrumental muſicians from that country began to appear in London.

The firſt muſical drama, performed wholly after the Italian manner in recitative for the dialogue or narrative parts, and meaſured melody for the airs, was Arſinoë Queen of Cyprus, tranſlated from an Italian opera of the ſame name, written by Stanzani of Bologna. The Engliſh verſion of this opera was ſet to muſic by Thomas Clayton, one of the royal band, in the reign of William and Mary. The ſingers were all Engliſh, Meſſrs Hughes, Leveredge, and Cook; Mrs Tofts, Mrs Croſs, and Mrs Lyndſey. The tranſlation of Arſinoë, and the muſic to which it is ſet, are execrable; yet ſuch is the charm of novelty, that this miſerable performance, deſerving neither the name of a drama by its poetry, nor of an opera by its muſic, ſuſtained 24 repreſentations, and the ſecond year 11.

Operas, notwithſtanding their deficiencies in poetry, muſic and performance (no foreign compoſer or eminent ſinger having yet arrived), became ſo formidable to our actors at the theatres, that it appears from the Daily Courant, 14th January 1707, a ſubſcription was opened "for the encouragement of the comedians acting in the Haymarket, and to enable them to keep the diverſion of plays under a ſeparate intereſt from operas."

Mr Addiſon's opera of Roſamond appeared about this time; but the muſic ſet by Clayton is ſo contemptible, that the merit of the poetry, however great, could not of itſelf long ſupport the piece. The choice of ſo mean a compoſer as Clayton, and Mr Addiſon's partiality to his abilities, betray a want of muſical taſte in that elegant author.

The firſt truly great ſinger who appeared on the ſtage of Britain was *Cavalier Nicolino Grimaldi*, commonly known by the name of *Nicolini*. He was a Neapolitan; and though a beautiful ſinger indeed, was ſtill more eminent as an actor. In the Tatler, N° 115. the elegance and propriety of his action are particularly deſcribed *. Recently before his appearance, *Valentini Urbani*, and a female ſinger called *The*

---

* See alſo *Spectator*, vol. i. N° 13.

Baroneſs, arrived. Margarita de l'Epini, who afterwards married Dr Pepuſch, had been in this country ſome time before.

The firſt opera performed *wholly in Italian*, and *by Italian ſingers*, was *Almahide*. As at preſent, ſo at that time, operas were generally performed twice a week.

Arrival of Handel in England.

The year 1710 is diſtinguiſhed in the annals of muſic by the arrival in Britain of George Frederick Handel. Handel had been in the ſervice of the elector of Hanover, and came firſt to England on a viſit of curioſity. The fame of this great muſician had penetrated into this country before he himſelf arrived in it; and Aaron Hill, then in the direction of the Haymarket theatre, inſtantly applied to him to compoſe an opera. It was Rinaldo; the admirable muſic of which he produced entirely in a fortnight. Soon after this period appeared, for the firſt time as an opera ſinger, the celebrated Mrs Anaſtaſia Robinſon. Mrs Robinſon, who was the daughter of a portrait painter, made her firſt public exhibitions in the concerts at York-buildings; and acquired ſo much the public favour, that her father was encouraged to take a houſe in Golden Square, for the purpoſe of eſtabliſhing weekly concerts and aſſemblies, in the manner of *Converſazioni*, which became the reſort of the moſt polite audiences.

Soon after Mrs Robinſon accepted an engagement at the Opera, where her ſalary is ſaid to have been 1000l. and her other emoluments equal to that ſum. She quitted the ſtage in conſequence of her marriage with the gallant earl of Peterborough, the friend of Pope and Swift. The eminent virtues and accompliſhments of this lady, who died at the age of 88, entitled her to be mentioned even in a compend too ſhort for biography.

Progreſs of the opera under his management.

The conducting the opera having been found to be more expenſive than profitable, it was entirely ſuſpended from 1717 till 1720, when a fund of 50,000l. for ſupporting and carrying it on was ſubſcribed by the firſt perſonages of the kingdom. The ſubſcribers, of whom King George I. was one for 1000l. were formed into a ſociety, and named *The Royal Academy of Muſic*. Handel was commiſſioned to engage the performers: For that purpoſe he went to Dreſden, where Italian operas were at that time performed in the moſt ſplendid manner at the court of Auguſtus elector of Saxony, then king of Poland. Here Handel engaged Seneſino-Berenſtadt, Boſchi, and the Duranſtanti.

In the 1723, the celebrated Franceſca Cuzzoni appeared as a firſt rate ſinger; and two years afterwards arrived her diſtinguiſhed rival Signora Fauſtina Bordoni.

In a cantabile air, though the notes Cuzzoni added were few, ſhe never loſt an opportunity of enriching the cantilena with the moſt beautiful embelliſhments. Her ſhake was perfect. She poſſeſſed a creative fancy; and ſhe enjoyed the power of occaſionally accelerating and retarding the meaſure in the moſt artificial and able manner, by what is in Italy called *tempo rubato*. Her high notes were unrivalled in clearneſs and ſweetneſs. Her intonations were ſo juſt and ſo fixed, that it ſeemed as if ſhe had not the power to ſing out of tune.

Fauſtina Bordoni, wife of the celebrated Saxon compoſer Haſſe, invented a new kind of ſinging, by running diviſions, with a neatneſs and velocity which aſtoniſhed all who heard her. By taking her breath imperceptibly, ſhe had the art of ſuſtaining a note apparently longer than any other ſinger. Her beats and trills were ſtrong and rapid; her intonation perfect. Her profeſſional perfections were enhanced by a beautiful face, fine ſymmetry of figure, and a countenance and geſture on the ſtage which indicated an entire intelligence and poſſeſſion of the ſeveral parts allotted to her.

Theſe two angelic performers excited ſo ſignally the attention of the public, that a party ſpirit between the abettors of the one and of the other was formed, as violent and as inveterate almoſt as any of thoſe that had ever occurred relative to matters either theological or political; yet ſo diſtinct were their ſtyles of ſinging, ſo different their talents, that the praiſe of the one was no reproach to the other.

In leſs than ſeven years, the whole 50,000l. ſubſcribed by the Royal Academy, beſides the produce of admiſſion to non-ſubſcribers, was expended, and the governor and directors of the ſociety relinquiſhed the idea of continuing their engagements; conſequently, at the cloſe of the ſeaſon 1727, the whole band of ſingers diſperſed. The next year we find Seneſino, Fauſtina, Balde, Cuzzoni, Nicolini, Farinelli, and Boſche, at Venice.

Handel, however, at his own riſk, after a ſuſpenſion of about a twelvemonth, determined to recommence the Opera; and accordingly engaged a band of performers entirely new. Theſe were Signior Bernacchi, Signora Merighi, Signora Strada, Signior Anibale Pio Fabri, his wife, Signora Bertoldi, and John Godfrid Reimſchneider.

Invention of the oratorio, and its introduction into England.

The ſacred muſical drama, or oratorio, was invented early in the 14th century. Every nation in Europe ſeems firſt to have had recourſe to religious ſubjects for dramatic exhibitions. The oratorios had been common in Italy during the laſt century. They had never been *publicly* introduced in England, till Handel, ſtimulated by the rivalſhip of other adventurers, exhibited in 1732 his oratorios of Eſther, and of Acis and Galatea, the laſt of which he had compoſed twelve years before for the duke of Chandos's chapel at Cannons. The moſt formidable oppoſition which Handel met with in his conduct of the Italian opera was a new theatre for exhibiting theſe operas, opened by ſubſcription in Lincoln's-inn-Fields, under the conduct of Nicola Porpora, a reſpectable compoſer. A difference having occurred between Handel and Seneſino; Seneſino had for ſome time deſerted the Haymarket, where Handel managed, and was now engaged at the rival theatre of Lincoln's-inn Fields. To ſupply the place of Seneſino, Handel brought over *Giovanni Careſtini*, a ſinger of the moſt extenſive powers. His voice was at firſt a powerful and clear ſoprano: Afterwards it changed into the fulleſt, fineſt, deepeſt counter-tenor that has perhaps ever been heard. Careſtini's perſon was tall, beautiful, and majeſtic. He rendered every thing he ſung intereſting by energy, taſte, and judicious embelliſhment. In the execution of difficult diviſions from the cheſt, his manner was articulate and admirable. It was the opinion of Haſſe, as well as other eminent profeſſors, that

that whoever had not heard Careſtini, was unacquainted with the moſt perfect ſtyle of ſinging. The opera under the direction of Porpora was removed to the Haymarket, which Handel had left. Handel occupied the theatre of Lincoln's-inn Fields; but his rivals now acquired a vaſt advantage of attraction, by the acceſſion of Carlo Broſchi detto Farinelli to their part, who at this time arrived. This renowned ſinger ſeems to have tranſcended the limit of all anterior vocal excellence. No vocal performer of the preſent century has been ſo unanimouſly allowed to poſſeſs an uncommon power, ſweetneſs, extent, and agility of voice, as Farinelli. Nicolini, Seneſino, and Careſtini, gratified the eye as much by the dignity, grace, and propriety of their action and deportment, as the ear, by the judicious uſe of a few notes within the limits of a ſmall compaſs of voice; but Farinelli, without the aſſiſtance of ſignificant geſtures or graceful attitudes, enchanted and aſtoniſhed his hearers, by the force, extent, and mellifluous tones of the mere organ, when he had nothing to execute, articulate, or expreſs. Though during the time of ſinging he was as motionleſs as a ſtatue, his voice was ſo active that no intervals were too cloſe, too wide, or too rapid, for his execution.

Handel having loſt a great part of his fortune by the opera, was under the neceſſity of trying the public gratitude in a benefit, which was not diſgraced by the event. The theatre, for the honour of the nation, was ſo crowded, that he is ſaid to have cleared 800l.

Opera in England given up.

After a fruitleſs attempt by Heidegger, the coadjutor of Handel in the conduct of the opera, and patentee of the King's Theatre in Haymarket, to procure a ſubſcription for continuing it, it was found neceſſary to give up the undertaking.

It was about this time that the ſtatue of Handel was erected in Vauxhall, at the expence of Mr Tyers, proprietor of thoſe gardens.

Revived.

The next year (1739) Handel carried on oratorios at the Haymarket, as the opera there was ſuſpended. The earl of Middleſex now undertook the troubleſome office of *impreſario* of the Italian opera. He engaged the King's theatre, with a band of ſingers from the continent almoſt entirely new. Calluppi was his compoſer. Handel, almoſt ruined, retired at this time to Ireland, where he remained a conſiderable time. In 1744 he again attempted oratorios at the King's theatre, which was then, and till 1746, unoccupied by the opera, on account of the rebellion.

The arrival of Giardini in London this year forms a memorable æra in the hiſtory of inſtrumental muſic of England. His powers on the violin were unequalled. The ſame year Dr Croza, then manager of the opera, eloped, leaving the performers, and innumerable trades people, his creditors. This incident put an end to operas of all kinds for ſome time.

This year a comic opera, called *Il Filoſofo di Campagna*, compoſed by Calluppi, was exhibited, which ſurpaſſed in muſical merit all the comic operas performed in England till the *Bicona Figliula*. Signora Paganini acquired ſuch fame by the airs allotted to her in that piece, that the crowds at her benefit were beyond example. Caps were loſt, gowns torn in pieces, and ladies in full dreſs, without ſervants or carriages, were obliged to walk home, amidſt the merriment of the ſpectators on the ſtreets.

1764 and 1765, Manzoli.

At this period the arrival of Giovanni Manzoli marked a ſplendid era in the annals of muſical drama, by conferring on ſerious opera a degree of importance to which it had ſeldom yet ariſen ſince its eſtabliſhment in England. Manzoli's voice was the moſt powerful and voluminous ſoprano that had been heard ſince the time of Farinelli: His manner of ſinging was grand, and full of taſte and dignity.

Tenducci.

At this time Tenducci, who had been in England ſome time before, and was now returned much improved, performed in the ſtation of ſecond man to Manzoli.

1769. Guadagni.

Gaetano Guadagni made a great figure at this time. He had been in this country early in life (1748), as ſerious man in a burletta troop of ſingers. His voice was then a full and well-toned counter tenor; but he ſung wildly and careleſsly. The excellence of his voice, however, attracted the notice of Handel, who aſſigned him the parts in his oratorios, the Meſſiah and Samſon, which had been originally compoſed for Mrs Cibber. He quitted London for the firſt time about 1753. The higheſt expectations of his abilities were raiſed by fame before his ſecond arrival, at the time of which we treat. As an actor he ſeems to have had no equal on any ſtage in Europe. His figure was uncommonly elegant and noble; his countenance replete with beauty, intelligence, and dignity; his attitudes were full of grace and propriety. Thoſe who remembered his voice when formerly in England were now diſappointed: It was comparatively thin and feeble: He had now changed it to a ſoprano, and extended its compaſs from ſix or ſeven notes to fourteen or fifteen. The muſic he ſung was the moſt ſimple imaginable; a few notes with frequent pauſes, and opportunities of being liberated from the compoſer and the band, were all he required. In theſe effuſions, ſeemingly extemporaneous, he diſplayed the native power of melody unaided by harmony or even by uniſonous accompaniment: The pleaſure he communicated proceeded principally from his artful manner of diminiſhing the tones of his voice, like the dying notes of the Æolian harp. Moſt other ſingers affect a ſwell, or *meſſa de voce*; but Guadagni, after beginning a note with force, attenuated it ſo delicately that it poſſeſſed all the effect of extreme diſtance. During the ſeaſon 1770 and 1771, Tenducci was the immediate ſucceſſor of Guadagni, This performer, who appeared in England firſt only as a ſinger of the ſecond or third claſs, was during his reſidence in Scotland and Ireland ſo much improved as to be well received as firſt man, not only on the ſtage of London, but in all the great theatres of Italy.

It was during this period that dancing ſeemed firſt to gain the aſcendant over muſic by the ſuperior talents of Mademoiſelle Heinel, whoſe grace and execution were ſo perfect as to eclipſe all other excellence.

1773. Miſs Davies.

In the firſt opera performed this ſeaſon (*Lucco Vero*) appeared Miſs Cecilia Davies, known in Italy by the name of L'Ingleſina. Miſs Davies had the honour of being the firſt Engliſh woman who had ever been thought worthy of ſinging on any ſtage in Italy. She even performed with eclat the principal female characters on many of the great theatres of that country.

Gabrielli only on the Continent was ſaid to ſurpaſs her. Her voice, though not of great volume, was clear and perfectly in tune; her ſhake was open and diſtinct, without the ſluggiſhneſs of the French cadence. The flexibility of her throat rendered her execution equal to the moſt rapid diviſions.

Next ſeaſon introduced Venanzio Ravygini, a beautiful and animated young man; a compoſer as well as a ſinger.—His voice was ſweet, clear, flexible; in compaſs more than two octaves.

Caterina Gabrielli.

The ſeaſon 1775 and 1776 was rendered memorable by the arrival of the celebrated *Caterina Gabrielli*, ſtyled early in life *La Cuochetina*, being the daughter of a cardinal's cook at Rome. She had, however, in her countenance and deportment no indications of low birth. Her manner and appearance depicted dignity and grace. So great was her reputation before her arrival in England for ſinging and for caprice, that the public, expecting perhaps in both too much, were unwilling to allow her due praiſe for her performance, and were apt to aſcribe every thing ſhe did to pride and inſolence. Her voice, though exquiſite, was not very powerful. Her chief excellence having been the neatneſs and rapidity of her execution, the ſurpriſe of the public muſt have been much diminiſhed on hearing her after Miſs Davies, who ſung many of the ſame ſongs in the ſame ſtyle, and with a neatneſs ſo nearly equal, that common hearers could diſtinguiſh no difference. The diſcriminating critic, however, might have diſcovered a ſuperior ſweetneſs in the natural tone of Gabrielli's voice, an elegance in the finiſhing of her muſical periods or paſſages, an accent and preciſion in her diviſions, ſuperior not only to Miſs Davies, but to every other ſinger of her time. In ſlow movements her pathetic powers, like thoſe in general of performers moſt renowned for agility, were not exquiſitely touching.

Agujari at the Pantheon.

About the time of which we have been treating, the proprietors of the Pantheon ventured to engage *Agujari* at the enormous ſalary of 100l. per night, for ſinging two ſongs only: *Lucrezia Agujari* was a truly wonderful performer. The lower part of her voice was full, round, and of excellent quality; its compaſs amazing. She had two octaves of fair natural voice, from A on the fifth line in the baſe to A on the ſixth line in the treble, and beyond that *in alt* ſhe had in early youth more than another octave. She has been heard to aſcend to B b *in altiſſimo*. Her ſhake was open and perfect: her intonation true; her execution marked and rapid; the ſtyle of her ſinging, in the natural compaſs of her voice, grand and majeſtic.

Anna Pozzi.

In 1776 arrived Anna Pozzi, as ſucceſſor to Gabrielli. She poſſeſſed a voice clear, ſweet, and powerful; but her inexperience, both as an actreſs and as a ſinger, produced a contraſt very unfavourable to her when compared with ſo celebrated a performer as Gabrielli. After that time, however, Pozzi, with more ſtudy and knowledge, became one of the beſt and moſt admired female ſingers in Italy.

Georgi.

After the departure of Ajugari for the ſecond and laſt time, the managers of the Pantheon engaged *Georgi* as her ſucceſſor. Her voice was exquiſitely fine, but totally uncultivated. She was thereafter employed as the firſt woman in the operas of the principal cities of Italy.

Roncaglia and Danze.

During the ſeaſons 1777 and 1778, the principal ſingers at the opera in London were Franceſco Roncaglia and Franceſco Danze, afterwards Madame Le Brun.

Roncaglia poſſeſſed a ſweet toned voice; but of the three great requiſites of a complete ſtage ſinger, pathos, grace, and execution, which the Italians call *cantabile*, *grazioſa*, and *bravura*, he could lay claim only to the ſecond. His voice, a *voce de camera*, when confined to the *grazioſa* in a room, left nothing to wiſh for.

Danze had a voice well in tune, a good ſhake, great execution, prodigious compaſs, with great knowledge of muſic; yet the pleaſure her performance imparted was not equal to theſe accompliſhments. But her object was not ſo much pathos and grace, as to ſurpriſe by the imitation of the tone and difficulties of inſtruments.

Pacchierotti.

This year *Gaſparo Pacchierotti* appeared in London, whither his high reputation had penetrated long before. The natural tone of his voice was intereſting, ſweet, and pathetic. His compaſs downwards was great, with an aſcent up to B b, and ſometimes to C *in alt*. He poſſeſſed an unbounded fancy, and the power not only of executing the moſt difficult and refined paſſages, but of inventing embelliſhment entirely new. *Ferdinando Bertoni*, a well known compoſer, came along with Pacchierotti to Britain.

Dancing gains the aſcendant over muſic at the opera houſe.

About this time dancing became an important branch of the amuſements of the opera houſe. Mademoiſelle Heinel, M. Veſtris le Jeune, Mademoiſelle Baccelli, had, during ſome years, delighted the audience at the opera; but on the arrival of M. Veſtris l'Ainè, pleaſure was exchanged for ecſtaſy. In the year 1781, Pacchierotti had by this time been ſo frequently heard, that his ſinging was no impediment te converſation; but while the elder Veſtris was on the ſtage, not a breathing was to be heard. Thoſe lovers of muſic who talked the loudeſt while Pacchierotti ſung, were in agonies of terror leſt the graceful movements of Veſtris, *le dieu de la danſe*, ſhould be diſturbed by audible approbation. After that time, the moſt mute and reſpectful attention was paid to the manly grace of Le Picq, and the light fantaſtic toe of the younger Veſtris; to the Roſſis, the Theodores, the Coulons, the Hillingſburgs; while the ſlighted ſingers were diſturbed, not by the violence of applauſe, but the clamour of inattention.

Commemoration of Handel in Weſtminſter Abbey.

The year 1784 was rendered a memorable era in the annals of muſic by the ſplendid and magnificent manner in which the birth and genius of Handel were celebrated in Weſtminſter Abbey and the Pantheon, by five performances of pieces ſelected from his own works, and executed by a band of more than 500 voices and inſtruments, in the preſence and under the immediate auſpices of their majeſties and the firſt perſonages of the kingdom. The commemoration of Handel has been ſince eſtabliſhed as an annual muſical feſtival for charitable purpoſes; in which the number of performers and the perfection of the performances have continued to increaſe. In 1785 the band, vocal and inſtrumental, amounted to 616: in 1786 to 741; in 1787 to 806; and in ſubſequent years to ſtill greater numbers.

Dr Burney publiſhed An Account of the Muſical Performances in Commemoration of Handel, for the benefit

benefit of the Muſical Fund. The members and guardians of that fund are now incorporated under the title of *Royal Society of Muſicians*. See HANDEL.

This year Pacchierotti and his friend Bertoni left England. About the ſame time our country was deprived of the eminent compoſer Sacchini, and Giardini the greateſt performer on the violin now in Europe.

xcellence
f Madame
ara.

As a compenſation for theſe loſſes, this memorable year is diſtinguiſhed by the arrival of Madame Mara, whoſe performance in the commemoration of Handel in Weſtminſter Abbey inſpired an audience of 3000 of the firſt people of the kingdom, not only with pleaſure but with ecſtacy and rapture.

ubinelli.

In 1786 arrived *Giovanni Rubinelli*. His voice was a true and full contr'alto from C in the middle of the ſcale to the octave above. His ſtyle was grand; his execution neat and diſtinct; his taſte and embelliſhments new, ſelect, and maſterly.

new
ance by
M. No-
erre.

In 1788 a new dance, compoſed by the celebrated M. Noverre, called *Cupid and Pſyche*, was exhibited along with the opera *La Locandiera*, which produced an effect ſo uncommon as to deſerve notice. So great was the pleaſure it afforded to the ſpectators, that Noverre was unanimouſly brought on the ſtage and crowned with laurel by the principal performers. This, though common in France, was a new mark of approbation in England.

Marcheſi.

This year arrived Signior Luige Marcheſi, a ſinger whoſe talents have been the ſubject of praiſe and admiration on every great theatre of Europe. Marcheſi's ſtyle of ſinging was not only elegant and refined in an uncommon degree, but often grand and full of dignity, particularly in his recitative and occaſional low notes. His variety of embelliſhment and facility of running extempore diviſions were wonderful. Many of his graces were elegant and of his own invention.

Diſcriminated characters of Pacchierotti, Rubinelli, and Marcheſi.

The three greateſt Italian ſingers of theſe times were certainly Pacchierotti, Rubinelli, and Marcheſi. In diſcriminating the ſeveral excellencies of theſe great performers, a very reſpectable judge, Dr Burney, has particularly praiſed the ſweet and touching voice of Pacchierotti; his fine ſhake, his exquiſite taſte, his great fancy, and his divine expreſſion in pathetic ſongs: Of Rubinelli's voice, the fulneſs, ſteadineſs, and majeſty, the accuracy of his intonations, his judicious graces: Of Marcheſi's voice, the elegance and flexibility, his grandeur in recitative, and his boundleſs fancy and embelliſhments.—Having mentioned Dr Burney, we are in juſtice bound to acknowledge the aid we have derived from his hiſtory; a work which we greatly prefer to every other modern production on the ſubject.

During the latter part of the 18th century many eminent compoſers flouriſhed on the continent; ſuch as Jomelli, the family of the Bachs, Gluck, Haydn, and many others, whoſe different ſtyles and excellencies would well deſerve to be particularized, would our limits permit.

Sovereign princes dilettanti.

With the ſame regard to brevity, we can do no more than juſt mention the late king of Pruſſia, the late elector of Bavaria, and Prince Lobkowitz, as eminent dilettanti of modern times.

Singers on theatres and in public gardens.

Beſides the opera ſingers whom we have mentioned, our theatres and public gardens have exhibited ſingers of conſiderable merit. In 1730 Miſs Rafter, afterwards the celebrated Mrs Clive, firſt appeared on the ſtage at Drury-lane as a ſinger. The ſame year introduced Miſs Cecilia Young, afterwards the wife of Dr Arne. Her ſtyle of ſinging was infinitely ſuperior to that of any other Engliſh woman of her time.

Favourite muſicians.

Our favourite muſicians at this time were, Dubourg, Clegg, Clarke, and Feſting, on the violin; Kytch on the hautboy; Jack Feſting on the German flute; Baſton on the common flute; Karba on the baſſoon; Valentine Snow on the trumpet: and on the organ, Roſeingrave, Green, Robinſon, Magnus, Jack James, and the blind Stanley, who ſeems to have been preferred. The favourite playhouſe ſinger was Salway; and at concerts Mountier of Chicheſter.

As compoſers for our national theatre, Pepuſch and Galliard ſeem to have been unrivalled till 1732; when two competitors appeared, who were long in poſſeſſion of the public favour: We allude to John Frederick Lampe and Thomas Auguſtus Arne.

In 1736 Mrs Cibber, who had captivated every hearer of ſenſibility by her native ſweetneſs of voice and powers of expreſſion as a ſinger, made her firſt attempt as a tragic actreſs. The ſame year Beard became a favourite ſinger at Covent-garden. At this time Miſs Young, afterwards Mrs Arne, and her two ſiſters Iſabella and Eſther, were the favourite Engliſh female ſingers.

Fund for decayed muſicians.

In 1738 was inſtituted the fund for the ſupport of decayed muſicians and their families.

It was in 1745 that Mr Tyers, proprietor of Vauxhall gardens, firſt added vocal muſic to the other entertainments of that place. A ſhort time before Ranelagh had become a place of public amuſement.

Arrival of Giardini.

In 1749 arrived Giardini, whoſe great taſte, hand, and ſtyle in playing on the violin, procured him univerſal admiration. A few years after his arrival he formed a morning *academia* or concert at his houſe, compoſed chiefly of his ſcholars.

About this time San Martini and Charles Aviſon were eminent compoſers.

Style of Arne.

Of near 150 muſical pieces brought on our national theatres within 40 years, 38 of them at leaſt were ſet by Arne. The ſtyle of this compoſer, if analyzed, would perhaps appear to be neither Italian nor Engliſh; but an agreeable mixture of both and of Scotch.

The earl of Kelly.

The late earl of Kelly, who died ſome years ago, deſerves particular notice, as poſſeſſed of a very eminent degree of muſical ſcience, far ſuperior to other dilettanti, and perhaps not inferior to any profeſſor of his time. There was no part of theoretical or practical muſic in which he was not thoroughly verſed: He poſſeſſed a ſtrength of hand on the violin, and a genius for compoſition, with which few profeſſors are gifted.

Abel.

Charles Frederic Abel was an admirable muſician: His performance on the viol da gamba was in every particular complete and perfect. He had a hand which no difficulties could embarraſs; a taſte the moſt refined and delicate; a judgment ſo correct and certain as never to permit a ſingle note to eſcape him without meaning. His compoſitions were eaſy and elegantly ſimple. In writing and playing an *adagio* he was ſuperior to all praiſe; the moſt pleaſing yet learned modulation, the richeſt harmony, the moſt elegant and poliſhed melody, were all expreſſed with the moſt exquiſite feeling, taſte, and ſcience. His manner of playing

playing an adagio ſoon became the model of imitation for all our young performers on bowed inſtruments. Bartholemon Cervetto, Cramer, and Croſdil, were in this reſpect to be ranked as of his ſchool. All lovers of muſic muſt have lamented that Abel in youth had not attached himſelf to an inſtrument more worthy of his genius, taſte, and learning, than the viol da gamba, that remnant of the old cheſt of viols which during the 17th century was a neceſſary appendage of a nobleman's or gentleman's family throughout Europe, previous to the admiſſion of violins, tenors, and baſſes, in private houſes or public concerts. Since the death of the late elector of Bavaria, (who was next to Abel the beſt performer on the viol da gamba in Europe), the inſtrument ſeems quite laid aſide. It was uſed longer in Germany than elſewhere; but the place of gambiſt ſeems now as much ſuppreſſed in the chapels of German princes as that of lutaniſt. The celebrated performer on the violin, Lolle, came to England in 1785. Such was his caprice, that he was ſeldom heard; and ſo eccentric was his ſtyle and compoſition, that by many he was regarded as a madman. He was, however, during his lucid intervals a very great and expreſſive performer in the ſerious ſtyle.

Mrs Billington.

Mrs Billington, after diſtinguiſhing herſelf in childhood as a neat and expreſſive performer on the pianoforte, appeared all at once in 1786 as a ſweet and captivating ſinger. In emulation of Mara and other great bravura ſingers, ſhe at firſt too frequently attempted paſſages of difficulty; afterward, however, ſo greatly was ſhe improved, that no ſong ſeemed too high or too rapid for her execution. Now, at the diſtance of 20 years, ſhe retains her high reputation. The natural tone of her voice is ſo exquiſitely ſweet, her knowledge of muſic ſo conſiderable, her ſhake ſo true, her cloſes and embelliſhments ſo various, her expreſſions ſo grateful, that envy only or apathy could hear her without delight.

The preſent compoſers, and performers of the firſt claſs, are ſo well known to the lovers of the art, that it would be needleſs and improper to mention them particularly.

The catch-club and the concert of ancient muſic.

The Catch-club at the Thatched Houſe, inſtituted in 1762 by the earl of Eglinton, the duke of Queenſberry, and others; and the concert of ancient muſic, ſuggeſted by the earl of Sandwich in 1776, have had a beneficial effect in improving the art.

Two female performers have lately appeared of diſtinguiſhed eminence.

Madame Graſſini.

Madame Graſſini had exhibited her vocal powers in Paris with extraordinary applauſe, and arrived in London in 1805, where ſhe excited uncommon admiration. She appeared in Zaira, where the diſplay of her powers not only pleaſed, but ſhe aſtoniſhed, when it was conſidered that the compaſs of her voice did not exceed eight or ten notes.

Madame Catalani.

The year following Madame Catalani divided the public attention with Graſſini.—This eminent performer is a native of Sinigaglia in Italy, where her father was a ſinger of the comic order.

She was educated in a convent. The virtuous impreſſions ſhe there received, have continued ever ſince invariably to influence her conduct.

Her father ſoon diſcovered the excellence and the value of her vocal powers, which were firſt exhibited on the provincial theatres of Italy.—He ſoon carried her to Spain, where ſhe attained very high celebrity. It was there her huſband, M. de Valabregue, firſt paid his addreſſes to her; and it was not till after a perſeverance of ſeven months that he at laſt obtained her conſent to unite her fortunes with his. Her heſitation proceeded from the reluctance of her father, at once to be deprived of his daughter, and of the very great emolument which ſhe brought him. M. de Valabregue had been an officer in the French army under General Moreau.

From Spain Madame Catalani (for ſhe has retained her father's name), proceeded to Portugal, where ſhe accepted an engagement to come to London. She travelled through France, and at Paris appeared at an occaſional concert, where her fame was ſo great, that the uſual price of admiſſion was trebled. She particularly attracted the attention of the ſingular man who now holds the imperial ſceptre of the continent of Europe. He ordered her a penſion (its value is about 30l. per annum); and it was with much difficulty, and only through the interference of the Britiſh ambaſſador (the earl of Lauderdale) then at Paris, that ſhe was permitted to leave that capital, and proceed on her journey.

In the dramatic muſic of the opera, this ſinger is far ſuperior to any performer ever heard in this country. Her merit in Semiramide, in particular, preſents almoſt the idea of perfection. Her voice is equal to the moſt difficult execution, while her countenance is intereſting, her geſtures graceful, and her perſon elegant. It has been reported that ſhe does not ſing in tune; but it is an undeniable fact, vouched by the firſt muſicians, that ſhe poſſeſſes a moſt accurate ear. Every vocal performer occaſionally emits a falſe ſound in conſequence of ſome temporary organic cauſe.

Catalani's eaſy and clear articulation are particularly ſtriking, her tones are full and liquid. Her cadences are appropriate and maſterly. She has a practice of rapidly deſcending in half notes, which has excited admiration chiefly by its entire novelty. The clearneſs and rapidity diſplayed by her in chromatic paſſages excite aſtoniſhment; and ſhe combines mellowneſs with diſtinctneſs, a high qualification, which Mara firſt taught us to appreciate. In the courſe of ſummer 1807, Madame Catalani viſited the provincial theatres of England, and appeared likewiſe in Dublin, Edinburgh, and Glaſgow. Her total receipts for that year are ſaid to have exceeded 15,000l.

We have been ſomewhat particular in our account of muſical affairs in our own country during the 18th century, as what would be moſt intereſting to general readers, and of which a well-informed gentleman would not wiſh to be ignorant. The profeſſor and connoiſſeur will have recourſe to diſquiſitions much more minute than thoſe of which our limits can be ſuppoſed to admit.

ELEMENTS OF MUSIC,

THEORETICAL AND PRACTICAL (C).

PRELIMINARY DISCOURSE.

uſic conſ ered in a ouble vw.

MUSIC may be conſidered, either as an art, which has for its object one of the greateſt pleaſures of which our ſenſes (D) are ſuſceptible; or as a ſcience, by which that art is reduced to principles. This is the double view in which we mean to treat of muſic in this work.

ogreſs muſic like t of o-er arts d ſcien-s.

It has been the caſe with muſic as with all the other arts invented by man: ſome facts were at firſt diſcovered by accident; ſoon afterwards reflection and obſervation inveſtigated others: and from theſe facts, properly diſpoſed and united, philoſophers were not ſlow in forming a body of ſcience, which afterwards increaſed by degrees.

The firſt theories of muſic were perhaps as ancient as the earlieſt age which we know to have been diſtinguiſhed by philoſophy, even as the age of Pythagoras; nor does hiſtory leave us any room to doubt, that from the period when that philoſopher taught, the ancients cultivated muſic, both as an art and as a ſcience, with great aſſiduity. But there remains to us much uncertainty concerning the degree of perfection to which they brought it. Almoſt every queſtion which has been propoſed with reſpect to the muſic of the ancients has divided the learned; and probably may ſtill continue to divide them, for want of monuments ſufficient in their number, and inconteſtable in their nature, from whence we might be enabled to exhibit teſtimonies and diſcoveries inſtead of ſuppoſitions and conjectures. In the preceding hiſtory we have ſtated a few facts reſpecting the nature of ancient muſic, and the inventors of the ſeveral muſical inſtruments; but it were to be wiſhed, that, in order to elucidate, as much as poſſible, a point ſo momentous in the hiſtory of the ſciences, ſome perſon of learning, equally ſkilled in the Greek language and in muſic, ſhould exert himſelf to unite and diſcuſs in the ſame work the moſt probable opinions eſtabliſhed or propoſed by the learned, upon a ſubject ſo difficult and curious. This philoſophical hiſtory of ancient muſic is a work which might highly embelliſh the literature of our times.

The hiſtory of muſic a deſideratum in literature.

In the mean time, till an author can be found ſufficiently inſtructed in the arts and in hiſtory to undertake ſuch a labour with ſucceſs, we ſhall content ourſelves with conſidering the preſent ſtate of muſic, and limit our endeavours to the explication of thoſe acceſſions which have accrued to the theory of muſic in theſe latter times.

There are two departments in muſic, melody * and harmony †. Melody is the art of arranging ſeveral ſounds in ſucceſſion one to another in a manner agreeable to the ear; harmony is the art of pleaſing that organ by the union of ſeveral ſounds which are heard at one and the ſame time. Melody has been known and felt through all ages: perhaps the ſame cannot be affirmed of harmony (E); we know not whether the ancients made any uſe of it or not, nor at what period it began to be practiſed.

* See *Melody*.

† See *Harmony*.

Not but that the ancients certainly employed in their muſic

(C) To deliver the elementary principles of muſic, theoretical and practical, in a manner which may prove at once entertaining and inſtructive, without protracting this article much beyond the limits preſcribed in our plan, appears to us no eaſy taſk. We therefore heſitated for ſome time whether to try our own ſtrength, or to follow ſome eminent author on the ſame ſubject. Of theſe the laſt ſeemed preferable. Amongſt theſe authors, none appeared to us to have written any thing ſo fit for our purpoſe as M. d'Alembert, whoſe treatiſe on muſic is the moſt methodical, perſpicuous, conciſe, and elegant diſſertation on that ſubject with which we are acquainted. As it was unknown to moſt Engliſh readers before a former edition of this work, it ought to have all the merit of an original. We have given a tranſlation of it; and in the notes, we have added, from the works of ſucceeding authors, and from our own obſervations, ſuch explanations as appeared neceſſary, to adapt the work to the preſent day.

(D) In this paſſage, and in the definitions of melody and harmony, our author ſeems to have adopted the vulgar error, that the pleaſures of muſic terminate in corporeal ſenſe. He would have pronounced it abſurd to aſſert the ſame thing of painting. Yet if the former be no more than a mere pleaſure of corporeal ſenſe, the latter muſt likewiſe be ranked in the ſame predicament. We acknowledge that corporeal ſenſe is the vehicle of ſound; but it is plain from our immediate feelings, that the reſults of ſound arranged according to the principles of melody, or combined and diſpoſed according to the laws of harmony, are the objects of a reflex or internal ſenſe.

For a more ſatisfactory diſcuſſion of this matter, the reader may conſult that elegant and judicious treatiſe on Muſical Expreſſion by Mr Aviſon. In the mean time it may be neceſſary to add, that, in order to ſhun the appearance of affectation, we ſhall uſe the ordinary terms by which muſical ſenſations, or the mediums by which they are conveyed, are generally denominated.

(E) Though no certainty can be obtained what the ancients underſtood of harmony, nor in what manner and in what period they practiſed it; yet it is not without probability, that, both in ſpeculation and practice, they were in poſſeſſion of what we denomiate *counterpoint*. Without ſuppoſing this, there are ſome paſſages in the Greek authors which can admit of no ſatisfactory interpretation. See the *Origin and Progreſs of Language*, vol. ii. Beſides, muſic thoſe chords which were moſt perfect and ſimple; ſuch as the octave, the fifth, and the third; but it ſeems doubtful whether they knew any of the other conſonances or not, or even whether in practice they could deduce the ſame advantages from the ſimple chords which were known to them, that have afterwards accrued from experience and combinations.

If that harmony which we now practiſe owes its origin to the experience and reflection of the moderns, there is the higheſt probability that the firſt eſſays of this art, as of all the others, were feeble, and the progreſs of its efforts almoſt imperceptible; and that, in the courſe of time, improving by ſmall gradations, the ſucceſſive labours of ſeveral geniuſes have elevated it to that degree of perfection in which at preſent we find it.

The origin of arts often accidental, and their progreſs gradual.

The firſt inventor of harmony eſcapes our inveſtigation, from the ſame cauſes which leave us ignorant of thoſe who firſt invented each particular ſcience; becauſe the original inventors could only advance one ſtep, a ſucceeding diſcoverer afterwards made a more ſenſible improvement, and the firſt imperfect eſſays in every kind were loſt in the more extenſive and ſtriking views to which they led. Thus the arts which we now enjoy, are for the moſt part far from being due to any particular man, or to any nation excluſively: they are produced by the united and ſucceſſive endeavours of mankind; they are the reſults of ſuch continued and united reflections, as have been formed by all men at all periods and in all nations.

It might, however, be wiſhed, that after having aſcertained, with as much accuracy as poſſible, the ſtate of ancient muſic by the ſmall number of Greek authors which remain to us, the ſame application were immediately directed to inveſtigate the firſt inconteſtable traces of harmony which appear in the ſucceeding ages, and to purſue thoſe traces from period to period. The products of theſe reſearches would doubtleſs be very imperfect, becauſe the books and monuments of the middle ages are by far too few to enlighten that gloomy and barbarous era; yet theſe diſcoveries would ſtill be precious to a philoſopher, who delights to obſerve the human mind in the gradual evolution of its powers, and the progreſs of its attainments.

Delineations of the laws of harmony recent and imperfect.

The firſt compoſitions upon the laws of harmony which we know, are of no higher antiquity than two ages prior to our own; and they were followed by many others. But none of theſe eſſays was capable of ſatisfying the mind concerning the principles of harmony: they confined themſelves almoſt entirely to the ſingle occupation of collecting rules, without endeavouring to account for them; neither had their analogies one with another, nor their common ſource, been perceived; a blind and unenlightened experience was the only compaſs by which the artiſt could direct and regulate his courſe.

Its precepts not deduced from any principle till by M. Rameau.

M. Rameau was the firſt who began to transfuſe light and order through this chaos. In the different tones produced by the ſame ſonorous body, he found the moſt probable origin of harmony, and the cauſe of that pleaſure which we receive from it. His principle he unfolded, and ſhowed how the different phenomena of muſic were produced by it: he reduced all the conſonances to a ſmall number of ſimple and fundamental chords, of which the others are only combinations or various arrangements. He has, in ſhort, been able to diſcover, and render ſenſible to others, the mutual dependence between melody and harmony.

The author's motives for writing theſe elements.

Though theſe different topics may be contained in the writings of this celebrated artiſt, and in theſe writings may be underſtood by philoſophers who are likewiſe adepts in the art of muſic; ſtill, however, ſuch muſicians as were not philoſophers, and ſuch philoſophers as were not muſicians, have long deſired to ſee theſe objects brought more within the reach of their capacity. Such is the intention of the preſent treatiſe; in which we claim no other merit than that of having developed, elucidated, and perhaps in ſome reſpects improved, the ideas of another (F).

Improvements of this edition.

Account of the work in general.

The firſt edition of this eſſay, publiſhed in 1752, having been favourably received, we have endeavoured to render this more perfect. The detail which is meant to be given of my labour, will preſent the reader with a general idea of the principle of M. Rameau, of the conſequences deduced from it, of the manner in which I have diſpoſed this principle and its conſequences; in ſhort, of what is ſtill wanting, and might be advantageous to the theory of this delightful art; of what ſtill remains for the learned to contribute towards the perfection of this theory; of the rocks and quickſands which they ought to avoid in this reſearch, and which could ſerve no other purpoſe than to retard their progreſs.

Rameau's origin of harmony.

Every ſonorous body, beſides its principal ſound, likewiſe exhibits to the ear the 12th and 17th major of that ſound. This multiplicity of different yet concordant ſounds, known for a conſiderable time, conſtitutes the baſis of the whole theory of M. Rameau, and the foundation upon which he builds the whole ſuperſtructure of a muſical ſyſtem*. In theſe our *elements* may be ſeen, how from this experiment one may deduce, by an eaſy operation of reaſon, the chief points of melody and harmony; the perfect † chord, as well major as minor; the two ‡ tetrachords employed in ancient muſic; the formation of our diatonic || ſcale; the different values § which the ſame ſound may have in that ſcale, according to the turn which is given to the baſs ¶; the alterations * which we obſerve in that ſcale, and the reaſon why they are totally imperceptible to the ear; the rules peculiar to the mode † major; the difficulty in ‡ intonation of forming three tones || in ſucceſſion; the reaſon why two perfect chords are proſcribed

* See *Syſtem.*
† See *Chord.*
‡ See *Tetrachord.*
|| See *Diatonic.*
§ See *Value.*
¶ See *Baſs.*
* See *Alteration.*
† See *Mode.*
‡ See *Intonation.*
|| See *Tone.*

Beſides, we can diſcover ſome veſtiges of harmony, however rude and imperfect, in the hiſtory of the Gothic ages, and amongſt the moſt barbarous people. This they could not have derived from more cultivated countries, becauſe it appears to be incorporated with their national muſic. The moſt rational account, therefore, which can be given, ſeems to be, that it was conveyed in a mechanical or traditionary manner through the Roman provinces from a more remote period of antiquity.

(F) See M. Rameau's letter upon this ſubject, *Merc. de Mai*, 1752.

ſcribed in immediate ſucceſſion in the diatonic order; the origin of the minor mode, its ſubordination to the mode major, and its variations; the uſe of diſcord §; the cauſes of ſuch effects as are produced by different kinds of muſic, whether diatonic, chromatic *, or enharmonic †; the principles and laws of temperament ‡. In this diſcourſe we can only point out thoſe different objects, the ſubſequent eſſay being deſigned to explain them with the minuteneſs and preciſion which they require.

§ See *Diſ-*
rd.
* See *Chro-*
atic.
† See *En-*
rmonic.
‡ See *Tem-*
rament.

One end which we have propoſed in this treatiſe, was not only to elucidate, but to ſimplify the diſcoveries of M. Rameau.—For inſtance, beſides the fundamental experiment mentioned above, that celebrated muſician, to facilitate the explication of certain phenomena, had recourſe to another experiment; that which ſhows that a ſonorous body ſtruck and put in vibration, forces its 12th and 17th major in deſcending to divide themſelves and produce a tremulous ſound. The chief uſe which M. Rameau made of this ſecond experiment was to inveſtigate the origin of the minor mode, and to account for ſome other rules eſtabliſhed in harmony; but we have found means to deduce from the firſt experiment alone the formation of the minor mode, and, beſides, to diſengage that formation from all queſtions foreign to it.

In ſome other points alſo, (as, the origin of the chord of the ſub-dominant *, and the explication of the ſeventh in certain caſes) it is imagined that we have ſimplified, and perhaps in ſome meaſure extended the principles of the celebrated artiſt.

* See *Sub-*
ominant.

We have likewiſe baniſhed every conſideration of geometrical, arithmetical, and harmonical proportions and progreſſions, which have been ſought in the mixture and protraction of tones produced by a ſonorous body; perſuaded as we are, that M. Rameau was under no neceſſity of paying the leaſt regard to theſe proportions, which we believe to be not only uſeleſs, but even, if we may venture to ſay ſo, fallacious when applied to the theory of muſic. In ſhort, though the relations produced by the octave, the fifth, and the third, &c. were quite different from what they are; though in theſe chords we ſhould neither remark any progreſſion nor any law; though they ſhould be incommenſurable one with another; the protracted tone of a ſonorous body, and the multiplied ſounds which reſult from it, are a ſufficient foundation for the whole harmonic ſyſtem.

Theoretical
nuſicians
cautioned
with regard
o the ad-
miſſion of
mathemati-
cal or me-
aphyſical
principles
n muſic.

But though this work is intended to explain the theory of muſic, and to reduce it to a ſyſtem more complete and more luminous than has hitherto been done, we ought to caution our readers againſt miſapprehenſion either of the nature of our ſubject or of the purpoſe of our endeavours.

We muſt not here look for that ſtriking evidence which is peculiar to geometrical diſcoveries alone, and which can be ſo rarely obtained in theſe mixed diſquiſitions, where natural philoſophy is likewiſe concerned. Into the theory of muſical phenomena there muſt always enter a particular kind of metaphyſics, which theſe phenomena implicitly take for granted, and which brings along with it its natural obſcurity. In this ſubject, therefore, it would be in vain to expect what is called *demonſtration:* it is much to have reduced the principal facts to a conſiſtent and connected ſyſtem; to have deduced them from one ſimple experiment; and to have eſtabliſhed upon this foundation the moſt common and eſſential rules of the muſical art. But if the intimate and unalterable conviction which can only be produced by the ſtrongeſt evidence is not here to be required, we muſt alſo doubt whether a clearer elucidation of our ſubject be poſſible.

After this declaration, it will not excite ſurpriſe, that, amongſt the facts deduced from our fundamental experiment, ſome ſhould immediately appear to depend upon that experiment, and others to reſult from it in a way more remote and leſs direct. In diſquiſitions of natural philoſophy, where we are ſcarcely allowed to uſe any other arguments than thoſe which ariſe from analogy or congruity, it is natural that the analogy ſhould be ſometimes more and ſometimes leſs ſenſible; and we will venture to pronounce that mind very unphiloſophical, which cannot recogniſe and diſtinguiſh this gradation and the different circumſtances on which it proceeds. It is not even ſurpriſing, that, in a ſubject where analogy alone can take place, this conducteſs ſhould deſert us all at once in our attempts to account for certain phenomena. This likewiſe happens in the ſubject which we now treat; nor do we conceal the fact, however mortifying, that there are certain points (though their number be but ſmall) which appear ſtill in ſome degree unaccountable from our principle. Such, for inſtance, is the procedure of the diatonic ſcale of the minor mode in deſcending, the formation of the chord commonly termed the *ſixth redundant* † or *ſuperfluous*, and ſome other facts of leſs importance, for which as yet we can ſcarcely offer any ſatisfactory account except from experience alone.

† See *Redundant.*

Rameau's
primary
experiment
has not as
yet accounted for
all the phenomena of
muſic.
Perhaps
ſome other
may be neceſſary.

Thus, though the greateſt number of the phenomena of muſic appear to be deducible in a ſimple and eaſy manner from the protracted tone of ſonorous bodies, it ought not perhaps with too much temerity to be affirmed as yet that this mixed and protracted tone is *demonſtratively* the only original principle of harmony. But in the mean time it would not be leſs unjuſt to reject this principle, becauſe certain phenomena appear to be deduced from it with leſs ſucceſs than others. It is only neceſſary to conclude from this, either that by future ſcrutinies means may be found for reducing theſe phenomena to this principle; or that harmony has perhaps ſome other unknown principle, more general than that which reſults from the protracted and compounded tone of ſonorous bodies, and of which this is only a branch; or, laſtly, that we ought not perhaps to attempt the reduction of the whole ſcience of muſic to one and the ſame principle; which, however, is the natural effect of an impatience ſo frequent even among philoſophers themſelves, which induces them to take a part for the whole, and to judge of objects in their full extent by the greateſt number of their appearances.

In thoſe ſciences which are called *phyſico mathematical* (and amongſt this number perhaps the ſcience of ſounds may be placed), there are ſome phenomena which depend only upon one ſingle principle and one ſingle experiment: there are others which neceſſarily ſuppoſe a greater number both of experiments and principles, whoſe combination is indiſpenſable in forming an exact and complete ſyſtem; and muſic perhaps is in this laſt caſe. It is for this reaſon, that whilſt

Preliminary Diſcourſe.

we beſtow on M. Rameau all due praiſe, we ſhould not at the ſame time neglect to ſtimulate the learned in their endeavours to carry them ſtill to higher degrees of perfection, by adding, if it is poſſible, ſuch improvements as may be wanting to conſummate the ſcience.

Whatever the reſult of their efforts may be, the reputation of this intelligent artiſt has nothing to fear: he will ſtill have the advantage of being the firſt who rendered muſic a ſcience worthy of philoſophical attention; of having made the practice of it more ſimple and eaſy; and of having taught muſicians to employ in this ſubject the light of reaſon and analogy.

Tartini's experiments.

We would the more willingly perſuade thoſe who are ſkilled in theory and eminent in practice to extend and improve the views of him who before them purſued and pointed out the career, becauſe many amongſt them have already made laudable attempts, and have even been in ſome meaſure ſucceſsful in diffuſing new light through the theory of this enchanting art. It was with this view that the celebrated Tartini has preſented us in 1754 with a treatiſe of harmony, founded on a principle different from that of M. Rameau. This principle is the reſult of a moſt beautiful experiment (G). If at once two different ſounds are produced from two inſtruments of the ſame kind, theſe two ſounds generate* a third different from both the others. We have inſerted in the *Encyclopédie*, under the article *Fundamental*, a detail of this experiment according to M. Martini; and we owe to the public an information, of which in compoſing this article we were ignorant: M. Romieu, a member of the Royal Society at Montpelier, had preſented to that ſociety in the year 1753, before the work of M. Tartini had appeared, a memorial printed the ſame year, and where may be found the ſame experiment diſplayed at full length. In relating this fact, which it was neceſſary for us to do, it is by no means our intention to detract in any degree from the reputation of M. Tartini; we are perſuaded that he owes this diſcovery to his own reſearches alone: but we think ourſelves obliged in honour to give public teſtimony in favour of him who was the firſt in exhibiting this diſcovery.

Preliminary Diſcourſe.

* See *Generate.*

Its diſcovery originally due to Romieu.

But whatever be the caſe, it is in this experiment that M. Tartini attempts to find the origin of harmony: his book, however, is written in a manner ſo obſcure, that it is impoſſible for us to form any judgement of it; and we are told that others diſtinguiſhed for their knowledge of the ſcience are of the ſame opinion. It were to be wiſhed that the author would engage ſome man of letters, equally practiſed in muſic and ſkilled in the art of writing, to unfold theſe ideas which

---

(G) Had the utility of the preliminary diſcourſe in which we are now engaged been leſs important and obvious than it really is, we ſhould not have given ourſelves the trouble of tranſlating, or our readers that of peruſing it. But it muſt be evident to every one, that the cautions here given, and the advices offered, are no leſs applicable to ſtudents than to authors. The firſt queſtion here decided is, Whether pure mathematics can be ſucceſsfully applied to the theory of muſic? The author is juſtly of a contrary opinion. It may certainly be doubted with great juſtice, whether the ſolid contents of ſonorous bodies, and their degrees of coheſion or elaſticity, can be aſcertained with ſufficient accuracy to render them the ſubjects of muſical ſpeculation, and to determine their effects with ſuch preciſion as may render the concluſions deduced from them geometrically true. It is admitted, that ſound is a ſecondary quality of matter, and that ſecondary qualities have no obvious connexion which we can trace with the ſenſations produced by them. Experience, therefore, and not ſpeculation, is the grand criterion of muſical phenomena. For the effects of geometry in illuſtrating the theory of muſic (if any will ſtill be ſo credulous as to pay them much attention), the Engliſh reader may conſult Smith's Harmonics, Malcolm's Diſſertation on Muſic, and Pleydel's Treatiſe on the ſame ſubject inſerted in a former edition of this work. Our author next treats of the famous diſcovery made by Signor Tartini, of which the reader may accept the following compendious account.

If two ſounds be produced at the ſame time properly tuned and with due force, from their conjunction a third ſound is generated, ſo much more diſtinctly to be perceived by delicate ears as the relation between the generating ſounds is more ſimple; yet from this rule we muſt except the uniſon and octave. From the fifth is produced a ſound uniſon with its loweſt generator; from the fourth, one which is an octave lower than the higheſt of its generators; from the third major, one which is an octave lower than its loweſt; and from the ſixth minor (whoſe higheſt note forms an octave with the loweſt in the third formerly mentioned) will be produced a ſound lower by a double octave than the higheſt of the leſſer ſixth; from the third minor, one which is double the diſtance of a greater third from its loweſt; but from the ſixth major (whoſe higheſt note makes an octave to the loweſt in the third minor) will be produced a ſound only lower by double the quantity of a greater third than the higheſt; from the ſecond major, a ſound lower by a double octave than the loweſt; from a ſecond minor, a ſound lower by triple the quantity of a third major than the higheſt; from the interval of a diatonic or greater ſemitone, a ſound lower by a triple octave than the higheſt; from that of a minor or chromatic ſemitone, a ſound lower by the quantity of a fifth four times multiplied than the loweſt, &c. &c. But that theſe muſical phenomena may be tried by experiments proper to aſcertain them, two hautboys tuned with ſcrupulous exactneſs muſt be procured, whilſt the muſicians are placed at the diſtance of ſome paces one from the other, and the hearers in the middle. The violin will likewiſe give the ſame chords, but they will be leſs diſtinctly perceived, and the experiment more fallacious, becauſe the vibrations of other ſtrings may be ſuppoſed to enter into it.

If our Engliſh reader ſhould be curious to examine theſe experiments and the deductions made from them in the theory of muſic, he will find them clearly explained and illuſtrated in a treatiſe called *Principles and Power of Harmony*, printed at London in the year 1771.

which he has not communicated with ſufficient perſpicuity, and from whence the art might perhaps derive conſiderable advantage if they were placed in a proper light. Of this we are ſo much the more perſuaded, that even though this experiment ſhould not be regarded by others in the ſame view with M. Tartini as the foundation of the muſical art, it is nevertheleſs extremely probable that one might uſe it with the greateſt advantage to enlighten and facilitate the practice of harmony.

Mechanical onclusions nadequate o the ſituaion of muical phenomena.

In exhorting philoſophers and artiſts to make new attempts for the advancement of the theory of muſic, we ought at the ſame time to caution them againſt miſtaking the real end of their reſearches. Experience is the only foundation upon which they can proceed; it is alone by the obſervation of facts, by bringing them together in one view, by ſhowing their dependency upon one, if poſſible, or at leaſt upon a very ſmall number of primary facts, that they can reach the end to which they ſo ardently aſpire, the important end of eſtabliſhing a theory of muſic, at once great, complete and luminous. The enlightened philoſopher will not attempt the explanation of facts, becauſe he knows how little ſuch explanations are to be relied on. To eſtimate them according to their proper value, it is only neceſſary to conſider the attempts of natural philoſophers who have diſcovered the greateſt ſkill in their ſcience, to explain, for inſtance, the multiplicity of tones produced by ſonorous bodies. Some having remarked (what is by no means difficult to conclude) that the univerſal vibration of a muſical ſtring is a mixture of ſeveral partial vibrations, infer, that a ſonorous body ought to produce a multiplicity of tones, as it really does. But why ſhould this multiplied ſound only appear to contain three, and why theſe three preferable to others? Others pretend that there are particles in the air, which, by their different degrees of tenſion, being naturally ſuſceptible of different oſcillations, produce the multiplicity of ſound in queſtion. But what do we know of all this? And though it ſhould even be granted, that there is ſuch a diverſity of tenſion in theſe aerial particles, how ſhould this diverſity prevent them from being all of them confounded in their vibrations by the motions of a ſonorous body? What then ſhould be the reſult, when the vibrations arrive at our ears, but a confuſed and inappretiable * noiſe, where one could not diſtinguiſh any particular ſound?

* See *Inappretiable.*

Metaphyſical concluſions leſs adequate.

If philoſophical muſicians ought not to loſe their time in ſearching for mechanical explications of the phenomena in muſic, explications which will always be found vague and unſatisfactory; much leſs is it their province to exhauſt their powers in vain attempts to riſe above their ſphere into a region ſtill more remote from the proſpect of their faculties, and to loſe themſelves in a labyrinth of metaphyſical ſpeculations upon the cauſes of that pleaſure which we feel from harmony. In vain would they accumulate hypotheſis on hypotheſis, to find a reaſon why ſome chords ſhould pleaſe us more than others. The futility of theſe ſuppoſititious accounts muſt be obvious to every one who has the leaſt penetration. Let us judge of the reſt by the moſt probable which has till now been invented for that purpoſe. Some aſcribe the different degrees of pleaſure which we feel from chords, to the more or leſs frequent coincidence of vibrations; others to the relations which theſe vibrations have among themſelves as they are more or leſs ſimple. But why ſhould this coincidence of vibrations, that is to ſay, their ſimultaneous impulſe on the ſame organs of ſenſation, and the accident of beginning frequently at the ſame time, prove ſo great a ſource of pleaſure? Upon what is this gratuitous ſuppoſition founded? And though it ſhould be granted, would it not follow, that the ſame chord ſhould ſucceſſively and rapidly affect us with contrary ſenſations, ſince the vibrations are alternately coincident and diſcrepant? On the other hand, how ſhould the ear be ſo ſenſible to the ſimplicity of relations, whilſt for the moſt part theſe relations are entirely unknown to him whoſe organs are notwithſtanding ſenſibly affected with the charms of agreeable muſic? We may conceive without difficulty how the eye judges of relations; but how does the ear form ſimilar judgments? Beſides, why ſhould certain chords which are extremely pleaſing in themſelves, ſuch as the fifth, loſe almoſt nothing of the pleaſure which they give us, when they are altered, and of conſequence when the ſimplicity of their relations are deſtroyed; whilſt other chords, which are likewiſe extremely agreeable, ſuch as the third, become harſh almoſt by the ſmalleſt alteration; nay, whilſt the moſt perfect and the moſt agreeable of all chords, the octave, cannot ſuffer the moſt inconſiderable change? Let us in ſincerity confeſs our ignorance concerning the genuine cauſes of theſe effects (H). The metaphyſical

---

(H) We have as great an averſion as our author to the explication of muſical phenomena from mechanical principles; yet we fear the following obſervations, deduced from irreſiſtible and univerſal experience, evidently ſhow that the latter neceſſarily depend on the former. It is, for inſtance, univerſally allowed, that diſſonances grate, and concords pleaſe a muſical ear: It is likewiſe no leſs unanimouſly agreed, that in proportion as a chord is perfect, the pleaſure is increaſed; now the perfection of a chord conſiſts in the regularity and frequency of coincident oſcillations between two ſonorous bodies impelled to vibrate: thus the third is a chord leſs perfect than the fifth, and the fifth than the octave. Of all theſe conſonances, therefore, the octave is moſt pleaſing to the ear; the fifth next, and the third laſt. In abſolute diſcords, the vibrations are never coincident, and of conſequence a perpetual pulſation or jarring is recogniſed between the protracted ſounds, which exceedingly hurts the ear; but in proportion as the vibrations coincide, thoſe pulſations are ſuperſeded, and a kindred formed betwixt the two continued ſounds, which delights even the corporeal ſenſe: that relation, therefore, without recognizing the aptitudes which produce it, muſt be the obvious cauſe of the pleaſure which chords give to the ear. What we mean by coincident vibrations is, that while one ſonorous body performs a given number of vibrations, another performs a different number in the ſame time: ſo that the vibrations of the quickeſt muſt ſometimes be ſimultaneous with thoſe of the ſloweſt, as will plainly appear from the following phyſical conjectures concerning the acouſtic organs are probably in the ſame predicament with thoſe which are formed concerning the organs of viſion, if one may ſpeak ſo, in which philoſophers have even till now made ſuch inconſiderable progreſs, and in all likelihood will not be ſurpaſſed by their ſucceſſors.

Since the theory of muſic, even to thoſe who confine themſelves within its limits, implies queſtions from which every wiſe muſician will abſtain; with much greater reaſon ſhould they avoid idle excurſions beyond the boundaries of that theory, and endeavours to inveſtigate between muſic and the other ſciences chimerical relations which have no foundation in nature. The ſingular opinions advanced upon this ſubject by ſome even of the moſt celebrated muſicians, deſerve not to be reſcued from oblivion, nor refuted; and ought only to be regarded as a new proof how far men of genius may err, when they engage in ſubjects of which they are ignorant.

The rules which we have attempted to eſtabliſh concerning the track to be followed in the theory of the muſical art, may ſuffice to ſhow our readers the end which we have propoſed, and which we have endeavoured to attain in this Work. We have here (we repeat it), nothing to do with the mechanical principles of protracted and harmonic tones produced by ſonorous bodies; principles which have hitherto been and perhaps may yet be long explored in vain: we have leſs to do with the metaphyſical cauſes of the ſenſations impreſſed on the mind by harmony; cauſes which are ſtill leſs diſcovered, and which, according to all appearances, will remain latent in perpetual obſcurity. We are alone concerned to ſhow how the principal laws of harmony may be deduced from one ſingle experiment; for which, if we may ſpeak ſo, preceding artiſts have been under a neceſſity of groping in the dark.

With an intention to render this work as generally uſeful as poſſible, we have endeavoured to adapt it to the capacity even of thoſe who are abſolutely uninſtructed in muſic. To accompliſh this deſign, it appeared neceſſary to purſue the following plan.

Plan of the treatiſe.

To begin with a ſhort introduction, in which are defined the technical terms moſt frequently uſed in this art; ſuch as *chord*, *harmony*, *key*, *third*, *fifth*, *octave*, &c.

Afterwards to enter into the theory of harmony, which is explained according to M. Rameau, with all poſſible perſpicuity. This is the ſubject of the *Firſt Part;* which, as well as the introduction, preſuppoſes no other knowledge of muſic than that of the names of the notes, C, D, E, F, G, A, B, which all the world knows (1).

The theory of harmony requires ſome arithmetical calculations, neceſſary for comparing ſounds one with another. Theſe calculations are ſhort, ſimple, and may be comprehended by every one; they demand no operation but what is explained, and which every ſchool-boy may perform. Yet, that even the trouble of this may be ſpared to ſuch as are not diſpoſed to take it, theſe calculations are not inſerted in the text, but in the notes, which the reader may omit, if he can take for granted the propoſitions contained in the text which will be found proved in the notes.

Theſe calculations we have not endeavoured to multiply; we could even have wiſhed to ſuppreſs them, if it had been poſſible: ſo much did it appear to us to be apprehended that our readers might be miſled upon this ſubject, and might either believe, or ſuſpect us of believing,

---

following deduction: Between the extremes of a third, the vibrations of the higheſt are as 5 to 4 of the loweſt; thoſe of the fifth as 3 to 2; thoſe of the octave as 2 to 1. Thus it is obvious, that in proportion to the frequent coincidence of periodical vibrations, the compound ſenſation is more agreeable to the ear. Now, to inquire why that organ ſhould be rather pleaſed with theſe than with the pulſation and tremulous motion of encountering vibrations which can never coaleſce, would be to aſk why the touch is rather pleaſed with poliſhed than rough ſurfaces; or, why the eye is rather pleaſed with the waving line of Hogarth than with ſharp angles and abrupt or irregular prominences? No alteration of which any chord is ſuſceptible will hurt the ear unleſs it ſhould violate or deſtroy the regular and periodical coincidence of vibrations. When alterations can be made without this diſagreeable effect, they form a pleaſing diverſity; but ſtill this fact corroborates our argument, that in proportion as any chord is perfect, it is impatient of the ſmalleſt alteration; for this reaſon, even in temperament, the octave endures no alteration at all, and the fifth as little as poſſible.

(1) In our former editions, the French ſyllabic names of the notes *ut*, *re*, *mi*, *fa*, *ſol*, *la*, *ſi*, were retained, as being thought to convey the idea of the relative ſounds more diſtinctly than the ſeven letters uſed in Britain. It is no doubt true, that by conſtantly uſing the ſyllables, and conſidering each as repreſenting one certain ſound in the ſcale, a ſinger will in time aſſociate the idea of each ſound with its proper ſyllable, ſo that he will habitually give *ut* the ſound of the firſt or fundamental note, *re* that of a ſecond, *mi* of a third, &c. but this requires a long time, and much application: and is, beſides, uſeleſs in *modulation* or changes of the key, and in all inſtrumental muſic. Teachers of *ſol-fa'ing* as it is called, or ſinging by the ſyllables, in Britain, have long diſcarded, (if they ever uſed), the ſyllables *ut*, *re*, and *ſi:* and the prevalent, and we think, the ſounder opinion is now, that a ſcholar will, by attending to the ſounds themſelves rather than to their names, ſoon learn their diſtinct characters and relations to the key, and to each other, and be able of courſe to aſſign to each its proper degree in the ſcale which he employs for the time, by whatever name the note repreſenting that degree may be generally known. See *Holden's Eſſay towards a Rational Syſtem of Muſic*, Part I. chap. i. § 32, 33.

We have therefore, in our preſent edition, preferred to the French ſyllables the Britiſh nomenclature by the letters C, D, E, F, G, A, B, as being more ſimple, more familiar to Britiſh muſicians, and equally applicable to inſtrumental as to vocal muſic.

believing, all this arithmetic neceſſary to form an artiſt. Calculations may indeed facilitate the underſtanding of certain points in the theory, as of the relations between the different notes in the gammut and of the temperament; but the calculations neceſſary for treating of theſe points are ſo ſimple, and of ſo little importance, that nothing can require a leſs oſtentatious diſplay. Let us not imitate thoſe muſicians, who, believing themſelves geometers, or thoſe geometers who, believing themſelves muſicians, fill their writings with figures upon figures; imagining, perhaps, that this apparatus is neceſſary to the art. The propenſity of adorning their works with a falſe air of ſcience, can only impoſe upon ignorance, and render their treatiſes more obſcure and leſs inſtructive.

athema-al conuſions not anſferable ſenſible jects ithout ution.

This abuſe of geometry in muſic may be condemned with ſo much more reaſon, that in this ſubject the foundations of thoſe calculations are in ſome manner hypothetical, and can never ariſe to a degree of certainty above hypotheſis. The relation of the octave as 1 to 2, that of the fifth as 2 to 3, that of the third major as 4 to 5, &c. are not perhaps the genuine relations eſtabliſhed in nature; but only relations which approach them, and ſuch as experience can diſcover. For are the reſults of experience any thing more but mere approaches to truth?

But happily theſe approximated relations are ſufficient, though they ſhould not be exactly agreeable to truth, for giving a ſatisfactory account of thoſe phenomena which depend on the relations of ſound; as in the difference between the notes in the gammut, of the alterations neceſſary in the fifth and third, of the different manner in which inſtruments are tuned, and other facts of the ſame kind. If the relations of the octave, of the fifth, and of the third, are not exactly ſuch as we have ſuppoſed them, at leaſt no experiments can prove that they are not ſo; and ſince theſe relations are ſignified by a ſimple expreſſion, ſince they are beſides ſufficient for all the purpoſes of theory, it would be uſeleſs, and contrary to ſound philoſophy, to invent other relations in order to form the baſis of any ſyſtem of muſic leſs eaſy and ſimple than that which we have delineated in this treatiſe.

The *ſecond part* contains the moſt eſſential rules of compoſition *, or in other words the practice of harmony. Theſe rules are founded on the principles laid down in the *firſt part*; yet thoſe who wiſh to underſtand no more than is neceſſary for practice, without exploring the reaſons why ſuch practical rules are neceſſary, may limit the objects of their ſtudy to the *introduction* and the *ſecond part*. They who have read the *firſt part*, will find at every rule contained in the *ſecond*, a reference to that paſſage in the *firſt* where the reaſons for eſtabliſhing that rule are given.

* ee *Com-oſition.*

Some rules, on account of their intricacy, transferred to the notes.

That we may not preſent at once too great a number of objects and precepts, we have transferred to the notes in the ſecond part ſeveral rules and obſervations which are leſs frequently put in practice, which perhaps it may be proper to omit till the treatiſe is read a ſecond time, when the reader is well acquainted with the eſſential and fundamental rules explained in it.

This ſecond part preſuppoſes, no more than the firſt, any habit of ſinging, nor even any knowledge of muſic; it only requires that one ſhould know, not even the intonation, but merely the poſition of the notes in the cleff F on the fourth line, and that of G upon the ſecond: and even this knowledge may be acquired from the work itſelf; for in the beginning of the ſecond part we explain the poſition of the cleffs and of the notes. Nothing is neceſſary but to render it a little familiar, and any difficulty in it will diſappear.

All the rules of compoſition not to be expected in an elementary eſſay.

It would be wrong to expect here all the rules of compoſition, and eſpecially thoſe which direct the compoſition of muſic in ſeveral parts, and which, being leſs ſevere and indiſpenſable, may be chiefly acquired by practice, by ſtudying the moſt approved models, by the aſſiſtance of a proper maſter, but above all by the cultivation of the ear and of the taſte. This treatiſe is properly nothing elſe, if the expreſſion may be allowed, but the rudiments of muſic, intended for explaining to beginners the fundamental principles, not the practical detail of compoſition. Thoſe who wiſh to enter more deeply into this detail, will either find it in M. Rameau's treatiſe of harmony, or in the code of muſic which he publiſhed more lately (K), or laſtly in the explication of the theory and practice of muſic by M. Bethizi (L); this laſt book appears to us clear and methodical (M).

Nature the eſſential miſtreſs of muſical compoſition.

Is it neceſſary to add, that in order to compoſe muſic in a proper taſte, it is by no means enough to have familiarized with much application the principles explained in this treatiſe? Here can only be learned the mechaniſm of the art; it is the province of nature alone to accompliſh the reſt. Without her aſſiſtance, it is no more poſſible to compoſe agreeable muſic by having read theſe elements, than to write verſes in a proper manner with the Dictionary of Richelet. In one word, it is the elements of muſic alone, and not the principles of genius, that the reader may expect to find in this treatiſe.

DEFINITIONS.

I. *What is meant by Melody, by Chord, by Harmony, by Interval.*

Melody, what.

1. *Melody* is a ſeries of ſounds which ſucceed one to another in a manner agreeable to the ear.

Chord and harmony, what.

2. A *Chord* is a combination of ſeveral ſounds heard together; and *Harmony* is properly a ſeries of chords of which the ſucceſſion pleaſes the ear. A ſingle chord is

---

(K) From my general recommendation of this code, I except the reflections on the principle of ſound which are at the end, and which I ſhould not adviſe any one to read.

(L) Printed at Paris by Lambert in the year 1754.

(M) In addition to the works mentioned in the text, we recommend to our readers, Holden's Eſſay, Glaſgow 1770, Edin. 1805; Kollmann's Eſſay on Muſical Harmony, 1796; his Eſſay on Muſical Compoſition, fol. 1799; Shield's Introduction, 1800; and Dr Callcott's Muſical Grammar, 1806.

is likewiſe ſometimes called *harmony*, to ſignify the coaleſcence of the ſounds which form the chord, and the ſenſation produced in the ear by that coaleſcence. We ſhall occaſionally uſe the word *harmony* in this laſt ſenſe, but in ſuch a manner as never to leave our meaning ambiguous.

See *Interval.*

3. An *Interval*, in melody and harmony, is the diſtance, or difference in pitch, between one ſound, and another higher or lower than it.

4. That we may learn to diſtinguiſh the intervals, and the manner of perceiving them, let us take the ordinary ſcale C, D, E, F, G, A, B, c, which every perſon whoſe ear or voice is not extremely falſe naturally modulates. The following obſervations will occur to us in ſinging this ſcale.

Account of the ſimple intervals.

The ſound D is higher or ſharper than the ſound C, the ſound E higher than the ſound D, the ſound F higher than the ſound E, &c. and ſo through the whole octave; ſo that the interval, or the diſtance from the ſound C to the ſound D, is leſs than the interval or diſtance between the ſound C and the ſound E, the interval from C to F is leſs than that between C and F, &c. and in ſhort that the interval from the firſt to the ſecond C is the greateſt of all.—To diſtinguiſh the firſt from the ſecond C, we have marked the laſt with a ſmall letter (N).

The diſtinction between ſtrong and faint, or acute and grave.

5. In general, the interval between two ſounds is proportionably greater, as one of theſe ſounds is higher or lower with relation to the other: but it is neceſſary to obſerve, that two ſounds may be equally high or low, though unequal in their force. The ſtring of a violin touched with a bow produces always a ſound equally high, whether ſtrongly or faintly ſtruck; the ſound will only have a greater or leſſer degree of ſtrength. It is the ſame with vocal modulation; let any one form a ſound by gradually ſwelling the voice, the ſound may be perceived to increaſe in force, whilſt it continues always equally low or equally high.

Between tonic and ſemitonic intervals.

6. We muſt likewiſe obſerve concerning the ſcale, that the intervals between C and D, between D and E, between F and G, between G and A, between A and B, are equal, or at leaſt nearly equal; and that the intervals between E and F, and between B and C, are likewiſe equal among themſelves, but conſiſt almoſt only of half the former. This fact is known and recogniſed by every one: the reaſon for it ſhall be given in the ſequel; in the mean time every one may aſcertain its reality by the aſſiſtance of an experiment (O).

7. It

(N) We ſhall afterwards find that three different ſeries of the ſeven letters are uſed, which we have diſtinguiſhed by capitals, ſmall Roman, and Italic characters. When the notes repreſented by ſmall Roman characters occur in this treatiſe we ſhall, merely to diſtinguiſh them from the typography of the text, place them in inverted commas, thus 'c', 'd', &c.

(O) This experiment may be eaſily tried. Let any one ſing the ſcale C, D, E, F, G, A, B 'c', it will be immediately obſerved without difficulty, that the laſt four notes of the octave G, A, B, 'c', are quite ſimilar to the firſt C, D, E, F; inſomuch, that if, after having ſung this ſcale, one would chooſe to repeat it, beginning with C in the ſame tone which was occupied by G in the former ſcale, the note D of the laſt ſcale would have the ſame ſound with the note A in the firſt, the E with the B, and the F with the 'c'.

Whence it follows, that the interval between C and D, is the ſame as between G and A; between D and F, as between A and B, and E and F, as between B and 'c'.

From D to E, from F to G, there is the ſame interval as from C to D. To be convinced of this, we need only ſing the ſcale once more; then ſing it again, beginning with C, in this laſt ſcale, in the ſame tone which was given to D in the firſt; and it will be perceived, that the D in the ſecond ſcale will have the ſame ſound, at leaſt as far as the ear can diſcover, with the E in the former ſcale; whence it follows, that the difference between D and E is, at leaſt as far as the ear can perceive, equal to that between C and D. It will alſo be found, that the interval between F and G is, ſo far as our ſenſe can determine, the ſame with that between C and D.

This experiment may perhaps be tried with ſome difficulty by thoſe who are not inured to form the notes and change the key; but ſuch may very eaſily perform it by the aſſiſtance of a harpſichord, by means of which the performer will be ſaved the trouble of retaining the ſounds in one intonation whilſt he performs another. In touching upon this harpſichord the keys G, A, B, 'f', and in performing with the voice at the ſame time C, D, E, F, in ſuch a manner that the ſame ſound may be given to C in the voice with that of the key G in the harpſichord, it will be found that D in the vocal intonation ſhall be the ſame with A upon the harpſichord, &c.

It will be found likewiſe by the ſame harpſichord, that if one ſhould ſing the ſcale beginning with C in the ſame tone with E on the inſtrument, the D, which ought to have followed C, will be higher by an extremely perceptible degree than the F which follows E: thus it may be concluded, that the interval between E and F is leſs than between C and D; and if one would riſe from F to another ſound which is at the ſame diſtance from F, as F from E, he would find, in the ſame manner, that the interval from E to this new ſound is almoſt the ſame as that between C and D. The interval then from E to F is nearly half of that between C and D.

Since then, in the ſcale thus divided, C, D, E, F,
G, A, B, 'c',

the firſt diviſion is perfectly like the laſt; and ſince the intervals between C and D, between D and E, and between F and G, are equal; it follows, that the intervals between G and A, and between A and B, are likewiſe equal to every one of the three intervals between C and D, between D and E, and between F and G; and that the intervals between E and F and between B and 'c' are alſo equal, but that they only conſtitute one half of the others.

D nitions.

7. It is for this reaſon that they have called the interval from E to F, and from B to C, a ſemitone; whereas thoſe between C and D, D and E, F and G, G and A, and A and B, are tones.

* ate CCLIV fig.

† Se Inter- va

The *tone* is likewiſe called a *ſecond major* *, and the *ſemitone* a *ſecond minor* †.

8. To deſcend or riſe diatonically, is to deſcend or riſe from one ſound to another by the interval of a tone or of a ſemitone, or in general by ſeconds, whether major or minor; as from D to C, or from C to D, from F to E, or from E to F.

II. *The terms by which the different Intervals of the Scale are denominated.*

Td mi- no what.

9. An interval compoſed of a tone and a ſemitone, as from E to G, from A to C, or from D to F, is called a *third minor*.

Trd ma- jorwhat.

An interval compoſed of two full tones, as from C to E, and from F to A, or from G to B, is called a *third major*.

Frth, wt.

An interval compoſed of two tones and a ſemitone, as from C to F, or from G to C, is called a *fourth*.

Trone, wt.

An interval conſiſting of three full tones, as from F to B, is called a *tritone* or *fourth redundant*.

Fi, what.

An interval conſiſting of three tones and a ſemitone, as from C to G, from F to C, from D to A, or from E to B, &c. is called a *fifth*.

Sih mi- no what.

An interval compoſed of three tones and two ſemitones, as from E to C, is called a *ſixth minor*.

Sih ma- jowhat.

An interval compoſed of four tones and a ſemitone, as from C to A, is called a *ſixth major*.

Senth mi- no what.

An interval conſiſting of four tones and two ſemitones, as from D to C, is called a *ſeventh minor*.

Senth mor, wt.

An interval compoſed of five tones and a ſemitone, as from C to B, is called a *ſeventh major*.

Oave, wt.

And in ſhort, an interval conſiſting of five tones and two ſemitones, as from C to 'c' is called an *octave*.

Several of the intervals now mentioned, are diſtinguiſhed by other names, as may be ſeen in the beginning of the ſecond part; but thoſe now given are the moſt common, and the only terms which our preſent purpoſe demands.

Uſon, wt.

10. Two ſounds equally high, or equally low, however unequal in their force, are ſaid to be in *uniſon* one with the other.

11. If two ſounds form between them any interval, whatever it be, we ſay, that the higheſt when aſcending is in that interval with relation to the loweſt; and when deſcending, we pronounce the loweſt in the ſame interval with relation to the higheſt. Thus in the third minor, E, G, where E is the loweſt and G the higheſt ſound, G is a third minor from E *aſcending*, and E is a third minor from G *in deſcending*.

12. In the ſame manner, if, ſpeaking of two ſonorous bodies, we ſhould ſay, that the one is a fifth above the other *in aſcending*; this infers that the ſound given by the one is at the diſtance of a fifth *aſcending* from the ſound given by the other.

III. *Of Intervals greater than the Octave.*

Fig. 2.

13. If, after having ſung the ſcale C, D, E, F, G, A, B, c, one would carry this ſcale ſtill farther in aſcent, it would be diſcovered without difficulty that a new ſcale would be formed, 'c, d, e, f', &c. entirely ſimilar to the former, and of which the ſounds will be an octave aſcending, each to its correſpondent note in the former ſcale; thus 'd', the ſecond note of the ſecond ſcale, will be an octave in aſcent to the D of the firſt ſcale; in the ſame manner 'e' ſhall be the octave to E, &c. and ſo of the reſt.

Ninth, what.

14. As there are nine notes from the firſt C to the ſecond 'd', the interval between theſe two ſounds is called a *ninth*, and this ninth is compoſed of ſix full tones and two ſemitones. For the ſame reaſon the interval from C to 'f' is called an *eleventh*, and the interval between C and 'g' a *twelfth*, &c.

Eleventh and twelfth what.

It is plain that the *ninth* is the octave of the *ſecond*, the *eleventh* of the *fourth*, and the *twelfth* of the *fifth*, &c.

* See *Interval* and *Double Octave*.

The octave above the octave of any ſound is called a *double octave* *; the octave of the double octave is called a *triple octave*, and ſo of the reſt.

The double octave is likewiſe called a *fifteenth*: and for the ſame reaſon the double octave of the third is called a *ſeventeenth*, the double octave of the fifth a *nineteenth*, &c. (P).

IV.

(P) Let us ſuppoſe two vocal ſtrings formed of the ſame matter, of the ſame thickneſs, and equal in their tenſion, but unequal in their length; it will be found by experience,

1ſt, That if the ſhorteſt is equal to half the longeſt, the ſound which it will produce muſt be an octave above the ſound produced by the longeſt.

2dly, That if the ſhorteſt conſtitutes a third part of the longeſt, the ſound which it produces muſt be a twelfth above the ſound produced by the longeſt,

3dly, That if it conſtitutes the fifth part, its ſound will be a ſeventeenth above.

Beſides, it is a truth demonſtrated and generally admitted, that in proportion as one muſical ſtring is leſs than another, the vibrations of the leaſt will be more frequent (that is to ſay, its departures and returns through the ſame ſpace) in the ſame time; for inſtance, in an hour, a minute, a ſecond, &c. in ſuch a manner that one ſtring which conſtitutes a third part of another, forms three vibrations, whilſt the largeſt has only accompliſhed one. In the ſame manner, a ſtring which is one half leſs than another, performs two vibrations, whilſt the other only completes one; and a ſtring which is only the fifth part of another, will perform five vibrations in the ſame time which is occupied by the other in one.

From thence it follows, that the ſound of a ſtring is proportionally higher or lower, as the number of its vibrations is greater or ſmaller in a given time; for inſtance, in a ſecond.

It is for that reaſon, that if we repreſent any ſound whatever by 1, one may repreſent the octave above by 2, that is to ſay, by the number of vibrations formed by the ſtring which produces the octave, whilſt the longeſt ſtring only vibrates once; in the ſame manner we may repreſent the twelfth above the ſound 1 by 3, the ſeventeenth

IV. *What is meant by Sharps and Flats.*

Sharps and flats, what. See *Interval.*

15. It is plain that one may imagine the five tones which enter into the ſcale, as divided each into two ſemitones; thus one may advance from C to D, forming in his progreſs an intermediate ſound, which ſhall be higher by a ſemitone than C, and lower in the ſame degree than D. A ſound in the ſcale is called *ſharp*, when it is raiſed by a ſemitone; and it is marked with this character ※: thus C ※ ſignifies C *ſharp*, that is to ſay, C raiſed by a ſemitone above its pitch in the natural ſcale. A ſound in the ſcale depreſſed by a ſemitone is called *flat*, and is marked thus, ♭: thus A ♭ ſignifies A *flat*, or A depreſſed by a ſemitone.

V. *What is meant by Conſonances and Diſſonances.*

Conſonance, what. See *Chord.*

16. A chord compoſed of ſounds whoſe union or coaleſcence pleaſes the ear is called a *conſonance;* and the ſounds which form this chord are ſaid to be conſonant one with relation to the other. The reaſon of this denomination is, that a chord is found more perfect, as the ſounds which form it coaleſce more cloſely among themſelves.

17. The octave of a ſound is the moſt perfect of conſonances of which that ſound is ſuſceptible; then the fifth, afterwards the third, &c. This is a fact founded on experiment.

Diſſonance, what.

18. A number of ſounds ſimultaneouſly produced whoſe union is diſpleaſing to the ear is called a *diſſonance*, and the ſounds which form it are ſaid to be diſſonant one with relation to the other. The ſecond, the tritone, and the ſeventh of a ſound, are diſſonants with relation to it. Thus the ſounds C D, C B, or F B, &c. ſimultaneouſly heard, form a diſſonance. The reaſon which renders diſſonance diſagreeable, is, that the ſounds which compoſe it, ſeem by no means coaleſcent to the ear, and are heard each of them by itſelf as diſtinct ſounds, though produced at the ſame time.

See *Diſcord.*

PART I. THEORY OF HARMONY.

CHAP. I. *Preliminary and Fundamental Experiments.*

EXPERIMENT I.

19. WHEN a ſonorous body is ſtruck till it gives a ſound, the ear, beſides the principal ſound and its octave, perceives two other ſounds very high, of which one is the twelfth above the principal ſound, that is to ſay, the octave to the fifth of that ſound; and the other is the ſeventeenth major about the ſame ſound, that is to ſay, the double octave of its third major.

20. This experiment is peculiarly ſenſible upon the thick ſtrings of the violoncello, of which the ſound being extremely low, gives to an ear, though not very much practiſed, an opportunity of diſtinguiſhing with ſufficient eaſe and clearneſs the twelfth and ſeventeenth now in queſtion (Q).

---

teenth major above 5, &c. But it is very neceſſary to remark, that by theſe numerical expreſſions we do not pretend to compare ſounds as ſuch; for ſounds in themſelves are nothing but mere ſenſations, and it cannot be ſaid of any ſenſation that it is double or triple to another: thus the expreſſions 1, 2, 3, &c. employed to denominate a ſound, its octave above, its twelfth above, &c. ſignify only, that if a ſtring performs a certain number of vibrations, for inſtance, in a ſecond, the ſtring which is in the octave above ſhall double the number in the ſame time, the ſtring which is in the twelfth above ſhall triple it, &c.

Thus to compare ſounds among themſelves is nothing elſe than to compare among themſelves the numbers of vibrations which are formed in a given time by the ſtrings that produce theſe ſounds.

(Q) Since the octave above the ſound 1 is 2, the octave below that ſame ſound ſhall be $\frac{1}{2}$; that is to ſay, that the ſtring which produces this octave ſhall have performed half its vibration, whilſt the ſtring which produces the ſound 1 ſhall have completed one. To obtain therefore the octave above any ſound, the operator muſt multiply the quantity which expreſſes the ſound by 2; and to obtain the octave below, he muſt on the contrary divide the ſame quantity by 2.

It is for that reaſon that if any ſound whatever, for inſtance C, is denominated	1
Its octave above will be	2
Its double octave above	4
Its triple octave above	8
In the ſame manner its octave below will be	$\frac{1}{2}$
Its double octave below	$\frac{1}{4}$
Its triple octave below	$\frac{1}{8}$
And ſo of the reſt.	
Its twelfth above	3
Its twelfth below	$\frac{1}{3}$
Its 17th major above	5
Its 17th major below	$\frac{1}{5}$

The fifth then above the ſound 1 being the octave beneath the twelfth, ſhall be, as we have immediately obſerved,

21. The principal ſound is called the *generator* *; and the two other ſounds which it produces, and with which it is accompanied, are, incluſive of its octave, called its *harmonics* †.

Teory of Hmony.

* Se *Genetor.* Geerator, wht.

† Se *Harmic.*

Experiment II.

22. There is no perſon inſenſible of the reſemblance with ſubſiſts between any ſound and its octave, whether above or below. Theſe two ſounds, when heard together, almoſt entirely coaleſce in the organ of ſenſation. We may beſides be convinced (by two facts which are extremely ſimple) of the facility with which one of theſe ſounds may be taken for the other.

Let it be ſuppoſed that any perſon has an inclination to ſing a tune, and having at firſt begun this air upon a pitch too high or too low for his voice, ſo that he is obliged, leſt he ſhould ſtrain himſelf too much, to ſing the tune in queſtion on a key higher or lower than the firſt; he will naturally, without being initiated in the art of muſic, take his new key in the octave below or the octave above the firſt; and in order to take this key in any other interval except the octave, he will find it neceſſary to exert a ſenſible degree of attention. This is a fact of which we may eaſily be perſuaded by experience.

Another fact. Let any perſon ſing a tune in our preſence, and let it be ſung in a tone too high or too low for our voice; if we wiſh to join in ſinging this air, we naturally take the octave below or above, and frequently, in taking this octave, we imagine it to be the uniſon (Q*).

ſerved, $\frac{3}{2}$; which ſignifies that this ſtring performs $\frac{3}{2}$ vibrations; that is to ſay, one vibration and a half during a ſingle vibration of the ſtring which gives the ſound 1.

To obtain the fourth above the ſound 1, we muſt take the twelfth below that ſound, and the double octave above that twelfth. In effect, the twelfth below C, for inſtance, is F, of which the double octave *f* is the fourth above *c*. Since then the twelfth below 1 is $\frac{1}{3}$, it follows that the double octave above this twelfth, that is to ſay, the fourth from the ſound 1 in aſcending, will be $\frac{1}{3}$ multiplied by 4, or $\frac{4}{3}$.

In ſhort, the third major being nothing elſe but the double octave beneath the ſeventeenth, it follows, that the third major above the ſound 1 will be 5 divided by 4, or in other words $\frac{5}{4}$.

The third major of a ſound, for inſtance the third major E, from the ſound C, and its fifth G, form between them a third minor E, G; now E is $\frac{5}{4}$, and G $\frac{3}{2}$, by what has been immediately demonſtrated: from whence it follows, that the third minor, or the interval between E and G, ſhall be expreſſed by the relation of the fraction $\frac{5}{4}$ to the fraction $\frac{3}{2}$.

To determine this relation, it is neceſſary to remark, that $\frac{5}{4}$ are the ſame thing with $\frac{12}{8}$, and that $\frac{3}{2}$ are the ſame thing with $\frac{10}{8}$: ſo that $\frac{5}{4}$ ſhall be to $\frac{3}{2}$ in the ſame relation as $\frac{10}{8}$ to $\frac{12}{8}$; that is to ſay, in the ſame relation as 10 to 12, or as 5 to 6. If, then, two ſounds form between themſelves a third minor, and that the firſt is repreſented by 5, the ſecond ſhall be expreſſed by 6; or, what is the ſame thing, if the firſt is repreſented by 1, the ſecond ſhall be expreſſed by $\frac{6}{5}$.

Thus the third minor, an harmonic ſound which is even found in the protracted and coaleſcent tones of a ſonorous body between the ſound E and G, an harmonic of the principal ſound, may be expreſſed by the fraction $\frac{6}{5}$.

N. B. One may ſee by this example, that in order to compare two ſounds one with another which are expreſſed by fractions, it is neceſſary firſt to multiply the numerator of the fraction which expreſſes the firſt by the denominator of the fraction which expreſſes the ſecond, which will give a primary number; as here the numerator 5 of the fraction $\frac{5}{4}$, multiplied by 2 of the fraction $\frac{3}{2}$, has given 10. Afterwards may be multiplied the numerator of the ſecond fraction by the denominator of the firſt, which will give a ſecondary number, as here 12 is the product of 4 multiplied by 3; and the relation between theſe two numbers (which in the preceding example are 10 and 12), will expreſs the relation between theſe ſounds, or, what is the ſame thing, the interval which there is between the one and the other; in ſuch a manner, that the farther the relation between theſe ſounds departs from unity, the greater the interval will be.

Such is the manner in which we may compare two ſounds one with another whoſe numerical value is known. We ſhall now ſhow the manner how the numerical expreſſion of a ſound may be obtained, when the relation which it ought to have with another ſound is known whoſe numerical expreſſion is given.

Let us ſuppoſe, for example, that the third major of the fifth $\frac{3}{2}$ is ſought. That third major ought to be, by what has been ſhown above, the $\frac{5}{4}$ of the fifth; for the third major of any ſound whatever is the $\frac{5}{4}$ of that ſound. We muſt then look for a fraction which expreſſes the $\frac{5}{4}$ of $\frac{3}{2}$; which is done by multiplying the numerators and denominators of both fractions one by the other, from whence reſults the new fraction $\frac{15}{8}$. It will likewiſe be found that the fifth of the fifth is $\frac{9}{4}$, becauſe the fifth of the fifth is the $\frac{3}{2}$ of $\frac{3}{2}$.

Thus far we have only treated of fifths, fourths, thirds major and minor, in aſcending; now it is extremely eaſy to find by the ſame rules the fifths, fourths, thirds major and minor in deſcending, For ſuppoſe C equal to 1, we have ſeen that its fifth, its fourth, its third, its major and minor in aſcending, are, $\frac{3}{2}$, $\frac{4}{3}$, $\frac{5}{4}$, $\frac{6}{5}$. To find its fifth, its fourth, its third, its major and minor in deſcending, nothing more is neceſſary than to reverſe theſe fractions, which will give $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$, $\frac{5}{6}$.

(Q*) It is not then imagined that we change the value of a ſound in multiplying or dividing it by 2, by 4, or by 8, &c. the number which expreſſes theſe ſounds, ſince by theſe operations we do nothing but take the ſimple double, or triple octave, &c. of the ſound in queſtion, and that a ſound coaleſces with its octave.

CHAP. II. *The Origin of the Modes Major and Minor; of the moſt natural Modulation, and the moſt perfect Harmony.*

Funda-mental and harmonics, what.

23. To render our ideas ſtill more preciſe and permanent, we ſhall call the tone produced by the ſonorous body C: it is evident, by the firſt experiment, that this ſound is always attended by its 12th and 17th major; that is to ſay, with the octave of G, and the double octave of E.

24. This octave of G then, and this double octave of E, produce the moſt perfect chord which can be joined with C, ſince that chord is the work and choice of nature (R).

Harmony reduced to chords, fifths, and octaves.

25. For the ſame reaſon, the modulation formed by C with the octave of G, and the double octave of E, ſung one after the other, would likewiſe be the moſt ſimple and natural of all modulations which do not deſcend or aſcend directly in the diatonic order, if our voices had ſufficient compaſs to form intervals ſo great without difficulty: but the eaſe and freedom with which we can ſubſtitute its octave to any ſound, when it is more convenient for the voice, afford us the means of repreſenting this modulation.

Mode major, what.

26. It is on this account that, after having ſung the tone C, we naturally modulate the third E, and the fifth G, inſtead of the double octave of E, and the octave of G; from whence we form, by joining the octave of the ſound G, this modulation, C, E, G, 'c', which in effect is the ſimpleſt and eaſieſt of them all; and which likewiſe has its origin even in the protracted and compounded tones produced by a ſonorous body.

See *Mode*. See likewiſe *Interval*.

27. The modulation C, E, G, 'c', in which the chord C, E, is a third major, conſtitutes that kind of harmony or melody which we call the *mode major;* from whence it follows, that this mode reſults from the immediate operation of nature.

Mode minor, what.

28. In the modulation C, E, G, of which we have now been treating, the ſounds E and G are ſo proportioned one to the other, that the principal ſound C (art. 19.) cauſes both of them to reſound; but the ſecond tone E does not cauſe G to reſound, which only forms the interval of a third minor.

29. Let us then imagine, that, inſtead of this ſound E, one ſhould ſubſtitute between the ſounds C and G, another note which (as well as the ſound C) has the power of cauſing G to reſound, and which is, however, different from the ſound C; the ſound which we explore ought to be ſuch, by art. 19. that it may have for its 17th major G, or one of the octaves of G; of conſequence the ſound which we ſeek ought to be a 17th major below G, or, what is the ſame thing, a third major below the ſame G. Now the ſound E being a third minor beneath G, and the third major being (art. 9.) greater by a ſemitone than the third minor, it follows, that the ſound of which we are in ſearch ſhall be a ſemitone beneath the natural E, and of conſequence E ♭.

30. This new arrangement, C, E ♭, G, in which the ſounds C and E ♭ have both the power of cauſing G to reſound, though C does not cauſe E ♭ to reſound, is not indeed equally perfect with the firſt arrangement C, E, G; becauſe in this the two ſounds E and G are both the one and the other generated by the principal ſound C; whereas, in the other, the ſound E ♭, is not generated by the ſound C; but this arrangement C, E ♭, G, is likewiſe dictated by nature (art. 19.), though leſs immediately than the former; and accordingly experience evinces that the ear accommodates itſelf almoſt as well to the latter as to the former.

Origin of mode minor. See *Mode*. See alſo *Interval*.

31. In this modulation or chord C, E ♭, G, C, it is evident that the third from C to E ♭ is minor; and ſuch is the origin of that mode which we call *minor* (S).

Perfect chords, what.

32. The moſt perfect chords then are, 1. All chords related one to another, as C, E, G, 'c', conſiſting of any ſound, of its third major, of its fifth, and of its octave. 2. All chords related one to another, as C E ♭, G, 'c', conſiſting of any ſound, of its third minor,

---

(R) The chord formed with the twelfth and ſeventeenth major united with the principal ſound, being exactly conformed to that which is produced by nature, is likewiſe for that reaſon the moſt agreeable of all; eſpecially when the compoſer can proportion the voices and inſtruments together in a proper manner to give this chord its full effect. M. Rameau has executed this with the greateſt ſucceſs in the opera of *Pygmalion*, page 34. where Pygmalion ſings with the chorus *L'amour triomphe*, &c.: in this paſſage of the chorus, the two parts of the vocal and inſtrumental baſſes give the principal ſound and its octave; the firſt part above, or treble, and that of the counter-tenor, produce the ſeventeenth major, and its octave, in deſcending; and the ſecond part, or tenor abo gives the twelfth.

See fig. 3.

(S) The origin which we have here given of the mode minor, is the moſt ſimple and natural that can poſſibly be given. M. Rameau deduces it, more artificially, from the following experiment.—If you put in vibration a muſical ſtring HI, and if there are at the ſame time contiguous to this two other ſtrings KN, RW, of which the firſt ſhall be a twelfth, and the ſecond a ſeventeenth major below the ſtring HI, the ſtrings KN, RW will vibrate without being ſtruck as ſoon as the ſtring HI ſhall give a ſound, and divide themſelves by a kind of undulation, the firſt into three, the laſt into five equal parts; in ſuch a manner, that, in the vibration of the ſtring KN, you may eaſily diſtinguiſh two points at reſt LM, and in the tremulous motion of the ſtring RW, four quieſcent points S, T, U, V, all placed at equal diſtances from each other, and dividing the ſtrings into three or five equal parts. In this experiment, ſays M. Rameau, if we repreſent by the note C the tone of the ſtring HI, the two other ſtrings will repreſent the ſounds F and A ♭; and from thence M. Rameau deduces the modulation F, A ♭, C, and of conſequence the mode minor. The origin which we have aſſigned to the minor mode, appears more direct and more ſimple, becauſe it preſuppoſes no other experiment than that of art. 19. and becauſe alſo the fundamental ſound C is ſtill retained in both the modes, without being obliged, as M. Rameau found himſelf, to change it into F.

minor, of its fifth, and of its octave. In effect, theſe two kinds of chords are exhibited by nature; but the firſt more immediately than the ſecond. The firſt are called *perfect chords major*, the ſecond *perfect chords minor*.

Chap. III. *Of the Succeſſion by Fifths, and of the Laws which it obſerves.*

nda- ntal baſs, at.

33. Since the ſound C cauſes the ſound G to be heard, and is itſelf heard in the ſound F, which ſounds G and F are its two twelfths, we may imagine a modulation compoſed of that ſound C and its two twelfths, or, which is the ſame thing (art. 22.), of its two fifths, F and G, the one below, the other above; which gives the modulation or ſeries of fifths F, C, G, which we call the *fundamental baſs* of C by fifths.

We ſhall find in the ſequel (Chap. XVIII.), that there may be ſome fundamental baſs by thirds, deduced from the two ſeventeenths, of which the one is an attendant of the principal ſound, and of which the other includes that ſound. But we muſt advance ſtep by ſtep, and ſatisfy ourſelves at preſent to conſider immediately the fundamental baſes by fifths.

34. Thus, from the ſound C, one may make a tranſition indifferently to the ſound G, or to the ſound F.

35. One may, for the ſame reaſon, continue this kind of fifths in aſcending, and in deſcending, from C, in this manner:

E♭, B♭, F, C, G, D, A, &c.

And from this ſeries of fifths one may paſs to any ſound which immediately precedes or follows it.

xception the rule.

36. But it is not allowed in the ſame manner to paſs from one ſound to another which is not immediately contiguous to it; for inſtance, from C to D, or from D to C: for this very ſimple reaſon, that the ſound D is not contained in the ſound C, nor the ſound C in that of D; and thus theſe ſounds have not any alliance the one with the other, which may authoriſe the tranſition from one to the other.

wo per- ect chords ſucceſ- n proſcri- ed.

37. And as theſe ſounds C and D, by the firſt experiment, naturally bring along with them the perfect chords conſiſting of greater intervals C, E, G, 'c', and D, F✕, A, 'd'; hence may be deduced this rule, That two perfect chords, eſpecially if they are major (T), cannot ſucceed one another diatonically in a fundamental baſs; we mean, that in a fundamental baſs two ſounds cannot be diatonically placed in ſucceſſion, each of which, with its harmonics, forms a perfect chord, eſpecially if this perfect chord be major in both.

Chap. IV. *Of Modes in General.*

Mode in eneral, hat.

38. A *MODE*, in muſic, is, the order of ſounds preſcribed, as well in harmony as melody, by the ſeries of fifths. Thus the three ſounds F, C, G, and the harmonics of each of theſe three ſounds, that is to ſay, their thirds major and their fifths, compoſe all the major modes which are proper to C.

Modes, how repreſented by the ſeries of fifths.

39. The ſeries of fifths then, or the fundamental baſs F, C, G, of which C holds the middle ſpace, may be regarded as repreſenting the mode of C. One may likewiſe take the ſeries of fifths, or fundamental baſs, C, G, D, as repreſenting the mode of G; in the ſame manner B♭, F, C, will repreſent the mode of F.

Thus the mode of G, or rather the fundamental baſs of that mode, has two ſounds in common with the fundamental baſs of the mode of C. It is the ſame with the fundamental baſs of the mode F.

Principal mode, and adjuncts, what. See *Adjunct*.

40. The mode of C (F, C, G) is called the *principal mode* with reſpect to the modes of theſe two fifths, which are called its two *adjuncts*.

Modes reliſhed in proportion as their ſounds are common.

41. It is then, in ſome meaſure, indifferent to the ear whether a tranſition be made to the one or to the other of theſe adjuncts, ſince each of them has equally two ſounds in common with the principal mode. Yet the mode of G ſeems a little more eligible: for G is heard amongſt the harmonics of C, and of conſequence is implied and ſignified by C; whereas C does not cauſe F to be heard, though C is included in the ſame ſound F. It is hence that the ear, affected by the mode of C, is a little more prepoſſeſſed for the mode of G than for that of F. Nothing likewiſe is more frequent, nor more natural, than to paſs from the mode of C to that of G.

Dominant and ſub-dominant, what. See *Dominant*

42. It is for this reaſon, as well as to diſtinguiſh the two fifths one from the other, that we call G the fifth above the generator the *dominant* ſound, and the fifth F, below the generator, the *ſubdominant*.

Tranſition to contiguous ſounds, how to be managed.

43. As in the ſeries of fifths, we may indifferently paſs from one ſound to that which is contiguous: ſo having paſſed from the mode of C to that of G, one may from thence proceed to the mode of D. And on the other hand, having paſſed from the mode of C to that of F we may then paſs to the mode of B♭. But it is neceſſary, however, to obſerve, that the ear, which has been immediately affected with the principal mode, feels always a ſtrong propenſity to return to it. Thus the further the mode to which we make a tranſition is removed from the principal mode, the leſs time we ought to dwell upon it; or rather, to ſpeak in the terms of the art, the leſs ought the phraſe (U) of that mode to be protracted.

Chap. V. *Of the Formation of the Diatonic Scale as uſed by the Greeks.*

44. From this rule, that two ſounds which are contiguous may be placed in immediate ſucceſſion in the ſeries of fifths, F, C, G, it follows, that one may form

---

(T) We ſay *eſpecially if they are major*; for in the major chord D, F✕, A, 'd', beſides that the ſounds C and D have no common harmonical relation, and are even diſſonant between themſelves (art. 13.), it will likewiſe be found, that F✕ forms a diſſonance with C. The minor chord D, F, A, 'd', would be more tolerable, becauſe the natural F, which occurs in this chord carries along with it its fifth C, or rather the octave of that fifth: It has likewiſe been ſometimes the practice of compoſers, though rather by a licence indulged them than ſtrictly agreeable to their art, to place a minor in diatonic ſucceſſion to a major chord.

(U) As the mere Engliſh reader, unacquainted with the technical phraſeology of muſic, may be ſurpriſed at the form this modulation, or this fundamental baſs, by fifths,

G, C, G, C, F, C, F.

See fig. 4. Formation of the Greek diatonic ſcale by the fundamental baſs.

45. Each of the ſounds which forms this modulation brings neceſſarily along with itſelf its third major, its fifth, and its octave; inſomuch that he who, for inſtance, ſings the note G, may be reckoned to ſing at the ſame time the notes G, B, 'd, g': in the ſame manner the ſound C in the fundamental baſs brings along with it this modulation, C, E, G, C: and, in ſhort, the ſound F brings along with it F, A, C, 'f'. This modulation then, or this fundamental baſs,

G, C, G, C, F, C, F,

gives the following diatonic ſeries,

B, 'c, d, e, f, g, a';

See fig. 4.

which is preciſely the diatonic ſcale of the Greeks. We are ignorant upon what principles they had formed this ſcale; but it may be ſenſibly perceived, that that ſeries ariſes from the baſs G, C, G, C, F, C, F; and that of conſequence this baſs is juſtly called *fundamental*, as being the real primitive modulation, that which conducts the ear, and which it feels to be implied in the diatonic modulation, B, 'c, d, e, f, g, a' (x).

46. We ſhall be ſtill more convinced of this truth by the following remarks.

In the modulation B, 'c, d, e, f, g, a', the ſounds 'd' and 'f' form between themſelves a third minor, which is not ſo perfectly true as that between 'e' and 'g' (y). Nevertheleſs, this alteration in the third minor between 'd' and 'f' gives the ear no pain, becauſe that 'd' and that 'f' which do not form between themſelves a true third minor, form, each in particular, conſonances perfectly juſt with the ſounds in the fundamental baſs which correſpond with them: for 'd' in the ſcale is the true fifth of G, which anſwers to it in the fundamental baſs; and 'f' in the ſcale is the true octave of F, which anſwers to it in the ſame baſs.

Altered intervals, no objection.

47. If, therefore, theſe ſounds in the ſcale form conſonances perfectly true with the notes which correſpond to them in the fundamental baſs, the ear gives itſelf little trouble to inveſtigate the alterations which there may be in the intervals which theſe ſounds in the ſcale form between themſelves. This is a new proof that the fundamental baſs is the genuine guide of the ear, and the true origin of the diatonic ſcale.

Reaſons why this ſcale includes only ſeven ſounds.

48. Moreover, this diatonic ſcale includes only ſeven ſounds, and goes no higher than 'b', which would be the octave of the firſt: a new ſingularity, for which a reaſon may be given by the principles above eſtabliſhed.

---

the uſe of the word *phraſe* when transferred from language to that art, we have thought proper to inſert the definition of Rouſſeau.

A *phraſe*, according to him, is in melody a ſeries of modulations, or in harmony a ſucceſſion of chords, which form without interruption a ſenſe more or leſs complete, and which terminates in a repoſe by a cadence more or leſs perfect.

(x) Nothing is eaſier than to find in this ſcale the value or proportions of each ſound with relation to the ſound C, which we call 1; for the two ſounds G and F in the baſs are $\frac{3}{2}$ and $\frac{2}{3}$; from whence it follows,

1. That 'c' in the ſcale is the octave of C in the baſs; that is to ſay, 2.
2. That 'b' is the third major of G; that is to ſay $\frac{5}{4}$ of $\frac{3}{2}$ (note Q), and of conſequence $\frac{15}{8}$.
3. That 'd' is the fifth of G; that is to ſay $\frac{3}{2}$ of $\frac{3}{2}$, and of conſequence $\frac{9}{4}$.
4. That 'e' is the third major of the octave of C, and of conſequence the double of $\frac{5}{4}$; that is to ſay, $\frac{5}{2}$.
5. That 'f' is the double octave of F of the baſs, and conſequently $\frac{8}{3}$.
6. That 'g' of the ſcale is the octave of G of the baſs, and conſequently 3.
7. That 'a' in the ſcale is the third major of 'f' of the ſcale; that is to ſay, $\frac{5}{4}$ of $\frac{8}{3}$, or $\frac{10}{3}$.

Hence then will reſult the following table, in which each ſound has its numerical value above or below it.

Diatonic Scale.	$\frac{15}{8}$	2	$\frac{9}{4}$	$\frac{5}{2}$	$\frac{8}{3}$	3	$\frac{10}{3}$
	B,	c,	d,	e,	f,	g,	a.
Fundamental Baſs.	G,	C,	G,	C,	F,	C,	F.
	$\frac{3}{2}$	1,	$\frac{3}{2}$	1	$\frac{2}{3}$	1	$\frac{2}{3}$

And if, for the conveniency of calculation, we chooſe to call the ſound C of the ſcale 1; in this caſe we have only to divide each of the numbers by 2, which repreſent the diatonic ſcale, and we ſhall have

$\frac{15}{16}$	1	$\frac{9}{8}$	$\frac{5}{4}$	$\frac{4}{3}$	$\frac{3}{2}$	$\frac{5}{3}$
B,	c,	d,	e,	f,	g,	a.

(y) In order to compare 'd' with 'f', we need only compare $\frac{9}{8}$ with $\frac{4}{3}$; the relation between theſe fractions will be, (note c) that of 9 times 3 to 8 times 4; that is to ſay, of 27 to 32: the third minor, then, from 'd' to 'f', is not true; becauſe the proportion of 27 to 32 is not the ſame with that of 5 to 6, theſe two proportions being between themſelves as 27 times 6 is to 32 times 5, that is to ſay, as 162 to 160, or as the halves of theſe two numbers, that is to ſay, as 81 to 80.

M. Rameau, when he publiſhed, in 1726, his *New theoretical and practical System of Muſic*, had not as yet found the true reaſon of the alteration in the conſonance which is between 'd' and 'f', and of the little attention which the ear pays to it. For he pretends, in the work now quoted, that there are two thirds minor, one in the proportion of 5 to 6, the other in the proportion of 27 to 32. But the opinion which he has afterwards adopted, ſeems much preferable. In reality, the genuine third minor, is that which is produced by nature between 'e' and 'g', in the continued tone of thoſe ſonorous bodies of which 'e' and 'g' are the two harmonics: and that third minor, which is in the proportion of 5 to 6, is likewiſe that which takes place in the minor mode, and not that third minor which is falſe and different, being in the proportion of 27 to 32.

ed. In reality, in order that the ſound ‘b’ may ſucceed immediately in the ſcale to the ſound ‘a’, it is neceſſary that the note ‘g’, which is the only one from whence ‘b’ as a harmonic may be deduced, ſhould immediately ſucceed to the ſound ‘f’, in the fundamental baſs, which is the only one from whence ‘a’ can be harmonically deduced. Now, the diatonic ſucceſſion from F to G cannot be admitted in the fundamental baſs, according to what we have remarked (art. 36.). The ſounds ‘a’ and ‘b’, then, cannot immediately ſucceed one another in the ſcale: we ſhall ſee in the ſequel why this is not the caſe in the ſeries ‘c, d, e, f, g, a, b’, *c*, which begins upon C; whereas the ſcale in queſtion here begins upon B.

Completion of the Greek octave. See *Proſtambanomene.*

49. The Greeks likewiſe, to form an entire octave, added below the firſt B the note A, which they diſtinguiſhed and ſeparated from the reſt of the ſcale, which for that reaſon they called *proſlambanomene*, that is to ſay, a ſtring or note ſubadded to the ſcale, and put before B to form the entire octave.

The ſcale compoſed of two ſimilar conjunctive tetrachords.

50. The diatonic ſcale B, ‘c, d, e, f, g, a’, is compoſed of two tetrachords, that is to ſay, of two diatonic ſcales, each conſiſting of four ſounds, B, ‘c, d, e’, and ‘e, f, g, a’. Theſe two tetrachords are exactly ſimilar; for from ‘e’ to ‘f’ there is the ſame interval as from B to ‘c’, from ‘f’ to ‘g’ the ſame as from ‘c’ to ‘d’, from ‘g’ to ‘a’ the ſame as from ‘d’ to ‘e’ (Z): this is the reaſon why the Greeks diſtinguiſhed theſe two tetrachords; yet they joined them by the note ‘a’ which is common to both, and which gave them the name of *conjunctive tetrachords*.

Intervals in both tetrachords equal.

51. Moreover, the intervals between any two ſounds, taken in each tetrachord in particular, are preciſely true: thus, in the firſt tetrachord, the intervals of C ‘e’, and B ‘d’, are thirds, the one major and the other minor, exactly true, as well as the fourth B ‘e’ (AA); it is the ſame thing with the tetrachord ‘e, f, g, a’, ſince this tetrachord is exactly like the former.

Intervals between the notes of different tetrachords diſſimilar.

52. But the caſe is not the ſame when we compare two ſounds taken each from a different tetrachord; for we have already ſeen, that the note ‘d’ in the firſt tetrachord forms with the note ‘f’ in the ſecond a third minor, which is not true. In like manner it will be found, that the fifth from ‘d’ to ‘a’ is not exactly true, which is evident; for the third major from ‘f’ to ‘a’ is true, and the third minor from ‘d’ to ‘f’ is not ſo: now, in order to form a true fifth, a third major and a third minor, which are both exactly true, are neceſſary.

Another reaſon for diſtinguiſhing the ſcale into two tetrachords.

53. From thence it follows, that every conſonance is abſolutely perfect in each tetrachord taken by itſelf; but that there is ſome alteration in paſſing from one tetrachord to the other. This is a new reaſon for diſtinguiſhing the ſcale into theſe two tetrachords.

The ſource of tones major and minor inveſtigated.

54. It may be aſcertained by calculation, that in the tetrachord B, ‘c, d, e’, the interval, or the tone from ‘d’ to ‘e’, is a little leſs than the interval or tone from ‘c’ to ‘d’ (BB). In the ſame manner, in the ſecond tetrachord ‘e, f, g, a’, which is, as we have proved, perfectly ſimilar to the firſt, the note from ‘g’ to ‘a’ is a little leſs than the note from ‘f’ to ‘g’. It is for this reaſon that they diſtinguiſh two kinds of tones; the greater tone *, as from ‘c’ to ‘d’, from ‘f’ to ‘g’, &c.; and the leſſer †, from ‘d’ to ‘e’, from ‘g’ to ‘a’, &c.

Greater tone. *See *Interval.*
Leſſer tone. †See *Interval.*

CHAP. VI. *The formation of the Diatonic Scale among the Moderns, or the ordinary Gammut.*

The modern ſcale, how formed.

55. WE have juſt ſhown in the preceding chapter, how the ſcale of the Greeks is formed, B, ‘c, d, e, g, a’, by means of a fundamental baſs compoſed of three ſounds only, F, C, G; but to form the ſcale ‘c, d, e, f, g, a, b,’ *c*, which we uſe at preſent, we muſt neceſſarily add to the fundamental baſs the note D, and form, with theſe four ſounds F, C, G, D, the following fundamental baſs:

See fig. 5.
See *Scale.*

C, G, C, F, C, G, D, G, C;

from whence we deduce the modulation or ſcale

‘c, d, e, f, g, a, b’, *c*.

In effect (CC), ‘c’ in the ſcale belongs to the harmony of C which correſponds with it in the baſs; ‘d’, which is the ſecond note in the gammut, is included in the harmony of G, the ſecond note of the baſs; ‘e’, the third note of the gammut, is a natural harmonic of C, which is the third ſound in the baſs, &c.

56. Hence

(Z) The proportion of B to ‘c’ is as $\frac{15}{16}$ to 1, that is to ſay as 15 to 16; that between ‘e’ and ‘f’ is as $\frac{5}{4}$ to $\frac{4}{3}$, that is to ſay (note Q), as 5 times 3 to 4 times 4, or as 15 to 16: theſe two proportions then are equal. In the ſame manner, the proportion of ‘c’ to ‘d’ is as 1 to $\frac{9}{8}$, or as 8 to 9; that between ‘f’ and ‘g’ is as $\frac{4}{3}$ to $\frac{3}{2}$; that is to ſay (note Q), as 8 to 9. The proportion of ‘e’ to ‘c’ is as $\frac{5}{4}$ to 1, or as 5 to 4; that between ‘f’ and ‘a’ is as $\frac{5}{3}$ to $\frac{4}{5}$, or as 5 to 4: the proportions here then are likewiſe equal.

(AA) The proportion of ‘e’ to ‘c’ is as $\frac{5}{4}$ to 1, or as 5 to 4, which is a true third major; that from ‘d’ to ‘b’ is as $\frac{9}{8}$ to $\frac{15}{16}$; that is to ſay, as 9 times 16 to 15 times 8, or as 9 times 2 to 15, or as 6 to 5. In like manner we ſhall find, that the proportion of ‘c’ to ‘b’ is as $\frac{5}{4}$ to $\frac{15}{16}$; that is to ſay, as 5 times 16 to 15 times 4, or as 4 to 3, which is a true fourth.

(BB) The proportion of ‘d’ to ‘c’ is as $\frac{9}{8}$ to 1, or as 9 to 8; that of ‘e’ to ‘d’ is as $\frac{5}{4}$ to $\frac{9}{8}$, that is to ſay, as 40 to 36, or as 10 to 9: now $\frac{10}{9}$ is leſs removed from unity than $\frac{9}{8}$; the interval then from ‘d’ to ‘e’ is a little leſs than that from ‘c’ to ‘d’.

If any one would wiſh to know the proportion which $\frac{10}{9}$ bear to $\frac{9}{8}$, he will find (note Q) that it is as 8 times 10 to 9 times 9, that is to ſay, as 80 to 81. Thus the proportion of a leſſer to a greater tone is as 80 to 81; this difference between the greater and leſſer tone is what the Greeks called a *comma*.

We may remark, that this difference of a comma is found between the third minor when true and harmonical, and the ſame chord when it ſuffers alteration ‘d’, ‘f’, of which we have taken notice in the ſcale (note Y); for we have ſeen, that this third minor thus altered is in the proportion of 80 to 81 with the true third minor.

(CC) The values or eſtimates of the notes ſhall be the ſame in this as in the former ſcale, excepting only the tone

The Greek diatonic ſcale ſimpler than ours, and why.

56. Hence it follows, that the diatonic ſcale of the Greeks is, at leaſt in ſome reſpects, more ſimple than ours; ſince the ſcale of the Greeks (chap. v.) may be formed alone from the mode proper to C; whereas ours is originally and primitively formed, not only from the mode of C (F, C, G), but likewiſe from the mode of G, (C, G, D).

It will likewiſe appear, that this laſt ſcale conſiſts of two parts; of which the one, 'c, d, e, f, g,' is in the mode of C; and the other, 'g, a, b,' *c*, in that of G.

The note *g* twice repeated in the diatonic ſcale from its harmonic relations to the fundamental baſs.

57. For this reaſon the note 'g' is twice repeated in immediate ſucceſſion in this ſcale; once as the fifth of C, which correſponds with it in the fundamental baſs; and again as the octave of G, which immediately follows G in the ſame baſs. Theſe two conſecutive 'g's' are otherwiſe in perfect uniſon. For this reaſon we ſing only one of them when we modulate the ſcale 'c, d, e, f, g, a, b,' *c*; but this does not prevent us from employing a pauſe or repoſe, expreſſed or underſtood, after the ſound 'f'. There is no perſon who does not perceive this whilſt he himſelf ſings the ſcale.

The modern ſcale compoſed of two disjunctive tetrachords of different modes.

58. The ſcale of the moderns, then, may be conſidered as conſiſting of two tetrachords, disjunctive indeed, but perfectly ſimilar one to the other, 'c, d, e, f', and 'g, a, b, c', one in the mode of C, the other in that of G. We ſhall ſee in the ſequel, by what artifice one may cauſe the ſcale 'c, d, e, f, g, a, b, c', to be regarded as belonging to the mode of C alone. For this purpoſe it is neceſſary to make ſome changes in the fundamental baſs, which we have already aſſigned: but this ſhall be explained at large in chap. xiii.

The mode of G introduced in the fundamental baſs productive of conveniences.

59. The introduction of the mode proper to G in the fundamental baſs has this happy effect, that the notes 'f, g, a, b', may immediately ſucceed each other in aſcending the ſcale, which cannot take place (art. 48.) in the diatonic ſeries of the Greeks, becauſe that ſeries is formed from the mode of C alone. Whence it follows:

1. That we change the mode at every time when we modulate three whole tones in ſucceſſion.

2. That if theſe three tones are ſung in ſucceſſion in the ſcale 'c, d, e, f, g, a, b', *c*, this cannot be done but by the aſſiſtance of a pauſe expreſſed or underſtood after the note 'f'; inſomuch, that the three tones 'f g,' 'g a', 'a b', are ſuppoſed to belong to two different tetrachords.

Change of mode the cauſe of the difficulty in ſinging three conſecutive tones aſcending.

60. It ought not then any longer to ſurpriſe us, that we feel ſome difficulty whilſt we aſcend the ſcale in ſinging three tones in ſucceſſion, becauſe this is impracticable without changing the mode; and if one pauſes in the ſame mode, the fourth ſound above the firſt note will never be higher than a ſemitone above that which immediately precedes it; as may be ſeen by 'e, d, e, f', and by 'g, a, b', *c*, where there is no more than a ſemitone between 'e' and 'f', and between 'b' and *c*.

Intervals, though altered in themſelves, form true conſonances with the fundamental baſs.

61. We may likewiſe obſerve in the ſcale 'c, d, e, f', that the third minor from 'd' to 'f', is not true, for the reaſons which have been already given (art. 49.). It is the ſame eaſe with the third minor from 'a' to *c*, and with the third major from 'f' to 'a'; but each of theſe ſounds forms otherwiſe conſonances perfectly true, with their correſpondent ſounds in the fundamental baſs.

62. The thirds 'a' *c*, 'fa', which were true in the former ſcale, are falſe in this; becauſe in the former ſcale 'a' was the third of 'f', and here it is the fifth of D, which correſponds with it in the fundamental baſs.

Fewer altered conſonances in the Greek ſcale than in ours.

63. Thus it appears, that the ſcale of the Greeks contains fewer conſonances that are altered than ours (DD); and this likewiſe happens from the introduction of the mode of G into the fundamental baſs (EE).

We ſee likewiſe that the value of 'a' in the diatonic ſcale, a value which authors have been divided in aſcertaining, ſolely depends upon the fundamental baſs, and that

---

tone 'a'; for 'd' being repreſented by $\frac{9}{8}$, its fifth will be expreſſed by $\frac{27}{16}$; ſo that the ſcale will be numerically ſignified thus:

1	$\frac{9}{8}$	$\frac{5}{4}$	$\frac{4}{3}$	$\frac{3}{2}$	$\frac{27}{16}$	$\frac{15}{8}$	2
c,	d,	e,	f,	g,	a,	b,	*c*,

Where you may ſee, that the note 'a' of this ſcale is different from that in the ſcale of the Greeks; and that the 'a' in the modern ſeries ſtands in proportion to that of the Greeks as $\frac{27}{16}$ to $\frac{5}{3}$, that is to ſay, as 81 to 80; theſe two 'a's' then likewiſe differ by a *comma*.

(DD) In the ſcale of the Greeks, the note 'a' being a third from 'f', there is an altered fifth between 'a' and 'd': but in ours, 'a' being a fifth to 'd', produces two altered thirds, 'f a' and 'a' *c*; and likewiſe a fifth altered, 'a' *e*, as we ſhall ſee in the following chapter. Thus there are in our ſcale two intervals more than in the ſcale of the Greeks which ſuffer alteration.

(EE) But here it may be with ſome colour objected: The ſcale of the Greeks, it may be ſaid, has a fundamental baſs more ſimple than ours; and beſides, in it there are fewer chords which will not be found exactly true: why then, notwithſtanding this, does ours appear more eaſy to be ſung than that of the Greeks? The Grecian ſcale begins with a ſemitone, whereas the intonation prompted by nature ſeems to impel us to riſe by a full tone at once. This objection may be thus anſwered. The ſcale of the Greeks is indeed better diſpoſed than ours for the ſimplicity of the baſs, but the arrangement of ours is more ſuitable to natural intonation. Our ſcale commences by the fundamental ſound c, and it is in reality from that ſound that we ought to begin; it is from this that all the others naturally ariſe, and upon this that they depend; nay, if we ſpeak ſo, in this they are included: on the contrary, neither the ſcale of the Greeks, nor its fundamental baſs, commences with C; but it is from this C that we muſt depart, in order to regulate our intonation, whether in riſing or deſcending; now, in aſcending from 'c', the intonation, even of the Greek ſcale, gives the ſeries 'c, d, e, f, g, a': and ſo true is it that the fundamental ſound C is here the genuine guide of the ear, that if, before we modulate the ſound 'c', we ſhould that it muſt be different according as the note 'a' ha 'f' or 'd' for its baſs. See the note (CC).

CHAP. VII. *Of Temperament.*

Tempera-ment, why neceſſary.

64. THE alterations which we have obſerved in the intervals between particular ſounds of the diatonic ſcale, naturally lead us to ſpeak of temperament. To give a clear idea of this, and to render the neceſſity of it palpable, let us ſuppoſe that we have before us an inſtrument with keys, a harpſichord, for inſtance, conſiſting of ſeveral octaves or ſcales, of which each includes its twelve ſemitones.

See fig. 6.

Let us chooſe in that harpſichord one of the ſtrings which will ſound the note C, and let us tune the ſtring G to a perfect fifth with C in aſcending; let us afterwards tune to a perfect fifth with this G the 'd' which is above it; we ſhall evidently perceive that this 'd' will be in the ſcale above that from which we ſet out: but it is alſo evident that this 'd' muſt have in the ſcale a D which correſponds with it, and which muſt be tuned a true octave below 'd'; and between 'd' and G there ſhould be the interval of a fifth; ſo that the D in the firſt ſcale will be a true fourth below the G of the ſame ſcale. We may afterwards tune the note A of the firſt ſcale to a juſt fifth with this laſt D; then the note 'e' in the higheſt ſcale to a true fifth with this new A, and in conſequence the E in the firſt ſcale to a true fourth beneath this ſame A: Having finiſhed this operation, it will be found that the laſt E, thus tuned, will by no means form a juſt third major from the ſound C (FF): that is to ſay, that it is impoſſible for E to conſtitute at the ſame time the third major of C and the true fifth of A; or, what is the ſame thing, the true fourth of A in deſcending.

65. If, after having ſucceſſively and alternately tuned the ſtrings C, G, 'd', A, E, in perfect fifths and fourths one from the other, we continue to tune ſucceſſively by true fifths and fourths the ſtrings E, B, F※, C※, G※, 'd※', E※, B※; we ſhall find, that, though B※, being a ſemitone higher than the natural note, ſhould be equivalent to 'c' natural, it will by no means form a juſt octave to the firſt C in the ſcale, but be conſiderably higher (GG); yet this B※ upon the harpſichord ought not

---

ſhould attempt to riſe to it by that note in the ſcale which is moſt immediately contiguous, we cannot reach it but by the note B, and by the ſemitone from B to 'c'. Now to make a tranſition from B to 'c', by this ſemitone, the ear muſt of neceſſity be prediſpoſed for that modulation, and conſequently preoccupied with the mode of C: if this were not the caſe, we ſhould naturally riſe from B to 'c※', and by this operation paſs into another mode.

(FF) The A conſidered as the fifth of D is $\frac{27}{16}$, and the fourth beneath this A will conſtitute $\frac{3}{4}$ of $\frac{17}{16}$, that is to ſay, $\frac{81}{64}$; $\frac{81}{64}$ then ſhall be the value of E, conſidered as a true fourth from A in deſcending: now E, conſidered as the third major of the ſound C, is $\frac{5}{3}$, or $\frac{80}{64}$: theſe two E's then are between themſelves in the proportion of 81 to 80; thus it is impoſſible that E ſhould be at the ſame time a perfect third major from C, and a true fourth beneath B.

(GG) In effect, if you thus alternately tune the fifth above and the fourth below, in the ſame octave, you may here ſee what will be the proceſs of your operation.

C, G, a fifth; D a fourth; A a fifth; E a fourth; B a fifth; F※ a fourth; C※ a fifth; G※ a fourth: 'd※' a fifth; A※ a fourth; 'e※' or 'f♮' a fifth; B※ a fourth: now it will be found, by a very eaſy computation, that the firſt C being repreſented by 1, G ſhall be $\frac{3}{2}$, D $\frac{9}{8}$, A $\frac{27}{16}$, E $\frac{81}{64}$, &c. and ſo of the reſt till you arrive at B※, which will be found $\frac{531441}{262144}$. This fraction is evidently greater than the number 2, which expreſſes the perfect octave c to its correſpondent C: and the octave below B※ would be one half of the ſame fraction, that is to ſay $\frac{531441}{524288}$, which is evidently greater than C repreſented by unity. This laſt fraction $\frac{531441}{524288}$ is compoſed of two numbers; the numerator of the fraction is nothing elſe but the number 3 multiplied 11 times in ſucceſſion by itſelf, and the denominator is the number 2 multiplied 18 times in ſucceſſion by itſelf. Now it is evident, that this fraction which expreſſes the value of B※, is not equal to the unity which expreſſes the value of the ſound C, though upon the harpſichord, B※ and C are identical. This fraction riſes above unity by $\frac{7153}{524288}$, that is to ſay, by about $\frac{1}{73}$; and this difference was called the *comma of Pythagoras*. It is palpable that this comma is much more conſiderable than that which we have already mentioned (note BB), and which is only $\frac{1}{80}$.

We have already proved that the ſeries of fifths produces a 'c' different from B※, the ſeries of thirds major gives another ſtill more different. For, let us ſuppoſe this ſeries of thirds, C, E, G※, B※, we ſhall have E equal to $\frac{5}{4}$, G※ to $\frac{15}{16}$, and B to $\frac{125}{64}$, whoſe octave below is $\frac{125}{128}$; from whence it appears, that this laſt B is leſs than unity (that is to ſay than C), by $\frac{3}{128}$, or by $\frac{1}{42}$, or near it: A new comma, much greater than the preceding, and which the Greeks have called *apotome major*.

It may be obſerved, that this B※, deduced from the ſeries of thirds, is to the B※ deduced from the ſeries of fifths, as $\frac{125}{128}$ is to $\frac{531441}{524288}$: that is to ſay, in multiplying by 524288, as 125 multiplied by 4096 is to 531441, or as 51200 to 531441, that is to ſay, nearly as 26 is to 27: from whence it may be ſeen, that theſe two B's※ are very conſiderably different one from the other, and even ſufficiently different to make the ear ſenſible of it; becauſe the difference conſiſts almoſt of a minor ſemitone, whoſe value, as will afterwards be ſeen (art. 139.), is $\frac{25}{24}$.

Moreover, if, after having found the G※ equal to $\frac{25}{16}$, we then tune by fifths and by fourths, G※, 'd※', A※, C※, B※, as we have done with reſpect to the firſt ſeries of fifths, we find that the B※ muſt be $\frac{2025}{2048}$; its difference, then, from unity, or, in other words, from C, is $\frac{23}{2048}$, that is to ſay, about $\frac{1}{89}$; a comma ſtill leſs than any of the preceding, and which the Greeks have called *apotome minor*.

Reaſons and rules for temperament.

not to be different from the octave above C; for every B※ and every 'c' is the ſame ſound, ſince the octave or the ſcale only conſiſts of twelve ſemitones.

66. From thence it neceſſarily follows, 1. That it is impoſſible that all the octaves and all the fifths ſhould be juſt at the ſame time, particularly in inſtruments which have keys, where no intervals leſs than a ſemitone are admitted. 2. That, of conſequence, if the fifths are juſtly tuned, ſome alteration muſt be made in the octaves; now the ſympathy or ſound which ſubſiſts between any note and its octave, does not permit us to make ſuch an alteration: this perfect coaleſcence of ſound is the cauſe why the octave ſhould ſerve as limits to the other intervals, and that all the notes which riſe above or fall below the ordinary ſcale, are no more than replications, i. e. repetitions, of all that have gone before them. For this reaſon, if the octave were altered, there could be no longer any fixed point either in harmony or melody. It is then abſolutely neceſſary to tune the 'c' or B※ in a juſt octave with the firſt; from whence it follows, that, in the progreſſion of fifths, or, what is the ſame thing, in the alternate ſeries of fifths and fourths, C, G, D, A, E, B, F※, C※, G※, 'd※', A※, 'e※', B※, it is neceſſary that all the fifths ſhould be altered, or at leaſt ſome of them. Now, ſince there is no reaſon why one ſhould rather be altered than another, it follows, that we ought to alter them all equally. By theſe means, as the alteration is made to influence all the fifths, it will be in each of them almoſt imperceptible; and thus the fifth, which, after the octave, is the moſt perfect of all conſonances, and which we are under the neceſſity of altering, muſt only be altered in the leaſt degree poſſible.

67. It is true, that the thirds will be a little harſh: but as the interval of ſounds which conſtitutes the third, produces a leſs perfect coaleſcence than that of the fifth, it is neceſſary, ſays M. Rameau, to ſacrifice the juſtice of that chord to the perfection of the fifth; for the more perfect a chord is in its own nature, the more diſpleaſing to the ear is any alteration which can be made in it. In the octave the leaſt alteration is inſupportable.

Its definition.

68. This change in the intervals of inſtruments which have, or even which have not, keys, is that which we call *temperament*.

Principle whence its theory may be deduced.

69. It reſults then from all that we have now ſaid, that the theory of temperament may be reduced to this queſtion.—The alternate ſucceſſion of fifths and fourths having been given, (art. 66.), in which B※ or C is not the true octave of the firſt C; it is propoſed to alter all the fifths equally, in ſuch a manner that the two C's may be in a perfect octave the one to the other.

Practical directions for temperament.

70. For a ſolution of this queſtion, we muſt begin with tuning the two C's in a perfect octave the one to the other; in conſequence of which, we will render all the ſemitones which compoſe the octave as equal as poſſible. By this means (HH) the alteration made in each

---

In a word, if, after having found E equal to $\frac{5}{4}$ in the progreſſion of thirds, we then tune by fifths and fourths E, B, F※, C※, &c. we ſhall arrive at a new B※, which ſhall be $\frac{32805}{32768}$, and which will not differ from unity but by about $\frac{1}{885}$, which is the laſt and ſmalleſt of all the commas; but it muſt be obſerved, that, in this caſe, the thirds major from E to G※, from G※ to B※ or C, &c. are extremely falſe, and greatly altered.

(HH) All the ſemitones being equal in the temperament propoſed by M. Rameau, it follows, that the twelve ſemitones C, C※, D, D※, E, E※, &c. ſhall form a continued geometrical progreſſion; that is to ſay, a ſeries in which C ſhall be to C※ in the ſame proportion as C※ to D, as D to D※, &c. and ſo of the reſt.

Theſe twelve ſemitones are formed by a ſeries of thirteen ſounds, of which C and its octave 'c' are the firſt and laſt. Thus to find by computation the value of each ſound in the temperament, which is the preſent object of our ſpeculations, our ſcrutiny is limited to the inveſtigation of eleven other numbers between 1 and 2 which may form with the 1 and the 2 a continued geometrical progreſſion.

However little any one is practiſed in calculation, he will eaſily find each of theſe numbers, or at leaſt a number approaching to its value. Theſe are the characters by which they may be expreſſed, which mathematicians will eaſily underſtand, and which others may neglect.

C	C※	D	D※	E	F	F※	G	G※
1	$\sqrt[12]{2}$	$\sqrt[12]{2^2}$	$\sqrt[12]{2^3}$	$\sqrt[12]{2^4}$	$\sqrt[12]{2^5}$	$\sqrt[12]{2^6}$	$\sqrt[12]{2^7}$	$\sqrt[12]{2^8}$
	A	A※	B	'c'				
	$\sqrt[12]{2^9}$	$\sqrt[12]{2^{10}}$	$\sqrt[12]{{}^{11}}$	$\sqrt[12]{{}^{12}}$				

It is obvious, that in this temperament all the fifths are equally altered. One may likewiſe prove, that the alteration of each in particular is very inconſiderable; for it will be found, for inſtance, that the fifth from C to G, which ſhould be $\frac{3}{2}$, ought to be diminiſhed by about $\frac{1}{12}$ of $\frac{1}{73}$; that is to ſay, by $\frac{1}{876}$, a quantity almoſt inconceivably ſmall.

It is true, that the thirds major will be a little more altered; for the third major from C to E, for inſtance, ſhall be increaſed in its interval by about $\frac{1}{100}$: but it is better, according to M. Rameau, that the alteration ſhould fall upon the third than upon the fifth, which after the octave is the moſt perfect chord, and from the perfection of which we ought never to degenerate but as little as poſſible.

Beſides, it has appeared from the ſeries of thirds major C, E, G※, B※, that this laſt B※ is very different from 'c' (note GG); from whence it follows, that if we would tune this B※ in uniſon with the octave of C, and alter at the ſame time each of the thirds major by a degree as ſmall as poſſible, they muſt all be equally altered. This is what occurred in the temperament which we propoſe; and if in it the third be more altered than the fifth, it is a conſequence of the difference which we find between the degrees of perfection in theſe intervals; a difference with which, if we may ſpeak ſo, the temperament propoſed conforms itſelf. Thus this diverſity of alteration is rather advantageous than inconvenient.

each fifth will be very conſiderable, but equal in all of them.

Rameau's method of temperament propoſed.

71. In this, then, the theory of temperament conſiſts: but as it would be difficult in practice to tune a harpſichord or organ by thus rendering all the ſemitones equal, M. Rameau, in his *Generation Harmonique*, has furniſhed us with the following method, to alter all the fifths as equally as poſſible.

72. Take any key of the harpſichord which you pleaſe; but let it be towards the middle of the inſtrument; for inſtance, C: then tune the note G a fifth above it, at firſt with as much accuracy as poſſible; this you may imperceptibly diminiſh: tune afterwards the fifth to this with equal accuracy, and diminiſh it in the ſame manner; and thus proceed from one fifth to another in aſcent: and as the ear does not appreciate ſo exactly ſounds that are extremely ſharp, it is neceſſary, when by fifths you have riſen to notes extremely high, that you ſhould tune in the moſt perfect manner the octave below the laſt fifth which you had immediately formed; then you may continue always in the ſame manner; till in this proceſs you arrive at the laſt fifth from E※ to B※, which ſhould of themſelves be in tune; that is to ſay, they ought to be in ſuch a ſtate, that B※, the higheſt note of the two which compoſe the fifth, may be identical with the ſound C, with which you began, or at leaſt the octave of that ſound perfectly juſt: it will be neceſſary then to try if this C, or its octave, forms a juſt fifth with the laſt ſound E※ or F, which has been already tuned. If this be the caſe, we may be certain that the harpſichord is properly tuned. But if this laſt fifth be not true, in this caſe it will be too ſharp, and it is an indication that the other fifths have been too much diminiſhed, or at leaſt ſome of them; or it will be too flat, and conſequently diſcover that they have not been ſufficiently diminiſhed. We muſt then begin and proceed as formerly, till we find the laſt fifth in tune of itſelf, and without our immediate interpoſition (II).

(II) We have only to acknowledge, with M. Rameau, that this temperament is far remote from that which is now in practice: it may here be ſeen in what this laſt temperament conſiſts as applied to the organ or harpſichord. They begin with C in the middle of the keys, and they flatten the four firſt fifths G, D, A, E, till they form a true third major from E to C; afterwards, ſetting out from this E, they tune the fifths B, F※, C※, G※, but flattening them ſtill leſs than the former, ſo that G※ may almoſt form a true third major with E. When they have arrived at G※, they ſtop; they reſume the firſt C, and tune to it the fifth F in deſcending, then the fifth B♭, &c and they heighten a little all the fifths till they have arrived at A♭, which ought to be the ſame with the G※ already tuned.

If, in the temperament commonly practiſed, ſome thirds are found to be leſs altered than in that preſcribed by M. Rameau, in return, the fifths in the firſt temperament are much more falſe, and many thirds are likewiſe ſo; inſomuch, that upon a harpſichord tuned according to the temperament in common uſe, there are five or ſix modes which the ear cannot endure, and in which it is impoſſible to execute any thing. On the contrary, in the temperament ſuggeſted by M. Rameau, all the modes are equally perfect; which is a new argument in its favour, ſince the temperament is peculiarly neceſſary in paſſing from one mode to another, without ſhocking the ear; for inſtance, from the mode of C to that of G, from the mode of G to that of D, &c. It is true, that this uniformity of modulation will to the greateſt number of muſicians appear a defect: for they imagine, that, by tuning the ſemitones of the ſcale unequal, they give each of the modes a peculiar character; ſo that, according to them, the ſcale of C,

C, D, E, F, G, A, B, C,

is not perfectly ſimilar to the gammut or diatonic ſcale of the mode of E,

E, F※, G※, A※, B, c※, d※, e,

which, in their judgment, renders the modes of C and E proper for different manners of expreſſion. But after all that we have ſaid in this treatiſe on the formation of diatonic intervals, every one ſhould be convinced, that, according to the intention of nature, the diatonic ſcale ought to be perfectly the ſame in all its modes: The contrary opinion, ſays M. Rameau, is a mere prejudice of muſicians. The character of an air ariſes chiefly from the intermixture of the modes; from the greater or leſſer degrees of vivacity in the movement; from the tones, more or leſs grave, or more or leſs acute, which are aſſigned to the generator of the mode; and from the chords more or leſs beautiful, as they are more or leſs deep, more or leſs flat, more or leſs ſharp, which are found in it.

In ſhort, the laſt advantage of this temperament is, that it will be found conformed with, or at leaſt very little different from that which is practiſed upon inſtruments without keys; as the baſs-viol, the violin, in which true fifths and fourths are preferred to thirds and ſixths tuned with equal accuracy; a temperament which appears incompatible with that commonly uſed in tuning the harpſichord.

Yet M. Rameau, in his *New Syſtem of Muſic*, printed in 1726, adopted the ordinary temperament. In that work, (as may be ſeen chap. xxiv.), he pretends that the alteration of the fifths is much more ſupportable than that of the thirds major; and that this laſt interval can hardly ſuffer a greater alteration than the octave, which, as we know, cannot ſuffer the ſlighteſt alteration. He ſays, that if three ſtrings are tuned, one by an octave, the other by a fifth, and the next by a third major to a fourth ſtring, and if a ſound be produced from the laſt, the ſtrings tuned by a fifth will vibrate, though a little leſs true than it ought to have been; but that the octave and the third major, if altered in the leaſt degree, will not vibrate: and he adds, that the temperament which is now practiſed, is founded upon that principle. M. Rameau goes ſtill farther; and as, in the ordinary

By this method all the twelve ſounds which compoſe one of the ſcales ſhall be tuned: nothing is neceſſary but to tune with the greateſt poſſible exactneſs their octaves in the other ſcales, and the harpſichord ſhall be well tuned.

Alterations by either method hardly diſagreeable.

We have given this rule for temperament from M. Rameau; and it belongs only to diſintereſted artiſts to judge of it. However this queſtion be determined, and whatever kind of temperament may be received, the alteration which it produces in harmony will be but very ſmall, or not perceptible to the ear, whoſe attention is entirely engroſſed in attuning itſelf with the fundamental baſs, and which ſuffers, without uneaſineſs, theſe alterations, or rather takes no notice of them, becauſe it ſupplies from itſelf what may be wanting to the truth and perfection of the intervals.

Simple and daily experiments confirm what we now advance. Liſten to a voice which is accompanied, in ſinging, by different inſtruments; though the temperament of the voice, and the temperament of each of the inſtruments, are all different one from another, yet you will not be in the leaſt affected with the kind of cacophony which ought to reſult from theſe diverſities, becauſe the ear ſuppoſes theſe intervals true, of which it does not appreciate differences.

We may give another experiment. Let the three keys E, G, B be ſtruck upon an organ, and the minor perfect chord only will be heard; though E, by the conſtruction of that inſtrument, muſt cauſe G ※ likewiſe to be heard; though G ſhould have the ſame effect upon D, and B upon F ※; inſomuch that the ear is at once affected with all theſe ſounds, D, E, F ※, G, G ※, B: how many diſſonances perceived at the ſame time, and what a jarring multitude of diſcordant ſenſations, would reſult from thence to the ear, if the perfect chord with which it is preoccupied had not power entirely to abſtract its attention from ſuch ſound as might offend!

CHAP. VIII. *Of Repoſes or Cadences* (KK).

Cadences perfect and imperfect, what and why.

73. In a fundamental baſs whoſe procedure is by fifths, there always is, or always may be, a *repoſe*, or criſis, in which the mind acquieſces in its tranſition from one ſound to another: but a repoſe may be more or leſs diſtinctly ſignified, and of conſequence more or leſs perfect. If one ſhould riſe by fifths; if, for inſtance, we paſs from C to G; it is the generator which paſſes to one of theſe fifths, and this fifth was already pre-exiſtent in its generator: but the generator exiſts no longer in this fifth; and the ear, as this generator is the principle of all harmony and of all melody, feels a deſire to return to it. Thus the tranſition from a ſound to its fifth in aſcent, is termed an *imperfect repoſe*, or *imperfect cadence*; but the tranſition from any ſound to its fifth in deſcent, is denominated a *perfect cadence*, or an *abſolute repoſe*: it is the offspring which returns to its generator, and as it were recovers its exiſtence once more in that generator itſelf, with which when ſounding it reſounds (chap. i.).

See *Repoſe* or *Cadence*.

Perfect cadences more or leſs perfect, and why.

74. Amongſt abſolute repoſes, there are ſome, if we may be allowed the expreſſion, more abſolute, that is to ſay, more perfect, than others. Thus in the fundamental baſs

C, G, C, F, C, G, D, G, C,

which forms, as we have ſeen, the diatonic ſcale of the moderns, there is an abſolute repoſe from D to G, as from G to C; yet this laſt abſolute repoſe is more perfect than the preceding, becauſe the ear, prepoſſeſſed with the mode of C by the multiplied impreſſion of the ſound C which it has already heard thrice before, feels a deſire to return to the generator C; and it accordingly does ſo by the abſolute repoſe G C.

Cadence in melody different from what it is in harmony.

75. We may ſtill add, that what is commonly called *cadence* in melody, ought not to be confounded with what we name *cadence* in harmony.

In

---

temperament, there is a neceſſity for altering the laſt thirds major, and to make them a little more ſharp, that they may naturally return to the octave of the principal ſound, he pretends that this alteration is tolerable, not only becauſe it is almoſt inſenſible, but becauſe it is found in modulations not much in uſe, unleſs the compoſer ſhould chooſe it on purpoſe to render the expreſſion ſtronger. "For it is proper to remark (ſays he), that we receive different impreſſions from the intervals in proportion to their different alterations: for inſtance, the third major, which naturally elevates us to joy, in proportion as we feel it, heightens our feelings even to a kind of fury, when it is tuned too ſharp; and the third minor, which naturally inſpires us with tenderneſs and ſerenity, depreſſes us to melancholy when it is too flat." All this is very different from what this celebrated muſician afwards exhibited in his *Generation Harmonique*, and in the performances which followed it. From this we can only conclude, that the reaſons which, after him, we have urged for the new temperament, muſt without doubt have appeared to him very ſtrong, becauſe in his mind they had ſuperſeded thoſe which he had formerly adduced in favour of the ordinary temperament.

We do not pretend to give any deciſion for either the one or the other of theſe methods of temperament, each of which appears to us to have its particular advantages. We ſhall only remark, that the choice of the one or the other muſt be left abſolutely to the taſte and inclination of the reader; without, however, admitting this choice to have any influence upon the principles of the ſyſtem of muſic, which we have followed even till this period, and which muſt always ſubſiſt, whatever temperament we adopt.

(KK) That the reader may have a clear idea of the term before he enters upon the ſubject of this chapter, it may be neceſſary to caution him againſt a miſtake into which he may be too eaſily led by the ordinary ſignification of the word *repoſe*. In muſic, therefore, it is far from being ſynonymous with the word *reſt*. It is, on the contrary, the termination of a muſical *phraſe* which ends in a cadence more or leſs emphatic, as the ſentiment implied in the phraſe is more or leſs complete. Thus a repoſe in muſic anſwers the ſame purpoſe as punctuation in language. See REPOSE, in Rouſſeau's Muſical Dictionary.

In the firſt caſe, this word only ſignifies an agreeable and rapid alteration between two contiguous ſounds, called likewiſe a *trill* or *ſhake*; in the ſecond, it ſignifies a repoſe or cloſe. It is however true, that this ſhake implies, or at leaſt frequently enough preſages, a repoſe, either preſent or impending, in the fundamental baſs (LL).

Cadences in the fundamental baſs neceſſary in the diatonic ſcale, and which the moſt perfect.

76. Since there is a repoſe in paſſing from one ſound to another in the fundamental baſs, there is alſo a repoſe in paſſing from one note to another in the diatonic ſcale, which is formed from it, and which this baſs repreſents: and as the abſolute repoſe G C is of all others the moſt perfect in the fundamental baſs, the repoſe from B to ‘c’, which anſwers to it in the ſcale, and which is likewiſe terminated by the generator, is for that reaſon the moſt perfect of all others in the diatonic ſcale aſcending.

Definition and uſe of a ſenſible note.

See *Senſible Note*.

77. It is then a law dictated by nature itſelf that if you would aſcend diatonically to the generator of a mode, you can only do this by means of the third major from the fifth of that very generator. This third major, which with the generator forms a ſemitone, has for that reaſon been called the *ſenſible note* or *leading note*, as introducing the generator, and preparing us for the moſt perfect repoſe.

We have already proved, that the fundamental baſs is the principle of melody. We ſhall beſides make it appear in the ſequel, that the effect of a repoſe in melody ariſes ſolely from the fundamental baſs.

CHAP. IX. *Of the Minor Mode and its Diatonic Series.*

The diatonic ſeries of the minor mode aſcertained by different examples.

78. In the ſecond chapter, we have explained (art. 20. 30. 31. and 32.) by what means, and upon what principle, the minor chord C, E♭, G, ‘c’, may be formed, which is the characteriſtical chord of the minor mode. Now what we have there ſaid, taking C for the principal and fundamental ſound, we might likewiſe have ſaid of any other note in the ſcale, aſſumed in the ſame manner as the principal and fundamental ſound: but as in the minor chord, C, E♭, G, ‘c’, there occurs an E♭ which is not found in the ordinary diatonic ſcale, we ſhall immediately ſubſtitute, for greater eaſe and conveniency, another chord, which is likewiſe minor and exactly ſimilar to the former, of which all the notes are found in the ſcale.

79. The ſcale affords us three chords of this kind, viz. D, F, A, ‘d’; A, ‘c, e, a’; and E, G, B, ‘c’. Among theſe three we ſhall chooſe A, ‘c, e, a’; becauſe this chord, without including any ſharp or flat, has two ſounds in common with the major chord C, E, G, ‘c’; and beſides, one of theſe two ſounds is the very ſame ‘c’: ſo that this chord appears to have the moſt immediate, and at the ſame time the moſt ſimple, relation with the chord C, E, G, ‘c’. Concerning this we need only add, that this preference of the chord A, ‘c, e, a’, to every other minor chord, is by no means in itſelf neceſſary for what we have to ſay in this chapter upon the diatonic ſcale of the minor mode. We might in the ſame manner have choſen any other minor chord; and it is only, as we have ſaid, for greater eaſe and conveniency that we fix upon this.

Tonic or key in harmony, what

See *Principal*.

See *Tonic*.

80. In every mode, whether major or minor, the *principal* ſound which implies the perfect chord, whether major or minor, is called the *tonic note* or *key*; thus C is the key in its proper mode, A in the mode of A, &c. Having laid down this principle,

The formation of the ſcale purſued

See fig. 4.

See fig. 7.

81. We have ſhown how the three ſounds, F, C, G, which conſtitute (art. 38.) the mode of C, of which the firſt, F, and the laſt, G, are the two fifths of C, one deſcending, the other riſing, produce the ſcale, B, ‘c, d, e, f, g, a’, of the major mode, by means of the fundamental baſs G, C, G, C, F, C, F; let us in the ſame manner take the three ſounds D, A, E, which conſtitute the mode of A, for the ſame reaſon that the ſounds F, C, G, conſtitute the mode of C; and of them let us form this fundamental baſs, perfectly like the preceding E, A, F, A, D, A, D; let us afterwards place below each of theſe ſounds one of their harmonics, as we have done (chap. v.), for the firſt ſcale of the major mode; with this difference, that we muſt ſuppoſe D and A as implying their thirds minor in the fundamental baſs to characterize the minor mode; and we ſhall have the diatonic ſcale of that mode,

G♯, A, B, ‘c, d, e, f’.

82. The G♯, which correſponds with E in the fundamental baſs, forms a third major with that E, though the mode be minor; for the ſame reaſon that a third from the fifth of the fundamental ſound ought to be major (art. 77.) when that third riſes to the fundamental ſound A.

See *Imply* or *Carry*.

83. It is true, that, in cauſing E to imply its third minor G, one might alſo riſe to A by a diatonic progreſs. But that manner of riſing to A would be leſs perfect than the preceding; for this reaſon (art. 76.), that the abſolute repoſe or perfect cadence E, A, in the fundamental baſs, ought to be repreſented in the moſt perfect manner in the two notes of the diatonic ſcale which anſwer to it, eſpecially when one of theſe two notes is A, the key itſelf upon which the repoſe is made. From whence it follows, that the preceding note G ought rather to be ſharp than natural; becauſe G♯, being included in E (art. 19.), much more perfectly repreſents the note E in the baſs, than the natural G could do, which is not included in E.

Diverſities in the ſcales of the major and minor mode.

84. We may remark this firſt difference between the ſcale

G♯, A, B, ‘c, d, e, f’,

and the ſcale which correſponds with it in the major mode

B, ‘c, d, e, f, g, a’,

that from ‘c’ to ‘f’ which are the two laſt notes of the former ſcale, there is only a ſemitone; whereas from ‘g’ to ‘a’, which are the two laſt ſounds of the latter ſeries, there is the interval of a complete tone; but this is not the only diſcrimination which may be found between the ſcales of the two modes.

(LL) M. Rouſſeau, in his letter on French muſic, has called this alternate undulation of different ſounds a *trill*, from the Italian word *trillo*, which ſignifies the ſame thing; and ſome French muſicians already appear to have adopted this expreſſion.

Inveſtigation of theſe differences and their reaſons.

85. To inveſtigate theſe differences, and to diſcover the reaſon for which they happen, we ſhall begin by forming a new diatonic ſcale of the minor mode, ſimilar to the ſecond ſcale of the major mode,

'c, d, e, f, g, g, a, b', *c*.

See fig. 5.

That laſt ſeries, as we have ſeen, was formed by means of the fundamental baſs F, C, G, D, diſpoſed in this manner,

C, G, C, F, C, G, D, G, C.

Let us take in the ſame manner the fundamental baſs D, A, E, B, and arrange it in the following order,

A, E, A, D, A, E, B, E, A,

See fig. 8.

and it will produce the ſcale immediately ſubjoined,

A, B, 'c, d, e, e, f※, g※, a',

in which 'c' forms a third minor with A, which in the fundamental baſs correſponds with it, which denominates the minor mode; and, on the contrary, 'g※' forms a third major with E in the fundamental baſs, becauſe 'g※' riſes towards 'a' (art. 82. 83.).

86. We ſee beſides an 'f※', which does not occur in the former,

G※, A, B, 'c, d, e, f',

where 'f' is natural. It is becauſe, in the firſt ſcale, 'f' is a third minor from D in the baſs; and in the ſecond, 'f※' is the fifth from B in the baſs (MM).

Difference between the two ſcales of the minor mode greater than thoſe of the major.

87. Thus the two ſcales of the minor mode are ſtill in this reſpect more different one from the other than the two ſcales of the major mode; for we do not remark this difference of a ſemitone between the two ſcales of the major mode. We have only obſerved (art. 63.) ſome difference in the value of A as it ſtands in each of theſe ſcales, but this amounts to much leſs than a ſemitone.

'f' and 'g' ſharp in the minor mode, and why.

88. From thence it may be ſeen why 'f' and 'g' are ſharp when aſcending in the minor mode; beſides the 'f' is only natural in the firſt ſcale G※, A, B, 'c, d, e, f', becauſe this 'f' cannot riſe to 'g※', (art. 48.).

The caſe different in deſcending, and why.

89. It is not the ſame caſe in deſcending. For E, the fifth of the generator, ought not to imply the third major 'g※', but in the caſe when that E deſcends to the generator A to form a perfect repoſe (art. 77. and 83.); and in this caſe the third major 'g※' riſes to the generator 'a': but the fundamental baſs AE may, in deſcending, give the ſcale 'a, g', natural, provided 'g' does not riſe again to 'a'.

Explication of the deſcending ſcale in the minor mode from a fundamental baſs difficult.

90. It is much more difficult to explain how the 'f' which ought to follow this 'g' in deſcending, is natural and not ſharp; for the fundamental baſs

A, E, B, E, A, D, A, E, A,

produces in deſcending,

'a, g, f※, e, e, d, c', B, A.

And it is plain that the 'f' cannot be otherwiſe than ſharp, ſince 'f※' is the fifth of the note B of the fundamental baſs. Experience, however, evinces that the 'f' is natural in deſcending in the diatonic ſcale of the major mode of A, eſpecially when the preceding 'g' is natural: and it muſt be acknowledged, that here the fundamental baſs appears defective.

Rameau's ſolution, though the only one, yet unſatiſfactory.

M. Rameau has attempted the following ſolution of this difficulty. In the diatonic ſcale of the minor mode in deſcending, ('a, g, f, e, d, c', B, A,) 'g' may be regarded ſimply as a note of paſſage, merely added to give ſweetneſs to the modulation, and as a diatonic gradation by which we may deſcend to 'f' natural. This is eaſily perceived, according to M. Rameau, by the fundamental baſs,

A, D, A, D, A, E, A,

which produces

'a, f, e, d, c', B, A;

which may be regarded, as he ſays, as the real ſcale of the minor mode in deſcending; to which is added 'g' natural between 'a' and 'f', to preſerve the diatonic order.

This appears the only poſſible anſwer to the difficulty above propoſed: but we know not whether it will fully ſatiſfy the reader; whether he will not ſee with regret, that the fundamental baſs does not produce, to ſpeak properly, the diatonic ſcale of the minor mode in deſcent, when at the ſame time this ſame baſs ſo happily produces the diatonic ſcale of that identical mode in aſcending, and the diatonic ſcale of the major mode whether in riſing or deſcending (NN).

CHAP. X. *Of Relative Modes.*

Modes relative, what. See *Mode*.

91. Two modes of ſuch a nature that we can paſs from the one to the other, are called *relative modes*. Thus the major mode of C is relative to the major mode of F and to that of G. It has alſo been ſeen how many intimate connexions there are between the major mode of C, and the minor mode of A. For, 1. The perfect chords, one major, C, E, G, 'c', the other minor, A, 'c, e, a', which characterize each of thoſe two kinds of modulation * or harmony, have two ſounds in common, 'c' and 'e'. 2. The ſcale of the minor mode of A in deſcent, abſolutely contains the ſame ſounds with the ſcale of the major mode of C.

* See *Modulation*.

Hence the tranſition is ſo natural and eaſy from the major mode of C to the minor mode of A, or from the minor mode of A to the major mode of C, as experience proves.

92. In the minor mode of E, the minor perfect chord E, G, B, 'e', which characterizes it, has likewiſe two ſounds, E, G, in common with the perfect chord major C, E, G, 'c', which characterizes the major mode of

---

(MM) Beſides, without appealing to the proof of the fundamental baſs, 'f※' obviouſly preſents itſelf as the ſixth note of this ſcale; becauſe the ſeventh note being neceſſarily 'g※' (art. 77.) if the ſixth were not 'f※', but 'f♮', there would be an interval of three ſemitones between the ſixth and the ſeventh, conſequently the ſcale would not be diatonic, (art. 8.).

(NN) When 'g' is ſaid to be natural in deſcending the diatonic ſcale of the minor mode of A, it is only meant that this 'g' is not neceſſarily ſharp in deſcending as it is in riſing; for it may be ſharp, as may be proved by numberleſs examples, of which all muſical compoſitions are full. It is true, that when 'g' is found ſharp in deſcending to the minor mode of A, we are not ſure that the mode is minor till the 'f' or 'c' natural is found; both of which impreſs a peculiar character on the minor mode, viz. 'c' natural, in riſing and in deſcending, and the 'f' natural in deſcending.

of C. But the minor mode of E is not ſo cloſely related nor allied to the major mode of C as the minor mode of A; becauſe the diatonic ſcale of the minor mode of E in deſcent, has not, like the ſeries of the minor mode of A, all theſe ſounds in common with the ſcale of C. In reality, this ſcale is 'e, d, c', B, A, G, F♯, E, where there occurs an 'f' ſharp which is not in the ſcale of C. Though the minor mode of E is thus leſs relative to the major mode of C than that of A; yet the artiſt does not heſitate ſometimes to paſs immediately from the one to the other.

When we paſs from one mode to another by the interval of a third, whether in deſcending or riſing, as from C to A, or from A to C, from C to E, or from E to C, the major mode becomes minor, or the minor mode becomes major.

93. There is ſtill another minor mode, into which an immediate tranſition may be made in iſſuing from the major mode of C. It is the minor mode of C itſelf in which the perfect minor chord C, E♭, G, 'c', has two ſounds, C and G, in common with the perfect major chord C, E, G, 'c'. Nor is there any thing more common than a tranſition from the major mode of C to the minor mode, or from the minor to the major (oo).

Chap. XI. *Of Diſſonance.*

Caſes in which the mode is uncertain.

94. We have already obſerved, that the mode of C (F, C, G,) has two ſounds in common with the mode of G (C, G, D); and two ſounds in common with the mode of F (B♭, F, C); of conſequence, this procedure of the baſs C G may belong to the mode of C, or to the mode of G, as the procedure of the baſs F C, or C F, may belong to the mode of C or the mode of F. When one therefore paſſes from C to F or to G in a fundamental baſs, he is ſtill ignorant what mode he is in. It would be, however, advantageous to know it, and to be able by ſome means to diſtinguiſh the generator from its fifths.

How we may inveſtigate the generator and its fifths, and by that means determine the mode.

95. This advantage may be obtained by uniting at the ſame time the ſounds G and F in the ſame harmony, that is to ſay, by joining to the harmony G, B, 'd' of the fifth G, the other fifth F in this manner, G, B, 'd, f'; this 'f' which is added, forms a diſſonance with G (art. 18.). Hence the chord G, B, 'd, f', is called a *diſſonant* chord, or a chord of the ſeventh. It ſerves to diſtinguiſh the fifth G from the generator C, which always implies, without mixture or alteration, the perfect chord C, E, G, 'c', reſulting from nature itſelf (art. 32.). By this we may ſee, that when we paſs from C to G, one paſſes at the ſame time from C to F, becauſe 'f' is found to be comprehended in the chord of G; and the mode of C by theſe means plainly appears to be determined, becauſe there is none but that mode to which the ſounds F and G at once belong.

Manner of treating diſſonances continued.

96. Let us now ſee what may be added to the harmony F, A, C, of the fifth F *below* the generator, to diſtinguiſh this harmony from that of the generator. It ſeems probable at firſt, that we ſhould add to it the other fifth G, ſo that the generator C, in paſſing to F, may at the ſame time paſs to G, and that by this the mode ſhould be determined: but this introduction of G, in the chord F, A, C, would produce two ſeconds in ſucceſſion, F G, G A, that is to ſay, two diſſonances whoſe union would prove extremely harſh to the ear; an inconvenience to be avoided. For if, to diſtinguiſh the mode, we ſhould alter the harmony of the fifth F in the fundamental baſs, it muſt only be altered in the leaſt degree poſſible.

Chord of the great ſixth.

97. For this reaſon, inſtead of G, we ſhall take its fifth 'd', the ſound that approaches it the neareſt, and we ſhall have, inſtead of the fifth F, the chord F, A, 'c, d', which is called a *chord of the great ſixth*.

One may here remark the analogy there is obſerved between the harmony of the fifth G and that of the fifth F.

The ſubject of diſſonances continued.

98. The fifth G, in riſing above the generator, gives a chord entirely conſiſting of thirds aſcending from G, C, B, 'd, f'; now the fifth F being below the generator C in deſcending, we ſhall find, as we go lower by thirds from 'c' towards E, the ſame ſounds 'c', A, F, D, which form the chord F, A, 'c, d', given to the fifth F.

99. It appears beſides, that the alteration of the harmony in the two fifths conſiſts only in the third minor D, F, which was reciprocally added to the harmony of theſe two fifths.

Chap. XII. *Of the Double Uſe or Employment of Diſſonance.*

Account of the double employment.

100. It is evident by the reſemblance of ſounds to their octaves, that the chord F, A, 'c, d', is in effect the ſame as the chord D, F, A, 'c', taken inverſely †, that the inverſe of the chord C, A, F, D, has been found (art. 98.) in deſcending by thirds, from the generator C (pp).

101. The

† See *Inverted.*

(oo) There are likewiſe other minor modes, into which we may paſs in our egreſs from the mode major of C; as that of F minor, in which the perfect minor chord F, A♭, 'c', includes the ſound 'c', and whoſe ſcale in aſcent F, G, A♭, B♭, 'c, d, e, f', only includes the two ſounds A♭, B♭, which do not occur in the ſcale of C. This tranſition, however, is not frequent.

The minor mode of D has only in its ſcale aſcending D, E, F, G, A, B, 'c♯, d', one 'c' ſharp which is not found in the ſcale of C. For this reaſon a tranſition may likewiſe be made, without grating the ear, from the mode of C major to the mode of D minor; but this paſſage is leſs immediate than the former, becauſe the chords C, E, G, 'c', and D, F, A, 'd', not having a ſingle ſound in common, one cannot (art. 37.) paſs immediately from the one to the other.

(pp) M. Rameau, in ſeveral paſſages of his works (for inſtance, in p. 110, 111, 112, and 113. of the *Generation Harmonique*), appears to conſider the chord D, F, A, C, as the primary chord and generator of the chord F, A, 'c, d', which is that chord reverſed; in other paſſages (particularly in p. 116. of the ſame performance), he ſeems to conſider the firſt of theſe chords as nothing elſe but the reverſe of the ſecond. It would ſeem that this

Difference between dominant and tonic dominant.

101. The chord D, F, A, 'c', is a chord of the ſeventh like the chord G, B, 'd, f'; with this only difference, that the latter in the third G, B, is major: whereas in the former, the third D, F, is minor. If the F were ſharp, the chord D, F♯, A, 'c', would be a genuine chord of the dominant, like the chord G, B, D, 'f'; and as the dominant G may deſcend to C in the fundamental baſs, the dominant D implying or carrying with it the third major F♯ might in the ſame manner deſcend to G.

102. Now if the F♯ ſhould be changed into F natural, D, the fundamental tone of this chord D, F, A, 'c', might ſtill deſcend to G; for the change from F♯ to F natural will have no other effect, than to preſerve the impreſſion of the mode of C, inſtead of that of the mode of G, which the F♯ would have here introduced. The note D will, however, preſerve its character as a dominant, on account of the mode of C, which forms a ſeventh. Thus in the chord of which we treat, (D, F, A, 'c'), D may be conſidered as an *imperfect dominant*: we call it *imperfect*, becauſe it carries with it the third minor F, inſtead of the third major F♯. It is for this reaſon that in the ſequel we ſhall call it ſimply the *dominant*, to diſtinguiſh it from the dominant G, which ſhall be named the *tonic dominant* †.

† See *Dominant.*

103. Thus the ſounds F and G, which cannot ſucceed each other (art. 36.) in a diatonic baſs, when they only carry with them the perfect chords F A C, G B d, may ſucceed one another, if 'd' be added to the harmony of the firſt, and 'f' to the harmony of the ſecond; and if the firſt chord be inverted, that is to ſay, if the two chords take this form, D, F, A, C, G, B, d, a.

Seeming contradictions reconciled.

104. Beſides, the chord F, A, 'c, d', being allowed to ſucceed the perfect chord C, E, G, 'c', it follows for the ſame reaſons, that the chord C, E, G, C may be ſucceeded by D, F, A, 'c'; which is not contradictory to what we have above ſaid (art. 37.), that the ſounds C and D cannot ſucceed one another in the fundamental baſs: for in the paſſage quoted, we had ſuppoſed that both C and D carried with them a perfect chord major; whereas, in the preſent caſe, D carries the third minor E, and likewiſe the ſound 'c', by which the chord DFA 'c' is connected with that which precedes it C E G 'c'; and in which the ſound 'c' is found. Beſides, this chord, D F A 'c', is properly nothing elſe but the chord F A 'c d' inverted, and if we may ſpeak ſo, diſguiſed.

105. This manner of preſenting the chord of the ſubdominant under two different forms, and of employing it under theſe two different forms, has been called by M. Rameau its *double office* or *employment* †. This is the ſource of one of the fineſt varieties in harmony; and we ſhall ſee in the following chapter the advantages which reſult from it.

Double employment, what, and why ſo called.

† See *Double Employment.*

We may add, that as this double employment is a kind of licenſe, it ought not to be practiſed without ſome precaution. We have lately ſeen that the chords D F A 'c', conſidered as the inverſe of F A 'c d, may ſucceed to C E G 'c', but this liberty is not reciprocal: and though the chord F A 'c d' may be followed by the chord C E G 'c', we have no right to conclude from thence that the chord D F A 'c', conſidered as the inverſe of F A 'c d', may be followed by the chord C E G 'c'. For this the reaſon ſhall be given in chap. xvi.

CHAP. XIII. *Concerning the Uſe of this Double Employment, and its Rules.*

By the double uſe of the above-mentioned chord, the impreſſion of the mode may be preſerved.

106. We have ſhown (chap. xvi) how the diatonic ſcale, or ordinary gammut, may be formed from the fundamental baſs F, C, G, D, by twice repeating the note G in that ſeries; ſo that this gammut is primitively compoſed of two ſimilar tetrachords, one in the mode of C, the other in that of G. Now it is poſſible, by means of this double employment, to preſerve the impreſſion of the mode of C through the whole extent of the ſcale, without twice repeating the note C, or even without ſuppoſing this repetition. For this effect we form the following fundamental baſs,

C, G, C, F, C, D, G, C:

in which C is underſtood to carry with it the perfect chord C E G 'c'; G, the chord G B 'd f'; F the chord F A 'c d'; and D, the chord D F A 'c'. It is plain from what has been ſaid in the preceding chapter, that in this caſe C may aſcend to D in the fundamental baſs, and D deſcend to G, and that the impreſſion of the mode of C is preſerved by the 'f' natural, which forms the third minor 'd f', inſtead of the third major which D ought naturally to imply.

107. This fundamental baſs will give, as it is evident, the ordinary diatonic ſcale,

'c, d, e, f, g, a, b', *c*,

which of conſequence will be in the mode of C alone; and if one ſhould chooſe to have the ſecond tetrachord in the mode of G, it will be neceſſary to ſubſtitute 'f♯' inſtead of 'f♮' in the harmony of D (QQ).

108. Thus the generator C may be followed according

---

this great artiſt has neither expreſſed himſelf upon this ſubject with ſo much uniformity nor with ſo much preciſion as is required. We think that there is ſome foundation for conſidering the chord F, A, 'c, d', as primitive: 1. Becauſe in this chord, the fundamental and principal note is the ſubdominant F, which ought in effect to be the fundamental and principal ſound in the chord of the ſub-dominant. 2. Becauſe that without having recourſe, with M. Rameau, to harmonical and arithmetical progreſſions, of which the conſideration appears to us quite foreign to the queſtion, we have found a probable and even a ſatisfactory reaſon for adding the note 'd' to the harmony of the fifth F (art. 96. and 97.). The origin thus aſſigned for the chord of the ſub-dominant appears to us the moſt natural, though M. Rameau does not appear to have felt its full value; for ſcarcely has it been ſlightly inſinuated by him.

(QQ) It is obvious that this fundamental baſs C, G, C, F, C, D, G, C, which formed the aſcending ſcale 'c, d, e, f, g, a, b', *c*, cannot by inverting it, and taking it inverſely in this manner, C, G, D, C, F, C, G, C, form the diatonic ſcale *c*, 'b, a, g. f, e, d, c', in deſcent. In reality, from the chord G, B, 'd, f', we cannot paſs to the chord D, F, A, 'c', nor from thence to C, E, G 'c'. For this reaſon, in order to have the fundamental baſs ing to pleaſure in aſcending diatonically either by a tonic dominant (D F♯ A C), or by a ſimple dominant (D F A C).

109. In the minor mode of A, the tonic dominant E ought always to imply its third major E G♯, when this dominant E deſcends to the generator A (art. 83.); and the chord of this dominant ſhall be E G♯ B ‘d’, entirely ſimilar to G B ‘d f’. With reſpect to the ſub-dominant D, it will immediately imply the third minor F, to denominate the minor mode; and we may add B above its chord D F A, in this manner D F A B, a chord ſimilar to that of F A ‘c d’; and as we have deduced from the chord F A ‘c d’ that of D F A ‘c’, we may in the ſame manner deduce from the chord D F A B ‘a’ a new chord of the ſeventh B ‘d f a’, which will exhibit the *double employment of diſſonances* in the minor mode.

110. One may employ this chord B ‘d f a’, to preſerve the impreſſion of the mode of A in the diatonic ſcale of the minor mode, and to prevent the neceſſity of twice repeating the ſound E; but in this caſe, the F muſt be rendered ſharp, and the chord changed to B ‘d f♯ a’, the fifth of B being ‘f’♯, as we have ſeen above. This chord is then the inverſe of D F♯ A B, the ſubdominant implying the third major, which ought not to ſurpriſe us; for in the minor mode of A, the ſecond tetrachord E F♯ G♯ A is exactly the ſame as it would be in the major mode of A: Now, in the major mode of A the ſubdominant D ought to imply the third major F♯.

Diverſities in the minor mode more numerous than in the major.

111. Hence the minor mode is ſuſceptible of a much greater number of varieties than the major: the major mode is found in nature alone; whereas the minor is in ſome meaſure the product of art. But, in return, the major mode has received from nature, to which it owes its immediate formation, a force and energy which the minor cannot boaſt.

Chap. XIV. *Of the different Kinds of Chords of the Seventh.*

Inveſtigation whether art, in conſequence of ſome ſucceſsful advances, may not be carried farther.

112. The diſſonance added to the chord of the dominant and of the ſubdominant, though in ſome meaſure ſuggeſted by nature (chap. xi.), is nevertheleſs a work of art; but as it produces great beauties in harmony by the variety which it introduces into it, let us diſcover whether, in conſequence of this firſt advance, art may not ſtill be carried farther.

Different chords of the ſeventh.

113. We have already three different kinds of chords of the ſeventh, viz.

1. The chord G B ‘d f’, compoſed of a third major followed by two thirds minor.

2. The chord D F A ‘c’, or B ‘d f♯ a’, a third major between two minors.

3. The chord B ‘d f a’, two thirds minor followed by a major.

114. There are ſtill two other kinds of chords of the ſeventh which are employed in harmony; one is compoſed of a third minor between two thirds major, C E G B, or F A ‘c e’; the other is wholly compoſed of thirds minor G♯ B ‘d f’. Theſe two chords, which at firſt appear as if they ought not to enter into harmony if we rigorouſly keep to the preceding rules, are nevertheleſs frequently practiſed with ſucceſs in the fundamental baſs. The reaſon is this:

The chords laſt deſcribed admiſſible, and why.

115. According to what has been ſaid above, if we would add a ſeventh to the chord C E G, to make a dominant of C, one can add nothing but B♭; and in this caſe C E G B♭ would be the chord of the tonic dominant in the mode of F, as G B ‘d f’ is the chord of the tonic dominant in the mode of C; but if we would preſerve the impreſſion of the mode of C in the harmony, we change this B♭ into B natural, and the chord C E G B♭ becomes C E G B. It is the ſame caſe with the chord F A ‘c e’, which is nothing elſe but the chord F A ‘c e♭’; in which one may ſubſtitute for ‘e♭’, ‘e’ natural, to preſerve the impreſſion of the mode of C, or that of F.

Beſides, in ſuch chords as C E G B, F A ‘c e’, the ſounds B and ‘e’, though they form a diſſonance with C in the firſt caſe, and with F in the ſecond, are nevertheleſs ſupportable to the ear, becauſe theſe ſounds B and ‘e’ (art. 19.) are already contained and underſtood, the firſt in the note E of the chord C E G B, as likewiſe in the note G of the ſame chord; the ſecond in the note A of the chord FA ‘c e’, as likewiſe in the note ‘c’ of the ſame chord. All together then ſeem to allow the artiſt to introduce the note B and ‘e’ into theſe two chords (RR).

Chords of the ſeventh continued and explained.

116. With reſpect to the chord of the ſeventh G♯ B ‘d f’, wholly compoſed of thirds minor, it may be regarded as formed from the union of the two chords of the

---

baſs of the ſcale, *c*, ‘b, a, g, f, e, d, c’, in deſcent, we muſt either determine to invert the fundamental baſs mentioned in art. 55. in this manner, C, G, D, G, C, F, C, G, C, in which the ſecond G and the ſecond C anſwer to the G alone in the ſcale; or otherwiſe we muſt form the fundamental baſs C, G, D, G, C, G, C, in which all the notes imply perfect chords major, except the ſecond G, which implies the chord of the ſeventh G, B, ‘d, f’, and which anſwers to the two notes of the ſcale G, F, both comprehended in the chord G, B, ‘d, f’.

Whichever of theſe two baſes we ſhall chooſe, it is obvious that neither the one nor the other ſhall be wholly in the mode of C, but in the mode of C and in that of G. Whence it follows, that the double employment which gives to the ſcale a fundamental baſs all in the ſame mode when aſcending, cannot do the ſame in deſcending; and that the fundamental baſs of the ſcale in deſcending will be neceſſarily in two different modes.

(RR) On the contrary, a chord ſuch as C E♭ G B, in which E would be flat, could not be admitted in harmony, becauſe in this chord the B is not included and underſtood in E♭. It is the ſame caſe with ſeveral other chords, ſuch as B D F A♯, B D♯ F A, &c. It it true, that in the laſt of theſe chords, A is included in F, but it is not contained in D♯; and this D♯ likewiſe forms with F and with A a double diſſonance, which, joined with the diſſonance B F, would neceſſarily render this chord not very pleaſing to the ear; we ſhall yet, however, ſee in the ſecond part, that this chord is ſometimes uſed.

the dominant and of the ſub-dominant in the minor mode. In effect, in the minor mode of A, for inſtance, theſe two chords are E G※ B, ‘d’, and D E A B, whoſe union produces E G※ B, ‘d, f, a’. Now, if we ſhould ſuffer this chord to remain thus, it would be diſagreeable to the ear, by its multiplicity of diſſonances, D E, E F, F G※, A B, D G※, (art. 18.); ſo that, to avoid this inconveniency, the generator A is immediately expunged, which, (art. 19.) is as it were underſtood in D, and the fifth or dominant E, whoſe place the ſenſible note G※ is ſuppoſed to hold: thus there remains only the chord G※ B ‘d f’, wholly compoſed of thirds minor, and in which the dominant E is conſidered as underſtood: in ſuch a manner that the chord G※ B‘d f’ repreſents the chord of the tonic dominant E G※B ‘d’, to which we have joined the chord of the ſub-dominant D F A B, but in which the dominant E is always reckoned the principal note (ss).

117. Since, then, from the chord EG※B ‘d’, we may paſs to the perfect A C ‘e a’, and *vice verſa*, we may in like manner paſs from the chord G※B ‘d f’ to the chord A C ‘e a’, and from this laſt to the chord G※B ‘d f’: this remark will be very uſeful to us in the ſequel.

Chap. XV. *Of the* Preparation *of Diſcords.*

Diſſonance, what.

118. In every chord of the ſeventh, the higheſt note, that is to ſay, the ſeventh above the fundamental, is called a *diſſonance* or *diſcord;* thus ‘f’ is the diſſonance of the chord G B ‘d f’; ‘c’ in the chord D F, A ‘c’, &c.

Manner of preparing diſſonances inveſtigated.

119. When the chord G B ‘d f’ follows the chord C E G ‘c’, as often happens, it is obvious that we do not find the diſſonance ‘f’ in the preceding chord C E G ‘c’. Nor ought it indeed to be found in that chord; for this diſſonance is nothing elſe but the ſub-dominant added to the harmony of the dominant to determine the mode: now, the ſub-dominant is not found in the harmony of the generator.

120. For the ſame reaſon, when the chord of the ſub-dominant F A ‘c d’ follows the chord C E G ‘c’, the note ‘d’, which forms a diſſonance with ‘c’, is not found in the preceding chord.

It is not ſo when the chord D F A ‘c’ follows the chord C E G ‘c’; for ‘c’ which forms a diſſonance in the ſecond chord, ſtands as a conſonance in the preceding.

Diſſonance is only tolerable to the ear when found in preceding chords.

121. In general, diſſonance being the production of art (chap. xi.), eſpecially in ſuch chords as are not of the tonic dominant nor ſub-dominant, the only means to prevent its diſpleaſing the ear by appearing too heterogeneous to the chord, is, that it may be, if we may ſpeak ſo, announced to the ear by being found in the preceding chord, and by that means connect the two chords. Hence follows this rule:

Preparation of diſſonances how performed.

122. In every chord of the ſeventh, which is not the chord of the tonic dominant, that is to ſay, (art. 102.) which is not compoſed of a third major followed by two thirds minor, the diſſonance which this chord forms ought to ſtand as a conſonance in the chord which precedes it.

This is what we call a *prepared diſſonance.*

See *Preparation.*

123. Hence, in order to prepare a diſſonance, the fundamental baſs muſt neceſſarily aſcend by the interval of a ſecond, as

C E G ‘c’, D F A ‘c’;

or deſcend by a third, as

C E G ‘c’, A C E G;

or deſcend by a fifth, as

C E G ‘c’, F A C E:

in every other caſe the diſſonance cannot be prepared. This may be eaſily aſcertained. If, for inſtance, the fundamental baſs riſes by a third, as C E G ‘c’, E G B ‘d’, the diſſonance ‘d’ is not found in the chord C E G ‘c’. The ſame might be ſaid of C E G ‘c’, G B ‘d f’, and C E G ‘c’, B D ‘f a’, in which the fundamental baſs riſes by a fifth or deſcends by a ſecond.

124. When a tonic, that is to ſay, a note which carries with it a perfect chord, is followed by a dominant in the interval of a fifth or third, this ſucceſſion may be regarded as a proceſs from that ſame tonic to another, which has been rendered a dominant by the addition of the diſſonance.

Moreover, we have ſeen (art. 119. and 120.) that a diſſonance does not require preparation in the chords of the tonic dominant and of the ſub-dominant: whence it follows, that every tonic carrying with it a perfect chord, may be changed into a tonic dominant (if the perfect chord be major), or into a ſub-dominant (whether the chord be major or minor) by adding the diſſonance all at once.

Chap. XVI. *Of the Rules for* reſolving *Diſſonances.*

Diſſonances to be reſolved, muſt be diſguiſed and made to appear in the character of harmonics.

125. We have ſeen (chap. v. and vi.) how the diatonic ſcale, ſo natural to the voice, is formed by the harmonies of fundamental ſounds; from whence it follows, that the moſt natural ſucceſſion of harmonical ſounds is to be diatonic. To give a diſſonance then, in ſome meaſure, as much the character of an harmonic ſound as may be poſſible, it is neceſſary that this diſſonance, in that part of the modulation where it is found, ſhould deſcend or riſe diatonically upon another note, which may be one of the conſonances of the ſubſequent chord.

In the chord of the tonic dominant, the diſſonance ſhould rather riſe than deſcend, and why.

126. Now in the chord of the tonic dominant it ought

(ss) We have ſeen (art. 109.) that the chord B ‘d f a’, in the minor mode of A, may be regarded as the inverſe of the chord D F A B; it would likewiſe ſeem, that, in certain caſes, this chord B ‘d f a’ may be conſidered as compoſed of the two chords G B ‘d f’, F A ‘c d’ of the dominant and of the ſub-dominant of the major mode of C; which chords may be joined together after having excluded from them, 1. The dominant G, repreſented by its third major B, which is preſumed to retain its place 2. The note C which is underſtood in F, which will form this chord B ‘d f a’. The chord B ‘d f a’, conſidered in this point of view, may be underſtood as belonging to the major mode of C upon certain occaſions.

ought rather to deſcend than to riſe ; for this reaſon. Let us take, for inſtance, the chord G B ‘d f’ followed by the chord C E G ‘c’ ; the part which formed the diſſonance ‘f’ ought to deſcend to ‘e’ rather than riſe to ‘g’, though both the ſounds E and G are found in the ſubſequent chord C E G ‘c’ ; becauſe it is more natural and more conformed to the connexion which ought to be found in every part of the muſic, that G ſhould be found in the ſame part where G has already been ſounded, whilſt the other part was ſounding ‘f’, as may be here ſeen (Parts Firſt and Fourth).

Firſt part, - -	‘f’	‘c’
Second, - -	‘d’	‘c’
Third, - - -	B	
Fourth, - -	G	G
Fundamental baſs, -	G	C

Conſequences of the former rule.

127. So, in the chord of the ſimple dominant D F A ‘c’, followed by G B d ‘f’, the diſſonance ‘c’ ought rather to deſcend to B than riſe to ‘d’.

Another conſequence.

128. And, for the ſame reaſon, in the chord of the ſub-dominant F A ‘c d’, the diſſonance ‘d’ ought to riſe to ‘e’ of the following chord C E G ‘c’, rather than deſcend to ‘c’ ; whence may be deduced the following rules.

But is deduced from the former propoſitions.

129. 1°, In every chord of the dominant, whether tonic or ſimple, the note which conſtitutes the ſeventh, that is to ſay the diſſonance, ought diatonically to deſcend upon one of the notes which form a conſonance in the ſubſequent chord.

2°, In every chord of the ſub-dominant, the diſſonance ought to riſe diatonically upon the third of the ſubſequent chord.

Diſſonance reſolved, what. See *Reſolution.*

130. A diſſonance which deſcends or riſes diatonically according to theſe two rules, is called a *diſſonance reſolved.*

From theſe rules it is a neceſſary reſult, that the chord of the ſeventh D F A ‘c’, though it ſhould even be conſidered as the inverſe of F A ‘c d’, cannot be ſucceeded by the chord C E G ‘c’, ſince there is not in this laſt chord the note B, upon which the diſſonance ‘c’ of the chord D F A ‘c’ can deſcend.

One may beſides find another reaſon for this rule, in examining the nature of the double employment of diſſonances. In effect, in order to paſs from D F A ‘c’, to C E G ‘c’, it is neceſſary that D F A ‘c’ ſhould in this caſe be underſtood as the inverſe of F A ‘c d’. Now the chord D F A ‘c’ can only be conceived as the inverſe of F A ‘c d’, when this chord D F A ‘c’ precedes or immediately follows the C E G ‘c’ ; in every other caſe the chord D F A ‘c’ is a primitive chord, formed from the perfect minor chord D F A, to which the diſſonance ‘c’ was added, to take from D the character of a tonic. Thus the chord D F A ‘c’, could not be followed by the chord C E G ‘c’, but after having been preceded by the ſame chord. Now, in this caſe, the *double employment* would be entirely a futile expedient, without producing any agreeable effect : becauſe, inſtead of this ſucceſſion of chords, C E G ‘c’, D F A ‘c’, C E G ‘c’, it would be much more eaſy and natural to ſubſtitute this other, which furniſhes this natural ſucceſſion C E G ‘c’, F A ‘c d’, C E G ‘c’. The proper uſe of the double employment is, that, by means of inverting the chord of the ſub-dominant, it may be able to paſs from that chord thus inverted to any other chord except that of the tonic, to which it naturally leads.

Chap. XVII. *Of the Broken or Interrupted Cadence.*

The teſt of perfection in cadences to be found in the fundamental baſs.

131. In a fundamental baſs which moves by fifths, there is always, as we have formerly obſerved (chap. viii.), a repoſe more or leſs perfect from one ſound to another ; and of conſequence there muſt likewiſe be a repoſe more or leſs perfect from one ſound to another in the diatonic ſcale, which reſults from that baſs.—It may be demonſtrated by a very ſimple experiment, that the cauſe of a repoſe in melody is ſolely in the fundamental baſs expreſſed or underſtood. Let any perſon ſing theſe three notes ‘c d g’, performing on the ‘d’ a ſhake, which is commonly called a *cadence ;* the modulation will appear to him to be finiſhed after the ſecond ‘c’, in ſuch a manner that the ear will neither expect nor wiſh any thing to follow. The caſe will be the ſame if we accompany this modulation with its natural fundamental baſs C G C : but if, inſtead of this baſs, we ſhould give it the following, C G A : in this caſe the modulation ‘c d c’ would not appear to be finiſhed, and the ear would ſtill expect and deſire ſomething more. This experiment may eaſily be made.

Broken cadences, what, and why. See *Cadence.*

132. This paſſage G A, when the dominant G diatonically aſcends upon the note A inſtead of deſcending by a fifth upon the generator C, as it ought naturally to do, is called a *broken cadence ;* becauſe the perfect cadence G C, which the ear expected after the dominant G, is, if we may ſpeak ſo, broken and ſuſpended by the tranſition from G to A.

133. Hence it follows, that if the modulation ‘c d c’ appeared finiſhed when we ſuppoſed no baſs to it at all, it is becauſe its natural fundamental baſs C G C is implied ; for the ear deſires ſomething to follow this modulation, as ſoon as it is reduced to the neceſſity of hearing another baſs.

Origin of broken cadence the double employment of diſſonances.

134. The broken cadence may be conſidered as having its origin in the *double employment of diſſonances ;* ſince this cadence, like the double employment, only conſiſts in a diatonic procedure of the baſs aſcending (chap. xii.). In effect, nothing hinders us to deſcend from the chord G B ‘d f’ to the chord C E G A by converting the tonic C into a ſub-dominant, that is to ſay, by paſſing all at once from the mode of C to the mode of G : now to deſcend from G B ‘d f’ to C E G A is the ſame thing as to riſe from the chord G B ‘d f’ to the chord A ‘c e g’, in changing the chord of the ſub-dominant C E G A for the imperfect chord of the dominant, according to the laws of the double employment.

Manner of performing this cadence.

135. In this kind of cadence, the diſſonance of the firſt chord is reſolved by deſcending diatonically upon the fifth of the ſubſequent chord. For inſtance, in the broken cadence G B ‘d f’, A ‘c e g’, the diſſonance ‘f’ is reſolved by deſcending diatonically upon the fifth ‘e’.

Interrupted cadence, what. See *Cadence.*

136. There is another kind of cadence, called an *interrupted cadence*, where the dominant deſcends by a third to another dominant, inſtead of deſcending by a fifth upon the tonic, as in this ſucceſſion of the baſs

G B 'd f', E G B 'd'; in the caſe of an interrupted cadence, the diſſonance of the former chord is reſolved by deſcending diatonically upon the octave of the fundamental note of the ſubſequent chord, as may be here ſeen, where 'f' is reſolved upon the octave of E.

Origin of this kind of cadence, likewiſe in the double employment.

137. This kind of interrupted cadence has likewiſe its origin in the double employment of diſſonances. For let us ſuppoſe theſe two chords in ſucceſſion, G B 'd f', G B 'd e', where G is ſucceſſively a tonic dominant and ſub-dominant: that is to ſay, in which we paſs from the mode of C to the mode of D; if we ſhould change the ſecond of theſe chords into the chord of the dominant, according to the laws of the double employment, we ſhall have the interrupted cadence G B 'd f', E G B 'd'.

CHAP. XVIII. *Of the Chromatic Species.*

Fundamental baſs formed by thirds major

138. THE ſeries or fundamental baſs by fifths produces the diatonic ſpecies in common uſe (chap. vi.); now the third major being one of the harmonics of a fundamental ſound as well as the fifth, it follows, that we may form fundamental baſſes by thirds major, as we have already formed fundamental baſſes by fifths.

A chromatic interval or minor ſemitone, how found. See fig. 10.

139. If then we ſhould form this baſe C, E, G♯, the two firſt ſounds carrying each along with it their thirds major and fifths, it is evident that C will give G, and that E will give G♯: now the ſemitone which is between this G and this G♯ is an interval much leſs than the ſemitone which is found in the diatonic ſcale between E and F, or between B and 'c'. This may be aſcertained by calculation (TT): and for this reaſon the ſemitone from E to F is called *major*, and the other *minor* (UU).

140. If the fundamental baſs ſhould proceed by thirds minor in this manner, C, E♭, a ſucceſſion which is allowed when we have inveſtigated the origin of the minor mode (chap. ix.), we ſhall find this modulation G, G♭, which would likewiſe give a minor ſemitone (XX).

An intonation minor ſemitone difficult to be hit, and why.

141. The minor ſemitone is hit by young practitioners in intonation with more difficulty than the ſemitone major. For which this reaſon may be aſſigned: The ſemitone major which is found in the diatonic ſcale, as from E to F, reſults from a fundamental baſs by fifths C F, that is to ſay, by a ſucceſſion which is moſt natural, and for this reaſon the eaſieſt to the ear. On the contrary, the minor ſemitone ariſes from a ſucceſſion by thirds, which is ſtill leſs natural than the former. Hence, that ſcholars may truly hit the minor ſemitone, the following artifice is employed. Let us ſuppoſe, for inſtance, that they intend to riſe from G to G♯; they riſe at firſt from G to A, then deſcend from A to G♯ by the interval of a ſemitone major: for this G ſharp, which is a ſemitone major below A, proves a ſemitone minor above G. [See the notes (TT) and (UU).]

Minor ſemitone to be found in every procedure of the fundamental baſs by thirds.

142. Every procedure of the fundamental baſs by thirds, whether major or minor, riſing or deſcending, gives the minor ſemitone. This we have already ſeen from the ſucceſſion of thirds in aſcending. The ſeries of thirds minor in deſcending, C A, gives, C, C♯ (YY); and the ſeries of thirds major in deſcending, C, A♭, gives C, C♭, (ZZ).

The minor ſemitone, when prevalent, conſtitutes chromatic muſic.

143. The minor ſemitone conſtitutes the ſpecies, called *chromatic*; and with the ſpecies which moves by diatonic intervals, reſulting from the ſucceſſion of fifths (chap. v. and vi.), it comprehends the whole of melody.

CHAP. XIX. *Of the Enharmonic Species.*

Dieſis or enharmonic interval, what, and how formed.

144. THE two extremes, or higheſt and loweſt notes, C G♯, of the fundamental baſs by thirds major C E G♯, give this modulation 'c' B♯; and theſe two ſounds 'c' B♯, differ between themſelves by a ſmall interval which is called the *dieſis*, or *enharmonic fourth* of a tone* (3A), which

* See *Fourth of a Tone*. Fig. 11.

(TT) In reality, C being ſuppoſed 1, as we have always ſuppoſed it, E is $\frac{4}{5}$, and ♯ $\frac{25}{16}$: now G being $\frac{3}{2}$, G♯ then ſhall be to G as $\frac{25}{16}$ to $\frac{3}{2}$; that is to ſay, as 25 times 2 to 3 times 16: the proportion then of G♯ to G is as 25 to 24, an interval much leſs than that of 16 to 15, which conſtitutes the ſemitone from 'c' to B, or from F to E (note Z).

(UU) A minor joined to a major ſemitone will form a minor tone; that is to ſay, if one riſes, for inſtance, from E to F, by the interval of a ſemitone major, and afterwards from F to F♯ by the interval of a minor ſemitone, the interval from E to F♯ will be a minor tone. For let us ſuppoſe E to be 1, F will be $\frac{16}{15}$, and F♯ will be $\frac{25}{24}$ of $\frac{16}{15}$; that is to ſay, 25 times 16 divided by 24 times 15, or $\frac{10}{9}$; E then is to F♯ as one is to $\frac{10}{9}$, the interval which conſtitutes the minor tone (note BB).

With reſpect to the tone major, it cannot be exactly formed by two ſemitones; for, 1. Two major ſemitones in immediate ſucceſſion would produce more than a tone major. In effect, $\frac{16}{15}$ multiplied by $\frac{16}{15}$ gives $\frac{256}{225}$, which is greater than $\frac{3}{8}$, the interval which conſtitutes (note BB) the major tone. 2. A ſemitone minor and a ſemitone major would give leſs than a major tone, ſince they amount only to a true minor. 3. And, *à fortiori*, two minor ſemitones would ſtill give leſs.

(XX) In effect, E♭ being $\frac{6}{5}$, G♭ will be $\frac{6}{5}$ of $\frac{6}{5}$; that is to ſay, (note Q) $\frac{36}{25}$: now the proportion of $\frac{3}{2}$ to $\frac{36}{25}$ (note Q) is that of 3 times 25 to 2 times 36; that is to ſay, as 25 to 24.

(YY) A being $\frac{5}{6}$ C♯ is $\frac{5}{4}$ of $\frac{5}{6}$; that is to ſay $\frac{25}{24}$, and C is 1: the proportion then between C and C♯ is that of 1 to $\frac{15}{24}$, or of 24 to 25.

(ZZ) A♭ being the third major below C, will be $\frac{4}{5}$ (note Q): C♭, then, is $\frac{7}{5}$ of $\frac{4}{5}$; that is to ſay $\frac{24}{25}$. The proportion, then, between C and C♭, is as 25 to 24.

(3A) G♯ being $\frac{25}{16}$ and B♯ being $\frac{5}{4}$ of $\frac{25}{16}$, we ſhall have B♯ equal (note Q) to $\frac{125}{64}$, and its octave below ſhall be $\frac{125}{128}$; an interval leſs than unity by about $\frac{3}{128}$ or $\frac{1}{43}$. It is plain then from this fraction, that the B♯ in queſtion muſt be conſiderably lower than C.

which is the difference between a ſemitone major and a ſemitone minor (3 B). This quarter tone is inappretiable by the ear, and impracticable upon ſeveral of our inſtruments. Yet have means been found to put it in practice in the following manner, or rather to perform what will have the ſame effect upon the ear.

Manner of ſeemingly introducing this interval upon inſtruments of fixed ſcales.

145. We have explained (art. 116.) in what manner the chord G※ B 'd f' may be introduced into the minor mode, entirely conſiſting of thirds minor perfectly true, or at leaſt ſuppoſed ſuch. This chord ſupplying the place of the chord of the dominant (art. 116.) from thence we may paſs to that of the tonic or generator A (art. 117.). But we muſt remark,

1. That this chord G※ B 'd f', entirely conſiſting of thirds minor, may be inverted or modified according to the three following arrangements, B 'd f g※', D F G※B, FG※B 'd'; and that in all theſe three different ſtates, it will ſtill remain compoſed of thirds minor; or at leaſt there will only be wanting the enharmonic fourth of a tone to render the third minor between F and G※ entirely juſt; for a true third minor, as that from E to G in the diatonic ſcale, is compoſed of a ſemitone and a tone both major. Now from F to G there is a tone major, and from G to G※ there is only a minor ſemitone. There is then wanting (art. 144.) the enharmonic fourth of a tone, to render the third F G※ exactly true.

2. But as this diviſion of a tone cannot be found in the gradations of any ſcale practicable upon moſt of our inſtruments, nor be appretiated by the ear, the ear takes the different chords.

B 'd' 'f' 'g※'
D F G※ B
F G※ B 'd',

which are abſolutely the ſame, for chords compoſed every one of thirds minor are exactly juſt.

Now the chord G※B 'd f', belonging to the minor mode of A, where G※ is the ſenſible note; the chord B 'd f g※', or B 'd f a♭', will, for the ſame reaſon, belong to the minor mode of C, where B is the ſenſible note. In like manner, the chord D F G※ B, or D F A♭ 'c♭', will belong to the minor mode of E♭, and the chord F G※B 'd', or F A♭ 'c♭ e♭♭', to the minor mode of G♭.

After having paſſed then by the mode of A to the chord G※ B 'd f' (art. 117.), one may by means of this laſt chord, and by merely ſatisfying ourſelves to invert it, afterwards paſs all at once to the modes of C minor, of E♭ minor, or of G♭ minor; that is to ſay, into the modes which have nothing, or almoſt nothing, in common with the minor mode of A, and which are entirely foreign to it (3 C).

The alteration, however, by which it is effectuated abrupt and ſenſible.

146. It muſt, however, be acknowledged, that a tranſition ſo abrupt, and ſo little expected, cannot deceive nor elude the ear; it is ſtruck with a ſenſation ſo unlooked-for, without being able to account for the paſſage to itſelf. And this account has its foundation in the enharmonic fourth of a tone; which is overlook-

---

This interval has been called *the fourth of a tone*, and this denomination is founded on reaſon. In effect, we may diſtinguiſh in muſic four kinds of quarter tones.

1. The fourth of a tone major: now, a tone major being $\frac{9}{8}$, and its difference from unity being $\frac{1}{8}$, the difference of this quarter tone from unity will be almoſt the fourth of $\frac{1}{8}$; that is to ſay, $\frac{1}{32}$.

2. The fourth of a tone minor; and as a tone minor, which is $\frac{10}{9}$, differs from unity by $\frac{1}{9}$, the fourth of a minor tone will differ from unity about $\frac{1}{36}$.

3. One half of a ſemitone major; and as this ſemitone differs from unity by $\frac{1}{15}$, one half of it will differ from unity about $\frac{1}{30}$.

4. Finally, one half of a ſemitone minor, which differs from unity by $\frac{1}{24}$: its half then will be $\frac{1}{48}$.

The interval, then, which forms the enharmonic fourth of a tone, as it does not differ from unity but by $\frac{1}{48}$, may juſtly be called the *fourth of a tone*, ſince it is leſs different from unity than the largeſt interval of a quarter tone, and more than the leaſt.

We ſhall add, that ſince the enharmonic fourth of a tone is the difference between a ſemitone major, and a ſemitone minor; and ſince the tone minor is formed (note UU) of two ſemitones, one major and the other minor; it follows, that two ſemitones major in ſucceſſion form an interval larger than that of a tone by the enharmonic fourth of a tone; and that two minor ſemitones in ſucceſſion form an interval leſs than a tone by the ſame fourth of a tone.

(3 B) That is to ſay, that if you riſe from E to F, for inſtance, by the interval of a ſemitone major, and afterwards, returning to E, you ſhould riſe by the interval of a ſemitone minor to another ſound which is not in the ſcale, and which I ſhall mark thus, F+, the two ſounds F+ and F will form the enharmonic fourth of a tone: for E being 1, F will be $\frac{16}{15}$; and F+ $\frac{25}{24}$: the proportion then between F+ and F is that of $\frac{25}{24}$ to $\frac{16}{15}$ (note Q); that is to ſay, as 25 times 15 to 16 times 24; or otherwiſe, as 25 times 5 to 16 times 8 or as 125 to 128. Now this proportion is the ſame which is found, in the beginning of the preceding note, to expreſs the enharmonic fourth of a tone.

(3 C) As this method for obtaining or ſupplying enharmonic gradations cannot be practiſed on every occaſion when the compoſer or practitioner would wiſh to find them, eſpecially upon inſtruments where the ſcale is fixed and invariable, except by a total alteration of their economy, and re-tuning the ſtrings, Dr Smith in his Harmonics has propoſed an expedient for redreſſing or qualifying this defect, by the addition of a greater number of keys or ſtrings, which may divide the tone or ſemitone into as many appretiable or ſenſible intervals as may be neceſſary. For this, as well as for the other advantageous improvements which he propoſes in the ſtructure of inſtruments, we cannot with too much warmth recommend the peruſal of his learned and ingenious book to ſuch of our readers as aſpire to the character of genuine adepts in the theory of muſic.

ed as nothing, becauſe it is inappretiable by the ear; but of which, though its value is not aſcertained, the whole harſhneſs is ſenſibly perceived. The inſtant of ſurpriſe, however, immediately vaniſhes; and that aſtoniſhment is turned into admiration, when one feels himſelf tranſported as it were all at once, and almoſt imperceptibly, from one mode to another, which is by no means relative to it, and to which he never could have immediately paſſed by the ordinary ſeries of fundamental notes.

Chap. XX. *Of the Diatonic Enharmonic Species.*

See fig. 12.

147. If we form a fundamental baſs, which riſes alternately by fifths and thirds, as F, C, E, B, this baſs will give the following modulation 'f, e, c, d※'; in which the ſemitones from 'f' to 'e', and from 'e' to 'd※', are equal and major (3 D).

See *Enharmonic.*

This ſpecies of modulation or of harmony, in which all the ſemitones are major, is called the *enharmonic diatonic* ſpecies. The major ſemitones peculiar to this ſpecies give it the name of *diatonic.* becauſe major ſemitones belong to the diatonic ſpecies; and the tones which are greater than major by the exceſs of a fourth, reſulting from a ſucceſſion of major ſemitones, give it the name of *enharmonic* (note 3 A).

Chap. XXI. *Of the Chromatic Enharmonic Species.*

Chromatic enharmonic intervals, how formed.

148. If we paſs alternately from a third minor in deſcending to a third major in riſing, as C, C, A, C※, C※, we ſhall form this modulation 'e♭, e, c, e e※', in which all the ſemitones are minor (3 E).

See fig. 13. From this ſpecies, the effects of harmony and melody appear to be in the fundamental baſs.

This ſpecies is called the *chromatic enharmonic* ſpecies: the minor ſemitones peculiar to this kind give it the name of *chromatic*, becauſe minor ſemitones belong to the chromatic ſpecies; and the ſemitones which are leſſer by the diminution of a fourth reſulting from a ſucceſſion of minor ſemitones, give it the name of *enharmonic* (note 3 F).

149. Theſe new ſpecies confirm what we have all along ſaid, that the whole effects of harmony and melody reſide in the fundamental baſs.

Diatonic ſpecies moſt agreeable, and why.

150. The diatonic ſpecies is the moſt agreeable, becauſe the fundamental baſs which produces it is formed from a ſucceſſion of fifths alone, which is the moſt natural of all others.

The chromatic next.

151. The chromatic being formed from a ſucceſſion of thirds, is the moſt natural after the preceding.

Laſtly, the enharmonic.

152. Finally, the enharmonic is the leaſt agreeable of all, becauſe the fundamental baſs which gives it is not immediately indicated by nature. The fourth of a tone which conſtitutes this ſpecies, and which is itſelf inappretiable to the ear, neither produces nor can produce its effect, but in proportion as imagination ſuggeſts the fundamental baſs from whence it reſults; a baſs whoſe procedure is not agreeable to nature, ſince it is formed of two ſounds which are not contiguous one to the other in the ſeries of thirds (art. 144.).

Chap. XXII. *Showing that Melody is the Offspring of Harmony.*

The effects of melody to be inveſtigated in harmony expreſſed or underſtood.

153. All that we have hitherto ſaid, as it ſeems to me, is more than ſufficient to convince us, that melody has its original principle in harmony; and that it is in harmony, expreſſed or underſtood, that we ought to look for the effects of melody.

154. If this ſhould ſtill appear doubtful, nothing more is neceſſary than to pay due attention to the firſt experiment (art. 19.), where it may be ſeen that the principal ſound is always the loweſt, and that the ſharper ſounds which it generates are with relation to it what the treble of an air is to its baſs.

155. Yet more, we have proved, in treating of the broken cadence (chap. xvii.), that the diverſification of baſſes produces effects totally different in a modulation which, in other reſpects, remains the ſame.

156. Can it be ſtill neceſſary to adduce more convincing proofs? We have but to examine the different baſſes which may be given to this very ſimple modulation GC. It will be found ſuſceptible of many, and each will give a different character to the modulation GC, though in itſelf it remains always the ſame. We may thus change the whole nature and effects of a modulation, without any other alteration than that of its fundamental baſs.

M. Rameau has ſhown, in his *New Syſtem of Muſic*, printed at Paris 1726, p. 44. that this modulation G, C, is ſuſceptible of 20 different fundamental baſſes. Now the ſame fundamental baſs, as may be ſeen in our ſecond part, will afford ſeveral continued or thorough baſſes. How many means, of conſequence, may be practiſed to vary the expreſſion of the ſame modulation?

Conſequences deducible from this principle.

157. From theſe different obſervations it may be concluded, 1. That an agreeable melody, naturally implies a baſs extremely ſweet and adapted for ſinging; and that reciprocally, as muſicians expreſs it, a baſs of this kind generally prognoſticates an agreeable melody (3 F).

2. That the character of a juſt harmony is only to form in ſome meaſure one ſyſtem with the modulation, ſo

---

(3 D) It is obvious, that if F in the baſs be ſuppoſed 1, 'f' of the ſcale will be 2, C of the baſs $\frac{3}{2}$ and 'e' of the ſcale $\frac{5}{4}$ of $\frac{3}{2}$, that is, $\frac{15}{8}$; the proportion of 'f' to 'e' is as 2 to $\frac{15}{8}$, or as 1 to $\frac{15}{16}$. Now E of the baſs being likewiſe $\frac{5}{4}$ of $\frac{3}{2}$, or $\frac{15}{8}$; B of the baſs is $\frac{3}{2}$ of $\frac{15}{8}$, and its third major D※ $\frac{5}{4}$ of $\frac{3}{2}$ of $\frac{15}{8}$, or $\frac{15}{8}$ of $\frac{15}{8}$; this third major, approximated as much as poſſible to 'e' in the ſcale by means of octaves, will be $\frac{15}{16}$ of $\frac{15}{8}$: 'e' then of the ſcale will be to 'd'※ which follows it, as $\frac{15}{8}$ is to $\frac{15}{16}$ of $\frac{15}{8}$, that is to ſay, as 1 to $\frac{15}{16}$. The ſemitones then from 'f' to 'e', and from 'e' to 'd'※, are both major.

(3 E) It is evident that 'e'♭ is $\frac{6}{5}$ (note Q), and that 'e' is $\frac{5}{4}$: theſe two 'e's, then, are between themſelves as $\frac{6}{5}$ to $\frac{5}{4}$, that is to ſay, as 6 times 4 to 5 times 5, or as 24 to 25, the interval which conſtitutes the minor ſemitone. Moreover, the A of the baſs is $\frac{5}{6}$, and C ※$\frac{5}{4}$ of $\frac{5}{6}$, or $\frac{25}{24}$: 'e'※ then is $\frac{5}{4}$ of $\frac{25}{24}$, the 'e' in the ſcale is likewiſe to the 'e'※ which follows it, as 24 to 25. All the ſemitones therefore in this ſcale are minor.

(3 F) Many compoſers begin with determining and writing the baſs; a method, however, which appears in general

ſo that from the whole taken together, the ear may only receive, if we may ſpeak ſo, one ſimple and indiviſible impreſſion.

3. That the character of the ſame modulation may be diverſified, according to the character of the baſs which is joined with it.

But notwithſtanding the dependency of melody upon harmony, and the ſenſible influence which the latter may exert upon the former; we muſt not however conclude, with ſome celebrated muſicians, that the effects of harmony are preferable to thoſe of melody. Experience proves the contrary. [See, on this account, what is written on the licenſe of muſic, printed in tom. iv. of D'Alembert's *Melanges de Literature*, p. 448]

GENERAL REMARK.

The diatonic ſcale or gammut being compoſed of twelve ſemitones, it is clear that each of theſe ſemitones taken by itſelf may be the generator of a mode; and that thus there muſt be twenty-four modes in all, twelve major and twelve minor. We have aſſumed the major mode of C, to repreſent all the major modes in general, and the minor mode of A to repreſent the modes minor, to avoid the difficulties ariſing from ſharps and flats, of which we muſt have encountered either a greater or leſſer number in the other modes. But the rules we have given for each mode are general, whatever note of the gammut be taken for the generator of a mode.

PART II. PRINCIPLES AND RULES OF COMPOSITION.

Compoſition in harmony, what. See *Compoſition*.

158. COMPOSITION, called alſo *counterpoint*, is not only the art of compoſing an agreeable air, but alſo that of compoſing ſeveral airs in ſuch a manner that when heard at the ſame time, they may unite in producing an effect agreeable and delightful to the ear; this is what we call *compoſing muſic in ſeveral parts*.

The higheſt of theſe parts is called the *treble*, the loweſt is termed the *baſs*; the other parts, when there are any, are termed *middle parts*; and each in particular is ſignified by a different name.

CHAP. I. *Of the Different Names given to the ſame Interval.*

Particular intervals ſignified by different names, and why.

159. In the introduction (art. 9.), we have ſeen a detail of the moſt common names given to the different intervals. But particular intervals have obtained different names, according to circumſtances; which it is proper to explain.

Second redundant, what.

160. An interval compoſed of a tone and a ſemitone, which is commonly called a *third minor*, is likewiſe ſometimes called a *ſecond redundant*; ſuch is the interval from C to D♯ in aſcending, or that of A to G♭ deſcending.

Why ſo called.

This interval is ſo termed, becauſe one of the ſounds which form it is always either ſharp or flat, and that, if that ſharp or flat be taken away, the interval will be that of a ſecond (3 G).

Falſe fifth, what.

161. An interval compoſed of two tones and two ſemitones, as that from B to 'f', is called a *falſe fifth*. This interval is the ſame with the *tritone* (art. 9.), ſince two tones and two ſemitones are equivalent to three tones. There are, however, reaſons for diſtinguiſhing them, as will appear below.

Fifth redundant, what.

162. As the interval from C to D♯ in aſcending has been called a ſecond redundant, we likewiſe call the interval from C to G♯ in aſcending, a *fifth redundant*, or from B to E♭ in deſcending, each of which intervals is compoſed of four tones (3 H.)

Diſtinguiſhed from the fixth minor.

This interval is, in the main, the ſame with that of the ſixth minor (art. 6.): but in the fifth redundant there is always a ſharp or flat; inſomuch, that if this ſharp or flat were removed, the interval would become a true fifth.

Seventh diminiſhed, what.

163. For the ſame reaſon, an interval compoſed of three tones and three ſemitones, as from G♯ to 'f' in aſcending, is called a *ſeventh diminiſhed*; becauſe, if we remove the ſharp from G, the interval from G to 'f' will become that of an ordinary ſeventh. The interval of a ſeventh diminiſhed is in other reſpects the ſame with that of the ſixth major (art. 9.) (3 I).

Seventh major and redundant coincident.

164. The major ſeventh is likewiſe ſometimes called a *ſeventh redundant* (3 K).

CHAP. II. *Compariſon of the Different Intervals.*

Notes in different octaves or ſcales replications each of the other.

165. IF we ſing 'c' B in deſcending by a ſecond, and afterwards C B in aſcending by a ſeventh, theſe two B's ſhall be octaves one to the other; or, as we commonly expreſs it, they will be *replications* one of the other.

166. On account then of the reſemblance between every

---

general more proper to produce a learned and harmonious muſic, than a ſtrain prompted by genius and animated by enthuſiaſm.

(3 G) For the ſame reaſon, this interval is frequently termed by Engliſh muſicians an *extreme ſharp ſecond*.

(3 H) This interval is uſually termed by Engliſh theoriſts *a ſharp fifth*.

(3 I) The material difference between the diminiſhed ſeventh and the major ſixth is, that the former always implies a diviſion of the interval into three minor thirds, whereas a diviſion into a fourth and third major, or into a ſecond and major and minor third, is uſually ſuppoſed in the latter.

(3 K) The chief uſe of theſe different denominations is therefore to diſtinguiſh chords: for inſtance, the chord of the redundant fifth and that of the diminiſhed ſeventh are different from the chord of the ſixth; the chord of the ſeventh redundant, from that of the ſeventh major. This will be explained in the following chapters.

every ſound and its octave (art. 22.), it follows, that *to riſe by a ſeventh*, or *deſcend by a ſecond*, amount to the ſame thing.

Hence to deſcend to one replication, and riſe to another, has the ſame effect.

167. In like manner, it is evident that the ſixth deſcending is nothing but a replication of the third aſcending, nor the fourth deſcending but a replication of the fifth aſcending.

Detail of replications.

168. The following expreſſions either are or ought to be regarded as ſynonymous.

Examples of this.

To riſe by a ſecond.—To deſcend by a ſeventh.
To deſcend by a ſecond.—To riſe by a ſeventh.
To riſe by a third.—To deſcend by a ſixth.
To deſcend by a third.—To riſe by a ſixth.
To riſe by a fourth.—To deſcend by a fifth.
To deſcend by a fourth.—To riſe by a fifth.

169. Thus, therefore, we ſhall employ them indifferently the one for the other; ſo that when we ſay, for inſtance, *to riſe by a third*, it may be ſaid with equal propriety *to deſcend by a ſixth*, &c.

CHAP. III. *Of the Cleffs; of the Value or Quantity; of the Rhythm; and of Syncopation.*

Cleffs, what, and how placed.

170. THERE are three cleffs * in muſic; the F cleff 𝄢; the C cliff 𝄡; and the G cleff 𝄞.

The F cleff is placed on the fourth line (3 l) or on the third; and the line on which this cleff is placed gives the name of F to all the notes on that line.

Plate CCCLV. Fig. 7.1. Fig. 7.2.

The C cleff is placed on the fourth, the third, the ſecond, or the firſt line: and in theſe different poſitions all

* See *Cleff*.

(3 l) Our author has treated this part of his ſubject with ſomewhat leſs perſpicuity than uſual. He has neither deſcribed the ſtaffs or ſyſtems of lines on which the cleffs are placed, nor explained their relation to each other. We have therefore attempted to ſupply the deficiency.

Muſical ſounds, like language, are repreſented by written characters, by which their graveneſs or acuteneſs, their duration, and the other qualities intended to be aſſigned to them, are accurately diſtinguiſhed.

The characters which denote the graveneſs or acuteneſs, or, as it is termed, the *pitch* of ſounds, are intended to repreſent the ordinary limits of the human voice, in the exerciſe of which, or the employment of inſtruments of nearly the ſame compaſs with it, all practical muſic conſiſts.

From the loweſt diſtinct note, without ſtraining, of the maſculine voice, to the higheſt note generally produced by the female voice, there is an interval of three octaves, or twenty-two diatonic notes.

Theſe notes are repreſented by characters deſcribed alternately on eleven parallel lines, and the ſpaces between them, forming what we ſhall here term the *general ſyſtem.*

The characters repreſenting the notes are differently formed according to their duration, but with this we have at preſent no concern. We ſhall employ the ſimpleſt, a ſmall circle or ellipſe.

The whole extent of the human voice, then, if deſcribed upon the *general ſyſtem*, would be repreſented as at Plate CCCLV. fig. 1.

The maſculine voice, riſing from the loweſt note of the general ſyſtem, will, generally ſpeaking, reach the note on the central line; and an ordinary female voice will reach the ſame note, deſcending from the higheſt. Male voices more acute, and female voices graver than uſual, will conſequently execute this note with greater facility.

This central note, then, being producible by every ſpecies of voice, has been aſſumed as a fundamental or key note, by which all the others are regulated (art. 4.). And to it is aſſigned the name of C, by which, in the theory of harmony, (as we have ſeen), the fundamental ſound of the diatonic ſcale is diſtinguiſhed.

The other notes take their denominations accordingly. The note below it is B, that above it 'd', &c.; and to diſtinguiſh this central C from its octaves, it is called the *middle* or *tenor* C.

As no human voice can execute the whole twenty-two notes, the general ſyſtem is divided into portions of five lines, each portion repreſenting the compaſs of an ordinary voice; and different portions are made uſe of, according to the graveneſs or acuteneſs of different voices.

The five lines in this ſtate form what is called a *ſtaff.* Each ſtaff is ſubdivided into *lines* and *ſpaces*. *On* the lines, and in the ſpaces, the heads of the notes are placed. The lines and ſpaces are counted upwards, from the loweſt to the higheſt; the loweſt line is termed the *firſt line;* the ſpace between it and the *ſecond line* is denominated the *firſt ſpace*, and ſo on. Both lines and ſpaces have the common name of *degrees;* the ſtaff thus contains nine degrees, viz. five lines and four ſpaces.

To aſcertain what part of the general ſyſtem is formed by a *ſtaff*, one of the *cleffs* mentioned in the text is placed at the beginning of the ſtaff, on one or other of the lines of it.

The C or tenor cleff always denotes the line on which it is placed to be that which carries the tenor C. The G or treble cleff diſtinguiſhes the line carrying 'g', the perfect fifth *above* the tenor C. And the F or baſs cleff aſcertains the line which repreſents F the perfect fifth *below* the tenor C.

The figures of the cleffs, (which are characters gradually corrupted from the Gothic C, G, and F), and their places in the general ſyſtem, appear on Plate CCCLV. fig. 2.

By this diſpoſition of the cleffs, we ſee that the ſtaff, which includes the line bearing the treble cleff, is formed by the five higheſt lines of the general ſyſtem; and that the ſtaff which comprehends the baſs cleff conſiſts of the five loweſt.

The central line, which carries the tenor C, belongs neither to the treble nor the baſs ſtaves. But as that note frequently occurs in compoſition written on theſe ſtaves, a ſmall portion of the tenor line is occaſionally introduced below the treble cleff and above that of the baſs (fig. 3.).

As

all the notes on the ſame line with the cleff take the name of C.

Fig 7. 3.

The G cleff is placed on the ſecond or firſt line; and all the notes on the line of the cleff take the name of G.

Names of the notes to be inveſtigated from the poſition of the cleffs.

171. As the notes are placed on the lines, and in the ſpaces between the lines, the name of any note may be diſcovered from the poſition of the cleff. Thus, in the F cleff, the note on the loweſt line is G; the note on the ſpace between the two firſt lines A; the note on ſecond line B, &c.

Marks and power of ſharps, flats, and naturals.

172. A note before which there is a ſharp (marked thus ※) muſt be raiſed by a ſemitone; and if there be a flat (marked ♭) before it, it muſt be depreſſed by a ſemitone.

The natural (marked thus ♮) reſtores to its natural value a note which had been raiſed or depreſſed by a ſemitone.

Fig. 8.

173. When a ſharp or a flat is placed at the cleff, all the notes upon the line or ſpace on which this ſharp or flat is marked, are ſharp or flat. For inſtance, if in the cleff of G a ſharp be placed on the higheſt line, which is the place of '*f*', all the notes on that line will be '*f*※'— to reſtore them to their original value of '*f*' natural, a ♮ muſt be placed before them.

Fig 9.

In the ſame manner, if a flat be marked at the cleff, all the notes on the ſame line or ſpace with the flat will be flat; to reſtore them to their natural ſtate, a ♮ muſt be placed before them (3 M).

Bars and Times, what,

174. Every piece of muſic is divided into different equal

As notes ſtill more remote from the ſtaff in uſe are ſometimes introduced, ſmall portions of the lines to which theſe lines belong are employed in the ſame manner. Thus, if in writing in the baſs ſtaff we want the note properly placed on the loweſt line of the treble ſtaff, we draw two ſhort lines above the baſs ſtaff, one repreſenting the tenor line, and the other the loweſt line of the treble ſtaff, and on this laſt ſhort line we place the note in queſtion, (fig. 4.).

On the other hand, if, in writing on the treble ſtaff, we would employ a note properly belonging to the baſs ſtaff, we place it below the treble ſtaff, and inſert the requiſite ſhort lines, repreſenting the correſponding lines of the general ſyſtem (fig. 5.).

The occaſional ſhort lines thus employed are termed *leger lines.*

The ſame expedient is uſed to repreſent notes beyond the limits of the general ſyſtem. Thus, we write the F which is one degree lower than the loweſt G of the baſs ſtaff, on the ſpace below that G; the E immediately lower, or on a leger line below the baſs ſtaff, and ſo on. Notes in this poſition are termed *double;* thus, the F juſt mentioned is double F, or FF; the E, double E, or EE, &c.

Again, the '*a*' above the higheſt '*g*' of the treble ſtaff is placed on a leger line above that ſtaff. The '*b*' is placed on the ſpace above the leger line: The next note '*c*' is ſet on a ſecond leger line, and ſo on. Theſe high notes are, in compoſitions for ſome inſtruments, carried more than an octave above the general ſyſtem. Thoſe in the firſt octave are ſaid to be *in alt;* thoſe beyond it, to be *in altiſſimo.*

The tenor or C cleff is employed to form different intermediate ſtaves between the treble and baſs, according to the compaſs of the voice or inſtrument for which the ſtaff is wanted.

Compoſitions for the graveſt maſculine voices and inſtruments are written on the baſs cleff, and thoſe for female voices and inſtruments higheſt in tone, on the treble ſtaff *.

For maſculine voices next in depth to the baſs, and for the higher octave of the violoncello and baſſoon, a ſtaff, called the *tenor ſtaff*, is formed by adding to the tenor line the three higheſt lines of the baſs ſtaff and the loweſt line of the treble (fig. 6. 1.).

For the higheſt maſculine voices, which are called *counter tenor*, and for the tenor violin, a ſtaff is formed by the tenor line, the two higheſt lines of the baſs, and the two loweſt of the treble ſtaff (fig. 6. 2.).

For the graveſt female voices, which are called *mezzo ſoprano*, the tenor line and four loweſt lines of the treble form a ſtaff (fig. 6. 3.).

The relation of all the ſtaves to the general ſyſtem, and to each other, will appear from fig. 6.

The baſs cleff on the third line, the tenor cleff on the ſecond, and the treble cleff on the firſt, rarely occur, except in old French muſic.

The tenor cleff, and the ſtaves diſtinguiſhed by it, are now leſs frequently uſed than the treble and baſs cleffs. Thoſe who cultivate muſic only as an amuſement find it irkſome to learn ſo many modes of notation. The tenor ſtaves are accordingly baniſhed from compoſitions for keyed inſtruments. Secular compoſitions for voices are likewiſe now written in the treble and baſs ſtaves only; although in this there is ſome inaccuracy, as the tenor parts now written in the treble ſtaff, muſt often be ſung an octave below that in which they appear. The chief uſe of the tenor cleff is in choral muſic and compoſitions for the baſſoon and tenor violin; and its principal advantage, the facility of reading ancient muſic, which is almoſt excluſively written in this cleff, has ſeldom been deemed an inſufficient recompenſe for the labour of acquiring it.

(3 M) The diſpoſition of ſharps or flats at the cleff, which is termed the *ſignature*, depends upon the mode, or tone aſſumed in the compoſition as a fundamental or key note, and will be afterwards explained.

The ſharps or flats of the ſignature affect not only the notes placed on the ſame *degree* with themſelves, as mentioned in the text, but alſo all the notes of the ſame letter, in every octave throughout the movement.

The ſharps or flats of the ſignature determine the ſcale in which the movement is compoſed, and are therefore ſaid to be *eſſential;* thoſe which occur in the courſe of the piece on an occaſional change of the ſcale, are termed *accidental.*

* Compoſitions for *French horns* are written in the treble ſtaff, although the tone of the inſtrument be very grave; but this is becauſe the horn is borrowed from, and has the ſame natural intervals with the *Trumpet*, which is an acute inſtrument.

equal times, called *meaſures ;* and each meaſure is likewiſe divided into different times.

See *Time.*

There are properly two kinds of meaſures or modes of time ; the meaſure of two times, or common time, marked by the figure 2 at the beginning of the time (fig. 10.) ; and the meaſure of three times, or triple time, marked by the figure 3 placed in the ſame manner (fig. 11.).

The different meaſures are diſtinguiſhed by perpendicular lines (3 N), called *bars*.

In a meaſure, we diſtinguiſh between the *ſtrong* and the *weak* time : the *ſtrong* time is that which is *beat ;* the *weak*, that in which the hand or foot *is raiſed.* A meaſure conſiſting of four times ought to be conſidered as compounded of two meaſures, each conſiſting of two times : thus there are in this meaſure two *ſtrong* and two *weak* times. In general by the words *ſtrong* and *weak* even the parts of the ſame time are diſtinguiſhed ; thus, the firſt note of each time is conſidered as *ſtrong* and the others as *weak*.

The value of notes in duration. Fig. 12.

175. The longeſt of all notes is a *ſemibreve.* A *minim* is half its value ; that is to ſay, two minims are to be performed in the time occupied by one ſemibreve. A minim in the ſame manner is equivalent to two *crotchets*, the crotchet to two *quavers* (3 O).

Syncopation, what

See *Syncopation.*

176. A note which is divided into two parts by a *bar*, that is, which begins at the end of a meaſure, and terminates in the meaſure following, is called a *ſyncopated* note (3 P).

Value of a pointed note.

179. A note followed by a point or dot is increaſed half its value. Thus a *dotted* ſemibreve is equivalent to a ſemibreve and a minim, a dotted minim, to a minim and a crotchet, &c. (Fig. 17.) (3 Q).

CHAP.

(3 N) All the notes, therefore, contained between two bars conſtitute one meaſure ; although in common language the word bar is improperly uſed for meaſure.

(3 O) The notes, in their figure, conſiſt of a *head* and a *ſtem*, except the ſemibreve, which has a *head* only. The place of the note in the ſtaff is determined by the *head*, which muſt be placed *on* the line, or *in* the ſpace, aſſigned to the note. The *ſtem* may be turned either up or down.

The quaver is equivalent to two *ſemiquavers*, and the ſemiquaver to two *demi-ſemiquavers.* In modern muſic the demi-ſemiquaver is alſo ſubdivided.

The quaver and the notes of ſhorter duration may be grouped together, by two, three, or four, &c. and joined by as many black lines acroſs the ends of the ſtem as there are hooks in the ſingle note (fig. 12.). This arrangement is convenient in writing, and aſſiſts the eye in performance.

When quavers, or the ſhorter notes, are to be repeated in the ſame degree for a time equal to the duration of a longer note, the iterations are, by a ſort of muſical ſhort-hand, repreſented by writing the long note only, and placing over or under it, as many ſhort lines as the ſhort note has hooks (fig. 13.). And the repetition of a ſeries of ſhort notes is repreſented by merely writing for each repetition as many ſhort lines as there are hooks to the ſhort notes of which the ſeries is compoſed (fig. 14.).

(3 P) A note in the middle of a meaſure is alſo ſaid to be ſyncopated when it begins on a *ſtrong*, and ends on a *weak* part of the meaſure, (ſee fig. 15.) where D, C, and B are each of them ſyncopated.

A note which of itſelf occupies one, two, or more meaſures, is not ſaid to be ſyncopated, but *continued* or *protracted.* See fig. 16.

(3 Q) Notes have ſometimes in modern muſic a double dot after them, which makes them longer by three-fourths. Thus a minim twice dotted is equal to three crotchets and a half, or ſeven quavers, &c.

Our author, in this chapter, has omitted the explanation of *reſts*, and of the particular modifications of time.

Reſts are characters indicating the temporary ſuſpenſion of muſical ſounds. There are as many different reſts as there are notes. Thus the ſemibreve reſt indicates a pauſe of the duration of a ſemibreve ; the minim reſt, of a minim, &c. (fig. 18.).

The ſemibreve reſt alſo denotes the ſilence of one entire meaſure, in triple as well as common time. The ſilence of ſeveral meaſures is marked as in fig. 18. ; but where the ſilence exceeds three bars, the number is uſually marked over the reſts.

Common time is either of a ſemibreve, or of a minim to the meaſure.

Common time of a ſemibreve is indicated by the letter C at the cleff, fig. 1. of Plate CCCLVI. When it is meant to be ſomewhat quicker than uſual, a perpendicular line is drawn through the C, (fig. 2.).

Common time of a minim to the meaſure, which is called *half time*, is indicated by the fraction $\frac{2}{4}$, that is, two-fourths of a ſemibreve, or two crotchets equal to a minim, (fig. 3.).

In triple time the meaſure conſiſts of three minims, three crotchets or three quavers, ſix crotchets or ſix quavers, nine quavers or twelve quavers.

Triple time of three minims is marked at the cleff $\frac{3}{2}$, that is, three halves of a ſemibreve, (fig. 4.)

Triple time of three crotchets is indicated by the fraction $\frac{3}{4}$, (three-fourths of a ſemibreve) (fig. 5.) and that of three quavers by $\frac{3}{8}$ (three-eighths of a ſemibreve), (fig. 6.).

In the laſt three examples the meaſure is divided into three *times*, of which the firſt is *ſtrong*, and the two others weak.

The meaſure of ſix crotchets is marked $\frac{6}{4}$, (fig. 7.) ; and that of ſix quavers $\frac{6}{8}$, (fig. 8.). In both there are two times, of which the firſt is ſtrong, and the ſecond weak.

The meaſure of nine quavers is marked $\frac{9}{8}$, (fig. 9.) ; and is divided into one ſtrong and two weak times. That of twelve quavers is marked $\frac{12}{8}$, (fig. 10.) ; and is accented as if it were two meaſures of ſix quavers.

The meaſures of $\frac{9}{4}$ and $\frac{9}{16}$ rarely occur.

Three notes are often performed in the time of two of the ſame name, and are then termed *triplets*, (fig. 11.) where

Chap. IV. *Definition of the principal Chords.*

Perfect chords, what.

178. (3 R) The chord compoſed of a third, a fifth, and an octave, as C, E, G, C, is called a *perfect chord* (art. 32.).

If the third be major, as in C, E, G, C, the perfect chord is denominated *major:* if the third be minor, as in A, C, E, A, the perfect chord is minor. The perfect chord major conſtitutes the *major mode;* and the perfect chord minor, the *minor mode* (art. 31.).

Chord of the ſeventh, what, and how to be practiſed.

179. A chord compoſed of a third, a fifth, and a ſeventh, as G, B, D, F, or D, F, A, C, &c. is called a *chord of the ſeventh.* Such a chord is wholly compoſed of thirds in aſcending.

All chords of the ſeventh are practiſed in harmony, ſave that which might carry the third minor and the ſeventh major, as C E♭ G B; and that which might carry a falſe fifth and a ſeventh major, B D F A♯, (chap. xiv. Part I.).

Thoſe of different kinds.

180. As thirds are either major or minor, and as they may be differently arranged, it is clear that there are different kinds of chords of the ſeventh; there is even one, B D F A, which is compoſed of a third, a falſe fifth, and a ſeventh.

Of the greater ſixth, what.

181. A chord compoſed of a third, a fifth, and a ſixth, as F A C D, D F A B, is called a *chord of the greater ſixth.*

Plate CCCLVII.

Tonic, what, and its chords, how figured.

182. Every note which carries a perfect chord is called a *tonic;* and a perfect chord is marked by an 8, by a 3, or by a 5, which is written above the note; but frequently theſe numbers are ſuppreſſed. Thus in the example I. the two C's equally carry a perfect chord.

Dominant, what, and how figured.

183. Every note which carries a chord of the ſeventh is called a *dominant* (art. 102.); and this chord is marked by a 7 written above the note. Thus in the example II. D carries the chord D F A C, and G the chord G B D F.

It is neceſſary to remark, that among the chords of the ſeventh we do not reckon the chord of the ſeventh diminiſhed, which is only improperly called a *chord of the ſeventh;* and of which we ſhall ſay more below.

Sub-dominant what, and how figured.

184. Every note which carries the chord of the great ſixth, is called a *ſubdominant,* (art. 97. and 42.) and is marked with a 6. Thus in the example III. F carries the chord of F A C D. The ſixth ſhould always be major, (art. 97. and 109.).

Fundamental note, what.

See *Fundamental.*

185. In every chord, whether perfect, or a chord of the ſeventh, or of the great ſixth, the note which carries this chord, and which is the flatteſt or loweſt, is called the *fundamental note.* Thus C in the example I. D and C in the example II. and F in the example III. are fundamental notes.

Diſſonance of a chord, what.

186. In every chord of the ſeventh, and of the great ſixth, the note which forms the ſeventh or ſixth above the fundamental, that is to ſay, the higheſt note of the chord, is called a *diſſonance.* Thus in the chords of the ſeventh G B D F, D F A C, F and C are the diſſonances, viz. F with relation to G in the firſt chord, and C with relation to D in the ſecond. In the chord of the great ſixth F A C D, D is the diſſonance (art. 120.); but that D is only, properly ſpeaking, a diſſonance with relation to C from which it is a *ſecond,* and not with reſpect to F from which it is a *ſixth major* (art. 17. and 18.).

Tonic and ſimple dominant, what.

187. When a chord of the ſeventh is compoſed of a third major followed by two thirds minor, the fundamental note of this chord is called the *tonic dominant.* In every other chord of the ſeventh the fundamental is called the *ſimple dominant* (art. 102.). Thus in the chord G B D F, the fundamental G is the *tonic dominant;* but in the other chords of the ſeventh, as C E G B, D F A C, &c. the fundamentals C and D are *ſimple dominants.*

Major chords, how rendered minor, and *vice verſa.*

188. In every chord, whether perfect, or of the ſeventh, or of the ſixth, if it is meant that the third above the fundamental note ſhould be major though it be naturally minor, a ſharp muſt be placed above the fundamental

---

where the groups of quavers in the ſecond meaſure are triplets, and each triplet occupies the time of two quavers only. Triplets alſo occur in triple time, fig. 12.

Certain other characters will be with propriety explained here.

The *Pauſe* ſignifies that the regular time is to be delayed, and the note marked with the pauſe protracted. See fig. 13. where the pauſe is on the laſt note of the ſecond meaſure.

The *Repeat,* a character reſembling an S, denotes, that the following part of the movement muſt be repeated. See fig. 14.

The *Direct* (fig. 15.) is placed at the end of the ſtaff, to ſhew upon what degree the firſt note of the following ſtaff is placed.

When the inner ſides of two bars are dotted, the meaſures between them are to be repeated (fig. 16.). The word *bis* is ſometimes placed over ſuch paſſages.

The double bar diſtinguiſhes the end of a movement or ſtrain, (fig. 17.). If the double bar be dotted on one or both ſides, the ſtrain is to be repeated, (fig. 18.). The double bar does not affect the time; ſo that when the ſtrain terminates before the end of a meaſure, as is often the caſe, the double bar only marks the concluſion of the ſtrain, but the time is kept exactly as if it were not inſerted. See fig. 19.

The graces of exertion and expreſſion, ſuch as the appogiature, the ſhake, the ſlur, the creſcendo, the diminuendo, &c. are not neceſſary to the conſideration of the theory of muſic or principles of compoſition, but belong to the performer only. See Shake, &c.

(3 R) In this part of our ſubject, we ſhall, in mentioning the harmonies of the chords, make uſe of the capital letters only, as the general names of the notes, without diſtinguiſhing octaves by minuſcular or Italic letters. The harmonics may be arranged in different octaves. Their different poſitions will be moſt eaſily ſeen and beſt underſtood from the examples in the plates.

fundamental note. For example, if we would mark the perfect major chord D F※ A D, as the third F above D is naturally minor, we place above D a ſharp, as in Example IV. In the ſame manner, the chord of the ſeventh D F※ A C, and the chord of the great ſixth D F※ A B, is marked with a ※ above D, and above the ※ a 7 or a 6 (ſee V. and VI.).

On the contrary, when the third is naturally major, and if we would render it minor, we place above the fundamental note a ♭. Thus the example VII. VIII. IX. ſhow the chords G B♭ D G G B♭ D F, G B♭ D E (3 s).

Chap. V. *Of the Fundamental Baſs.*

Fundamental baſs how formed.

189. Let a modulation be invented at pleaſure; and under this modulation let there be ſet a baſs compoſed of different notes, of which ſome may carry a perfect chord, others that of the ſeventh, and others that of the great ſixth, in ſuch a manner that each note of the modulation which anſwers to each of the baſs, may be one of thoſe which enters into the chord of that note in the baſs; this baſs being compoſed according to the rules which ſhall be immediately given, will be the *fundamental baſs* of the modulation propoſed. See Part I. where *the nature and principles of the fundamental baſs* are explained.

See *Fundamental baſs.*

Thus (Exam. XVI.) it will be found that this modulation, C D E F G A B C, has or may admit for its fundamental baſs, C $\overset{7}{\text{G}}$ C $\overset{6}{\text{F}}$ C $\overset{7}{\text{D}}$ $\overset{7}{\text{G}}$ C.

In reality, the firſt note C in the upper part is found in the chord of the firſt note C in the baſs, which chord is G E G C; the ſecond note D in the treble is found in the chord G B D G; which is the chord of the ſecond note in the baſs, &c. and the baſs is compoſed only of notes which carry a perfect chord, or that of the ſeventh, or that of the great ſixth. Moreover it is formed according to the rules which we are now about to give.

Chap. VI. *Rules for the Fundamental Baſs.*

Rules for the formation of the baſs.

190. All the notes of the fundamental baſs being only capable of carrying a perfect chord, or the chord of the ſeventh, or that of the great ſixth, are either tonics, or dominants, or ſub-dominants; and the dominants may be either ſimple or tonic.

The fundamental baſs ought always to begin with a tonic, as much as it is practicable. And now follow the rules for all the ſucceeding chords; rules which are evidently derived from the principles eſtabliſhed in the *Firſt Part* of this treatiſe. To be convinced of this we ſhall find it only neceſſary to review the articles 34, 91, 122, 124, 126, 127.

Rule I.

191. In every chord of the tonic, or of the tonic dominant, it is neceſſary that at leaſt one of the notes which form that chord ſhould be found in the chord that precedes it.

Rule II.

192. In every chord of the ſimple dominant, it is neceſſary that the note which conſtitutes the ſeventh, or diſſonance, ſhould likewiſe be found in the preceding chord.

Rule III.

193. In every chord of the ſub-dominant, at leaſt one of its conſonances muſt be found in the preceding chord. Thus, in the chord of the ſub-dominant F A C D, it is neceſſary that F, A, or C, which are the conſonances

---

(3 s) We may only add, that there is no occaſion for marking theſe ſharps or flats when they are originally placed at the cleff. For inſtance, if the ſharp be upon F which indicates the key of G (ſee Exam. X.) it is ſufficient to write D, without a ſharp, to mark the perfect chord major of D, D F※ A D. In the ſame manner, in the Example XI. where the flat is at the cleff upon B, which denotes the key of F, it is ſufficient to write G, to mark the perfect chord minor of G B♭ D G.

But where there is a ſharp or a flat at the cleff, if we would render the chord minor which is major, or *vice verſa*, we muſt place above the fundamental note a ♮ or natural. Thus the Example XII. marks the minor chord D F A D, and Example XIII. the major chord G B D G.—Sometimes, in lieu of a natural, a flat is uſed to ſignify the minor chord, and a ſharp to ſignify the major. Thus Example XIV. in the key of G, marks the minor chord D F A D, and Example XV. in F, the major chord G B D G.

When in a chord of the great ſixth, the diſſonance, that is to ſay, the ſixth, ought to be ſharp, and when the ſharp is not found at the cleff, we write before or after the 6 a ※; and if this ſixth ſhould be flat according to the cleff, we write a ♮.

In the ſame manner, if in a chord of the ſeventh of the tonic dominant, the diſſonance, that is to ſay, the ſeventh, ought to be flat or natural, we write by the ſide of the ſeventh a ♭ or a ♮. Many muſicians, when a ſeventh from the ſimple dominant ought to be altered by a ſharp or a natural, have likewiſe written by the ſide of the ſeventh a ※ or a ♮; but M. Rameau ſuppreſſes theſe characters. The reaſon ſhall be given below, when we ſpeak of chords by ſuppoſition.

If there be one ſharp at the cleff, and if we would mark the chord G B D F♮ or the chord A C E F♮, we ought to place before the ſeventh or the ſixth a ♮ or a ♭.

In the ſame manner, if there be one flat at the cleff, and if we would mark the chord C E G B♮, we ought to place before the ſeventh a ※ or a ♮; and ſo of the reſt.

All theſe intricate combinations of figuring ſhew the ſuperior convenience of the modern method of writing the notes themſelves inſtead of the figures, which has the farther advantage of exhibiting the proper arrangement of the chord, ſee Example II.

conſonances of the chord, ſhould be found in the chord preceding. The diſſonance D may either be found in it or not.

Rule IV.

194. Every ſimple or tonic dominant ought to deſcend by a fifth. In the firſt caſe, that is to ſay, when the dominant is ſimple, the note which follows can only be a dominant; in the ſecond it may be any one; or, in other words, it may either be a tonic, a tonic dominant, a ſimple dominant, or a ſub-dominant. It is neceſſary, however, that the conditions preſcribed in the ſecond rule ſhould be obſerved, if it be a ſimple dominant.

This laſt reflection is neceſſary, as will preſently be ſeen. For, let us aſſume the ſucceſſion of the two chords AC♯EG, DFAC (ſee Exam. xvii.), this ſucceſſion is by no means legitimate, though in it the firſt dominant deſcends by a fifth; becauſe the C which forms the diſſonance in the ſecond chord, and which belongs to a ſimple dominant, is not in the preceding chord. But the ſucceſſion will be admiſſible, if, without meddling with the ſecond chord, we take away the ſharp carried by the C in the firſt; or if, without meddling with the firſt chord, we render C and F ſharp in the ſecond (3 T); or, if we ſimply render the D of the ſecond chord a tonic dominant, in cauſing it to carry F♯ inſtead of F♮ (119. and 122.).

It is likewiſe by the ſame rule that we ought to reject the ſucceſſion of the two following chords,

D F A C, G B D F♯;

(ſee Exam. xviii.).

Rule V.

195. Every ſub-dominant ought to riſe by a fifth; and the note which follows it may, at pleaſure, be either a tonic, a tonic dominant, or a ſub-dominant.

Remark.

Other rules ſubſtituted.

Of the five fundamental rules which have now been given, inſtead of the three firſt, one may ſubſtitute the three following, which are conſequences from them.

Rule I.

If a note of the fundamental baſs be a tonic, and riſe by a fifth or a third to another note, that ſecond note may be either a *tonic* (34. & 91.), ſee Examples xix. and xx. (3 U); a *tonic dominant* (124.), ſee xxi. and xxii.; or a *ſub-dominant* (124.), ſee xxiii. and xxiv; or, to expreſs the rule more ſimply, that ſecond note may be any one, except a *ſimple dominant*.

Rule II.

If a note of the fundamental baſs be a tonic, and deſcend by a fifth or a third upon another note, this ſecond note may be either a tonic (34. & 91.) ſee Exam. xxv. and xxvi.; or a tonic dominant, or a ſimple dominant, yet in ſuch a manner that the rule of art. 192. may be obſerved (124.), ſee xxvii. xxviii. xxix. and xxx.; or a ſub-dominant (124.), ſee xxxi. and xxxii.

The ſucceſſion of the baſs C E♭ G C, F A C E, is excluded by art. 192.

Rule III.

If a note in the fundamental baſs be a tonic, and riſe by a ſecond to another note, that note ought to be a tonic dominant, or a ſimple dominant (101. & 102.). See xxxiv. and xxxv. (3 X).

We muſt here advertiſe our readers, that the examples xxxvi. xxxvii. xxxviii. xxxix. belong to the fourth rule above, art. 194.; and the examples xl. xli. xlii. to the fifth rule above, art. 195. See the articles 34, 35, 121, 123, 124.

Remark I.

Perfect and imperfect cadences, what, and how employed.

196. The tranſition from a tonic dominant to a tonic is called an *abſolute repoſe*, or a *perfect cadence* (73.); and the tranſition from a ſub-dominant to a tonic is called an *imperfect* or *irregular cadence* (73.); the tonic falls upon the accented part of the bar. See xliii. xliv. xlv. xlvi.

Remark II.

Syncopation only admiſſible in the fundamental baſs by licenſe.

197. We muſt avoid, as much as we can, ſyncopations in the fundamental baſs; that the ear may accurately diſtinguiſh the primarily accented part of a meaſure, by means of a harmony different from that which it had before perceived in the laſt unaccented part of the preceding meaſure. Nevertheleſs ſyncopation may be ſometimes admitted in the fundamental baſs, but it is by a licenſe (3 Y).

(3 T) In this chord it is neceſſary that the C and F ſhould be ſharp at the ſame time; for the chord D F A C♯, in which C would be ſharp without the F, is excluded by art. 179.

(3 U) When the baſs riſes or deſcends from one tonic to another by the interval of a third, the mode is commonly changed; that is to ſay, from a major it becomes a minor. For inſtance, if we aſcend from the tonic C to the tonic E, the major mode of C, C E G C, will be changed into the minor mode of E, E G B E. We muſt never aſcend from one tonic to another, when there is no ſound common to both their modes: for example, we cannot riſe from the mode of C, C E G C, to the minor mode of E♭, E♭ G♭ B♭ E♭ (91.).

(3 X) Thus all the intervals, viz. the third, the fifth, and ſecond, may be admitted in the fundamental baſs, except that of a ſecond in deſcending. The rules now given for the fundamental baſs, are not, however, without exception, as approved compoſitions in muſic will certainly diſcover; but theſe exceptions being in reality licences, and for the moſt part in oppoſition to the great principle of connection, which preſcribes that there ſhould be at leaſt one note in common between a preceding and a ſubſequent chord, it does not ſeem neceſſary to enter into a minute detail of theſe licences in an elementary work, where the firſt and moſt eſſential rules of the art alone ought to be expected.

(3 Y) There are notes which may be found ſeveral times in the fundamental baſs in ſucceſſion with a different

CHAP. VII. *Of the Rules which ought to be obſerved in the Treble with relation to the Fundamental Baſs.*

Definition of treble.

198. THE treble is nothing elſe but a modulation above the fundamental baſs, and whoſe notes are found in the chords of that baſs which correſponds with it (189.). Thus in Ex. XVI. the ſcale C D E F G A B C, is a treble with reſpect to the fundamental baſs C G C F C D G C.

One note in the treble or baſs may anſwer to its correſpondent parts, and why.

199. We are about to give the rules for the treble; but firſt we think it neceſſary to make the two following remarks.

1. It is obvious, that many notes of the treble may anſwer to one and the ſame note in the fundamental baſs, when theſe notes belong to the chord of the ſame note in the fundamental baſs. For example, this modulation C E G E C, may have for its fundamental baſs the note C alone, becauſe the chord of that note comprehends the ſounds C, E, G, which are found in the treble.

2. In like manner, a ſingle note in the treble may, for the ſame reaſon, anſwer to ſeveral notes in the baſs. For inſtance, G alone may anſwer to theſe three notes in the baſs, C G C (3 Z).

RULE I. *For the TREBLE.*

200. If the note which forms the ſeventh in a chord of the *ſimple dominant*, is found in the treble, the note which precedes it muſt be the very ſame. This is what we call a *diſcord prepared* (122.). For inſtance, let us ſuppoſe that the note of the fundamental baſs ſhall be D, bearing the chord of the ſimple dominant D F A C; and that this C, which (art. 18. and 118.) is the diſſonance, ſhould be found in the treble; it is neceſſary that the note which goes before it in the treble ſhould likewiſe be a C.

201. According to the rules which we have given for the fundamental baſs, C will always be found in the chord of that note in the fundamental baſs which precedes the ſimple dominant D. See XLVIII. XLIX. L. In the firſt example the diſſonance is C, in the ſecond G, and in the third E: and theſe notes are already in the preceding chord (4 A).

RULE II.

202. If a note of the fundamental baſs be a tonic dominant, or a ſimple dominant, and if the diſſonance be found in the treble, this diſſonance in the ſame treble ought to deſcend diatonically. But if the note of the baſs be a ſub-dominant, it ought to riſe diatonically. This diſſonance, which riſes or deſcends diatonically, is what we have called a *diſſonance ſaved* or *reſolved* (129, 130.). See LII. LIII. LIV.

203. According to the rules for the fundamental baſs which we have given, the note upon which the diſſonance

---

ferent harmony. For inſtance, the tonic C, after having carried the chord C E G C, may be followed by another C which carries the chord of the ſeventh, provided that this chord be the chord of the tonic dominant C E G B♭. In the ſame manner, the tonic C may be followed by the ſame tonic C, which may be rendered a *ſub-dominant*, by cauſing it to carry the chord C E G A.

A dominant, whether tonic or ſimple, ſometimes deſcends or riſes to another by the interval of a tritone or falſe fifth. For example, the dominant F carrying the chord F A C E, may be followed by another dominant B carrying the chord B D F A. This is a licence in which the muſician indulges himſelf, that he may not be obliged to depart from the ſcale in which he is; for inſtance, from the ſcale of C to which F and B belong. If one ſhould deſcend from F to B♭ by the interval of a juſt fifth, he would then depart from that ſcale, becauſe B♭ is no part of it.

(3 Z) There are often in the treble ſeveral notes which may, if we chooſe, carry no chord, and be regarded merely as notes of paſſage, ſerving only to connect between themſelves the notes that do carry chords, and to form a more agreeable modulation. Theſe notes of paſſage are commonly quavers. See Example XLVII. (Plate CCCLVIII). in which this modulation C D E F G, may be regarded as equivalent to this other, C E G, as D and F are no more than notes of paſſage. So that the baſs of this modulation may be ſimply C G.

When the notes are of equal duration, and arranged in a diatonic order, the notes which are accented ought each of them to carry chords. Thoſe which are unaccented, are mere notes of paſſage. Sometimes, however, the unaccented note may be made to carry harmony; but the duration of this note is then commonly increaſed by a point placed after it, which proportionably diminiſhes the continuance of the accented note, and makes it paſs more ſwiftly.

When the notes do not move diatonically, they ought generally all of them to enter into the chord which is placed in the lower part correſpondent with theſe notes.

(4 A) There is, however, one caſe in which the ſeventh of a ſimple dominant may be found in a modulation without being prepared. It is when, having already employed that dominant in the fundamental baſs, its ſeventh is afterwards heard in the modulation, while the dominant is ſtill retained. For inſtance, let us imagine this modulation,

C | D C B C | D;

and this fundamental baſs, C | $\overset{7}{\text{D}}$ $\overset{7}{\text{G}}$C | G;

(ſee example LI.); the $\overset{7}{\text{D}}$ of the fundamental baſs anſwers to the two notes D C of the treble. The diſſonance C has no need of preparation, becauſe the note $\overset{7}{\text{D}}$ of the fundamental baſs having already been employed for the D which precedes C, the diſſonance C is afterwards preſented, below which the chord D may be preſerved, or D F A C.

ance ought to deſcend or riſe will always be found in the ſubſequent chord (4 B).

Chap. VIII. *Of the Continued Baſs and its Rules.*

‡ See Continued Baſs.

Continued baſs, what.

204. The *continued*‡ baſs, is a fundamental baſs whoſe chords are *inverted.* We invert a chord when we change the order of the notes which compoſe it. For example, if, inſtead of the chord G B D F, we ſhould ſay B D F G or D F G B, &c. the chord is inverted.

Chord inverted, how.

The ways in which a Perfect Chord *may be* Inverted.

205. The perfect chord C E G C may be inverted in two different ways.

1. E G C E, which we call a chord of the *ſixth,* compoſed of a third, a ſixth, and an octave; and in this caſe the baſs note E is marked with a 6. (See lvi.).

2. G C E G, which we call a *chord of the ſixth and fourth,* compoſed of a fourth, a ſixth, and an octave; and it is marked with a $\genfrac{}{}{0pt}{}{6}{4}$. (See lvii.).

The perfect minor chord is inverted in the ſame manner.

The ways in which the Chord *of the* Seventh *may be* Inverted.

206. In the chord of the tonic dominant, as G B D F, the third major B above the fundamental note G is called a *ſenſible note* (77.); and the inverted chord B D F G compoſed of a third, a falſe fifth and a ſixth, is called the *chord of the falſe fifth,* and is marked as in examples lviii. and lix.

The chord D F G B, compoſed of a third, a fourth, and a ſixth, is called the *chord of the ſenſible ſixth,* and marked as in Example lx. (4 C). In this chord, the third is minor, and the ſixth major.

The chord F G B D, compoſed of a ſecond, a tritone, and a ſixth, is called the *chord of the tritone,* and is marked as in Example lxi. (4 D).

207. In the chord of the ſimple dominant D F A C, we find,

1. F A C D, a chord of the great ſixth, which is compoſed of a third, a fifth, and a ſixth, and which is figured with a $\genfrac{}{}{0pt}{}{6}{5}$. See lxii. (4 E).

2. A C D F, a chord of the leſſer ſixth, which is figured with a 6. See lxiii. (4 F).

3. C D F A, a chord of the ſecond, compoſed of a ſecond, a fourth, and a ſixth, and which is marked with a 2. See lxiv. (4 G).

The ways in which the Chord *of the ſub-*Dominant *may be Inverted.*

208. The chord of the ſub-dominant, as F A C D, may be inverted in three different manners; but the method of inverting it which is moſt in practice is the chord of the leſſer ſixth A C D F (lxiii.), and the chord of the ſeventh D F A C. See lxv.

Rules for the Continued Bass.

209. The continued baſs is a fundamental baſs, whoſe chords are only inverted in order to render it more in the taſte of ſinging, and ſuitable to the voice. See lxvi. in which the fundamental baſs which in itſelf is monotonic and little ſuited for ſinging, C G C G C G C, produces, by inverting its chords, this continued baſs highly proper to be ſung, C B C D E F E, &c. (4 H).

The continued baſs then is properly a treble with reſpect to the fundamental baſs. Its rules immediately follow, which are properly thoſe already given for the treble.

Rule I.

210. Every note which carries the chord of the falſe fifth,

(4 B) When the treble ſyncopates in deſcending diatonically, it is common enough to make the ſecond part of the ſyncope carry a diſcord, and the firſt a concord. See Example lv. where the firſt part of the ſyncopated note G, is in concord with the notes C E G C, which anſwers to it in the fundamental baſs, and where the ſecond part is a diſſonance in the ſubſequent chord A C E G. In the ſame manner, the firſt part of the ſyncopated note F is in concord with the notes D F A C, which anſwer to it; and the ſecond part is a diſſonance in the ſubſequent chord G B D F, which anſwer to it, &c.

(4 C) This chord is called by Engliſh muſicians, the chord of the *third* and *fourth,* and generally figured $\genfrac{}{}{0pt}{}{4}{3}$.

(4 D) This chord is in England called the chord of the ſecond and fourth, and is figured $\genfrac{}{}{0pt}{}{4}{2}$.

(4 E) We are obliged to mark likewiſe, in the continued baſs, the chord of the ſub-dominant with a $\genfrac{}{}{0pt}{}{6}{5}$ which in the fundamental baſs is figured with a 6 alone; and this to diſtinguiſh it from the chords of the ſixth and of the leſſer ſixth. (See examples lvi. and lxiii.). The chord of the great ſixth in the fundamental baſs carries always the ſixth major, whereas in the continued baſs it may carry the ſixth minor. For inſtance, the chord of the ſeventh C E G B, gives the chord of the great ſixth E G B C, thus improperly called, ſince the ſixth from E to C is minor.

(4 F) M. Rameau has juſtly obſerved, that we ought rather to figure this leſſer ſixth with a $\genfrac{}{}{0pt}{}{3}{4}$, to diſtinguiſh it from the ſenſible ſixth which ariſes from the chord of the tonic dominant, and from the ſixth which ariſes from the perfect chord. In the mean time he figures in his works with a 6 alone, the leſſer ſixths which do not ariſe from the tonic dominant; that is to ſay, he figures them as thoſe which ariſe from the perfect chord; and we have followed him in that notation, though we thought with him, that it would be better to mark this chord by a particular figure.

(4 G) The chord of the ſeventh B D F A gives, when inverted, the chord F A B D, compoſed of a third, a tritone, and a ſixth. The chord is commonly marked with a 6, as if the tritone were a juſt fourth. It is his buſineſs who performs the accompaniment, to know whether the fourth above F be a tritone or a fourth redundant.

One may figure this chord thus, $\genfrac{}{}{0pt}{}{4*}{3}$.

(4 H) The continued baſs is proportionably adapted to ſinging, as the ſounds which form it more ſcrupulouſly obſerve

fifth, and which of conſequence muſt be what we have called a *ſenſible note*, ought (77.) to riſe diatonically upon the note which follows it. Thus in example LXIV. the note B, carrying the chord of the falſe fifth, riſes diatonically upon C (4 I).

Rule II.

211. Every note carrying the chord of the tritone ſhould deſcend diatonically upon the ſubſequent note. Thus in the ſame example LXVI. F, which carries the chord of the tritone figured with a 4+, deſcends diatonically upon E (art. 202.).

Rule III.

212. The chord of the ſecond is commonly put in practice upon notes which are ſyncopated in deſcending, becauſe theſe notes are diſſonances which ought to be prepared and reſolved (200. 302.). See the example LXVII. where the ſecond C, which is ſyncopated, and which deſcends afterwards upon B, carries the chord of the ſecond (4 K).

Chap. IX. *Of ſome Licenſes aſſumed in the Fundamental Baſs.*

§ 1. *Of Broken and Interrupted Cadences.*

Broken cadence, how executed.

213. The broken cadence is executed by means of a dominant which riſes diatonically upon another, or upon a tonic by a licenſe. See, in the example LXXIV. G A, (132. and 134.).

Interrupted cadence, how formed.

214. The interrupted cadence is formed by a dominant,

---

obſerve the diatonic order, becauſe this order is the moſt agreeable of all. We muſt therefore endeavour to preſerve it as much as poſſible. It is for this reaſon that the continued baſs in Example LXV. is much more in the taſte of ſinging, and more agreeable, than the fundamental baſs which anſwers to it.

(4 I) The continued baſs being a kind of treble with relation to the fundamental baſs, it ought to obſerve the ſame rules with reſpect to that baſs as the treble. Thus a note, for inſtance D, carrying a chord of the ſeventh D F A C, to which the chord of the ſub-dominant F A C D correſponds in the fundamental baſs, ought to riſe diatonically upon E, (art. 129. N° 1. and art. 202.).

(4 K) When there is a *repoſe* in the treble, the note of the continued baſs ought to be the ſame with that of the fundamental baſs, (ſee Example LXVIII.). In the cloſes which are found in the treble at D and C (meaſures ſecond and fourth), the notes in the fundamental and continued baſs are the ſame, viz. G for the firſt cadence, and C for the ſecond. This rule ought above all to be obſerved in cadences which terminate a piece or a modulation.

It is neceſſary, as much as poſſible, to prevent coincidences of the ſame notes in the treble and continued baſs, unleſs the motion of the continued baſs ſhould be contrary to that of the treble. For example, in the firſt note of the ſecond meaſure in Example LXIX. D is found at the ſame time in the continued baſs and in the treble; but the treble riſes from C to D, and from D to E, whilſt the baſs deſcends from E to D, and from D to C.

Two octaves, or two fifths, in ſucceſſion, muſt likewiſe be avoided. For inſtance, in the treble ſounds G E, the baſs muſt be prevented from ſounding G E, C A, or D B; becauſe in the firſt caſe there are two octaves in ſucceſſion, E againſt E, and G againſt G; and becauſe in the ſecond caſe there are two fifths in ſucceſſion, C againſt E, and A againſt G, or D againſt G, and B againſt E. This rule, as well as the preceding, is founded upon this principle, that the continued baſs ought not to be a copy of the treble, but to form a different melody.

Every time that ſeveral notes of the continued baſs anſwer to one note alone of the fundamental, the compoſer ſatisfies himſelf with figuring the firſt of them. Nay he does not even figure it if it be a tonic; and he draws above the others a line, continued from the note upon which the chord is formed. See Example LXX. (Plate CCCLIX.) where the fundamental baſs C gives the continued baſs C E G E; the two E's ought in this baſs to carry the chord 6, and G the chord $^{6}_{4}$: but as theſe chords are comprehended in the perfect chord C E G C, which is the firſt of the continued baſs, we place nothing above C, only we draw a line over C E G E.

In like manner, in the ſecond meaſure of the ſame example, the notes F and D of the continued baſs, ariſing from the note G alone of the fundamental baſs which carries the chord G B D F, we think it ſufficient to figure F only, and to draw a line above F and D becauſe the ſame harmony is uſed with both.

It ſhould be remarked, that this F ought naturally to deſcend to E; but this note is conſidered as ſubſiſting ſo long as the chord ſubſiſts; and when the chord changes, we ought neceſſarily to find the E, as may be ſeen by that example.

In general, whilſt the ſame chord ſubſiſts in paſſing through different notes, the chord is reckoned the ſame as if the firſt note of the chord had ſubſiſted; in ſuch a manner, that, if the firſt note of the chord is, for inſtance, the ſenſible note, we ought to find the tonic when the chord changes. See Example LXXI. where this continued baſs, C B D B G C, is reckoned the ſame with this, C, B C. (Example LXXII.).

If a ſingle note of the continued baſs anſwers to ſeveral notes of the fundamental baſs, it is figured with the different chords which agree to it. For example, the note G in a continued baſs may anſwer to this fundamental baſs C G C, (ſee example LXXIII.); in this caſe, we may regard the note G as divided into three parts, of which the firſt carries the chord $^{6}_{4}$, the ſecond the chord 7, and the third the chord $^{6}_{4}$.

We ſhall repeat here, with reſpect to the rules of the continued baſs, what we have formerly ſaid concerning the rules of the fundamental baſs in the note upon the third rule, art. 193. The rules of the continued baſs have exceptions, which practice and the peruſal of good authors will teach. There are likewiſe ſeveral other rules which might require a conſiderable detail, and which will be found in the *Treatiſe of Harmony*, by M. Rameau, and minant which deſcends by a third upon another (136.). See, in the example LXXV. G E (4 L).

Theſe cadences ought to be permitted but rarely and with precaution.

2. *Of* SUPPOSITION.

Chord by ſuppoſition what.

215. When a dominant is preceded by a tonic in the fundamental baſs, we add ſometimes, in the continued baſs to the chord of that dominant, a new note which is a third or a fifth below; and the chord which reſults from it in this continued baſs is called *a chord by ſuppoſition.*

See *Suppoſition.*

For example, let us ſuppoſe, that in the fundamental baſs we have a dominant G carrying the chord of the ſeventh G B D F; let us add to this chord the note C, which is a fifth below this dominant, and we ſhall have the total chord C G B D F, or C D F G, which is called *a chord by ſuppoſition* (4 M).

Of the different kinds of Chords by Suppoſition.

216. Chords by ſuppoſition are of different kinds. For inſtance, the chord of the tonic dominant G B D F gives,

These different chords what, and how figured.

1. By adding the fifth C, the chord C G B D F, called *a chord of the ſeventh redundant*, and compoſed of a fifth, ſeventh, ninth, and eleventh. It is figured with a ※7; ſee LXXVI. (4 N). This chord is not practiſed but upon the tonic. They ſometimes leave out the ſenſible note, for reaſons which we ſhall give in the note (4 O), upon the art. 219; it is then reduced to C F G D, and marked with ${}^{5}_{4}$ or ${}^{5}_{2}$.

2. By adding the third E, we ſhall have the chord E G B D F, called *a chord of the ninth*, and compoſed of a third, fifth, ſeventh, and ninth. And it is figured with a 9. This third may be added to every third of the dominant. See LXXVII.

3. If

---

and elſewhere. Theſe rules, which are proper for a complete diſſertation, did not appear indiſpenſably neceſſary in an *elementary eſſay on muſic*, ſuch as the preſent. The books which we have quoted at the end of our *preliminary diſcourſe* will more particularly inſtruct the reader concerning this practical detail.

(4 L) One may ſometimes, but very rarely, cauſe ſeveral tonics in ſucceſſion to follow one another in aſcending or deſcending diatonically, as C E G C, D F A D, B♭ D F B♭; but, beſides that this ſucceſſion is harſh, it is neceſſary, in order to render it practicable, that the fifth below the firſt tonic ſhould be found in the chord of the tonic following, as here F, a fifth below the firſt tonic C, is found in the chord D F A D, and in the chord B♭ D F B♭ (37. and note T).

(4 M) Though ſuppoſition be a kind of licenſe, yet it is in ſome meaſure founded on the experiment related in the note (S), where you may ſee that every principal or fundamental ſound cauſes its twelfth and ſeventeenth major in deſcending to vibrate, whilſt the twelfth and the ſeventeenth major aſcending reſound: which ſeems to authorize us in certain caſes to join with the fundamental harmony this twelfth and ſeventeenth in deſcending; or, which is the ſame thing, the fifth or the third beneath the fundamental ſound.

Even without having recourſe to this experiment, we may remark, that the note added beneath the fundamental ſound, cauſes that very fundamental ſound to be heard. For inſtance, C added beneath G, cauſes G to reſound. Thus G is found in ſome meaſure to be implied at C.

If the third added beneath the fundamental ſound be minor, for example, if to the chord G B D F, we add the third E, the ſuppoſition is then no longer founded on the experiment, which only gives the ſeventeenth major, or, what is the ſame thing, the third major beneath the fundamental ſound. In this caſe the addition of the third minor muſt be conſidered as an extenſion of the rule, which in reality has no foundation in the chords emitted by a ſonorous body, but is authorized by the ſanction of the ear and by practical experiment.

(4 N) Many muſicians figure this chord with a ※${}^{7}_{2}$: M. Rameau ſuppreſſes this 2, and merely marks it to be the ſeventh redundant by a 7※ or ※7. But it may be ſaid, how ſhall we diſtinguiſh this chord from the ſeventh major, which, as it would ſeem, ought to be marked with a 7※? M. Rameau anſwers, that there is no danger of miſtake, becauſe in the ſeventh major, as the ſeventh ought to be prepared, it is found in the preceding chord; and thus the ſharp ſubſiſting already in the preceding chord, it would be uſeleſs to repeat it. Thus $\overset{\overset{7}{\text{※}}}{D}$ G, according to M. Rameau, would indicate D F※ A C, G B D F※. If we would change F※ of the ſecond chord into F♮, it would then be neceſſary to write $\overset{\overset{7}{\text{※}7♮}}{D}$ G. In notes ſuch as C, whoſe natural ſeventh is major, the figure 7 preceded or followed by a ſharp will ſufficiently ſerve to diſtinguiſh the chord of the ſeventh redundant C G B D F, from the ſimple chord of the ſeventh C E G B, which is marked with a 7 alone. All this appears juſt and well founded.

(4 O) Suppoſition introduces into a chord diſſonances which were not in it before. For inſtance, if to the chord E G B D, we ſhould add the note of ſuppoſition C deſcending by a third, it is plain that, beſides the diſſonance between E and D which was in the original chord, we have two new diſſonances, C B, and C D; that is to ſay, the ſeventh and the ninth. Theſe diſſonances, like the others, ought to be prepared and reſolved. They are prepared by being ſyncopated, and reſolved by deſcending diatonically upon one of the conſonances of the ſubſequent chord. The ſenſible note alone can be reſolved in aſcending: but it is even neceſſary that this ſenſible note ſhould be in the chord of the tonic dominant. As to the diſſonances which are found in the primitive chord, they ſhould always follow the common rules. (See art. 202.)

Principles of Compoſition.

3. If to a chord of the ſimple dominant, as D F A C, we ſhould add the fifth G, we would have the chord G D F A C, called a *chord of the eleventh*, and which is figured with a $^{9}_{4}$ or $^{4}_{9}$. (See LXXVIII.).

OBSERVE.

Occaſions when retrenchments of chords are proper.

217. When the dominant is not a tonic dominant, we often take away ſome notes from the chord. For example, let us ſuppoſe that there is in the fundamental baſs this ſimple dominant E, carrying the chord E G B D: if there ſhould be added the third C beneath, we ſhall have this chord of the continued baſs C E G B D; but we ſuppreſs the ſeventh B, for reaſons which ſhall be explained in the note upon art. 210. In this ſtate the chord is ſimply compoſed of a third, fifth, and ninth, and is marked with a 9. See LXXIX. (4 P).

218. In the chord of the ſimple dominant, as D F A C, when the fifth G is added, we frequently obliterate the ſounds F and A, that too great a number of diſſonances may be avoided, which reduces the chord to G C D. This laſt is compoſed only of the fourth and the fifth. It is called a *chord of the fourth*, and it is figured with a 4 (4 Q) (ſee LXXX.).

219. Sometimes we only remove the note A, and then the chord ought to be figured with $^{7}_{4}$ or $^{4}_{7}$ (4 R).

Chord of the fifth redundant what, and how figured.

220. Finally, in the minor mode, for example, in that of A, where the chord of the tonic dominant (109), is E G※B D; if we add to this chord the third C below, we ſhall have E G※B D, called the *chord of the fifth redundant*, and compoſed of a third, a fifth redundant, a ſeventh and a ninth. It is figured as in LXXXI. (4 S).

§ 3. *Of the* CHORD *of the* DIMINISHED SEVENTH.

Chord of the flat ſeventh what, and how figured.

221. In the minor mode, for inſtance, in that of A, E a fifth from A is the tonic dominant (109), and carries the chord E G※B D, in which G is the ſenſible note. For this chord we ſometimes ſubſtitute G B※D F, (116), all compoſed of minor thirds; and which has for its fundamental ſound the ſenſible note G※. This chord is called a *chord of the flat* or *diminiſhed ſeventh*. and is figured with a $\not{7}$ in the fundamental baſs, (ſee LXXXIV.); but it is always conſidered as repreſenting the chord of the tonic dominant.

Chords produced in the continued baſs by this what, and how figured.

222. This chord by inverſion produces in the continued baſs the following chords:

1. The chord B D F G※, compoſed of a third, falſe fifth, and ſixth major. They call it the *chord of the ſixth ſenſible and falſe fifth;* and it is figured as in Exam. LXXXV. (Plate CCCLX.).

2. The chord D F G※B, compoſed of a third, a tritone, and a ſixth. It is called the *chord of the tritone and third minor;* and marked as in LXXXVI.

3. The chord F G※B D, compoſed of a ſecond redundant, a tritone, and a ſixth. It is called the *chord of the ſecond redundant*, and figured as in LXXXVII. (4 T).

Alterations by ſuppoſition, chords which they produce, what, and how figured.

223. Beſides, ſince the chord G※ B D F repreſents the chord E G※B D, it follows, that if we operate by ſuppoſition upon the firſt of theſe chords, it muſt be performed as one would perform it upon E G※B D; that is to ſay, that it will be neceſſary to add to the chord G※B D F, the notes C or A, which are the third or fifth below E, and which will produce,

1. By adding C, the chord C G※B D F, compoſed of a fifth redundant, a ſeventh, a ninth, and eleventh, which is the octave of the fourth. It is called a *chord of the fifth redundant and fourth*, and marked as in LXXXVIII.

2. By adding A, we ſhall have the chord A G※B D F, compoſed of a ſeventh redundant, a ninth, an eleventh, and a thirteenth minor, which is the octave of the ſixth minor. It is called the *chord of the ſeventh redundant and ſixth minor*, and marked as in LXXXIX. It is of all chords the moſt harſh, and the moſt rarely practiſed (4 U).

CHAP.

(4 P) Several muſicians call this laſt chord the *chord of the ninth;* and that which, with M. Rameau, we have ſimply called a *chord of the ninth*, they term a *chord of the ninth and ſeventh*. This laſt chord they mark with a $^{9}_{7}$; but the denomination and figure uſed by M. Rameau are more ſimple and can lead to no error; becauſe the chord of the ninth always includes the ſeventh, except in the caſes of which we have already ſpoken.

(4 Q) In England it is figured $^{5}_{4}$.

(4 R) We often remove ſome diſſonances from chords of ſuppoſition, either to ſoften the harſhneſs of the chord, or to remove diſcords which can neither be prepared nor reſolved. For inſtance, let us ſuppoſe, that in the continued baſs the note C is preceded by the ſenſible note B carrying the chord of the falſe fifth, and that we ſhould chooſe to form upon this note C the chord CEGBD, we muſt obliterate the ſeventh B, becauſe in retaining it we ſhould deſtroy the effect of the ſenſible note B, which ought to riſe to C.

In the ſame manner, if to the harmony of a tonic dominant G B D F, one ſhould add the note by ſuppoſition C, it is uſual to retrench from this chord the ſenſible note B; becauſe, as the D ought to deſcend diatonically to C, and the B to riſe to it, the effect of the one would deſtroy that of the other. This above all takes place in the *ſuſpenſion*, concerning which we ſhall preſently treat.

(4 S) *Suppoſition* produces what we call *ſuſpenſion;* and which is almoſt the ſame thing. Suſpenſion conſiſts in retaining as many as poſſible of the ſounds in a preceding chord, that they may be heard in the chord which ſucceeds. For inſtance, in Example LXXXII. the C bearing ※7 is a ſuppoſition; but in Example LXXXIII. it is a ſuſpenſion, becauſe it ſuſpends or retards the perfect chord C E G C which the ear expects after the tonic dominant G B D F.

(4 T) The chord of the diminiſhed ſeventh, and the three derived from it, are termed *chords of ſubſtitution*. They are in general harſh, and proper for imitating melancholy objects.

(4 U) As the chord of the diminiſhed ſeventh G※B D F, and the chord of the tonic dominant E G※ BD, only differ

CHAP. X. *Of ſome licences uſed in the Treble and Continued Baſs.*

License 1ſt. 224. SOMETIMES in a treble, the diſſonance which ought to have been reſolved by deſcending diatonically upon the ſucceeding note, inſtead of deſcending, on the contrary riſes diatonically: but in that caſe, the note upon which it ought to have deſcended muſt be found in ſome of the other parts. This licenſe ought to be rarely practiſed.

In like manner, in a continued baſs, the diſſonance in a chord of the ſub-dominant inverted, as A in the chord A C E G, inverted from C E G A, may ſometimes deſcend diatonically inſtead of riſing as it ought to do, art. 129. N° 2.; but in that caſe the note ought to be repeated in another part, that the diſſonance may be there reſolved in aſcending.

License 2d. 225. Sometimes likewiſe, to render a continued baſs more agreeable by cauſing it to proceed diatonically, we place between two ſounds of that baſs a note which belongs to the chord of neither. See Example XCII. in which the fundamental baſs G C produces the continued baſs G A B G C, where A is added on account of the diatonic modulation. This A has a line drawn above it, to ſhow its reſolution by paſſing under the chord G B D F.

In the ſame manner, (ſee XCIII.) this fundamental baſs C F may produce the continued baſs C D E C F, where the note D, which is added, paſſes under the chord C E G C.

CHAP. XI. *Containing the Method of finding the Fundamental Baſs when the continued Baſs is figured.*

How to find the fundamental baſs when the continued is figured.

226. As the continued baſs alone appears in practical compoſitions, it becomes neceſſary to know how to find the fundamental baſs when the continued baſs is figured. This problem may be eaſily ſolved by the following rules.

227. 1. Every note which has no figure in the continued baſs, ought to be the ſame, and without a figure in the fundamental baſs; it is either a tonic, or reckoned ſuch (4 X).

2. Every note which in the continued baſs carries a 6, ought in the fundamental baſs to give its third below not figured *, or its fifth below marked with a 7. We ſhall diſtinguiſh theſe two caſes below. See LVI. and the note (4 Y).

* See *Figured.*

3. Every note carrying $\frac{6}{4}$ gives in the fundamental baſs its fifth below not figured. See LVII.

4. Every note figured with a 7, or a $\not{7}$, is the ſame in both baſſes, and with the ſame figure (4 Y).

5. Every note figured with a 2 gives in the fundamental baſs the diatonic note above figured with a 7. See LXIV. (4 Z).

6. Every note marked with a 4 gives in the fundamental

---

differ one from the other by the notes E and F; one may form a diatonic modulation of theſe two notes, and then the fundamental baſs does nothing but paſs from the tonic dominant to the ſenſible note, and from that note to the tonic dominant, till it arrives at the tonic. (See XC.).

For the ſame reaſon, as the chord of the diminiſhed ſeventh G✕B D F, and the chord B D F A, which carries the fifth B of the tonic dominant E, only differs by the ſenſible note G✕, and the tonic A; one may ſometimes, while the treble modulates G✕A G✕A G✕A, aſcend in the fundamental baſs, from the baſs note to the third above, provided one deſcend at laſt from thence to the tonic dominant, and from thence to the tonic; (ſee XCI.). This and the preceding examples are licenſes.

(4 X) We ſay a tonic, or *reckoned ſuch*, becauſe it may perhaps be a dominant from which the diſſonance has been removed. But in that caſe one may know that it is a real dominant by the note which precedes it. For inſtance, if the note G, carrying a perfect chord, is preceded by D a ſimple dominant, carrying the chord D F A C, that note G is not a real tonic; becauſe, in order to this, it would have been neceſſary that D ſhould have been a tonic dominant, and ſhould have carried the chord D F✕A C; and that a ſimple dominant, as D, carrying the chord D F A C, ſhould only naturally deſcend to a dominant, (art. 194.).

(4 Y) Sometimes a note which carries a 7 in the continued baſs, gives in the fundamental baſs its third above, figured with a 6. For example, this continued baſs $\overset{7}{\text{A}}\ \overset{6}{\text{B}}\ \text{C}$ gives this fundamental baſs $\overset{6}{\text{C}}\ \overset{7}{\text{G}}\ \text{C}$; but in this caſe it is neceſſary that the note figured with a 6 ſhould riſe by a fifth, as we ſee here C riſe to G.

(4 Z) A note figured with a 2, gives likewiſe ſometimes in the fundamental baſs its fourth above, figured with a 6; but it is neceſſary in that caſe that the note figured with a 6, may even here riſe to a fifth. (See note 4 Y.)

Theſe variations in the fundamental baſs, as well in the chord concerning which we now treat, as in the chord figured with a 7, and in two others which ſhall afterwards be mentioned (art. 228. and 229.), are cauſed by a deficiency in the ſigns proper for the chord of the ſub-dominant, and for the different arrangements by which it is inverted.

M. l'Abbé Rouſſier, to redreſs this deficiency, had invented a new manner of figuring the continued baſs. His method is moſt ſimple for thoſe who know the fundamental baſs. It conſiſts in expreſſing each chord by only ſignifying the fundamental ſound with that letter of the ſcale by which it is denominated, to which is joined a 7 or $\not{7}$, or a 6, in order to mark all the diſcords. Thus the fundamental chord of the ſeventh D F A C is expreſſed by a $\overset{7}{\text{D}}$; and the ſame chord, when it is inverted from that of the ſub-dominant F A C D, is characterized by $\overset{6}{\text{F}}$; the chord of the ſecond C D F A, inverted from the dominant D F A C, is likewiſe repreſented by $\overset{7}{\text{D}}$; and the ſame chord C D F A, inverted from that of the ſub-dominant F A C D, is ſignified by $\overset{6}{\text{F}}$; the caſe is the mental baſs the diatonic note above, figured with a 7. (See LXI.).

7. Every note figured with a *g* gives its third below figured with a 7. (See LVIII.).

8. Every note marked with a 6̸ gives the fifth below marked with a 7; (ſee LX.) and it is plain by art. 187. that in the chord of the ſeventh, of which we treat in theſe three laſt articles, the third ought to be major, and the ſeventh minor, this chord of the ſeventh being the chord of the tonic dominant. (See art. 102.).

9. Every note marked with a 9 gives its third above figured with a 7. (See LXXVII. and LXXIX.).

10. Every note marked with a $\frac{9}{4}$ gives the fifth above figured with a 7. (See LXXVIII.).

11. Every note marked with a ※5, or with a +5, gives the third above figured with a $\overset{7}{\text{※}}$. (See LXXXI.).

12. Every note marked with a ※7 gives a fifth above figured with a 7, or with a $\overset{7}{\text{※}}$. (See LXXVI.). It is the ſame caſe with the notes marked $\substack{7\\4}$, $\substack{5\\4\\2}$, or $\substack{5\\2}$: which ſhows a retrenchment, either in the complete chord of the eleventh, or in that of the ſeventh redundant.

13. Every note marked with a 4 gives a fifth above figured with a 7, or a $\overset{7}{\text{※}}$. (See LXXX.).

14. Every note marked with a ※6 gives the third minor below, figured with a 7̸. (See LXXXV.).

15. Every note marked with a $\overset{4}{\flat}$ gives the tritone above figured with a 7̸. (See LXXXVI.).

16. Every note marked with a ※2 gives the ſecond redundant above, figured with a 7̸. (See LXXXVII.).

17. Every note marked with a ※$\substack{5\\4}$ gives the fifth redundant above, figured with a 7̸. (See LXXXVIII.).

18. Every note marked with a $\substack{※7\\ \flat 6}$ gives the ſeventh redundant above, figured with a 7̸. (See LXXXIX.). (5 A).

REMARK.

A difficulty in finding the fundamental baſs.

228. We have omitted two caſes, which may cauſe ſome uncertainty.

The firſt is that where the note of the continued baſs is figured with a 6. We now preſent the reaſon of the difficulty.

Suppoſe we ſhould have the dominant $\overset{7}{D}$ in the fundamental baſs, the note which anſwers to it in the continued baſs may be A carrying the figure 6 (ſee LXIV.); that is to ſay, the chord A C D F: now if we ſhould have the ſubdominant $\overset{6}{F}$ in the fundamental baſs, this ſubdominant might produce in the continued baſs, the ſame note A figured with a 6. When therefore we find in the continued baſs a note marked with a 6, it appears at firſt uncertain whether we ſhould place in the fundamental baſs the fifth below marked with a 7, or the third below marked with a 6.

Another.

229. The ſecond caſe is that in which the continued baſs is figured with a $\frac{6}{5}$. For inſtanee, if there ſhould be found $\overset{\frac{6}{5}}{F}$ in the continued baſs, we may be ignorant whether we ought to inſert in the fundamental baſs F marked with a 6, or D figured with a 7.

Solution.

230. This difficulty may be removed by leaving for an inſtant this uncertain note in ſuſpenſe, and in examining the ſucceeding note of the fundamental baſs; for if that note be in the preſent caſe a fifth above F, that is to ſay, if it be C, in this caſe, and in this alone, we may place $\overset{6}{F}$ in the fundamental baſs. It is a conſequence of this rule, that in the fundamental baſs every ſub-dominant ought to riſe by a fifth (195).

CHAP. XII. *What is meant by being in a Mode or Tone.*

Method of determining the mode in which we are.

231. IN the firſt part of this treatiſe (ehap. vi.) we have explained, how by the means of the note C, and of its two-fifths G and F, one in aſcending, which is called a *tonic dominant*, the other in deſcending, which is called a *ſub-dominant*, the ſcale C D E F A B C may be found: the different ſounds which form this ſcale compoſe

---

the ſame when the chords are differently inverted. By this means it would be impoſſible to miſtake either with reſpect to the fundamental baſs of a chord, or with reſpect to the note which forms its diſſonance, or with reſpect to the nature and ſpecies of that diſcord.

(5 A) We may only add, that here, and in the preceding articles of the text, we ſuppoſe, that the continued baſs is figured in the manner of M. Rameau. For it is proper to obſerve, that there are not, perhaps, two muſicians who characterize their chords with the ſame figures; which produces a great inconveniency to the perſon who plays the accompaniments: but here we do not treat of accompaniments. We prefer the continued baſſes of M. Rameau to all the others, as by them the fundamental baſs will be moſt eaſily diſcovered.

M. Rameau only marks the leſſer ſixth by a 6 without a line, when this leſſer ſixth does not reſult from the chord of the tonie dominant; in ſuch a manner that the 6 renders it uncertain whether in the fundamental baſs we ought to chooſe the third or the fifth below; but it will be eaſy to ſee whether the third or the fifth is ſignified by that figure. This may be diſtinguiſhed, 1. In obſerving which of the two notes is excluded by the rules of the fundamental baſs. 2. If the two notes may with equal propriety be placed in the fundamental baſs, the preference muſt be determined by the tone or mode of the treble in that particular paſſage. In the following chapter we ſhall give rules for determining the mode (note 3 Z).

There is a chord of which we have not ſpoken in this enumeration, and which is called the *chord of the ſixth redundant*. This chord is compoſed of a note, of its third major, of its redundant fourth or tritone, and its redundant ſixth, as F A B D※. It is marked with a 6※. It appears difficult to find a fundamental baſs for this chord; nor is it indeed much in uſe amongſt us. (See the note upon the art. 115.).

This chord is called in England the chord of the *extreme ſharp ſixth*. When accompanied by the third only, it is called the *Italian ſixth*. When the fifth is ſubſtituted for the tritone, it has been called the *German ſixth*.

compoſe the *major mode* of C, becauſe the third E above C is major. If therefore we would have a modulation in the major mode of C, no other ſounds muſt enter into it than thoſe which compoſe this ſcale; in ſuch a manner that if, for inſtance, we ſhould find F※ in this modulation, this F※ diſcovers to us that we are not in the mode of C, or at leaſt that, if we have been in it, we are no longer ſo.

232. In the ſame manner, if we form this ſcale in aſcending A B C※ D E F※ G※ A, which is exactly ſimilar to the ſcale C D E F G A B C of the major mode of C, this ſcale, in which the third from A to C※ is major, ſhall be in the major mode of A; and if we incline to be in the minor mode of A, we have only to ſubſtitute for C ſharp C natural; ſo that the major third A C※ may become minor A C: we ſhall have then

A B C D E F※ G※ A,

which is (85.) the ſcale of the minor mode of A in aſcending; and the ſcale of the minor mode of A in deſcending ſhall be (90.),

A G F E C D B A,

in which the G and F are no longer ſharp. For it is a ſingularity peculiar to the minor mode, that its ſcale is not the ſame in riſing as in deſcending (89.).

Hence it appears what ſharps and flats ſhould be placed at the cleff in the major mode of A, and why they are omitted in the minor mode in deſcending.

233. This is the reaſon why, when we wiſh to begin a piece in the major mode of A, we place three ſharps at the cleff upon F, C, and G; and on the contrary, in the minor mode of A, we place none, becauſe the minor mode of A, in deſcending, has neither ſharps nor flats.

Modes 24 in the whole.

234. As the ſcale contains twelve ſounds, each diſtant from the other by the interval of a ſemitone, it is obvious that each of theſe ſounds can produce both a major and a minor mode, which conſtitute 24 modes upon the whole. Of theſe we ſhall immediately give a table, which may be very uſeful to diſcover the mode in which we are.

A TABLE of the DIFFERENT MODES.

Major Modes.

Maj. Mode.	
of C;	C, D, E, F, G, A, B, c.
of G;	G, A, B, c, d, e, f※, g.
of D;	D, E, F※, G, A, B, c※, d.
of A;	A, B, c※, d, e, f※, g※, a.
of E;	E, F※, G※, A B c※, d※, e.
of B;	B, c※, d※, e, f※, g※, a※, b.
Of F※.	F※, G※, A※, B, c※, d※, e※, f※ (5 B).
Of C※, or D♭;	D♭, E♭, F, G♭, A♭, B♭, c, d♭.
Of G※, or A♭;	A♭, B♭, c, d♭, e♭, f, g, a♭.
Of D※, or E♭;	E♭, F, G, A♭, B♭, c, d, e♭.
of A※, or B♭;	B♭, C, D, E♭, F, G, A, B♭.
of E※, or F♮;	F, G, A, B♭, c, d, e, f.
of B※, or C♮;	C, D, E, F, G, A, B, c.

(See Ex. XCIV.).

Minor Modes.

	Of A.
In deſcending.	A G F E D C B A.
In riſing.	A B C D E F※ G※ A.
	Of E.
In deſcending.	e d c B A G F※ E.
In riſing.	E F※ G A B c※ d※ e.
	Of B.
In deſcending.	B A G F※ E D C※ B.
In riſing.	B C※ D E F※ G※ A※ B.
	Of F※.
In deſcending.	f※ e d c※ B A G※ E※.
In riſing.	F※ G※ A B C※ d※ e※ f※.
	Of C※.
In deſcending.	C※ B A G※ F※ E D※ C※.
In riſing.	C※ D※ E F※ G※ A※ B※ C※.
	Of G※ or A♭.
In deſcending.	g※ f※ e d※ c※ B A※ G※.
In riſing.	A♭ B♭ C♭ d♭ e♭ f g a♭.
	Of D※ or E♭.
In deſcending.	e♭ d♭ c♭ B♭ A♭ G♭ F E♭.
In riſing.	E♭ F G♭ A♭ B♭ c d e♭.
	Of A※ or B♭.
In deſcending.	B♭ A♭, G♭ F E♭ D♭ C B♭.
In riſing.	D♭ C D♭ E♭ F G A B♭.

(5 B) The major mode of F※, of C※, and of G※, are not much practiſed.

When a piece begins upon C※, there ought to be ſeven ſharps placed at the cleff: but it is more convenient only to place five flats, and to ſuppoſe the key D♭, which is almoſt the ſame thing with C※. For this reaſon we ſubſtitute here the mode of D♭, for that of C※.

It is ſtill much more neceſſary to ſubſtitute the mode of A♭ for that of G※; for the ſcale of the major mode of G※ is, G※, A※, B※, C※, d※, e※, g, g※,
in which it appears that there are at the ſame time both a 'g♮' and a 'g※': it would then be neceſſary, even at the ſame time, that upon G there ſhould and ſhould not be a ſharp at the cleff; which is inconſiſtent. It is true that this inconvenience may be avoided by placing a ſharp upon G at the cleff, and by marking the note G with a natural through the courſe of the muſic wherever it ought to be natural; but this would become troubleſome, above all if there ſhould be occaſion to tranſpoſe. In the article 236. we ſhall give an account of tranſpoſition. We might likewiſe in this ſeries, inſtead of G natural, which is the note immediately before the laſt, ſubſtitute F※※, that is to ſay, F twice ſharp: which, however, is not abſolutely the ſame ſound with G natural, eſpecially upon inſtruments whoſe ſcales are fixed, or whoſe intervals are invariable. But in that caſe two ſharps muſt be placed at the cleff upon F, which would produce another inconvenience. But by ſubſtituting A♭ for G※, the trouble is eluded.

The double ſharp, however, is incidentally uſed, when in a compoſition in the key of F※ there is an occaſional modulation into the dominant of that key, and it is diſtinguiſhed by the character ✕ or ※※.

Of E♯ or F♮.
In deſcending. f F e♭ d♭ c B♭ A♭ G F.
In riſing. F G A♭ B♭ c d e f.

Of C.
In deſcending. c B♭ A♭ G F E♭ D C.
In riſing. C D E♭ F G A B c.

Of G.
In deſcending. g f e♭ d C B♭ A G.
In riſing. G A B♭ c d e f♯ g.

Of D.
In deſcending. d c B♭ A G F E D.
In riſing. D E F G A B c♯ d (5 c).

Modes crowded with ſharps and flats little practiſed.

235. Theſe then are all the modes, as well major as minor. Thoſe which are crowded with ſharps and flats are little practiſed, as being extremely difficult in execution.

Reſults.

236. Hence it follows,

1. That when there are neither ſharps nor flats at the cleff, the piece begins in the major mode of C, or in the minor mode of A.

2. That when there is one ſharp, it will always be placed upon F, and that the piece begins in the major mode of G, or the minor of E, in ſuch a manner that it may be ſung as if there were no ſharp, by ſinging B inſtead of F♯, and in ſinging the tune as if it had been in another cleff. For inſtance, let there be a ſharp upon F in the cleff of G upon the firſt line; one may then ſing the tune as if there were no ſharp; and as if, inſtead of the cleff of G upon the firſt line, it were the cleff of C; for the F♯, when changed into B, will require that the cleff of G ſhould be changed to the cleff of C, as may be eaſily ſeen. This is what we call *tranſpoſition* (5 D).

See *Tranſpoſition.*

237. It is evident, that when F♯ is changed into B,

(5 C) We have already ſeen, that in each mode, the principal note is called a *tonic;* that the fifth above that note is called a *tonic dominant*, or the *dominant of the mode*, or ſimply a *dominant;* that the fifth below the tonic, or, what is the ſame thing, the fourth above that tonic, is called a *ſub-dominant;* and in ſhort, that the note which forms a ſemitone below the tonic, and which is a third major from the dominant, is called a *ſenſible note.* The other notes have likewiſe in every mode particular names which it is advantageous to know. Thus a note which is a tone immediately above the tonic, as D in the mode of C, and B in that of A is termed a *ſuper-tonic;* the following note, which is a third major or minor from the tonic, according as the chord is major or minor, ſuch as E in the major mode of C, and C in the minor mode of A, is called a *mediant;* and the note which is a tone above the dominant, ſuch as A, in the mode of C, and F♯ in that of A, is called a *ſuper-dominant.*

(5 D) Though our author's account of this delicate operation in muſic will be found extremely juſt and compendious; though it proceeds upon ſimple principles, and comprehends every poſſible contingency; yet as the manner of thinking upon which it depends may be leſs familiar to Engliſh readers, if not profoundly ſkilled in muſic, it has been thought proper to give a more familiar, though leſs comprehenſive, explanation of the manner in which *tranſpoſition* may be executed.

It will eaſily occur to every reader, that if each of the intervals through the whole diatonic ſeries were equal, in a mathematical ſenſe, it would be abſolutely indifferent upon what note any air were begun, if within the compaſs of the gammut; becauſe the ſame equal intervals muſt always have the ſame effects. But ſince, beſides the natural ſemitones, there is another diſtinction of diatonic intervals into *greater* and *leſſer tones;* and ſince theſe vary their poſitions in the ſeries of an octave, according as the note from whence you begin is placed, that note is conſequently the beſt key for any tune whoſe natural ſeries is moſt exactly correſpondent with the intervals which that melody or harmony requires. But in inſtruments whoſe ſcales are fixed, notwithſtanding the temperament and other expedients of the ſame kind, ſuch a ſeries is far from being eaſily found, and is indeed in common practice almoſt totally neglected. All that can frequently be done is, to take care that the ear may not be ſenſibly ſhocked. This, however, would be the caſe, if, in tranſpoſing any tune, the ſituation of the ſemitones, whether natural or artificial, were not exactly correſpondent in the ſeries to which your air muſt be tranſpoſed, with their poſitions in the ſcale from which you tranſpoſe it. Suppoſe, for inſtance, your air ſhould begin upon C, requiring the natural diatonic ſeries through the whole gammut, in which the diſtance between E and F, as alſo that between B and C, is only a ſemitone. Again, ſuppoſe it neceſſary for your voice, or the inſtrument on which you play, that the ſame air ſhould be tranſpoſed to G, a fifth above its former key; then becauſe in the firſt ſeries the intervals between the third and the fourth, ſeventh and eighth notes, are no more than ſemitones, the ſame intervals muſt take the ſame place in the octave to which you tranſpoſe. Now, from G, the note with which you propoſe to begin, the three tones immediately ſucceeding are full; but the fourth C is only a ſemitone; it may therefore be kept in its place. But from F, the ſeventh note above, to G, the eighth, the interval is a full tone, which muſt conſequently be redreſſed by raiſing the F a ſemitone higher. Thus the ſituations of the ſemitonic intervals in both octaves will be correſpondent; and thus, by conforming the poſitions of the ſemitones in the octave to which you tranſpoſe, with thoſe in the octave in which the original key of the tune is contained, you will perform your operation with as much ſucceſs as the nature of fixed ſcales can admit.

The order to be obſerved in theſe alterations of the intervals, is deduced from the relation which the fifth aſcending and deſcending bear to the fundamental (art. 34, 35.); and therefore the farther we depart from the natural fundamental C by a ſeries of fifths aſcending or deſcending, the alterations, and conſequently the number ſharps or flats indicating them, will be the greater.

Thus if G, which is the perfect fifth aſcending from , therefore the note moſt nearly allied to C (art. 39, 40.), be

B, G muſt be changed into C, and E into A. Thus, by tranſpoſition, the air has the ſame melody as if it were in the major mode of C, or in the minor mode of A. The major mode then of G, and the minor of E, are by tranſpoſition reduced to thoſe of C major, and of A minor. It is the ſame caſe with all the other modes (5 E).

All the modes reducible to the major of C and the minor of A.

Chap. XIII. *To find the Fundamental Baſs of a given Modulation.*

Method of finding a fundamental baſs to a given air not difficult, and why.

238. As we have reduced to a very ſmall number the rules of the fundamental baſs, and thoſe which in the treble ought to be obſerved with relation to this baſs,

---

be taken for a fundamental, F, which is the ſeventh of the ſcale of G, muſt be made ſharp, that it may be a whole tone from the ſixth E, and only a ſemitone from the key note G, according to the laws of the diatonic ſcale (art. 77.). See Ex. XCIV. 1. 2.

Again, if D, the perfect fifth aſcending from G, and the ſecond in the ſeries of progreſſive fifths aſcending from C, be uſed as a fundamental, C, which is the ſeventh of the ſcale of D, muſt, to render it the ſenſible or leading note (art. 77.), be made ſharp in addition to F; ſo that in the ſcale of D, there are two ſharps, F and C. See Ex. XCIV. (3.).

If A, the perfect fifth above D, and the third in the ſeries of fifths aſcending from C, be the fundamental, the ſeventh G muſt, in addition to F and C, be made ſharp, for the ſame reaſon (4.); and ſo on, in the ſcale of E, which is next in order, F, C, G, and D, muſt be ſharp (5.): in that of B, the ſharps muſt be F, C, G, D, and A (6.).

The perfect fifth above B is F※, and in that ſcale F, C, G, D, A, and E, muſt be ſharp (7.). And in the next ſcale C※ all the notes of the ſyſtem are ſharp (8.).

This, for the reaſons mentioned in the note (5 B), is the laſt ſcale to which we can properly go by the progreſſions of fifths aſcending.

Returning to the natural ſcale of C, if, inſtead of aſſuming G, the perfect fifth above, for a fundamental, we take F, the perfect fifth below; B, which is the fourth note above F, and forms a *tritone* or ſharp fourth to it, muſt, to become a perfect fourth, according to the laws of the diatonic ſcale, (art. 60.) be made flat (12.).

Proceeding with the ſeries of fifths deſcending, if B♭, which is the perfect fifth below F, be taken for a fundamental; E, which, in its natural ſtate, is the tritone or ſharp fourth to B♭; muſt, to become the diatonic fourth (art. 60.), alſo be rendered flat (11.).

If E♭, which is the perfect fifth below B♭, and the third in the ſeries of fifths deſcending from C, be made the fundamental, A, the ſharp fourth, muſt, to become the diatonic fourth, be made flat, and the flats marked at the cleff are B, E, and A (10.).

To form the next ſcale in the ſeries of fifths deſcending, which is that of A flat, D muſt be flattened; and B, E, A, and D, are marked flat at the cleff (9.).

The next ſcale, that of D flat, is formed by flattening G, and adding its flat to the others at the cleff (8.). This is the ſcale recommended to be uſed rather than that of C※. (See note 5 B).

We do not proceed farther with the ſeries of fifths deſcending, ſince the next ſcale, that of G♭, would juſt or very nearly exhibit the ſounds already repreſented by the ſcale of F※ (7.). This ſcale is, however, ſometimes written in the key of G flat, and we even meet with the ſcale of its fifth below, C flat, and, with an occaſional modulation from that key into its fifth below, F flat, where B being neceſſarily twice flattened, is diſtinguiſhed by this character $\overset{\flat}{\flat}$, or ♭♭, called a double flat.

We have thus ſeen, 1ſt, That each of the notes of the diatonic ſcale of C, and each of the ſemitones into which the whole tones of that ſcale are divided, may be taken for the fundamental note of a diatonic ſcale, called the *ſcale of that note*. 2dly, That the notes of the natural ſcale are more or leſs altered, as the note aſſumed for a fundamental is more or leſs diſtant from C, in a progreſſion of fifths aſcending or deſcending. 3dly, That in the progreſſion by fifths aſcending, the notes are altered by ſharps, and in the progreſſion by fifths deſcending, the alterations are by flats. 4thly, That in the alteration by ſharps, the laſt ſharp is always on the ſeventh or *ſenſible* note of the ſcale; and where there are more than one, is always on the fifth above the ſharp immediately preceding; and in the alteration by flats, the laſt flat is always on the fourth of the ſcale; and where there are more than one, is always on the fifth below the flat immediately preceding.

The ſignatures of ſharps and flats at the cleffs, belonging to the twelve major ſcales, are alſo uſed for their relative minor ſcales. The occaſional elevation and depreſſion of the ſixths and ſevenths of the minor ſcales, are denoted by occaſional ſharps and flats placed before theſe notes.

(5 E) Many muſicians, and amongſt others the ancient muſicians of France, as Lulli, Campra, &c. place one flat leſs in the minor mode: ſo that in the minor mode of D, they place neither ſharp nor flat at the cleff; in the minor mode of G, one flat only; in the minor mode of C, two flats, &c.

This practice in itſelf is ſufficiently indifferent, and ſcarcely merits the trouble of a diſpute. Yet the method which we have here deſcribed, according to M. Rameau, has the advantage of reducing all the modes to two; and beſides it is founded upon this ſimple and very general rule, That in the major mode, we muſt place as many ſharps or flats at the cleff, as are contained in the diatonic ſcale of that mode in aſcending; and in the minor mode, as many as are contained in that ſame ſcale in deſcending.

baſs, it ſhould no longer be difficult to find the fundamental baſs of a given modulation, nay, frequently to find ſeveral; for every fundamental baſs will be legitimate, when it is formed according to the rules which we have given (chap. vi.); and that, beſides this, the diſſonances which the modulation may form with this baſs, will both be prepared, if it is neceſſary that they ſhould be ſo, and always reſolved (5 F).

Difficulty of aſſigning general rules for aſcertaining the mode of a melody whoſe fundamental baſs is ſought.

239. It is of the greateſt utility in ſearching for the fundamental baſs, to know what is the tone or mode of the melody to which that baſs ſhould correſpond.—But it is difficult in this matter to aſſign general rules, and ſuch as are abſolutely without exception, in which nothing may be left that appears indifferent or diſcretionary; becauſe ſometimes we ſeem to have the free choice of referring a particular melody either to one mode or another. For example, this melody G C may belong to all the modes, as well major as minor, in which G and C are found together; and each of theſe two ſounds may even be conſidered as belonging to a different mode.

Reaſons why we may proceed without the knowledge of the mode, and how we may be preſerved from deviating in compoſition.

240. We may ſometimes, as it ſhould ſeem, operate without the knowledge of the mode, for two reaſons; 1. Becauſe, ſince the ſame ſounds belong to ſeveral different modes, the mode is ſometimes conſiderably undetermined; above all, in the middle of a piece, and during the time of one or two bars. 2. Without giving ourſelves much trouble about the mode, it is often ſufficient to preſerve us from deviating in compoſition, if we obſerve in the ſimpleſt manner the rules above preſcribed (chap. vi.) for the procedure of the fundamental baſs.

Knowledge of the mode in beginning a piece indiſpenſable, and why.

241. In the mean time, it is above all things neceſſary to know in what mode we operate at the beginning of the piece, becauſe it is indiſpenſable that the fundamental baſs ſhould begin in the ſame mode, and that the treble and baſs ſhould likewiſe end in it; nay, that they ſhould even terminate in its fundamental note, which in the mode of C is C, and A in that of A, &c. Beſides, in thoſe paſſages of the modulation where there is a cadence, it is generally neceſſary that the mode of the fundamental baſs ſhould be the ſame with that of the part to which it correſponds.

Inveſtigation of the mode continued.

242. To know upon what mode or in what key a piece commences, our inquiry may be entirely reduced to diſtinguiſh the major mode of C from the minor of A. For we have already ſeen (art. 236. and 237.), that all the modes may be reduced to theſe two, at leaſt in the beginning of the piece. We ſhall now therefore give a detail of the different means by which theſe two modes may be diſtinguiſhed.

Means by which the modes may be determined.

1. From the principal and characteriſtical ſounds of the mode, which are C E G in the one, and A C E in the other; ſo that if a piece ſhould, for inſtance, begin thus, A C E A, it may be almoſt conſtantly concluded, that the tone or mode is in A minor, although the notes A C E belong to the mode of C.

2. From the ſenſible note, which is B in the one, and G♯ in the other; ſo that if G♯ appears in the firſt bars of a piece, we may be certain that we are in the mode A.

3. From the adjuncts of the mode, that is to ſay, the modes of its two-fifths, which for C are F and G, and D and E for A. For example, if after having begun a melody by ſome of the notes which are common to the modes of C and of A (as E D E F E D C B C), we ſhould afterwards find the mode of G, which we aſcertain by the F♯, or that of F which we aſcertain by the B♭ or C♮, we may conclude that we have begun in the mode of C; but if we find the mode of D, or that of E, which we aſcertain by B♭, C♯, or D♯, &c. we conclude from thence that we have begun in the mode of A.

4. A mode is not uſually changed, eſpecially in the beginning of a piece, unleſs in order to paſs into one or other of the modes moſt relative to it, which are the mode of its fifth above, and that of its third below, if the original mode of major, or of its third above if it be minor. Thus, for inſtance, the modes which are moſt intimately relative to the major mode of C, are the major mode of G, and that of A minor. From the mode of C we commonly paſs either into the one or the other of theſe modes; ſo that we may ſometimes judge of the principal mode in which we are, by the relative mode which follows it, or which goes before it, when theſe relative modes are deciſively marked. Beſides theſe two relative modes, there are likewiſe two others into which the principal mode may paſs, but leſs frequently, viz. the mode of its fifth below, and that of its third above, as F and E for the mode of C (5 G).

5. The modes may ſtill be likewiſe diſtinguiſhed by the cadences of the melody. Theſe cadences ought to occur at the end of every two, or at moſt of every four bars, as in the fundamental baſs: now the note of the fundamental baſs which is moſt ſuitable to theſe cloſes,

---

(5 F) We often ſay, *that we are upon a particular key* or *ſcale*, inſtead of ſaying *that we are in a particular mode.* The following expreſſions therefore are ſynonymous; *ſuch a piece is in* C *major*, or *in the mode of* C *major*, or *in the key of* C *major*, or in the ſcale of C *major*.

(5 G) It is certain that the minor mode of E has an extremely natural connection with the mode of C, as has been proven (art. 92.) both by arguments and by examples. It has likewiſe appeared in the note upon the art. 93. that the minor mode of D may be joined to the major mode of C: and thus in a particular ſenſe, this mode may be conſidered as relative to the mode of C, but it is ſtill leſs ſo than the major modes of G and F, or than thoſe of A and E minor; becauſe we cannot immediately, and without licence, paſs in a fundamental baſs from the perfect minor chord of C to the perfect minor chord of D; and if you paſs immediately from the major mode of C to the minor mode of D in a fundamental baſs, it is by paſſing, for inſtance, from the tonic C, or from E G C, to the tonic dominant of D, carrying the chord A C♯ E G, in which there are two ſounds, E G, which are found in the preceding chord, (Ex. xcv.) or otherwiſe from C E G C to G B♭ D E, a chord of the ſub dominant in the minor mode of D, which chord has likewiſe two ſounds, G and E, in common with that which went immediately before it. See Ex. xcvi.

cloſes *, is always eaſy to be found. For the ſounds which occur in the treble, M. Rameau may be conſulted, p. 54. of his *Nouveau Syſteme de Muſique theorique et pratique* (5 H).

* See Ca- nce.

aving aſ- rtained e mode, e funda- ental baſs t diffi- lt.

When the mode is aſcertained, by the different means which we have pointed out, the fundamental baſs will coſt little pains. For in each mode there are three fundamental ſounds.

1. The tonic of the mode, or its principal ſound, which carries always the perfect chord major or minor, according as the mode itſelf is major or minor.

Major mode of C,	C E G 'c'.
Minor mode of A,	A C E A.

2. The tonic dominant, which is a fifth above the tonic, and which, whether in the major or minor mode, always carries a chord of the ſeventh, compoſed of a third major followed by two thirds minor.

Tonic dominant.

Major mode of C, G B D 'f'.

Tonic dominant.

Minor mode of A, E G♯ B 'd'.

3. The ſub-dominant, which is a fifth below the tonic, and which carries a chord compoſed of a third, fifth, and ſixth major, the third being either greater or leſſer, according as the mode is major or minor.

Sub-dominant.

Major mode of C,	F A C 'd'.
Minor mode of A,	D F A B.

Theſe three ſounds, the tonic, the tonic dominant, and the ſub-dominant, contain in their chords all the notes which enter into the ſcale of the mode; ſo that when a melody is given, it may almoſt always be found which of theſe three ſounds ſhould be placed in the fundamental baſs, under any particular note of the upper part. Yet it ſometimes happens that not one of theſe notes can be uſed. For example, let it be ſuppoſed that we are in the mode of C, and that we find in the melody theſe two notes A B in ſucceſſion; if we confine ourſelves to place in the fundamental baſs one of the three ſounds C G F, we ſhall find nothing for the ſounds A and B but this fundamental baſs $\overset{6}{F}\,\overset{7}{G}$; now ſuch a ſucceſſion as $\overset{6}{F}$ to $\overset{7}{G}$ is prohibited by the fifth rule for the fundamental baſs, according to which every ſub-dominant, as F, ſhould riſe by a fifth; ſo that $\overset{6}{F}$ can only be followed by C in the fundamental baſs, and not by $\overset{7}{G}$.

To remedy this, the chord of the ſub-dominant F A C 'd' muſt be inverted into a fundamental chord of the ſeventh, in this manner, D F A 'c', which has been called the *double employment* (art. 105.) becauſe it is a ſecondary manner of employing the chord of the ſub-dominant. By theſe means we give to the modulation A B this fundamental baſs $\overset{7}{D}\,\overset{7}{G}$; which procedure is agreeable to rules. See Ex. XCVII.

Here then are four chords, C E G 'c', G B D 'f', F A C 'd', D F A 'c', which may be employed in the major mode of C. We ſhall find in like manner, for the minor mode of A, four chords.

A C 'e a', E G♯ B 'd',
D F A B, B D 'f a'.

And in this mode we ſometimes change the laſt of theſe chords into B D 'f♯ a', ſubſtituting the 'f♯' for 'f♮'. For inſtance, if we have this melody in the minor mode of A, E F♯ G♯ A, we would cauſe the firſt note E to carry the perfect chord A C E A; the ſecond note F♯ to carry the chord of the ſeventh B D F♯ A; the third note G♯, the chord of the tonic dominant E G♯ B D, and the laſt the perfect chord A C E A. See Ex. XCVIII.

On the contrary, if this melody is given always in the minor mode, A A G♯ A, the ſecond A being ſyncopated, it might have the ſame baſs as the modulation E F♯ G♯ A, with this difference alone, that F♮ might be ſubſtituted for F♯ in the chord B D F♯ A, the better to mark out the minor mode. See Exam. XCIX.

Beſides theſe chords which we have juſt mentioned, and which may be regarded as the principal chords of the mode, there are ſtill a great many others; for example, the ſeries of dominants,

$$C\,\overset{7}{A}\,\overset{7}{D}\,\overset{7}{G}\,\overset{7}{C}\,\overset{7}{F}\qquad \overset{7}{B}\,\overset{7}{E}\,\overset{7}{A}\,\overset{7}{D}\,\overset{7}{G}\,C,$$

which are terminated equally in the tonic C, either entirely belong, or at leaſt may be reckoned as belonging (51) to the mode of C; becauſe none of theſe dominants are tonic dominants, except G, which is the tonic dominant of the mode of C; and beſides, becauſe the chord of each of theſe dominants forms no other

---

(5 H) All theſe different manners of diſtinguiſhing the modes ought, if we may ſpeak ſo, to give mutual light and aſſiſtance one to the other. But it often happens, that one of theſe ſigns alone is not ſufficient to determine the mode, and may even lead to error. For example, if a piece of muſic begins with theſe three notes, E C G, we muſt not with too much precipitation conclude from thence that we are in the major mode of C, although theſe three ſounds, E C G, be the principal and characteriſtical ſounds in the major mode of C: we may be in the minor mode of E, eſpecially if the note E ſhould be long.

(51) I have ſaid, *that they may be reckoned as belonging to this mode*, for two reaſons: 1. Becauſe, properly ſpeaking, there are only three chords which eſſentially and primitively belong to the mode of C, viz. C carrying the perfect chord, F carrying that of the ſub-dominant, and G that of the tonic dominant, to which we may join the chord of the ſeventh, D F A C (art. 105.): but we here regard *as extended* the ſeries of dominants in queſtion, as belonging to the mode of C, becauſe it preſerves in the ear the impreſſion of that mode. 2. In a ſeries of dominants, there are a great many of them which likewiſe belong to other modes; for inſtance, the ſimple dominant A belongs naturally to the mode of G, the ſimple dominant B to that of A, &c. Thus it is only improperly, and by way of extenſion, as I have already ſaid, that we regard here theſe dominants as belonging to the mode of C.

other ſounds than ſuch as belong to the ſcale of C. See Ex. c.

But if we were to form this fundamental baſs,

7 7 7 7♭
C A D G C,

conſidering the laſt C as a tonic dominant in this manner, C E G B♭; the mode would then be changed at the ſecond C, and we ſhould enter into the mode of F, becauſe the chord C E G B♭ indicates the tonic dominant of the mode of F; beſides, it is evident that the mode is changed, becauſe B♭ does not belong to the ſcale of C. See Ex. ci.

In the ſame manner, were we to form this fundamental baſs

7 7 7 6
C A D G C,

conſidering the laſt C as a ſub-dominant in this manner, C E G A; this laſt C would indicate the mode of G, of which C is the *ſub-dominant*. See Ex. cii.

In like manner, ſtill, if in the firſt ſeries of dominants, we cauſed the firſt D to carry the third major, in this manner, D F※ A 'c'; this D having become a tonic dominant, would ſignify to us the major mode of G, and the $\overset{7}{G}$ which ſhould follow it, carrying the chord B D 'f', would relapſe into the mode of C, from whence we had departed. See Ex. ciii.

Finally, in the ſame manner, if in this ſeries of dominants, we ſhould cauſe B to carry F※ in this manner, B D F※ A, this F would ſhow that we had departed from the mode C, to enter into that of G. See Ex. civ.

Hence it is eaſy to form this rule for diſcovering the changes of mode in the fundamental baſs.

A rule for diſcovering the changes of mode.

1. When we find a tonic in the fundamental baſs, we are in the mode of that tonic; and the mode is major or minor, according as the perfect chord is major or minor.

2. When we find a ſub-dominant, we are in the mode of the fifth above that ſub-dominant; and the mode is major or minor, according as the third in the chord of the ſub-dominant is major or minor.

3. When we find a tonic dominant, we are in the mode of the fifth below that tonic dominant. As the tonic dominant carries always the third major, it cannot be aſcertained from this dominant alone, whether the mode be major or minor: but it is only neceſſary to examine the following note, which muſt be the tonic of the mode in which he is; by the third of this tonic it will be diſcovered whether the mode be major or minor.

243. Every change of the mode ſuppoſes a cadence; and when the mode changes in the fundamental baſs, it is almoſt always either after the tonic of the mode in which we have been, or after the tonic dominant of that mode, conſidered then as a tonic by favour of a cloſe which ought neceſſarily to be found in that place: Whence it happens that cadences in a melody for the moſt part preſage a change of mode which ought to follow them.

244. All theſe rules, joined with the table of modes which we have given (art. 234.), will ſerve to diſcover in what mode we are in the middle of a piece, eſpecially in the moſt eſſential paſſages, as cadences (5 k).

Chap. XIV. *Of the Chromatic and Enharmonic.*

Chromatic, what.

245. We call that melody *chromatic* which is compoſed of ſeveral notes in ſucceſſion, whether riſing or deſcending by ſemitones. See cv. and cvi.

To an air deſcending by chromatic intervals, fundamental baſs, what.

246. When an air is chromatic in deſcending, the moſt natural and ordinary fundamental baſs is a concatenated ſeries of tonic dominants; all of which follow one another in deſcending by a fifth, or, which is the ſame thing, in riſing by a fourth. See Ex. cv. (5 l).

(5 k) Two modes are ſo much more intimately relative, as they contain a greater number of ſounds common to both; for example, the minor mode of C and the major of G, or the major mode of C and the minor of A: on the contrary, two modes are leſs intimately relative as the number of ſounds which they contain as common to both is ſmaller; for inſtance, the major mode of C and the minor of B, &c.

When the compoſer, led away by the current of the modulation, that is to ſay, by the manner in which the fundamental baſs is conſtituted, into a mode remote from that in which the piece was begun, he ought to continue in it but for a ſhort time, becauſe the ear is always impatient to return to the former mode.

(5 l) We may likewiſe give to a chromatic melody in deſcending, a fundamental baſs, into which may enter chords of the ſeventh and of the diminiſhed ſeventh, which may ſucceed one another by the intervals of a falſe fifth and a fifth redundant: thus in the Example cvii. where the continued baſs deſcends chromatically, it may eaſily be ſeen that the fundamental baſs carries ſucceſſively the chords of the ſeventh and of the ſeventh diminiſhed, and that in this baſs there is a falſe fifth from D to G※, and a fifth redundant from G※ to C.

The reaſon of this licence is, as it appears to us, becauſe the chord of the diminiſhed ſeventh may be conſidered as repreſenting (art. 221.) the chord of the tonic dominant; in ſuch a manner that this fundamental baſs

7
7 7̸ 7 7 7 ※
A D G※ C F※ B E A

(ſee Example cviii.) may be conſidered as repreſenting (art. 116.) that which is written below,

7 7
7 ※ 7 7 7 ※
A D E C F※ B E A.

Now this laſt fundamental baſs is formed according to the common rules, unleſs that there is a broken cadence from D to $\overset{\overset{7}{※}}{E}$, and an interrupted cadence from E to C, which are licenſes (art. 213. and 214.).

Fig. 1.

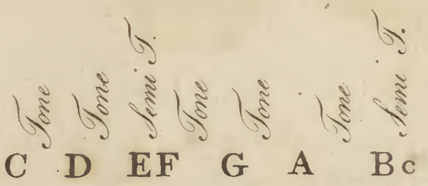


Fig. 9.

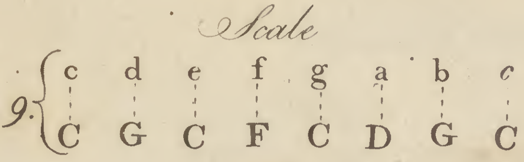
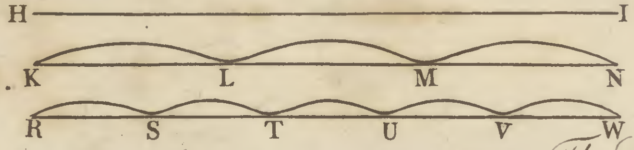


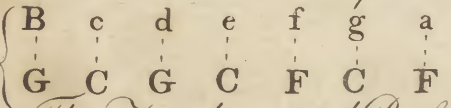
Fig. 2.

Fig. 3.



The Diatonic Scale of the Greeks

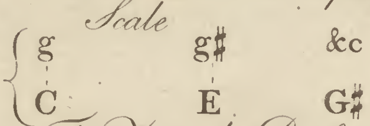
Fig. 4.



The Fundamental Baſs

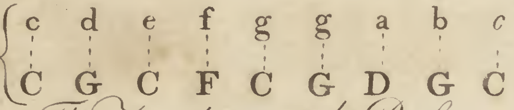
The Chromatic Species

Fig. 10.



The Fund. Baſs

Fig. 5.



The Fundamental Baſs

Fig. 11.

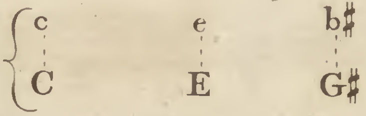
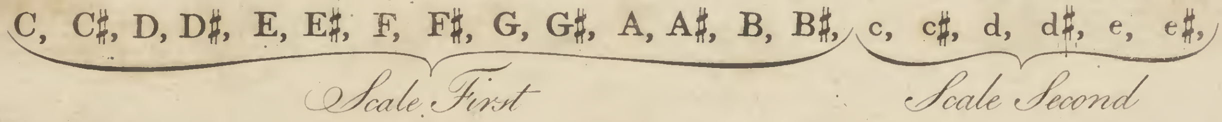
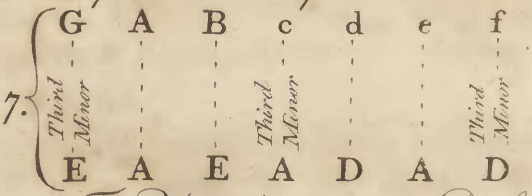


Fig. 6.



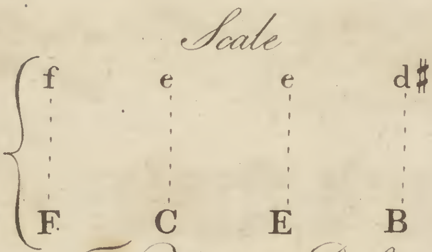
The first Scale of the Minor Mode

Fig. 7.



The Fundamental Baſs

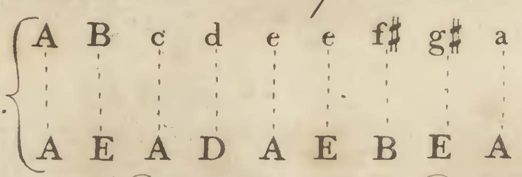
Fig. 12.



The Fund. Baſs

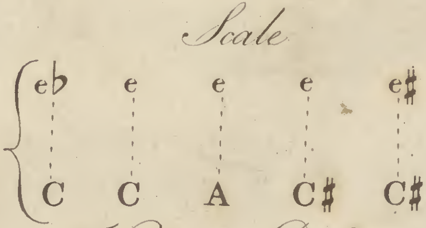
The Second Scale of the Minor Mode

Fig. 8.



The Fundamental Baſs

Fig. 13.



The Fund. Baſs.

W. Archibald Sculp.t

MUSIC.

PLATE CCCLV.

Fig. 1.

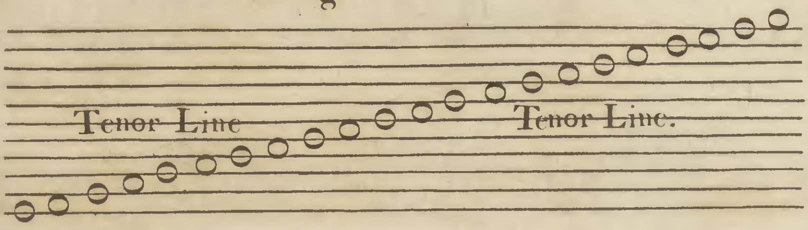


Fig. 2.

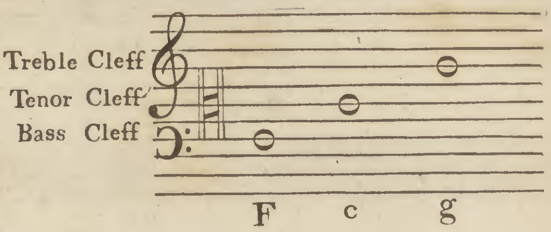


Fig. 3.

Fig. 4.

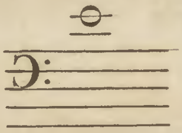


Fig. 5.

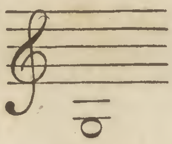


Fig. 6.

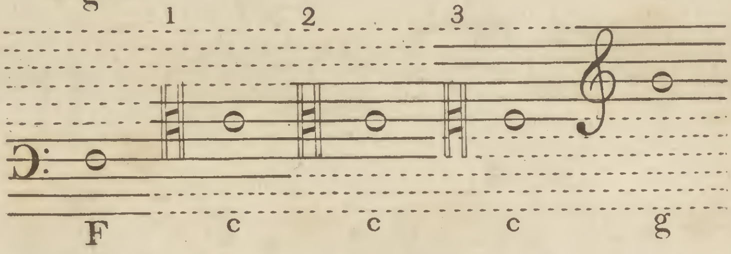


Fig. 7.

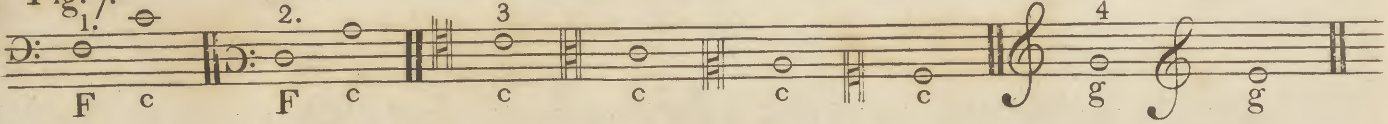


Fig. 8.

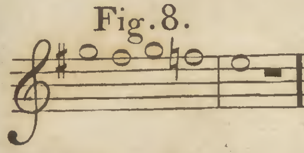


Fig. 9.

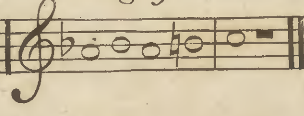


Fig 10.

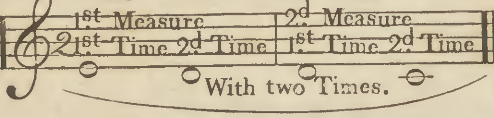


Fig. 11.

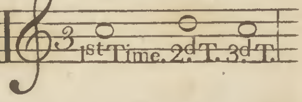


Fig. 12.

Fig. 13.

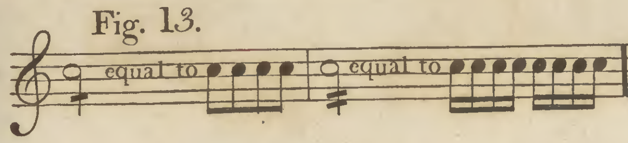


Fig. 14.

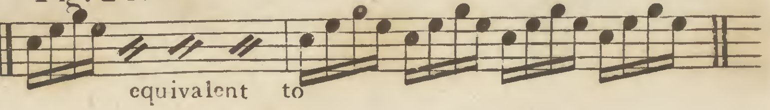


Fig. 15.

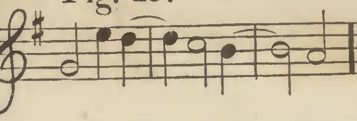


Fig. 16.

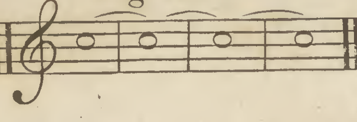


Fig. 17.

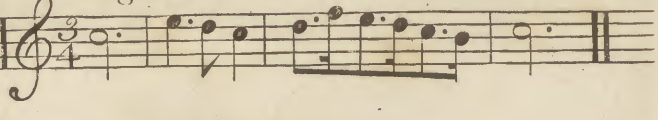
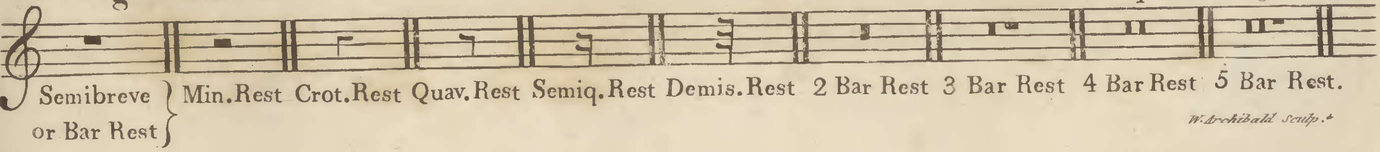


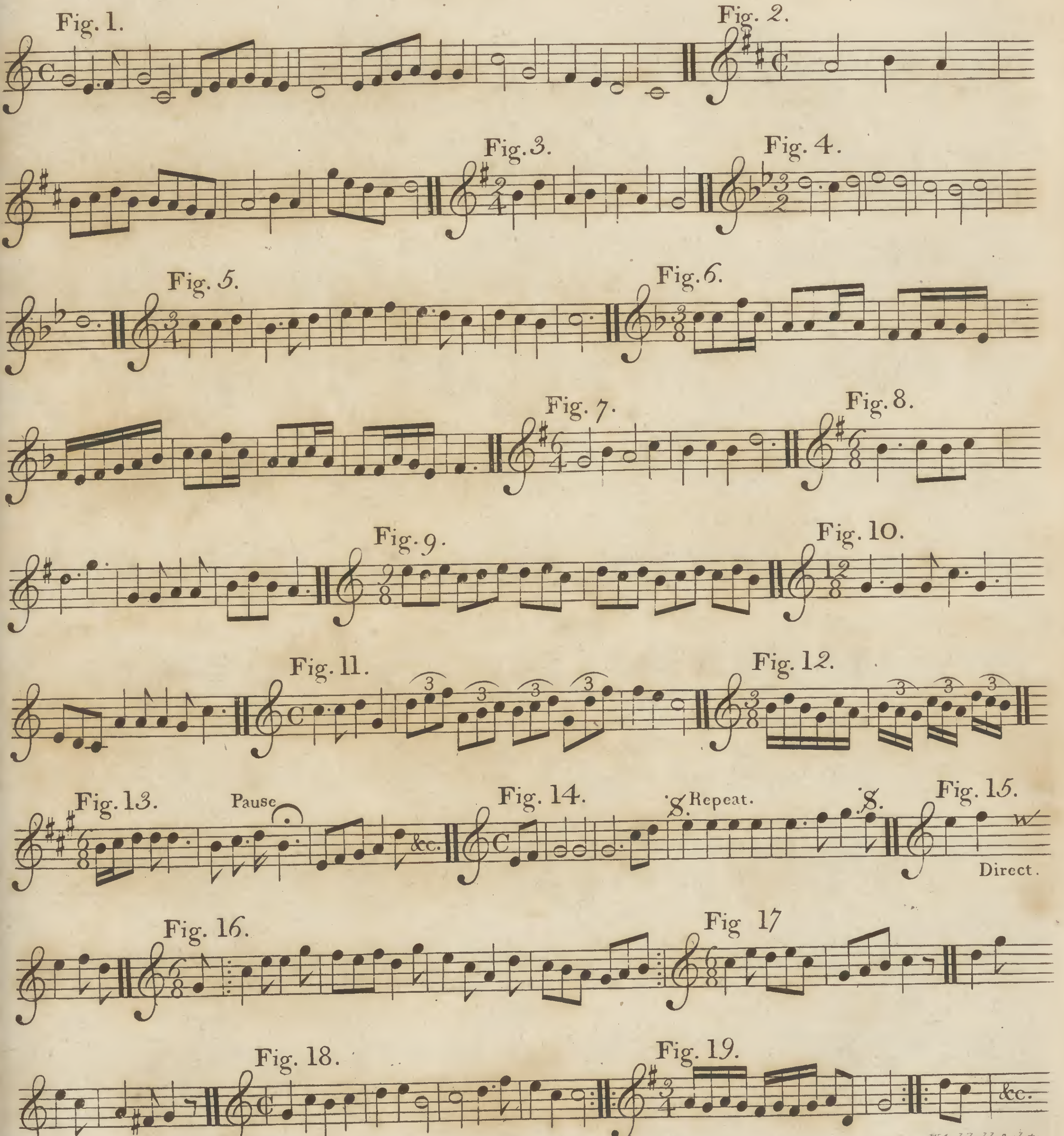
Fig. 18. Rests.

Rests of several Bars.

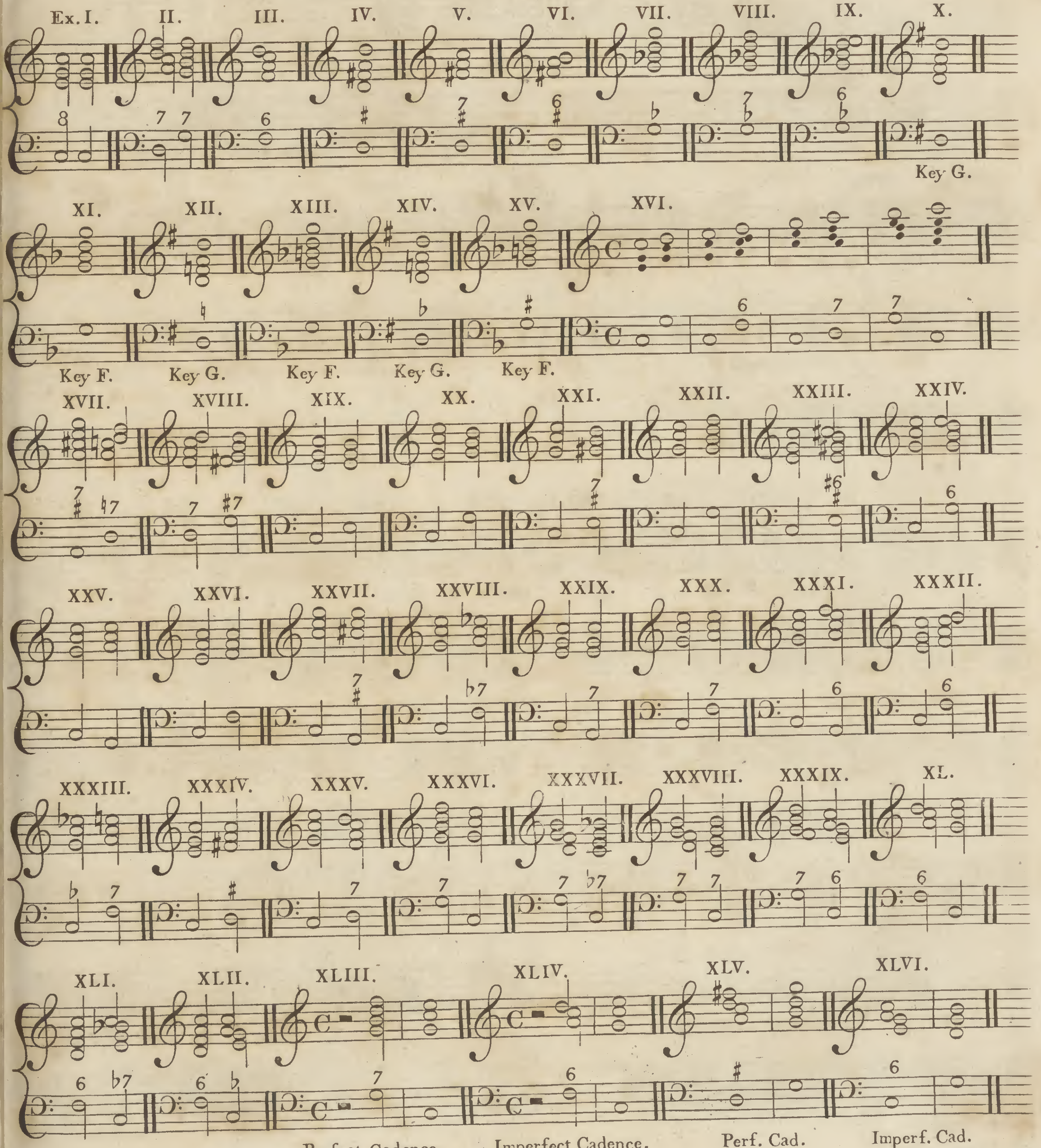


W. Archibald Sculp.t

MUSIC.



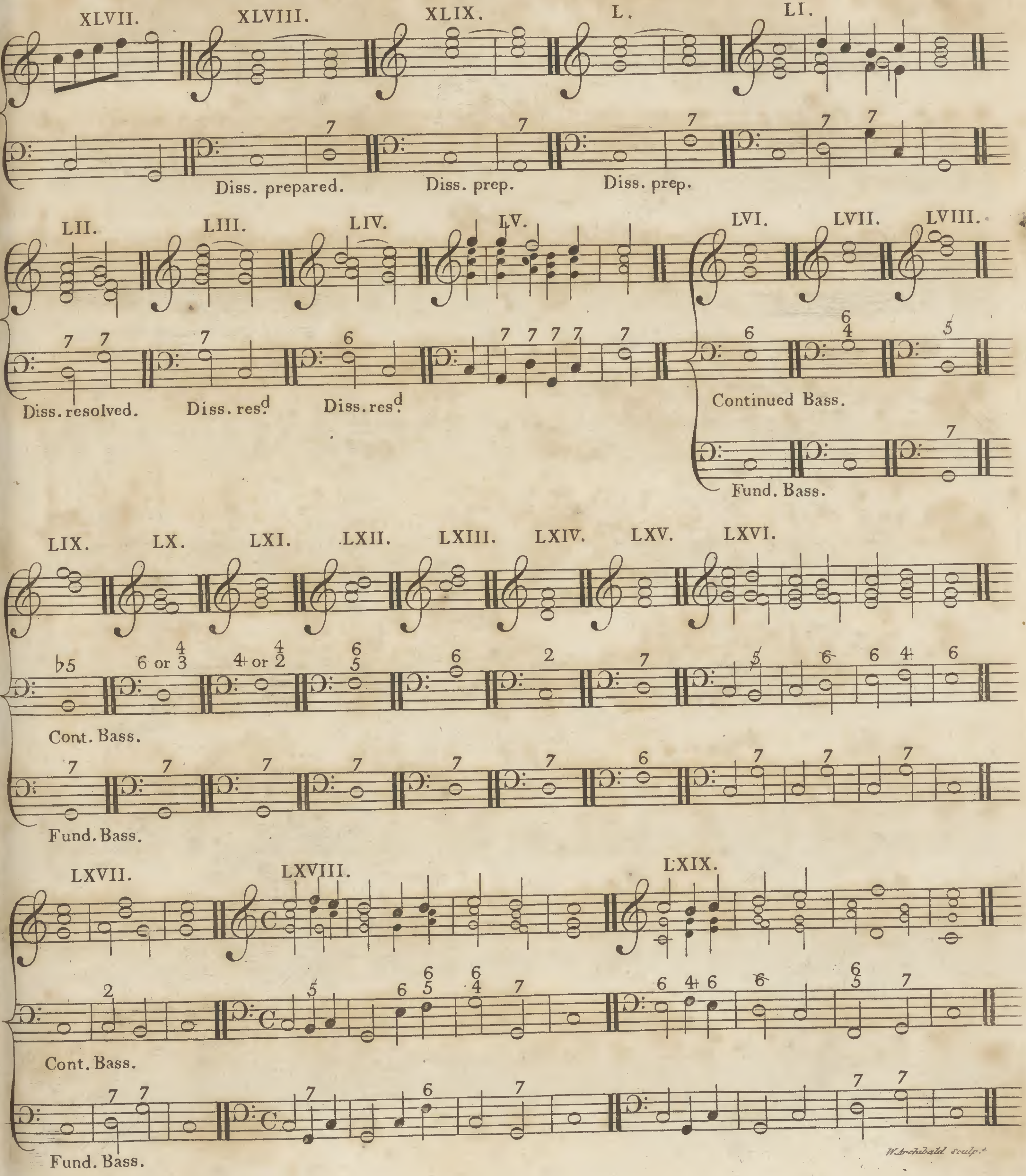
W. Archibald Sculpt.



W. Archibald Sculp.

MUSIC.

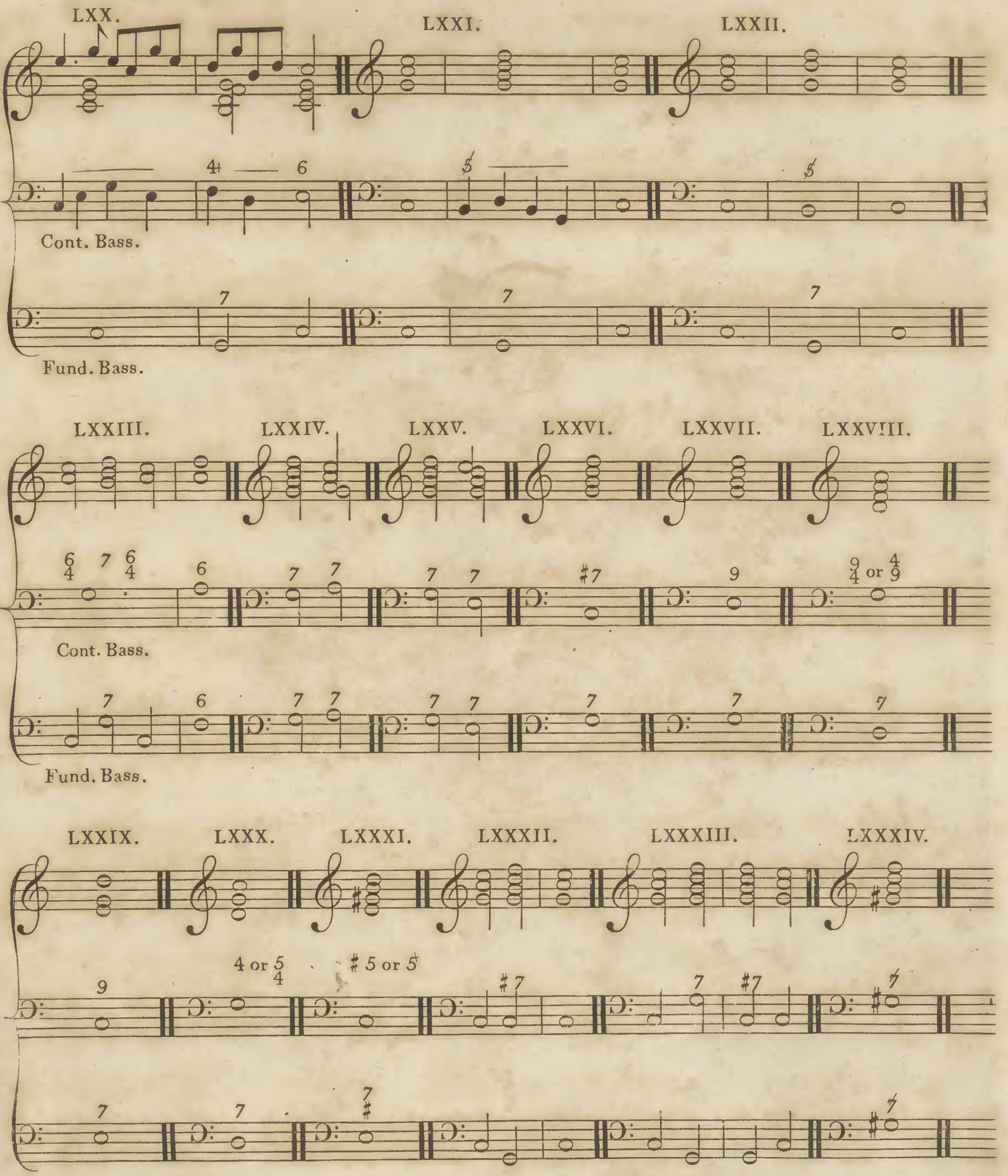
PLATE CCCLVIII.



W. Archibald sculp.t

MUSIC.

PLATE CCCLIX.

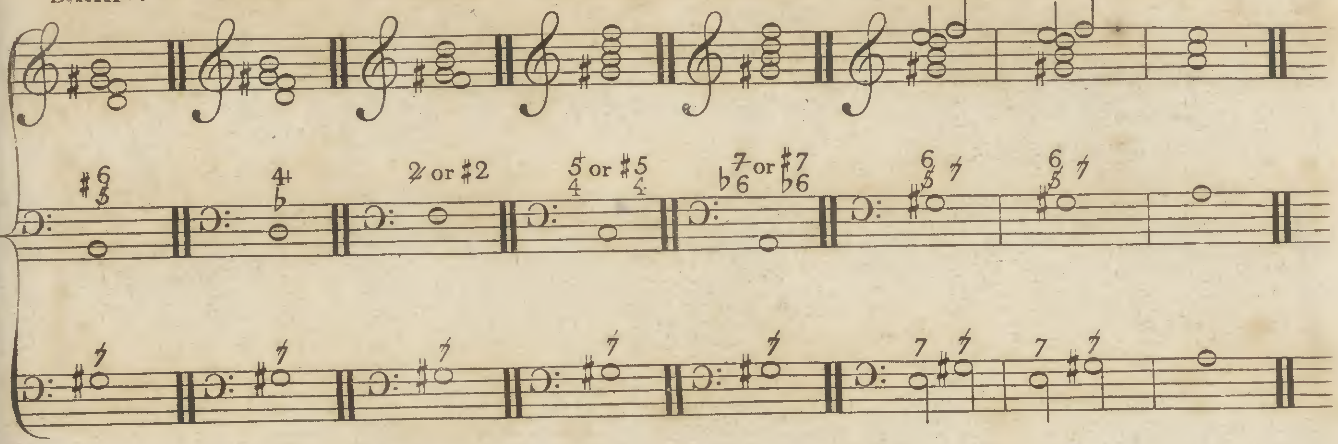


W. Archibald Sculp.

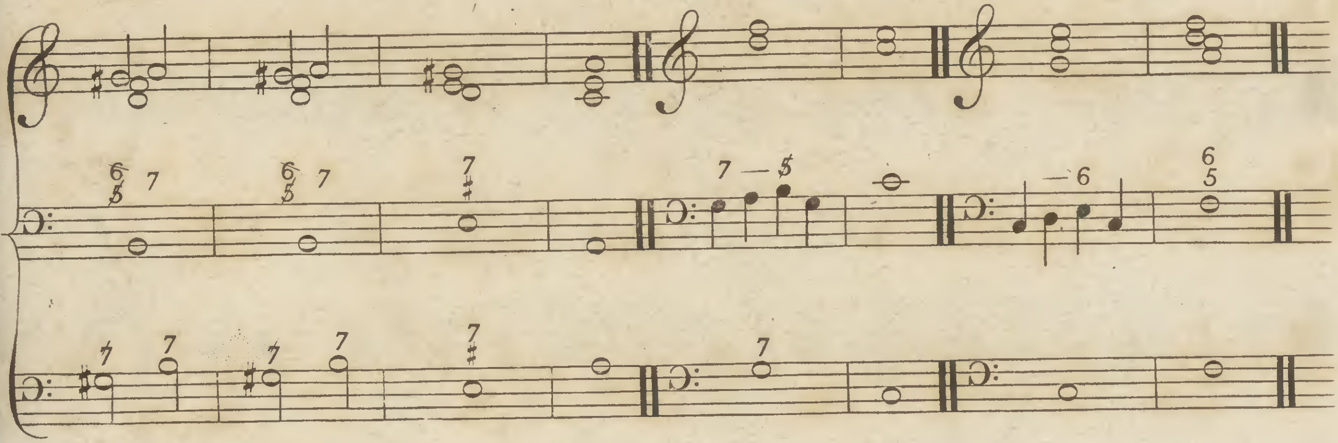
MUSIC.

PLATE CCCLX.

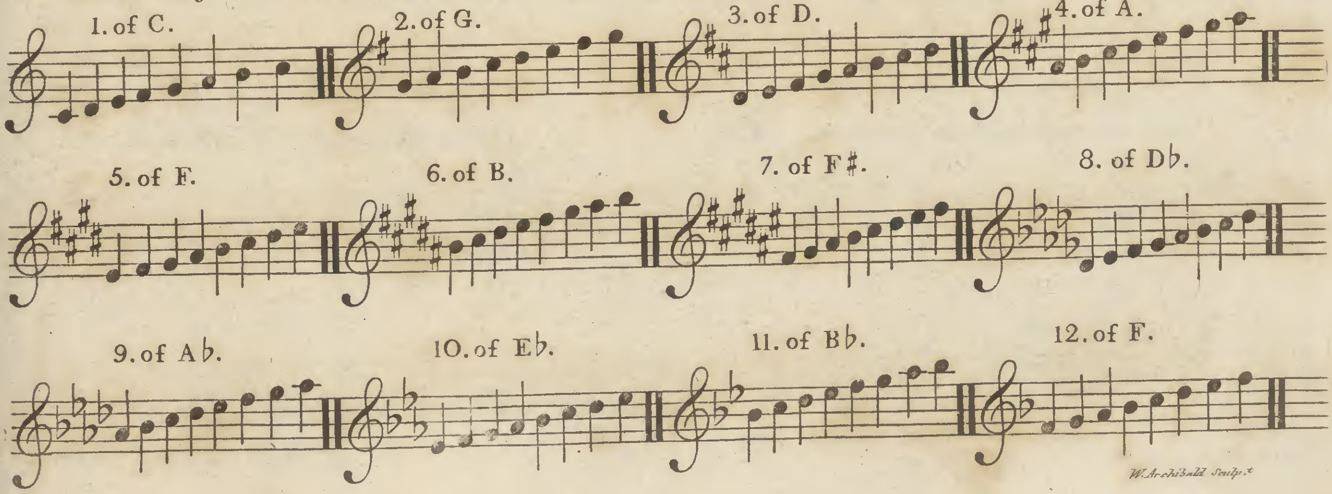
LXXXV. LXXXVI. LXXXVII. LXXXVIII. LXXXIX. XC. Diatonic Modulation.



XCI. XCII. XCIII.



XCIV. Major Scales.



1. of C. 2. of G. 3. of D. 4. of A.

5. of E. 6. of B. 7. of F♯. 8. of D♭.

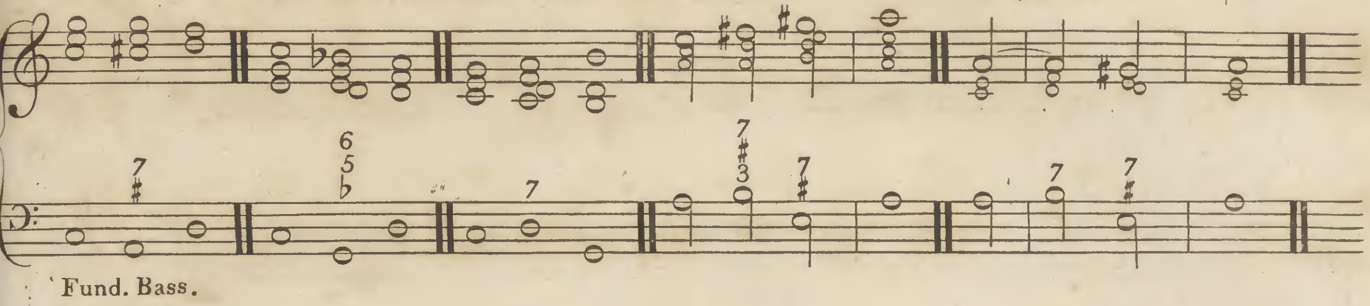
9. of A♭. 10. of E♭. 11. of B♭. 12. of F.

W. Archibald Sculp.t

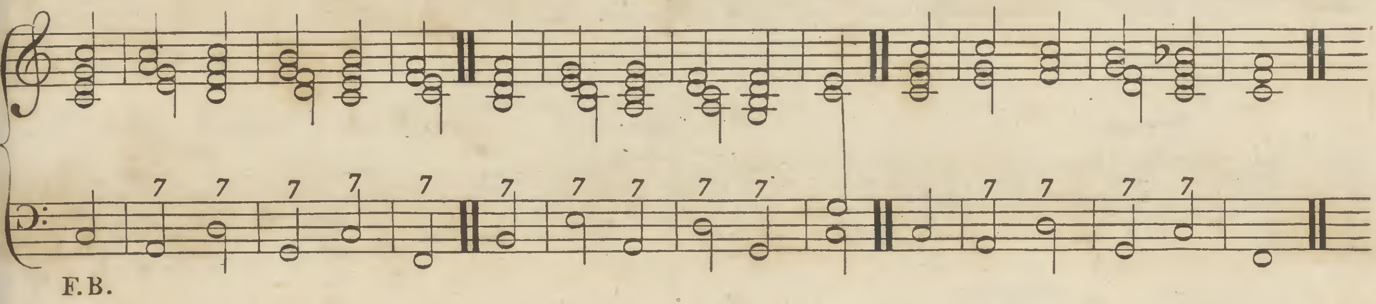
MUSIC.

PLATE CCCLXI.

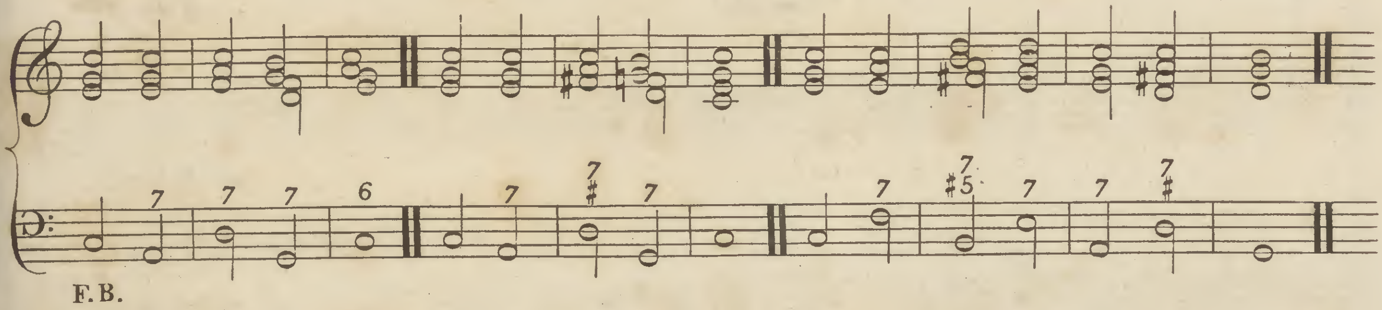
XCV. XCVI. XCVII. XCVIII. XCIX.



C. CI.

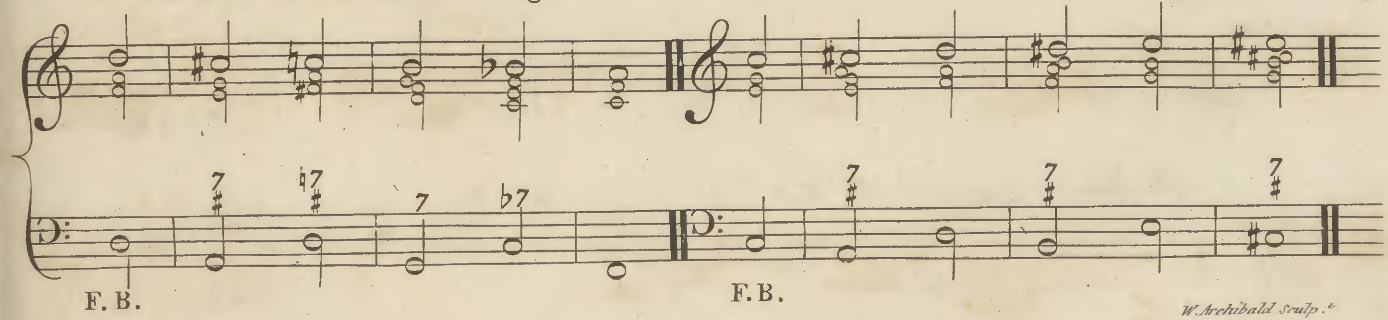


CII. CIII. CIV.



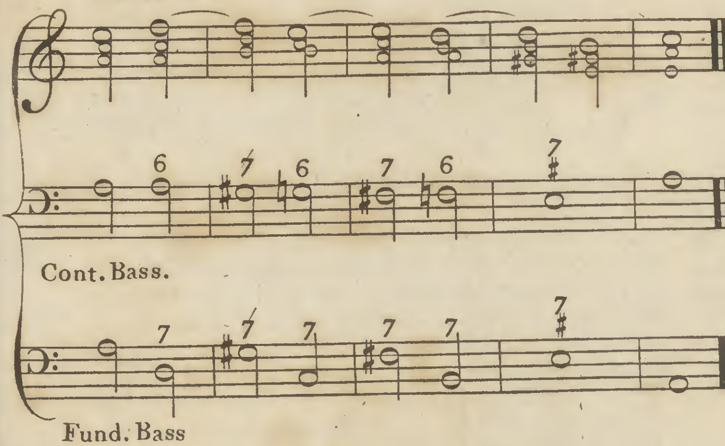
CV. Chromatic Modulation descending.

CVI. Chromatic Modulation ascending.

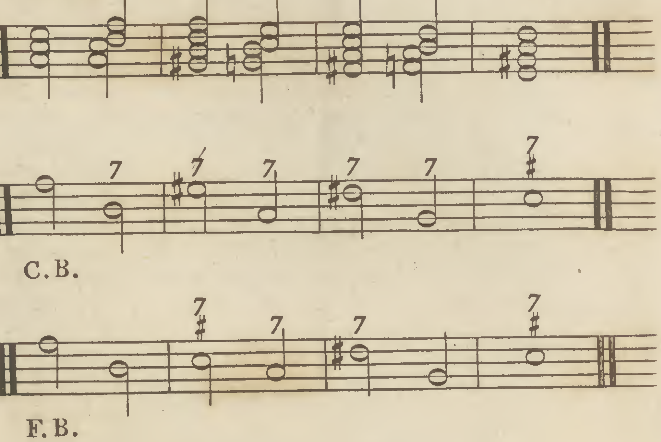


W. Archibald Sculp.t

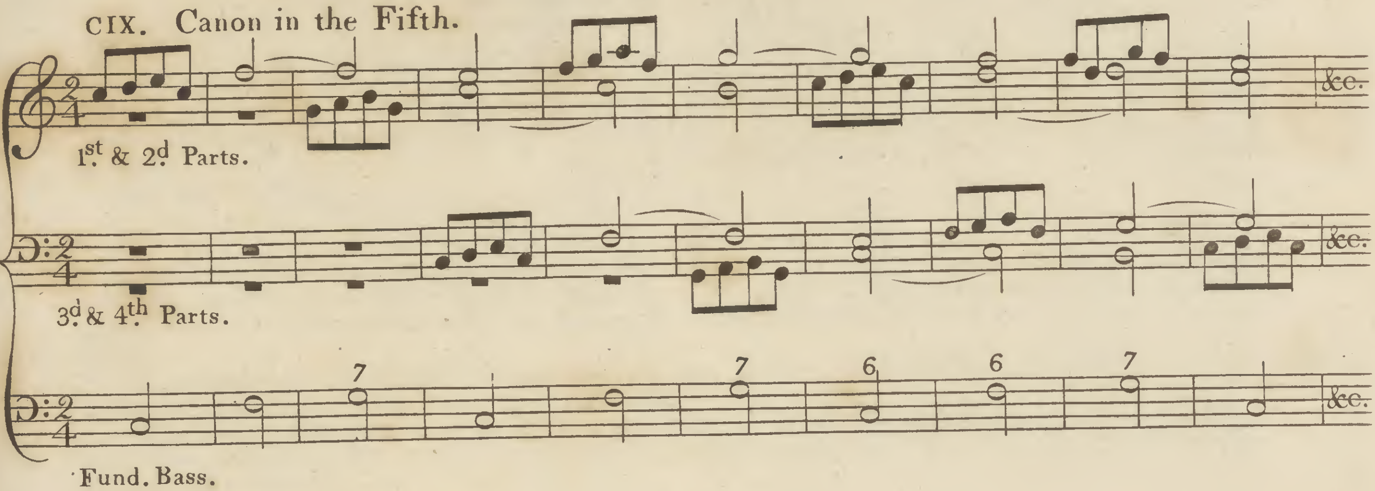
CVII.



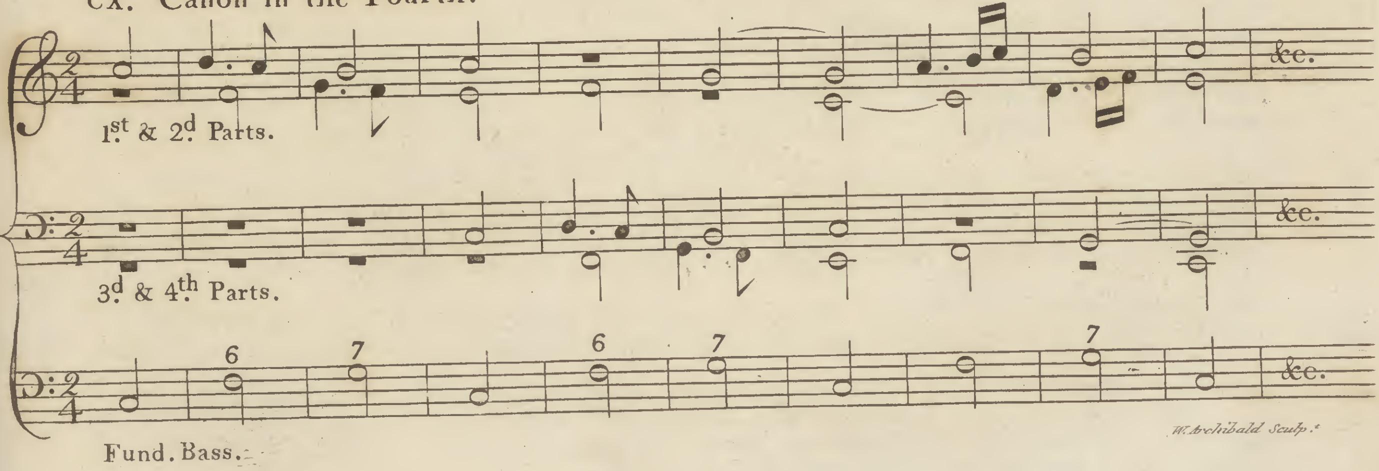
CVIII.



CIX. Canon in the Fifth.



CX. Canon in the Fourth.



W. Archibald Sculp.

Aſcending, what.

247. When the air is chromatic in aſcending, one may form a fundamental baſs by a ſeries of tonics and of tonic dominants, which ſucceed one another alternately by the interval of a third in deſcending, and of a fourth in aſcending, (ſee Ex. CVI.). There are many other ways of forming a chromatic air, whether in riſing or deſcending; but theſe details in an elementary eſſay are by no means neceſſary.

Enharmonic little practiſed.

248. The enharmonic is very rarely put in practice; and we have explained its formation in the firſt book, to which we refer our readers.

See *Deſign.*

CHAP. XV. *Of Deſign, Imitation, and Fugue.*

Deſign, what.

249. In muſic, the name of *deſign*, or *ſubject*, is generally given to a particular air or melody, which the compoſer intends ſhould prevail through the piece; whether it is intended to expreſs the meaning of words to which it may be ſet, or merely inſpired by the impulſe of taſte and fancy. In this laſt caſe, deſign is diſtinguiſhed into *imitation* and *fugue*.

See *Imitation.* Imitation, what.

250. *Imitation* conſiſts in cauſing to be repeated the melody of one or ſeveral meaſures in one ſingle part, or in the whole harmony, and in any of the various modes that may be choſen. When all the parts abſolutely repeat the ſame air * or melody, and beginning one after the other, this is called a *canon* (5 M).

* See *Air, Canon, Fugue.*

Fugue conſiſts in alternately repeating that air in the treble, and in the baſs, or even in all the parts, if there are more than two.

Principal rules for compoſing in ſeveral parts.

251. Imitation and fugue are ſometimes conducted by rules merely deducible from taſte, which may be ſeen in the 332d and following pages of M. Rameau's *Treatiſe on Harmony*; where will likewiſe be found a detail of the rules for compoſition in ſeveral parts. The chief rules for compoſition in ſeveral parts are, that the diſcords ſhould be found, as much as poſſible, prepared and reſolved in the ſame part; that a diſcord ſhould not be heard at the ſame time in ſeveral parts, becauſe its harſhneſs would diſguſt the ear; and that in no particular part there ſhould be found two octaves or two fifths in ſucceſſion (5 N) with reſpect to the baſs. Muſicians, however, do not heſitate ſometimes to violate this precept, when taſte or occaſion require. In muſic, as in all the other fine arts, it is the buſineſs of the artiſt to aſſign and to obſerve rules; and province of men of taſte and genius to find the exceptions.

APPENDIX.

The treatiſe of D'Alembert is well entitled to the merit of accuracy; but perhaps a perſon who has not particularly ſtudied the ſubject, may find difficulty in following the ſcientific deductions of that author.—We ſubjoin, therefore, a few general obſervations on the philoſophy of muſical ſound, commonly called *harmonics*, which may perhaps convey the full portion of knowledge of the theory of muſic, with which one in

---

(5 M) Compoſitions in ſtrict canon, where one part begins with a certain ſubject, and the other parts are bound to repeat the very ſame ſubject, or the reply, as it is called, in the uniſon, fifth, fourth, or octave, depend on the following rules, which are nothing more than a ſummary of the ſyſtem explained by our author.

1. The chords to be employed are the tonic, and its two adjuncts; the ſubdominant, ſuſceptible of an added ſixth, and the dominant, ſuſceptible of an added ſeventh.

2. The ſubject muſt begin in the harmony of the tonic, and as the fundamental progreſſion from the dominant to the ſubdominant is not permitted (art. 33, 36.), the ſubdominant muſt follow the tonic, and the dominant the ſubdominant, thus,

C, $\overset{6}{\text{F}}$, $\overset{7}{\text{G}}$, C, $\overset{6}{\text{F}}$, $\overset{7}{\text{G}}$, C, &c.

3. As the diatonic ſcale conſiſts of two tetrachords, of which the firſt is alſo the ſecond tetrachord of the mode of the ſub-dominant, and the ſecond the firſt tetrachord of the dominant; ſo, in canon, when the reply is meant to be in the mode of the dominant, the ſubject muſt be in the firſt tetrachord of the tonic, by which means the correſponding firſt tetrachord of the dominant being the ſecond tetrachord of the tonic, the whole piece is truly in that mode. On the other hand, if the reply is to be in the mode of the ſub-dominant, the ſubject muſt be in the ſecond tetrachord of the tonic, the correſponding tetrachord of the ſub-dominant being the firſt tetrachord of the tonic, and the mode of the tonic being thus preſerved.

4. For the ſame reaſon, where the reply is in the dominant, the ſubject is only allowed to modulate into the mode of the ſub-dominant, and the reply of courſe into that of the tonic. And where the reply is in the dominant, the ſubject is to modulate only into the mode of the ſub-dominant, the reply following of courſe into that of the tonic. Were the contrary modulation permitted, the reply would depart too far from the mode of the tonic.

Laſtly, When the reply is to be in the mode of the dominant it muſt commence in the meaſure bearing that harmony; and in the ſame way, the reply in the ſub-dominant muſt begin in the meaſure which bears the harmony of the ſub-dominant.

If theſe rules be obſerved, and due attention paid to the preparation and reſolution of diſſonances, compoſition in ſtrict canon, in any number of parts, will be found to be by no means difficult. See Ex. CIX. and CX.

(5 N) Yet there may be two fifths in ſucceſſion, provided the parts move in contrary directions, or, in other words, if the progreſs of one part be aſcending, and the other deſcending; but in this caſe they are not properly two fifths, they are a fifth and a twelfth: for example, if one of the parts in deſcending ſhould ſound F D, and the other 'c a' in riſing, C is the fifth of F, and 'a' the twelfth of D.

General Obſervations on Harmonics.

ſearch only of general information, and not a profeſſed ſtudent of this particular ſcience, would chooſe to reſt ſatisfied.

The theory of muſical ſound, which only in the beginning of the preſent century was ultimately eſtabliſhed by mathematical demonſtration, is no other than that which diſtinguiſhed the ancient muſical ſect who followed the opinions of Pythagoras on that ſubject.

No part of natural philoſophy has been more fruitful of hypotheſis than that of which muſical ſound is the object. The muſical ſpeculators of Greece arranged themſelves into a great number of ſects, the chief of whom were the Pythagoreans and the Ariſtoxenians.

Pythagoras ſuppoſed the air to be the *vehicle* of ſound; and the agitation of that element, occaſioned by a ſimilar agitation in the parts of the ſounding body, to be the *cauſe* of it. The vibrations of a ſtring or other ſonorous body, being communicated to the air, affected the auditory nerves with the ſenſation of ſound; and this ſound, he argued, was acute or grave in proportion as the vibrations were quick or ſlow.—He diſcovered by experiment, that of two ſtrings equal in every thing but length, the ſhorter made the quicker vibrations, and emitted the acuter ſound:—in other words, that the number of vibrations made in the ſame time by two ſtrings of different lengths, was inverſely as thoſe lengths; that is, the greater the length the ſmaller the number of vibrations in any given time. Thus ſound, conſidered in the vibrations that cauſe it, and the dimenſions of the vibrating body, came to be reduced to quantity, and as ſuch was the ſubject of calculation, and expreſſible by numbers.—For inſtance, the two ſounds that form an octave could be expreſſed by the numbers 1 and 2, which would repreſent either the number of vibrations in a given time, or the length of the ſtrings; and would mean, that the acuter ſound vibrates twice, while the graver vibrates once; or that the ſtring producing the lower ſound is twice the length of that which gives the higher. If the vibrations were conſidered, the higher ſound was as 2, the lower as 1; the reverſe, if the length was alluded to. In the ſame manner, in the ſame ſenſe, the 5th would be expreſſed by the ratio of 2 to 3, and the 4th by that of 3 to 4.

Ariſtoxenes, in oppoſition to the calculations of Pythagoras, held the ear to be the ſole ſtandard of muſical proportions. That ſenſe he accounted ſufficiently accurate for muſical, though not for mathematical purpoſes; and it was in his opinion abſurd to aim at an artificial accuracy in gratifying the ear beyond its own power of diſtinction. He, therefore, rejected the velocities, vibrations, and proportions of Pythagoras, as foreign to the ſubject, in ſo far as they ſubſtituted *abſtract cauſes* in the room of *experience*, and made muſic the object of *intellect* rather than of *ſenſe*.

Of late, however, as has been already mentioned, the opinions of Pythagoras have been confirmed by abſolute demonſtration; and the following propoſitions, in relation to muſical ſound, have paſſed from conjecture to certainty.

Sound is generated by the vibrations of elaſtic bodies, which communicate the like vibrations to the air, and theſe again the like to our organs of hearing. This is evident, becauſe ſounding bodies communicate tremors to other bodies at a diſtance from them. The vibrating motion, for inſtance, of a muſical ſtring, excites motion in others, whoſe tenſion and quantity of matter diſpoſe their vibrations to keep time with the undulations of air propagated from it (the ſtring firſt ſet in motion).

If the vibrations be iſochronous, and the ſound muſical, continuing at the ſame pitch, it is ſaid to be acuter, ſharper, or higher, than any other ſound whoſe vibrations are ſlower; and graver, flatter, or lower, than any other whoſe vibrations are quicker.—For while a muſical ſtring vibrates, its vibrations become quicker by increaſing its tenſion or diminiſhing its length; its ſound at the ſame time will be more acute: and, on the contrary, by diminiſhing its tenſion or increaſing its length, the vibrations will become ſlower and the ſound graver. The like alteration of the pitch of the ſound will follow, by applying, by means of a weight, an equal degree of tenſion to a thicker or heavier and to a ſmaller or lighter ſtring, both of the ſame length, as in the ſmaller ſtring the maſs of matter to be moved by the ſame force is leſs.

If ſeveral ſtrings, however, different in length, denſity, and tenſion, vibrate altogether in equal times, their ſounds, will have all one and the ſame pitch, however they may differ in loudneſs or other qualities.—They are called *uniſons*. The vibrations of uniſons are iſochronous.

The vibrations of a muſical ſtring, whether wider or narrower, are nearly iſochronous. Otherwiſe, while the vibrations decreaſe in breadth till they ceaſe, the pitch of the ſound could not continue the ſame (which we perceive by experience it does), unleſs where the firſt vibrations are made very violently; in which caſe, the ſound is a little acuter at the beginning than afterwards.

Laſtly, The word *vibration* is underſtood to mean the time which paſſes between the departure of the vibrating body from any aſſigned place and its return to the ſame.

Muſic, Muſimon.

Glaſs-Music. See Harmonica.

MUSIMON, in *Natural Hiſtory*, the name of an animal eſteemed a ſpecies of ſheep, deſcribed by the ancients as common in Corſica, Sardinia, Barbary, and the north-eaſt parts of Aſia. It has been doubted whether the animal deſcribed under this name is now any where to be found in the world, and whether it was not, probably, a ſpurious breed between two animals of different ſpecies, perhaps the ſheep and goat, which, like the mule, not being able to propagate its ſpecies, the production of them may have been diſcontinued.

Buffon ſuppoſes it to be the ſheep in a wild ſtate; and it is deſcribed as ſuch by Mr Pennant. Theſe animals live in the mountains, and run with great ſwiftneſs among the rocks. Thoſe of Kamtſchatka are ſo ſtrong, that 10 men can ſcarce hold one; and the horns are ſo large as ſometimes to weigh 30 pounds, and

and ſo capacious that young foxes often ſhelter themſelves in the hollow of ſuch as by accident fall off in the deſerts.

MUSIVUM AURUM. See CHEMISTRY, N° 1806.

MUSK, a very ſtrong ſcented ſubſtance, found in a bag under the belly of a ſpecies of moſchus. See MOSCHUS, MAMMALIA *Index*. And for an account of the nature and properties of muſk, ſee MATERIA MEDICA *Index*.

MUSK Animal. See MOSCHUS,
MUSK Ox. See BOS, } MAMMALIA *Index*.
MUSK Rat. See CASTOR,

MUSKET, or MUSQUET, properly a fire-arm borne on the ſhoulder, and uſed in war; to be fired by the application of a lighted match.

The length of the barrel is fixed to three feet eight inches from the muzzle to the touch-pan, and its bore is to be ſuch as may receive a bullet of 14 in a pound, and its diameter differs not above one 50th part from that of the bullet.

Muſkets were anciently borne in the field by the infantry, and were uſed in England ſo lately as the beginning of the civil wars. At preſent they are little uſed, except in the defence of places; fuſees or fire-locks having taken their place and name.

MUSKETOON, a kind of ſhort thick muſket, whoſe bore is the 38th part of its length; it carries five ounces of iron, or ſeven and a half of lead, with an equal quantity of powder. This is the ſhorteſt kind of blunderbuſſes.

MUSLIN, a fine ſort of cotton cloth, which bears a downy knot on its ſurface. There are ſeveral ſorts of muſlins brought from the Eaſt Indies, and more particularly from Bengal; ſuch as doreas, betelles, mulmuls, tanjecbs, &c. Muſlin is now manufactured in Britain, and brought to very great perfection.

MUSQUETOE. See CULEX, ENTOMOLOGY *Index*.

MUSSULMAN, or MUSYLMAN, a title by which the Mahometans diſtinguiſh themſelves; ſignifying, in the Turkiſh language, "true believer, or orthodox." See MAHOMETANISM.

In Arabic, the word is written *Moſlem*, *Moſleman*, or *Moſolman*. The appellation was firſt given to the Saracens, as is obſerved by Leunclavius.—There are two kinds of Muſſulmans, very averſe to each other; the one called *Sonnites*, and the other *Shiites*.—The Sonnites follow the interpretation of the Alcoran given by Omar; the Shiites are the followers of Ali. The ſubjects of the king of Perſia are Shiites; and thoſe of the grand ſignior, Sonnites. See SONNA, and ALCORAN.

According to ſome authors the word Muſſulman ſignifies *ſaved*, that is, predeſtinated: and hence the Mahometans give themſelves the appellation, as believing they are all predeſtinated to ſalvation.—Martinius is more particular as to the origin of the name; which he derives from the Arabic מסלם, *muſalem*, "ſaved, ſnatched out of danger:" the Mahometans, he obſerves, eſtabliſhing their religion by fire and ſword, maſſacred all thoſe who would not embrace it, and granted life to all that did, calling them *Muſſulmans*, q. d. *erepti è periculo*; whence the word, in courſe of time, became the diſtinguiſhing title of all thoſe of that ſect, who have affixed to it the ſignification of *true believers*.

MUST, MUSTUM, ſweet wine newly preſſed from the grape; or the new liquor preſſed from the fruit before it is fermented. See WINE.

MUSTARD. See SINAPI, BOTANY *Index*.

MUSTARD Seed. For an account of its medical qualities, ſee MATERIA MEDICA *Index*.

MUSTELA, the OTTER and WEASEL; a genus of quadrupeds of the order of feræ. See MAMMALIA *Index*.

MUSTER, in a military ſenſe, a review of troops under arms, to ſee if they be complete and in good order; to take an account of their numbers, the condition they are in, viewing their arms and accoutrements, &c.

MUSTER-Maſter general, or *Commiſſary-general of the MUSTERS*; one who takes account of every regiment, their number, horſes, arms, &c. reviews them, ſees the horſes be well mounted, and all the men well armed and accoutred, &c.

MUSTER-Rolls, liſts of ſoldiers in each company, troop, or regiment, by which they are paid, and the ſtrength of the army is known.

MUTABILITY is oppoſed to immutability. See IMMUTABILITY.

MUTATION, the act of changing, or ſometimes the change itſelf.

MUTATION, in the ancient muſic, is applied to the changes or alterations that happen in the order of the ſounds which compoſe the melody.

MUTATIONES, among the Romans, poſt ſtages, or places where the public couriers were ſupplied with freſh horſes.—The *mutationes* were wholly deſigned for the uſe of theſe couriers, or meſſengers of ſtate; in which reſpect they differ from *manſiones*.

MUTCHKIN, a liquid meaſure uſed in Scotland; it contains four gills, and is the fourth part of a Scotch pint.

MUTE, in a general ſenſe, ſignifies a perſon that cannot ſpeak, or has not the uſe of ſpeech.

MUTE, in *Law*, a perſon that ſtands dumb or ſpeechleſs when he ought to anſwer, or to plead. See ARRAIGNMENT.

MUTE, in *Grammar*, a letter which yields no ſound without the addition of a vowel. The ſimple conſonants are diſtinguiſhed into mutes and liquids, or ſemivowels. See the articles CONSONANT, LIQUID, &c.

The mutes in the Greek alphabet are nine, three of which, viz. π, κ, τ, are termed *tenues*; three β, γ, δ, termed *mediæ*; and three φ, χ, θ, termed *aſpiratæ*. See the article ASPIRATE, &c.

The mutes of the Latin alphabet are alſo nine, viz. B, C, D, G, I, K, P, Q, T.

MUTILATION, the retrenching or cutting away any member of the body.

This word is alſo extended to ſtatues and buildings, where any part is wanting, or the projecture of any member, as a cornice or an impoſt, is broken off. It is ſometimes alſo uſed in a more immediate manner for caſtration: (See CASTRATION and EUNUCH). The practice of this ſort of mutilation is of various kinds: the Hottentots are ſaid to cut away one teſticle from their children upon ſuppoſition that they are thereby made lighter and more active for running. In other countries, poor people completely mutilate their boys, to prevent the miſery and want which would attend their offspring. Thoſe who have nothing in view but the improvement of a vain talent, or the formation of a voice which disfigures nature, as was the caſe formerly in Italy, are contented with cutting away the teſticles. But in ſome countries of Aſia, eſpecially among the Turks, and in a part of Africa, thoſe whom jealouſy inſpires with diſtruſt would not think their wives ſafe in the cuſtody of ſuch eunuchs: They employ no ſlaves in their ſeraglios who have not been deprived of all the external parts of generation.

Amputation is not the only means of accompliſhing this end. Formerly, the growth of the teſticles was prevented, and their organization deſtroyed by ſimple rubbing, while the child was put into a warm bath made of a decoction of plants. Some pretend that by this ſpecies of caſtration the life is in no danger. Amputation of the teſticles is not attended with much danger; but complete amputation of the external parts of generation is often fatal. This operation can only be performed on children from ſeven to ten years of age. Eunuchs of this kind, owing to the danger attending the operation, coſt in Turkey five or ſix times more than others. *Chardin* relates, that this operation is ſo painful and dangerous after 15 years of age, that hardly a fourth part of thoſe by whom it is undergone eſcape with life. *Pietro della Valle*, on the contrary, informs us, that in Perſia thoſe who ſuffer this cruel and dangerous operation as a puniſhment for rapes and other crimes of this kind, are eaſily cured though far advanced in life; and that nothing but aſhes is applied to the wound.

There are eunuchs at Conſtantinople, throughout all Turkey, and in Perſia, of a gray complexion: they come for the moſt part from the kingdom of Golconda, the peninſula on this ſide the Ganges, the kingdoms of Aſſan, Aracan, Pegu, and Malabar. Thoſe from the gulf of Bengal are of an olive colour. There are ſome white eunuchs who come from Georgia and Circaſſia, but their number is ſmall. The black eunuchs come from Africa, and eſpecially from Ethiopia. Theſe, in proportion to their horrible appearance, are the more eſteemed and coſt dearer. It appears that a very conſiderable trade is carried on in this ſpecies of men; for Tavernier informs us, that when he was in the kingdom of Golconda, in the year 1657, 22,000 eunuchs were made in it. In that country they are ſold at the fairs.

The object of improving the voice by means of this ſpecies of mutilation, it is ſaid, often fails; for of 2000 victims to the luxury and extravagant caprices of the art, hardly three are found who unite good talents with good organs. The other languiſhing and inactive wretches are, in ſome meaſure, outcaſts from both ſexes, and paralytic members in the community. But let us pay the tribute which is due to that virtuous pontiff Pope Clement VIII. who, liſtening to the voice of modeſty and humanity, proſcribed and aboliſhed this deteſtable and infamous practice. Mutilation, he declared was the moſt abominable and diſgraceful of crimes.

MUTILLA, a genus of inſects belonging to the order of hymenoptera. See Entomology *Index*.

MUTINA, in *Ancient Geography*, a noble city of the Ciſpadana, made a Roman colony in the ſame year with Parma, ſituated between the rivers Gabellus and Scultenna, on the Via Æmilia. Here D. Brutus being beſieged by Antony, was relieved by the conſuls Hirtius and Panſa. The Greeks called it *Mutine;* except Polybius, in whom it is *Motine;* and in Ptolemy *Mutina*, after the Roman manner.—Now *Modena*, a city of Lombardy, and capital of a cognominal duchy. E. Long. 11. 20. N. Lat. 44. 45.

MUTINY, in a military ſenſe, to riſe againſt authority.—"Any officer or ſoldier who ſhall preſume to uſe traiterous or diſreſpectful words againſt the ſacred perſon of his majeſty, or any of the royal family, is guilty of mutiny.

"Any officer or ſoldier who ſhall behave himſelf with contempt or diſreſpect towards the general or other commander in chief of our forces, or ſhall ſpeak words tending to their hurt or diſhonour, is guilty of mutiny.

"Any officer or ſoldier who ſhall begin, excite, cauſe, or join in, any mutiny or ſedition, in the troop, company, or regiment, to which he belongs, or in any other troop or company in our ſervice, or in any party, poſt, detachment, or guard, on any pretence whatſoever, is guilty of mutiny.

"Any officer or ſoldier who, being preſent at any mutiny or ſedition, does not uſe his utmoſt endeavours to ſuppreſs the ſame, or coming to the knowledge of any mutiny, or intended mutiny, does not without delay give information to his commanding officer, is guilty of mutiny.

"Any officer or ſoldier, who ſhall ſtrike his ſuperior officer, or draw, or offer to draw, or ſhall lift up any weapon, or offer any violence againſt him, being in the execution of his office, on any pretence whatſoever, or ſhall diſobey any lawful command of his ſuperior officer, is guilty of mutiny."

MUTINY Act. See *MILITARY State.*

MUTIUS, Caius, ſurnamed *Codrus*, and afterwards *Scævola*, was one of the illuſtrious Roman family of the Mutii, and rendered his name famous in the war between Porſenna king of Tuſcany and the Romans. That prince reſolving to reſtore the family of Tarquin the Proud, went to beſiege Rome 507 B. C. Mutius reſolved to ſacrifice himſelf for the ſafety of his country; and boldly entering the enemy's camp, killed Porſenna's ſecretary, whom he took for Porſenna himſelf. Being ſeized and brought before Porſenna, he told him boldly, that 300 young men like himſelf had ſworn to murder him; *but ſince this hand has miſſed thee*, continued he, *it muſt be puniſhed;* then putting his right hand on the burning coals, he let it burn with ſuch conſtancy as aſtoniſhed the beholders. The king, amazed at the intrepidity of this young Roman, ordered that he ſhould have his freedom and return to Rome, and ſoon after concluded a peace with the Romans. From this action Mutius obtained the ſurname of *Scævola*, "or left-handed," which was enjoyed by his family.

MUTIUS Scævola, *Q.* ſurnamed the *Augur*, was an excellent civilian, and inſtructed Cicero in the laws. He was made prætor in Aſia; was afterwards conſul, and performed very important ſervices for the republic.

He ought not to be confounded with *Quintus Mutius Scævola*, another excellent civilian, who was prætor in Aſia, tribune of the people, and at length conſul, 95 B. C. He governed Aſia with ſuch prudence and equity, that his example was propoſed to the governors who were ſent into the provinces. Cicero ſays, "that he was the moſt eloquent orator of all the civilians, and the moſt able civilian of all the orators." He was aſſaſſinated in the temple of Veſta, during the wars of Marius and Sylla, 82 B. C.

MUTTON, the common name of the fleſh of a ſheep after the animal has been killed. Mutton has been commonly preferred to all the fleſhes of quadrupeds. And indeed, beſides its being more perfect, it has the advantage over them of being more generally ſuited to different climates: whereas beef, *e. g.* requires a very nice intermediate ſtate, which it ſeems to enjoy chiefly in England; for although Scotland ſupplies what are reckoned the beſt cattle, it is in the rich Engliſh paſtures that they are brought to perfection. Now the ſheep can be brought almoſt to the ſame perfection in this bleak northern region as in the ſouthern countries.

MUTUAL, a relative term, denoting ſomething that is reciprocal between two or more perſons.

Thus we ſay, *mutual aſſiſtance, mutual averſion*, &c. There are mutual or reciprocal duties, offices, &c. between ſuperiors and inferiors; as the king and his ſubjects, the maſter and his ſervants, &c.

Vaugelas makes a diſtinction between *mutual* and *reciprocal: mutual*, according to him, is underſtood of what is between two only; and *reciprocal*, of what is between more than two: but this diſtinction is little regarded in common uſe.

MUTULE, in *Architecture*, a kind of ſquare modillion ſet under the cornice of the Doric order.

MUTUNUS, or MUTINUS, in *Fabulous Hiſtory*, a deity among the Romans, ſimilar to the Priapus of the Greeks.

MUZZLE *of a* GUN *or* MORTAR, the extremity at which the powder and ball is put in; and hence the muzzle ring is the metalline circle or moulding that ſurrounds the mouth of the piece.

MYA, the GAPER; a genus of ſhell fiſh. See CONCHOLOGY *Index*.

MYAGRUM, GOLD OF PLEASURE, a genus of plants, belonging to the tetradynamia claſs; and in the natural method ranking under the 39th order, *Siliquoſæ*. See BOTANY *Index*.

MYCALE, a city and mountain of Caria; alſo a promontory of Aſia oppoſite Samos, celebrated for a battle which was fought there between the Greeks and Perſians about the year of Rome 275. The Perſians were about 100,000 men, who had juſt returned from the unſucceſsful expedition of Xerxes in Greece.—They had drawn their ſhips to the ſhore, and fortified themſelves ſtrongly, as if determined to ſupport a ſiege. They ſuffered the Greeks to diſembark from their fleet without the leaſt moleſtation, and were ſoon obliged to give way before the cool and reſolute intrepidity of an inferior number of men. The Greeks obtained complete victory, ſlaughtered ſome thouſands of the enemy, burned their camp, and ſailed back to Samos with an immenſe booty, in which were 70 cheſts of money.

MYCENÆ, in *Ancient Geography*, a town of Argolis, in Peloponneſus. The kingdom of the Argives was divided into two portions by Acriſius and his brother Prœtus. Argos and Mycenæ were their capitals.—Theſe, as belonging to the ſame family, and diſtant only about 50 ſtadia or ſix miles and a quarter from each other, had one tutelary deity, Juno, and were jointly proprietors of her temple, the Heræum, which was near Mycenæ. It was here that Agamemnon reigned. He enlarged his dominions by his valour and good fortune, and poſſeſſed, beſides Mycenæ, the region about Corinth and Sicyon, and that called afterwards Achæa. On his return from Troy, he was ſlain with his companions at a banquet. Mycenæ then declined: and under the Heraclidæ was made ſubject to Argos. (See ARGOS and ARGEIA). The Mycenæans ſending 80 men, partook with the Lacedæmonians in the glory acquired at Thermopylæ. The jealouſy of the Argives produced the deſtruction of their city, which was abandoned after a ſiege, and laid waſte in the firſt year of the 78th Olympiad, or 466 years before Chriſt. Some part of the wall remained in the ſecond century, with a gate on which were lions, a fountain, the ſubterraneous edifices where Atreus and his ſons had depoſited their treaſures, and, among other ſepulchral monuments, one of Agamemnon, and one of his fellow ſoldiers and ſufferers.

MYCONE, an iſland of the Archipelago, ſituated in E. Long. 25. 51. N. Lat. 37. 28. It is about 36 miles in circuit, and has a town of the ſame name, containing about 3000 inhabitants. The people of this iſland are ſaid to be the beſt ſailors in the Archipelago, and have about 150 veſſels of different ſizes. The iſland yields a ſufficient quantity of barley for the inhabitants, and produces abundance of figs, and ſome olives; but there is a ſcarcity of water, eſpecially in ſummer, there being but one well in the iſland.—There are a great number of churches and chapels, with ſome monaſteries.

MYCONUS, in *Ancient Geography*, one of the iſlands called Cyclades, near Delos, under which the laſt of the Centaurs ſlain by Hercules are feigned to lie buried. Hence the proverb, *Omnia ſub unam Myconum congerere*, applied to an injudicious or unnatural farrago. Myconii, the people, noted for baldneſs. Hence Myconius, a bald perſon. According to Strabo, the inhabitants became bald at the age of 20 or 25; and Pliny ſays that the children were always born without hair. The iſland was poor, and the inhabitants very avaricious; whence Archilochus reproached a certain Pericles, that he came to a feaſt like a Myconian; that is without previous invitation. Now called *Mycone*, which ſee.

MYCTERIA, the JABIRU, a genus of birds belonging to the order of grallæ. See ORNITHOLOGY *Index*.

MYGDONIA, in *Ancient Geography*, a diſtrict of Macedonia, to the north of the Sinus Thermaicus, and eaſt of the river Axius, which ſeparates it from Bottæis, and weſt of the river Strymon, (Pliny). Alſo a diſtrict of Meſopotamia, which took its name from that of Macedonia, running along the Euphrates, from Zeugma down to Thapſacus, extending a great way eaſt, becauſe Niſibis was reckoned to it.

MYGINDA, a genus of plants belonging to the tetrandria claſs; and in the natural method ranking with thoſe of which the order is doubtful. See BOTANY *Index*.

MYIAGRUS DEUS, in the heathen mythology, a name given ſometimes to Jupiter, and ſometimes to Hercules, on occaſion of their being ſacrificed to for the driving away the vaſt numbers of flies which infeſted the ſacrifices on certain public occaſions. The word is uſually ſpelt *Myagrus*; but this muſt be an error, as this word does not expreſs the *fly-deſtroyer*, but the *mouſe-deſtroyer*; and we have it ſufficiently teſtified by the ancients, that flies were the only creatures againſt whom this deity was invoked. Pliny calls this deity alſo *Myiodes*; and tells us, that the flies which uſed to peſter the Olympic rites went away in whole clouds on the ſacrificing a bull to this god. We find in Athenæus alſo, that this ſacrificing to the god of flies at the Olympic games was a conſtant cuſtom. Some diſtinguiſh theſe two deities, and tell us that the latter or Myiodes, uſed to viſit the nations in vengeance, with a vaſt multitude of flies: and that, on paying him the due honours of a ſacrifice, they all went away again; and this ſeems to agree with what Pliny tells us in ſome places.

At the time of the Olympic games, Jupiter was worſhipped under the name of *Apomyos* or *Myiagrus Deus*, to ſupplicate the deſtruction of thoſe troubleſome creatures. This happened only once in many years, when the ſacrifices were performed there; but the Elians worſhipped him continually under this name, to deprecate the vengeance of heaven, which uſually ſent, as they expreſſed it, an army of flies and other inſects, toward the latter end of the ſummer, that infeſted the whole country with ſickneſs and peſtilence.

MYIODES DEUS, in the heathen mythology, a name ſometimes given to Hercules, but more frequently to Jupiter, to whom a bull was ſacrificed, in order to make him propitious in driving away the flies that infeſted the Olympic games.

MYLÆ, in *Ancient Geography*, a Greek city ſituated on an iſthmus of a cognominal peninſula, on the north-eaſt ſide of the iſland. *Mylaei*, or *Mylenſes*, the people. A town built by thoſe of Zancle (Strabo). Mylæus, the epithet, as Mylæus Campus, mentioned by Polybius. Now called *Milazzo*, a port town of Sicily, in the Val di Demona. E. Long. 15. 5. N. Lat. 38. 36.

MYLASA, or MYLASSA, in *Ancient Geography*, a noble city of Caria in Aſia Minor, ſituated about three leagues from the *Sinus Ceramicus*. It was the capital of Hecatomnus king of Caria, and father of Mauſolus. Pliny ſpeaks of Menander king of Caria, and ſays that the Rhodians preſerved with the greateſt care his portrait painted by Apelles: but it was not in honour of this Menander that a Corinthian pillar was erected at Mylaſa, which ſtill exiſts, and on which is to be ſeen the following inſcription: "The people erected this pillar in honour of Menander, the ſon of Uliades, and grandſon of Euthydemus, the benefactor of his country, and whoſe anceſtors rendered it great ſervices alſo." Euthydemus, the grandfather of this Menander, lived in the time of Julius Cæſar and Auguſtus. Caria was taken by Mithridates, and afterwards by Labienus, whoſe father had been one of Cæſar's generals. Hybrias, whoſe eloquence and valour deſervedly entitled him to a diſtinguiſhed rank among his countrymen, in vain encouraged them to make a moſt obſtinate defence while it was beſieged by the latter. He himſelf was obliged to yield to neceſſity, and to take refuge at Rhodes: but ſcarcely had the conqueror quitted the city, when Hybrias returned, and reſtored liberty to his country.—Not content with rendering it this ſervice, he alſo deſtroyed the power of a dangerous citizen, whoſe riches and talents rendered him a neceſſary evil. Euthydemus, often baniſhed, and as often recalled, always too powerful in a ſtate the independence of which he threatened, ſaw his ambition checked by the zeal and activity of Hybrias. The Romans left to Mylaſa that liberty of which it rendered itſelf ſo worthy, by the great efforts it made to preſerve it. Pliny calls it *Mylaſa libera*. Strabo informs us, that it was one of the moſt magnificent cities of antiquity, and one of thoſe, the temples, porticoes, and other public monuments of which were highly admired. A quarry of white marble in the neighbourhood furniſhed it with abundance of materials for erecting theſe edifices.—The Mylaſians had two temples dedicated to Jupiter, one ſituated in the city, which was named *Oſogo*, and another built on a mountain, at the diſtance of 60 leagues. The latter was dedicated to *Jupiter Stratius*, Jupiter the Warrior. His ſtatue, which was very ancient, inſpired great veneration; people came from all quarters to implore his protection; and for the greater accommodation of his votaries a paved way was conſtructed, which reached from Mylaſa to this venerable fabric. This city is now called *Melaſſo*, and, according to Dr Chandler, is ſtill a large place.—The houſes are numerous, but chiefly of plaſter, and mean, with trees interſperſed. The air is accounted bad; and ſcorpions abound as anciently, entering often at the doors and windows, and lurking in the rooms. The plain is ſurrounded by lofty mountains, and cultivated. Round the town are ranges of broken columns, the remnants of porticoes, now with rubbiſh bounding the vineyards. A large portion of the plain is covered with ſcattered fragments, and with piers of ordinary aqueducts; beſides inſcriptions, moſtly ruined and illegible. Some altars dedicated to Hecatomnus have been diſcovered. Of all the ancient temples which formerly ornamented this city, one only eſcaped the power of time, the blind zeal of the early Chriſtians, and the barbarous ſuperſtition of the Mahometans. This monument was dedicated to Auguſtus and the divinity of Rome. When Pococke viſited Melaſſo, it was perfect and entire; but at preſent no traces of it remain, except a few fragments, which have been employed to conſtruct a Turkiſh moſque.

MYLOGLOSSUM, in *Anatomy*. See ANATOMY, *Table of the Muſcles*.

MYLOHYOIDÆUS. *Ibid.*

MYOLOGY, (formed of μυς, μυος, "a muſcle," and λογος, "diſcourſe"), in anatomy, a deſcription of the muſcles; or the knowledge of what relates to the muſcles of the human body. *Ibid.*

MYOMANCY, a kind of divination, or method of foretelling future events by means of mice.

Some authors hold myomancy to be one of the moſt ancient kinds of divination; and think it is on this account that Iſaiah, lxvi. 17. reckons mice among the abominable things of the Idolaters. But, beſide that, it is not certain that the Hebrew word עכבר uſed by the prophet ſignifies *a mouſe*, it is evident it is not the divination by that animal, be it what it will, that is ſpoken of, but the eating it.

MYOPIA, SHORT-SIGHTEDNESS; a ſpecies of viſion wherein objects are ſeen only at ſmall diſtances. See MEDICINE, N° 361.

MYOSOTIS, SCORPION-GRASS; a genus of plants belonging to the pentandria claſs, and in the natural method ranking under the 41ſt order, *Aſperifoliæ*. See BOTANY *Index*.

MYOSURUS, a genus of plants belonging to the pentandria claſs, and in the natural method ranking under the 26th order, *Multiſiliquæ*. See BOTANY *Index*.

MYOXUS, the DORMOUSE, a genus of quadrupeds belonging to the order of glires. See MAMMALIA *Index*.

MYRIAD, a term ſometimes uſed to denote ten thouſand.

MYRICA, GALE, or SWEET-WILLOW, a genus of plants belonging to the diœcia claſs, and in the natural method ranking under the 5th order, *Amentaceæ*. See BOTANY *Index*.

MYRIOPHYLLUM, a genus of plants belonging to the monœcia claſs, and in the natural method ranking under the 15th order, *Inundatæ*. See BOTANY *Index*.

MYRISTICA, the NUTMEG-TREE, in *Botany*, a genus of plants belonging to the claſs diœcia, and order ſyngeneſia, and of the natural order, *Lauri*. The deſcription of this genus having been omitted in its proper place under BOTANY, we ſhall here introduce a ſhort account of it.—The male calyx is monophyllous, ſtrong, and parted into three *laciniæ* of an oval ſhape, and ending in a point: it has no corolla. In the middle of the receptacle riſes a column of the height of the calyx, to the upper part of which the antheræ are attached. They vary in number from three to twelve or thirteen.—The female calyx and corolla as in the male, on a diſtinct tree. The germen of an oval ſhape; the ſtyle ſhort, with a bifid ſtigma, the lacinii of which are oval and ſpreading.—The fruit is of that ſort called *drupa*. It is fleſhy, roundiſh, ſometimes unilocular, ſometimes bivalved, and burſts when ripe at the ſide. The ſeed is enveloped with a fleſhy and fatty membranous ſubſtance which divides into filaments (this, in one of the ſpecies, is the mace of the ſhops). The ſeed or nutmeg is round or oval ſhaped, unilocular, and contains a ſmall kernel, variegated on the ſurface by the fibres running in the form of a ſcrew.

Species.—There are five ſpecies of this genus according to ſome authors; but ſeveral of theſe being only varieties, may be reduced into three, viz.

1. Myriſtica fatua, or wild nutmeg: this grows in Tobago, and riſes to the height of an apple-tree; has oblong, lanceolated, downy leaves, and hairy fruit:—the nutmeg of which is aromatic, but when given inwardly is narcotic, and occaſions drunkenneſs, delirium, and madneſs, for a time.

2. The myriſtica ſebifera, (*Virola Sebifera* Aublet, page 904. tab. 345.) a tree frequent in Guiana, riſing to 40 or even to 60 feet high; on wounding the trunk of which, a thick, acrid, red juice runs out. Aublet ſays nothing of the nutmegs being aromatic; he only obſerves, that a yellow fat is obtained from them, which ſerves many economical and medical purpoſes, and that the natives make candles of it.

3. The myriſtica moſchata, or nutmeg, riſes to the height of 30 feet, producing numerous branches; the bark of the trunk is of a reddiſh brown, but that of the young branches is of a bright green colour: the leaves are nearly elliptical, pointed, undulated, obliquely nerved, on the upper ſide of a bright green, on the under whitiſh, and ſtand alternately upon footſtalks: the flowers are ſmall, and hang upon ſlender peduncles, proceeding from the axillæ of the leaves: they are both male and female upon ſeparate trees.

M. Schwartz, who has carefully examined this as well as the two firſt ſpecies, preſerved in ſpirits, places them among the monadelphia.

The nutmeg has been ſuppoſed to be the *comacum* of Theophraſtus, but there ſeems little foundation for this opinion; nor can it with more probability be thought to be the *chryſobalanos* of Galen. Our firſt knowledge of it was evidently derived from the Arabians; by Avicenna it was called *jiauſiban*, or *jiauſiband*, which ſignifies nut of Banda. Rumphius both figured and deſcribed this tree; but the figure given by him is ſo imperfect, and the deſcription ſo confuſed, that Linnæus, who gave it the generic name *myriſtica*, was unable to aſſign its proper characters. M. Lamarck informs us, that he received ſeveral branches of the myriſtica, both in flower and fruit, from the iſle of France, where a nutmeg-tree, which was introduced by Monſieur Poivre in 1770, is now very large, and continually producing flowers and fruit. From theſe branches, which were ſent from Monſ. Cere, director of the king's garden in that iſland, Lamarck has been enabled to deſcribe and figure this and other ſpecies of the myriſtica. See Plate CXXIV. BOTANY.

Fig. *a*. A ſprig with fructification. The drupa of the natural ſize, and burſting open. Fig. *b*. The full-grown fruit cut lengthwiſe. Fig. *c*. Another ſection of the ſame. Fig. *d*. The nutmeg enveloped with its covering, the mace. Fig. *e*. The fatty membrane or mace ſpread out. Fig. *f*. The nutmeg of its natural ſize. Fig. *g*. The ſame with its external tegument removed at one end. Fig. *h*. The ſame with its outer tegument entirely removed. Fig. *i*. A tranſverſe ſection of the nutmeg.

The ſeeds or kernels called *nutmegs* are well known, as they have been long uſed both for culinary and medical purpoſes. Diſtilled with water, they yield a large quantity of eſſential oil, reſembling in flavour the ſpice itſelf; after the diſtillation an inſipid ſebaceous matter is found ſwimming on the water; the decoction inſpiſſated, gives an extract of an unctuous, very lightly bitteriſh taſte, and with little or no aſtringency. Rectified ſpirit extracts the whole virtue of nutmegs by infuſion, and elevates very little of it in diſtillation; hence the ſpirituous extract poſſeſſes the flavour of the ſpice in an eminent degree.

Nutmegs, when heated, yield to the preſs a conſiderable quantity of limpid yellow oil, which on cooling concretes into a ſebaceous conſiſtence. In the ſhops we meet with three ſorts of unctuous ſubſtances, called *oil of mace*, though really expreſſed from the nutmeg. The beſt is brought from the Eaſt Indies in ſtone jars; this is of a thick conſiſtence, of the colour of mace, and has an agreeable fragrant ſmell; the ſecond ſort, which is paler coloured, and much inferior in quality, comes from Holland in ſolid maſſes, generally flat, and of a ſquare figure: the third, which is the worſt of all, and uſually called *common oil of mace*, is an artificial compoſition of ſevum, palm oil, and the like, flavoured with a little genuine oil of nutmeg.

Method of gathering and preparing Nutmeg.—When the fruit is ripe the natives aſcend the trees, and gather it by pulling the branches to them with long hooks. Some are employed in opening them immediately, and in taking off the green ſhell or firſt rind, which is laid together in a heap in the woods, where in time it putrefies. As ſoon as the putrefaction has taken place, there ſpring up a kind of muſhrooms called *boleti moſchatyni*, of a blackiſh colour, and much valued by the natives, who conſider them as delicate eating. When the nuts are ſtripped of their firſt rind, they are carried home, and the mace is carefully taken off with a ſmall knife. The mace, which is of a beautiful red, but afterwards aſſumes a darkiſh or reddiſh colour, is laid to dry in the ſun for the ſpace of a day, and is then removed to a place leſs expoſed to his rays, where it remains for eight days, that it may ſoften a little. They afterwards moiſten it with ſea water, to prevent it from drying too much, or from loſing its oil. They are careful, however, not to employ too much water, leſt it ſhould become putrid, and be devoured by the worms. It is laſt of all put into ſmall bags, and ſqueezed very cloſe.

The nuts which are ſtill covered with their ligneous ſhell, are for three days expoſed to the ſun, and afterwards dried before a fire till they emit a ſound when they are ſhaken; they then beat them with ſmall ſticks in order to remove their ſhell, which flies off in pieces. Theſe nuts are diſtributed into three parcels, the firſt of which contains the largeſt and moſt beautiful, which are deſtined to be brought to Europe; the ſecond contains ſuch as are reſerved for the uſe of the inhabitants; and the third contains the ſmalleſt, which are irregular or unripe. Theſe are burnt; and part of the reſt is employed for procuring oil by preſſure. A pound of them commonly gives three ounces of oil, which has the conſiſtence of tallow, and has entirely the taſte of nutmeg. Both the nut and mace, when diſtilled, afford an eſſential, tranſparent, and volatile oil, of an excellent flavour.

The nutmegs which have been thus ſelected would ſoon corrupt if they were not watered, or rather pickled, with lime-water made from calcined ſhell fiſh, which they dilute with ſalt water till it attain the conſiſtence of fluid pap. Into this mixture they plunge the nutmegs, contained in ſmall baſkets, two or three times, till they are completely covered over with the liquour. They are afterwards laid in a heap, where they heat, and loſe their ſuperfluous moiſture by evaporation. When they have ſweated ſufficiently, they are then properly prepared, and fit for a ſea voyage.

In the iſland of Banda, the fruit of the nutmeg tree is preſerved entire in the following manner: When it is almoſt ripe, but previous to its opening, it is boiled in water and pierced with a needle. They next lay it in water to ſoak for ten days, till it has loſt its ſour and ſharp taſte. They then boil it gently in a ſyrup of ſugar, to which, if they wiſh it to be hard, a little lime is added. This operation is repeated for eight days, and each time the ſyrup is renewed. The fruit when thus preſerved is put for the laſt time into a pretty thick ſyrup, and is kept in earthen pots cloſely ſhut.

Theſe nuts are likewiſe pickled with brine or with vinegar; and when they intend to eat them, they firſt ſteep them in freſh water, and afterwards boil them in ſyrup of ſugar, &c.

Uſes.—Nutmegs preſerved entire are preſented as deſſerts, and the inhabitants of India ſometimes eat them when they drink tea. Some of them uſe nothing but the pulp; others likewiſe chew the mace; but they generally throw away the kernel, which is really the nutmeg. Many who perform ſea voyages to the north chew this fruit every morning.

The medicinal qualities of nutmeg are ſuppoſed to be aromatic, anodyne, ſtomachic, and reſtringent; and with a view to the laſt-mentioned effects, it has been much uſed in diarrhœas and dyſenteries.

Remarks on the Trade of Nutmegs.—Nutmeg trees grow in ſeveral iſlands in the eaſtern ocean. The wood pigeon of the Moluccas is unintentionally a great planter of theſe trees, and diſſeminates them in places where a nation, powerful by its commerce, thinks it for its intereſt that they ſhould be rooted out and deſtroyed. The Dutch, whoſe unwearied patience can ſurmount the greateſt obſtacles, formerly appropriated to themſelves the crop of nutmeg, as well as that of cloves and cinnamon, growing in the iſlands of Ternate, Ceylon, &c. either by right of conqueſt or by paying ſubſidies to the iſlanders, who find theſe much more profitable than the former produce of their trees. It is nevertheleſs true, that they have prevailed upon or compelled the inhabitants of the Moluccas to cut down and root out all the clove trees, which they have preſerved only in the iſlands of Amboyna and Ternate, which are in a great meaſure ſubject to them. We know for certain, that the Dutch pay 18,000 rixdollars yearly to the king of Ternate, by way of tribute or gift, in order to recompenſe him for the loſs of his clove trees in the other Molucca iſlands; and that they are moreover bound by treaty to take at 3¾d. a pound, all the cloves brought by the natives of Amboyna to their magazines.

The Dutch had formerly immenſe and very rich magazines of theſe precious aromatics, both in India and Europe. It is ſaid, that they had actually by them the produce of 16 years, and never ſupplied their neighbours with the laſt, but always with the oldeſt crop: in 1760 they ſold what was laid up in 1744; and when they had too great a quantity of cloves, nutmeg, &c. in their magazines, they threw them into the ſea, or deſtroyed them by burning. On the 10th of June 1760, M. Bomare ſaw at Amſterdam, near the Admiralty, a fire, the fuel of which was valued at 8,000,000 of livres; and as much was to be burned on the day following. The feet of the ſpectators were bathed in the eſſential oil of theſe ſubſtances; but no perſon was allowed to gather any of it, much leſs to take any of the ſpices which were in the fire. Some years before, upon a ſimilar occaſion, and at the ſame place, a poor man

man who had taken up ſome nutmegs which had rolled out of the fire, was, as M. Bomare was informed, ſeized and condemned to immediate execution.

But after all, although the ſpice trade is leſs excluſively limited to the Dutch of late years, it does not appear that the price of Eaſt Indian ſpiceries is in any degree reduced to the conſumer.

MYRMECOPHAGA, or Ant-bear, a genus of quadrupeds, belonging to the order of bruta. See Mammalia *Index*.

MYRMELEON, or Ant-lion, a genus of inſects of the neuroptera order. See Entomology *Index*.

MYRMIDONS, Myrmidones, in antiquity; a people in the ſouthern borders of Theſſaly, who accompanied Achilles to the Trojan war. They received their name from Myrmidon, a ſon of Jupiter and Eurymeduſa, who married one of the daughters of Æolus, ſon of Helen. His ſon Actor married Ægina the daughter of Æſopus. He gave his name to his ſubjects, who dwelt near the river Peneus in Theſſaly. According to ſome, the Myrmidons received their name from their having ariſen from ants or piſmires, upon a prayer put up for that purpoſe by King Æacus to Jupiter, after his kingdom had been diſpeopled by a ſevere peſtilence. According to Strabo, they received it from their induſtry, becauſe they imitated the diligence of the ants, and like them were indefatigable, and were continually employed in cultivating the earth.

MYRMILLONES were gladiators of a certain kind at Rome, who fought againſt the Retiarii. Their arms were a ſword, head-piece, and ſhield. On the top of the head-piece they wore a fiſh emboſſed, called Μορμυρες, whence their name is by ſome ſuppoſed to be derived. The Retiarii, in their engagements, made uſe of a net, in which they endeavoured to entangle their adverſaries; and ſung during the fight, "*Non te peto, piſcem peto; quid me fugis, Galle?*" "I aim not at thee, but I aim at thy fiſh; why doſt thou ſhun me, O Gaul?" The Myrmillones were called Galli, becauſe they wore Gallic armour. They were alſo named *Secutores*. This kind of gladiators was ſuppreſſed by Caligula. See Gladiators, Retiarii, &c.

MYROBALANS, a kind of medicinal fruit brought from the Indies, of which there are five kinds. 1. The citrine of a yellowiſh red colour, hard, oblong, and the ſize of an olive. 2. The black or Indian myrobalan, of the bigneſs of an acorn, wrinkled and without a ſtone. 3. Chebulic myrobalans, which are of the ſize of a date, pointed at the end, and of a yellowiſh brown. 4. Emblic, which are round, rough, the ſize of gall, and of a dark brown. 5. Balleric, which are hard, round, of the ſize of an ordinary prune, leſs angular than the reſt, and yellow. They are all ſlightly purgative and aſtringent. The word comes from the Greek μυρον, "ointment," and βαλανος, "acorn," as being in the form of acorns, and uſed in medicine.

MYRON, an excellent Grecian ſtatuary, flouriſhed 442 B. C. The cow he repreſented in braſs was an admirable piece of workmanſhip, and was the occaſion of many fine epigrams in Greek.

MYROXYLON, a genus of plants belonging to the decandria claſs. See Botany *Index*.

MYRRH, a gummy-reſinous concrete juice, which is brought from the Eaſt Indies or from Abyſſinia. See Materia Medica *Index*.

It is affirmed by ſome, that the myrrh we have at preſent is not equal in quality to that of the ancients, and has not that exquiſite ſmell which all authors aſcribe to the latter. They aromatized their moſt delicious wines with it; and it was preſented as a very valuable perfume to our Lord while he lay in the manger.

It was this gum alſo which was mingled with the wine given him to drink at his paſſion, to deaden his pains, and produce a ſtupor. (See Mark xv. 32.). The gall mentioned on the ſame occaſion by St Matthew is probably the ſame with myrrh; for any thing bitter was uſually diſtinguiſhed by the name of gall. The Hebrews were accuſtomed to give thoſe that were executed ſome ſtupefying draught. The difficulty which ariſes from the ſeeming difference betwixt the two evangeliſts, by ſome is ſolved by ſaying, that St Matthew, writing in Syriac, made uſe of the word *marra*, which ſignifies "myrrh, bitterneſs, or gall;" but the Greek tranſlator has taken it for gall, and St Mark for myrrh. Others think that our Saviour's drink was mingled with myrrh as a ſtupefying drug: but ſuppoſe that the ſoldiers out of wanton cruelty and inhumanity, infuſed gall; which was the reaſon, ſay they, why, when he had taſted, he refuſed to drink.

MYRRHINE, or Murrine. See Murrine.

MYRSINE, a genus of plants belonging to the pentandria claſs, and in the natural method ranking under the 18th order, *Bicornes*. See Botany *Index*.

MYRTIFORM, in *Anatomy*, an appellation given to ſeveral parts, from their reſembling myrtle berries.

MYRTLE. See Myrtus, Botany *Index*.

MYRTOUM mare, a part of the Ægean ſea, lying between Eubœa, Peloponneſus and Attica. It receives this name from Myrto a woman, or from Myrtos a ſmall iſland in the neighbourhood, or from Myrtilus the ſon of Mercury who was drowned there, &c.

MYRTUS, in *Ancient Geography*, a ſmall iſland near Caryſtus in Eubœa, which gave name to the mare Myrtoum. Others, according to Pauſanias, derive the appellation from *Myrto*, the name of a woman. Strabo extends this ſea between Crete, Argia, and Attica. Pauſanias beginning it at Eubœa, joins it at Helena, a deſert iſland, with the Ægean ſea. Ptolemy carries it to the coaſt of Caria. Pliny ſays, that the Cyclades and Sporades are bounded on the weſt by the Myrtoan coaſt of Attica.

Myrtus, the *Myrtle*, a genus of plants belonging to the icoſandria claſs; and in the natural method ranking under the 19th order, *Heſperideæ*. See Botany *Index*.

MYSIA, a country of Aſia Minor, generally divided into Major and Minor. Myſia Minor was bounded on the north and weſt by the Propontis and Bithynia, and Phrygia on the ſouthern and eaſtern borders. Myſia Major had Æolia on the ſouth, the Ægean ſea on the weſt, and Phrygia on the north and eaſt. Its chief cities were Cyzicum, Lampſacus, &c. The inhabitants were once very warlike; but they greatly degenerated, and the words *Myſorum ultimus* were emphatically uſed to ſignify a perſon of no merit. The ancients generally hired them to attend their funerals as mourners, becauſe they were naturally melancholy and inclined to ſhed tears. They were once governed by monarchs. They are ſuppoſed to be deſcended from the Myſians of Europe, a nation who inhabited that part of Thrace which was ſituated between Mount Hæmus and the Danube.

MYSON, a native of Sparta, one of the ſeven wiſe men of Greece. When Anacharſis conſulted the oracle of Apollo, to know which was the wiſeſt man in Greece, he received for anſwer, he who is now ploughing his fields. This was Myſon.

MYSORE, or MYSOREAN DOMINIONS, a kingdom of Aſia, in the Eaſt Indies, including the territories uſurped or ſubdued by Hyder Ali, and tranſmitted to his ſon Tippoo Saib, but now ſubject to the Britiſh government. For an account of the conqueſt of which, ſee INDIA.

MYSTERIES.

1
The gradual introduction of myſteries into religion.

RELIGION, in its original form, was ſimple and intelligible. It was intended for the inſtruction and education of all ranks of men; and of conſequence its doctrines were on a level with vulgar capacities. The Jewiſh diſpenſation was openly practiſed: nothing was performed in ſecret; every article was plain, open, and acceſſible. The divine Author of the Chriſtian economy commanded his diſciples to preach his doctrine in the moſt public manner: "What ye have heard in ſecret (ſays he) preach openly; and what I have taught you in private teach ye publicly, and proclaim it on the houſe tops." Such are the charms of truth, and ſuch the character of that religion which came down from heaven, that they, as it were, "delight, and lift up their voice in the ſtreets, and cry in the chief places of concourſe."

But ſuch is the depravity of the nature of man, that the nobleſt inſtitutions degenerate in his hands. Religion itſelf, originally pure, ſimple, and amiable, under his management has often been transformed into pollution, perplexity, and deformity. The miniſters of religion, whoſe province it was to guard the ſacred depoſite, and to ſecure it from foreign and ſpurious intermixtures, have generally been the firſt innovators, and the firſt and moſt induſtrious agents in corrupting its integrity and tarniſhing its beauty. Avarice and ambition prompted that claſs of men to deviate from the original plainneſs and ſimplicity of religious inſtitutions, and to introduce articles, rites, and uſages, which might furniſh them with opportunities of gratifying theſe unhallowed and inſatiable paſſions. Hence diſtinctions unknown to pure and undefiled religion were fabricated; and that heavenly inſtitution, heretofore, one, ſimple, indiviſible, was divided into two partitions: the one popular and public; the other dark, ſecret, and myſterious. The latter of theſe we intend as the ſubject of this article.

2
Etymology and import of the term.

The Engliſh word *myſtery* is derived from the Greek μυστηριον; and in its modern acceptation imports ſomething above human intelligence, ſomething awfully obſcure and enigmatical; any thing artfully made difficult; the ſecret of any buſineſs or profeſſion. The word is often uſed by the founder of the Chriſtian religion, and more frequently by his apoſtles, eſpecially St Paul. In theſe caſes, it generally ſignifies thoſe doctrines of Chriſtianity which the Jews, prior to the advent of the Meſſiah, either did not or could not underſtand. The Trinity in Unity, and the Unity in Trinity; the incarnation of the Son of God; the union of two natures in one and the ſame perſon, &c. we generally call *myſteries*, becauſe they are infinitely above human comprehenſion. All theſe ſignifications are out of the queſtion at preſent.

3
Object of this article.

Our intention in this article is to lay before our readers the fulleſt and faireſt account we have been able to collect, of thoſe απορρητα, or *ſecret rites*, of the Pagan ſuperſtition, which were carefully concealed from the knowledge of the vulgar, and which are univerſally known under the denomination of *myſteries*.

The word μυστηριον is evidently deduced from μυστης; but the origin of this laſt term is not altogether ſo obvious. The etymologies of it exhibited by the learned are various; ſome of them abſurd and inconſiſtent, others fooliſh and futile. Inſtead of fatiguing our readers with a detail of theſe, which would be equally unentertaining and unintereſting, we ſhall only produce one, which to us appears to come neareſt the truth. The myſteries under conſideration at preſent were certainly imported into Greece from the eaſt. In thoſe regions, then, we ought of courſe to look for the etymology of the word. *Miſtor* or *miſtur*, in Hebrew, ſignifies "any place or thing hidden or concealed." As this word implies a kind of definition of the nature of the thing intended, and as it is one of the excellencies of original languages to apply vocables with this propriety, we find ourſelves ſtrongly inclined to aſſign the word *miſtur* as the root of the term μυστης, *myſter*.

4
Motives to the introduction of the myſteries.

We have already obſerved, that the avarice and ambition of the Pagan prieſthood probably gave birth to the inſtitution of the myſteries. To this obſervation we may now add, that the miniſters of that ſuperſtition might poſſibly imagine, that ſome articles of their ritual were too profound to be comprehended by the vulgar; others, too ſacred to be communicated to a deſcription of men, whom the inſtitutions of civil ſociety had placed in a ſituation not only ſubordinate but even contemptible. It was imagined, that things ſacred and venerable would have contracted a taint and pollution by an intercourſe with ſordid and untutored ſouls. Theſe appear to us the moſt probable motives for making that odious and pernicious diſtinction between the popular religion and that contained in the ſacred and myſterious ritual.

The learned Biſhop Warburton is poſitive, that the myſteries of the Pagan religion were the invention of legiſlators * and other great perſonages, whom fortune or their own merit had placed at the head of thoſe civil ſocieties which were formed in the earlieſt ages in different parts of the world. It is with reluctance, and indeed

---

* Divin. Leg.

5 The hypotheſis of Warburton ill founded.

indeed with diffidence, that we preſume to differ in our ſentiments from ſuch reſpectable authority. Whatever hypotheſis this prelate had once adopted, ſo extenſive was his reading, and ſo exuberant his intellectual reſources, that he found little difficulty in defending it by an appearance of plauſibility, if not of rational argumentation. The large quotations he has adduced from Plato and Cicero, do indeed prove that the ſages and legiſlators of antiquity ſometimes availed themſelves of the influence derived from the doctrines of the myſteries, and from the authority they acquired by the opinion of their having been initiated in them; but that thoſe men were the inventors and fabricators of them is a poſition for which his quotations do not furniſh the moſt ſlender preſumption. At the ſame time, we think it not altogether certain, that the doctrine of a divine Providence, and a future ſtate of rewards and puniſhments, were revealed in the myſteries with all the clearneſs and cogency which is pretended by his lordſhip.

But granting that the fabric was raiſed by the hands of ſages and legiſlators, we imagine it would be rather difficult to diſcover what emolument that deſcription of men could propoſe to derive from the enterpriſe.—The inſtitution was evidently, and indeed confeſſedly, deviſed to conceal from the million thoſe very doctrines and maxims, which had they known and embraced them, would have contributed moſt effectually to diſpoſe them to ſubmit to thoſe wiſe regulations which their governors and legiſlators wiſhed moſt ardently to eſtabliſh. Experience has taught, that nothing has a more commanding influence on the minds of the vulgar, than thoſe very dogmas, which, according to the Biſhop, were communicated to the initiated. A conviction of the unity of the Deity, of his wiſdom, power, goodneſs, omnipreſence, &c. the ſteady belief of the immortality of the human ſoul, and of a future ſtate of rewards and puniſhments, have in all ages, and in all countries, proved the firmeſt ſupports of legal authority. The very ſame doctrines, in the dawn of Chriſtianity, contributed, of all other methods, the moſt effectually to tame and civilize the ſavage (A) inhabitants of the northern regions of Europe. Suppoſing thoſe principles to have been inculcated by the myſteries, the moſt prudent plan legiſlators could have adopted, would have been to publiſh them to all mankind. They ought to have ſent forth apoſtles to preach them to the ſavages whom they had undertaken to civilize. According to the learned prelate, they purſued the oppoſite courſe, and deprived themſelves of thoſe very arms by which they might have encountered and overthrown all the armies of ſavagiſm.

6 Myſteries of Eleuſis ſaid to be revealed publicly in Crete.

Of all the legiſlators of antiquity, the Cretan alone was prudent enough to foreſee and adopt this rational plan. Diodorus the Sicilian informs us *, that the myſteries of Eleuſis, Samothracia, &c. which were elſewhere buried in profound darkneſs, were among the Cretans taught publicly, and communicated to all the world. Minos, however, was a ſucceſsful legiſlator; and his intercourſe with Jupiter Idæus extended his influence and eſtabliſhed his authority. He was not under the neceſſity of calling in the myſteries to his aſſiſtance: on the contrary, it is highly probable that the univerſal knowledge of the doctrines of the myſteries among his countrymen contributed in a conſiderable degree to facilitate his labour, and enſure his ſucceſs.

* Lib. v.

The divine Author of the Chriſtian economy, viewed in the light of a human legiſlator, ſaw the propriety of this procedure. Nothing was concealed in his inſtitutions; nothing was veiled with myſtery, or buried in darkneſs. The ſucceſs was anſwerable to the wiſdom of the plan. The million flocked to the evangelical ſtandard: the goſpel was preached to the poor, to the illiterate and the vulgar; and the meaneſt of mankind eagerly embraced its maxims. Wherever it prevailed, it produced civilization, morality, ſobriety, loyalty, and every other private and ſocial virtue.—Upon the ſuppoſition that the myſteries had contained and inculcated the principles and practices which the prelate ſuppoſes they did, the civilizers of mankind, legiſlators, magiſtrates, and princes, ought to have combined to make them public for the ſake of their own tranquillity, and the more effectual ſupport of their authority and influence.

7 Myſteries the offſpring of Egyptian prieſtcraft; but

Upon the whole, we are inclined to believe that the myſteries were the offspring of Egyptian prieſtcraft. They were inſtituted with a view to aggrandize that order of men, to extend their influence, and enlarge their revenues. To accompliſh thoſe ſelfiſh projects, they applied every engine towards beſotting the multitude with ſuperſtition and enthuſiaſm. They taught them to believe, that themſelves were the diſtinguiſhed favourites of heaven; and that celeſtial doctrines had been revealed to them, too holy to be communicated to the profane rabble, and too ſublime to be comprehended by vulgar capacities. It is, we confeſs, exceedingly probable, that after the myſteries were inſtituted, and had acquired an exalted reputation in the world, legiſlators, magiſtrates, judges, and potentates, joined in the impoſture, with the ſame views and from the ſame principles.

8 adopted by legiſlators, &c.

Princes and legiſlators, who found their advantage in overawing and humbling the multitude, readily adopted a plan which they found ſo artfully fabricated to anſwer theſe very purpoſes. They had intereſt enough with the ſacerdotal (B) myſtagogues, to induce them to allow them to participate in thoſe venerable rites which had already eſtabliſhed the authority of that deſcription of men in whoſe hands they were depoſited. The views of both parties were exactly congenial. The reſpect, the admiration, and dependance on the million, were the ultimate objects of their ambition reſpectively.—Prieſts and princes were actuated by the very ſame ſpirit. The combination was advantageous, and of conſequence harmonious. For theſe reaſons we have taken the liberty of differing from his Lordſhip of Glouceſter with reſpect to

---

(A) The Germans, Ruſſians, and Scandinavians, who were never thoroughly civilized till the goſpel was preached among them.

(B) The myſtagogues were the miniſters who acted the chief part in celebrating the myſteries.

to the perſons who firſt inſtituted the ſecret myſteries of the Pagan religion.

9 Hypotheſis of Moſheim

Another writer of conſiderable reputation in the republic of letters, is of opinion, that the myſteries were entirely commemorative; that they were inſtituted with a view to preſerve the remembrance of heroes and great men, who had been deified in conſideration of their martial exploits, uſeful inventions, public virtues, and eſpecially in conſequence of the benefits by them conferred on their contemporaries.—According to him, the (c) myſteries of Mithras were eſtabliſhed for this very purpoſe. It would be no difficult matter to prove that the Perſian deity of that name was the ſun, and that his name and inſignia jointly aſcertain the truth of this aſſertion. The ſame writer extends this obſervation to the myſteries of the Egyptians, Phœnicians, Greeks, Hetruſcans; and in a word, to all the inſtitutions of that ſpecies throughout the world.

10 ſingular and indefenſible.

In oppoſition to this ſingular opinion, it may be argued, we think with ſome ſhow of reaſon, that the method of preſerving the memory of great and illuſtrious men generally adopted, was the eſtabliſhing feſtivals, celebrating games, offering ſacrifices, ſinging hymns, dances, &c. We can recollect no ſecret myſteries inſtituted for that purpoſe at leaſt in their original intention. If any uſage of the commemorative kind was admitted, it was ſuperinduced at ſome period poſterior to the primary inſtitution. At the ſame time, upon the ſuppoſition that the orgia of Bacchus were the ſame with thoſe of the Egyptian Oſiris, and that the myſteries of Ceres exhibited at Eleuſis were copied from thoſe of the Egyptian Iſis, and allowing that the former was the ſun, and the latter the moon; it will be difficult to find out the human perſons whoſe exploits, adventures, inventions, &c. were intended to be immortalized by thoſe inſtitutions. Upon the whole, the myſteries were performed in ſecret; they were intended to be communicated only to a few; of courſe, had they been inſtituted with a view to immortalize the memory of heroes and great men, the authors would have acted the moſt fooliſh and inconſiſtent part imaginable.—Inſtead of tranſmitting the fame of their heroes with eclat to poſterity, they would by this procedure have conſigned it to eternal oblivion.

11 Our firſt poſition ſupported by the character of the prieſts of Egypt.

We muſt then recur to our firſt poſition. The myſteries were the offſpring of bigotry and prieſtcraft; they originated in Egypt, the native land of idolatry. In that country the prieſthood ruled predominant. The kings were engrafted into their body before they could aſcend the throne. They were poſſeſſed of a third part * of all the land of Egypt. The ſacerdotal function was confined to one tribe, and was tranſmitted unalienably from father to ſon. All the orientals, but more eſpecially the Egyptians, delighted in myſterious and allegorical doctrines. Every maxim of morality, every tenet of theology, every dogma of philoſophy, was wrapt up in a veil of allegory and myſticiſm. This propenſity, no doubt, conſpired with avarice and ambition to diſpoſe them to a dark and myſterious ſyſtem of religion. Beſides, the Egyptians were a gloomy † race of men; they delighted in darkneſs and ſolitude. Their ſacred rites were generally celebrated with melancholy airs, weeping, and lamentation. This gloomy and unſocial bias of mind muſt have ſtimulated them to a congenial mode of worſhip. In Egypt then we are to ſearch for the origin of the myſteries. Both the nature of the inſtitution and the genius of the people confirm this poſition; and hiſtorians, both ancient and modern, are agreed in admitting the certainty of the fact.

12 The Oſiris and Iſis of Egypt the Bacchus and Ceres of Greece.

The Oſiris of Egypt, every body knows, was the original Bacchus; as the Iſis of the ſame country was the Ceres of the Greeks. The rites of Oſiris were performed with loud ſhrieks and lamentations when he was put into the coffin; and with the moſt extravagant mirth, when he was in a manner raiſed from the dead, or ſuppoſed to be found again. Their hymns were upon the whole always compoſed in melancholy affecting ſtrains; and conſiſted of lamentations for the loſs of Oſiris, the myſtic flight of Bacchus, the wanderings of Iſis, and the ſufferings ‡ of the gods. The Canaanites, who were a kindred tribe of the Mizraim or Egyptians, imitated them in their ſacred rites. At Byblus, Berytus, Sidon, and afterwards at Tyre, they uſed particularly mournful dirges for the death of Adonis or Tammuz §, who was the ſame with the Egyptian Oſiris, i. e. the ſun.

13 Death of Oſiris and wanderings of Iſis.

The Egyptians, then, naturally inclined to gloom and ſecrecy, inſtituted a mode of worſhip congenial with their natural diſpoſition of mind. The receſs of the ſun towards the ſouthern hemiſphere, was the death * of Oſiris; the wanderings of Iſis in ſearch of her huſband and brother, allegorically imported the longing of the earth † for the return of the fructifying influence of the ſolar heat.

When that luminary returned towards the ſummer ſolſtice, and grain, trees, fruits, herbs, and flowers adorned the face of nature, another feſtival was celebrated of a very different complexion from that of the former. In this ſeaſon all Egypt was diſſolved in the moſt extravagant mirth and jollity. During the celebration of thoſe feſtivals, the prieſts formed allegorical repreſentations of the ſun and the earth (d). They perſonified the one and the other, and allegorized their motions, aſpects, relations, ſympathies, acceſſes, receſſes, &c. into real adventures, peregrinations, ſufferings, conteſts, battles, victories, defeats, and ſo forth. Theſe, in proceſs of time, were held up to the vulgar as real occurrences; and theſe in a few ages became the moſt eſſential articles of the popular creed. From this ſource were derived the conqueſts of Dionyſus or Bacchus, ſo beautifully exhibited by Nonnus in his Dionyſiacs;

* *Diodor. Sicul.* lib. i.

† *Plutarch.*

‡ *Plut. Iſ. et Oſir.*

§ *Ezek.* chap viii. *and Nonni Dionyſ.*

* *Macrob. Saturn.*

† *Plut. Iſ. et Oſir.*

(c) Principio hoc ego quidem controverſia vacare, arbitror, myſteria quæ vocantur, ritus fuiſſe idcirco inſtitutos ne memoria petiret veterum beneficiorum, inventorum, fatorum rerum geſtarum quibus primi populorum conditores, aut alii præclari homines, decus nomen, et famam, inter ſuos ſibi comparaverant. Neque hæc cuiquam ſententia mirabilis videri poterit. *Cud. Syſt. Intellect. ed. Moſhemii*, p. 329.

(d) Iſis, among the Egyptians, ſometimes ſignifies the moon, and ſometimes the earth.

Dionyſiacs; the wanderings of Io, wonderfully adorned by Æſchylus; and the labours of Hercules, afterwards uſurped by the Greeks.

14 he Egyp- ans dei- ed depart- d heroes.

Whether the Egyptians deified mortal men in the earlieſt ages has been much controverted. Jablonſki[†] has taken much pains to prove the negative. Diodorus[‡] aſſures us, that they paid their monarchs a kind of divine adoration, even in their lifetime. Plutarch tells us plainly[§], that ſome were of opinion that Iſis, Oſiris, Horus, Anubis, Typhon, were once mortal perſons, who were exalted into demons after their death. The Sicilian, in his hiſtory of Iſis and Oſiris, Pan, Hermes, &c. plainly repreſents them as human perſonages; and informs us, that the Egyptians imagined, that after their deceaſe they tranſmigrated into particular ſtars. From theſe authorities, we are inclined to believe that the Egyptians, as well as the other Pagans, did actually deify perſons who had diſtinguiſhed themſelves in their days of nature by proweſs, wiſdom, uſeful arts, and inventions. This was a conſtant practice among the Greeks, who probably learned it from the people in queſtion.

Panth Egypt.

Lib. i.

Iſ et ſir.

15 ecrets re- pecting he objects f worſhip evealed in he myſte- ies.

The exploits of theſe heroes had been diſguiſed by allegorical traditions and hieroglyphical repreſentations. They had been magnified beyond all dimenſions, in order to aſtoniſh and intimidate the vulgar. They had been interlarded with the moſt extravagant fables, in order to gratify their propenſity towards the marvellous. All theſe ſecrets were developed in the myſteries. The catechumens (E) were informed of every particular relating to the birth, the life, the exploits, the adventures, the misfortunes, and deceaſe of thoſe heroic perſonages, and when, and by what means, they had attained to the high rank of divinities. At the ſame time we think it highly probable, that thoſe demi-gods were repreſented in their ſtate of exaltation and heavenly ſplendour. The magicians of Egypt were abundantly qualified for exhibiting *angels in machines*. The ſouls of virtuous men, who had not been eminent enough to merit the honour of deification, were ſhown in all the perfection of Elyſian felicity; and perhaps the ſouls of tyrants, and of the children of (F) Typhon, were ſhown in Tartarus, ſuffering all the extremes of infernal puniſhment. From theſe exhibitions the myſtagogues might naturally enough take occaſion to read their pupils ſuitable lectures on the happy tendency of a virtuous conduct, and the diſhonour and miſery conſequent upon a contrary courſe. They might ſet before them immortal renown, deification, and Elyſium, on the one hand, and eternal infamy and miſery on the other. This will probably be deemed the chief advantage accruing from this inſtitution.

16 Chief advantage of the myſteries

Beſides the communications above mentioned, the catechumens were taught many ſecrets of phyſiology, or the nature of the phenomena of the world. This Pharnutus[*] every where affirms, eſpecially in his laſt book towards the end. Plutarch too informs us, that many of the Greek philoſophers were of opinion, that moſt of the Egyptian fables were allegorical details of phyſical operations. Euſebius acquaints us[†], that the phyſiology, not only of the Greeks, but likewiſe of the barbarians, was nothing elſe but a kind of ſcience of nature, a concealed and dark theology, involved in fable and fiction, whoſe hidden myſteries were ſo veiled over with enigmas and allegories, that the ignorant million were as little capable of comprehending what was ſaid as what was ſuppreſſed in ſilence. This, ſays he, is apparent from the poems of Orpheus and the fables of the Phrygians and Egyptians. Dionyſius of Halicarnaſſus likewiſe obſerves[‡], that the fables of the Greeks detail the operations of nature by allegories. Proclus[§] makes the ſame obſervation concerning the people in queſtion. The Egyptians, ſays he, taught the latent operations of nature by fables.

[*] *De Nat Deorum.*

[†] *Prop. Evangel.*

[‡] *Antiq. Rom.*

[§] *In Tim.*

17 Phyſiological ſecrets expounded in the myſteries of Egypt.

Theſe phyſiological ſecrets were no doubt expounded to the initiated; and that the Egyptian prieſts were deeply ſkilled in phyſiological ſcience, can ſcarce be queſtioned, if we believe that Jannes and Jambres rivalled Moſes with their enchantments. The preceding detail comprehends all that was revealed to the Epoptæ in the original Egyptian myſteries. What articles might have been introduced afterwards we cannot pretend to determine.

Be that as it may, one thing is certain, namely, that the vulgar were excluded from all thoſe choice ſecrets, which were carefully reſerved for the nobility and ſacerdotal tribes. To them it was given to know the myſteries of the kingdom of darkneſs; but to thoſe who were without, all was myſtery and parable. While the laity fed on huſks, the clergy and the quality feaſted on royal dainties. The prieſts who had deviſed theſe allegories underſtood their original import, and bequeathed it as an ineſtimable legacy to their children. Here then we have the primary object of the myſteries, namely, to develope to the initiated the original and rational import of thoſe allegorical and myſtical doctrines which were tendered to the uninitiated, wrapt up in impenetrable allegory and obſcurity. To the former, theſe were communicated and explained: The latter were obliged to ſtand at an awful diſtance, and retire as the *Procul, O procul eſte profani*, thundered in their ears.

Theſe allegorical traditions originated in Egypt, (ſee MYTHOLOGY.) It was the general bias of the oriental genius. The Egyptians, however, according to the moſt authentic accounts (G), were the greateſt proficients in that ſcience. The original ſubject of theſe inſtitutions were, we imagine, the articles we have ſpecified above: but in proceſs of time, according to the natural courſe of things, numerous improvements were made, and many new rites, ceremonies, uſages, and even doctrines, were ſuperinduced, which were utterly unknown to the original hierophants (H). Simplicity is, for

---

(E) Catechumens were pupils who were learning the elements of any ſcience.

(F) Typhon was the evil genius, or devil, of the Egyptians.

(G) As early as the age of Joſeph, the Egyptians were ſkilled in the interpretations of dreams, divinations, &c. and in the age of Moſes they were become wiſe men, magicians, &c.

(H) Hierophant imports a prieſt employed in explaining the doctrines, rites, &c. communicated to the initiated.

for the moſt part, one of the diſtinguiſhing characters of a new inſtitution; but ſucceeding architects generally imagine that ſomething is ſtill wanting to complete the beauty, the regularity, the uniformity, the magnificence, and perhaps the conveniency of the ſtructure. Hence, at length, it comes to be ſo overloaded with adventitious drapery, that its primary elegance and ſymmetry are altogether defaced. This was the caſe with the earlieſt Egyptian myſteries. Their ſubject was at firſt ſimple and eaſy to be comprehended; in time it became complex, intricate, and unintelligible.

18 Temples where the myſteries were celebrated.

In order to celebrate thoſe myſteries with the greater ſecrecy, their temples were ſo conſtructed as to favour the artifice of the prieſts. The fanes, in which they uſed to execute their ſacred functions, and to perform the rites and ceremonies of their religion, were ſubterraneous apartments, conſtructed with ſuch wonderful ſkill and dexterity, that every thing that appeared in them breathed an air of ſolemn ſecrecy. Their walls were covered with hieroglyphic paintings and ſculpture, and the altar was ſituated in the centre of the apartment. Modern ‡ travellers have of late years diſcovered ſome veſtiges of them, and bear witneſs to the above deſcription of thoſe dark abodes (I). In thoſe ſubterraneous manſions, which the prieſts of that ingenious nation had planned with the moſt conſummate ſkill, the kings, princes, and great men of the ſtate, encountered the dangers and hardſhips contrived to prove their prudence, fortitude, patience, abſtinence, &c. Theſe were appointed to try their merit; and by theſe the hierophants were enabled to decide whether or not they were duly qualified for receiving that benefit. Upon theſe occaſions, we may believe, abundance of thoſe magical tricks were exhibited, for which the magicians of Egypt were ſo much celebrated among the ancients. The ſtrange and aſtoniſhing ſights, the alternate ſucceſſions of light and darkneſs, the hideous ſpectres expoſed to view, the frightful howlings reechoed by theſe infernal domes, the ſcenes of Tartarus and Elyſium, exhibited alternately and in quick ſucceſſion, muſt have made a deep and laſting impreſſion on the mind of the affrighted votary (K). Theſe ſcenes we ſhall deſcribe more fully in the ſequel.

‡ *Norden, Shaw, Pococke*, &c.

19 The Grecian Infernal regions copied from the Egyptian myſteries.

From the ſcenes exhibited in celebrating the Egyptian myſteries, eſpecially thoſe of Iſis and Oſiris, the Greeks ſeem to have copied their ideas of the infernal regions, and the ſubterraneous manſions of departed ſouls. Many colonies of Egyptians ſettled in Greece. From theſe the ἀοιδοι (L), or moſt early bards of Greece, learned them imperfectly. Of courſe, we find Homer's account of the infernal regions, and of the ſtate of departed ſouls, lame and incoherent. Succeeding bards obtained more full and more diſtinct information. Euripides and Ariſtophanes ſeem to have paved the way for the prince of Roman poets. Plato † and ſome of the other philoſophers have ſhown by their deſcriptions or alluſions, that the whole apparatus of Tartarus and Elyſium had become a hackneyed topic ſome centuries before Virgil was born. This incomparable poet borrowed his ideas from Homer, Ariſtophanes, Euripides, Plato, &c. Theſe, under his plaſtic hand, in the ſixth Æneid, grew into a ſyſtem beautiful, regular, uniform, and conſiſtent. The materials he has employed were created to his hand; he had only to collect, poliſh, arrange, and connect them.—The ſentiments collected from the Platonic philoſophy, and the inimitable epiſode copied from the annals of Rome, by the maſterly ſkill which he has diſplayed in the application of them, form the chief excellencies of the piece. For the reſt, he could well diſpenſe with going to Eleuſis (M): every old woman in Athens and Rome could repeat them.

† *Phædo.*

20 Myſteries brought from Egypt into Perſia and Greece.

Egypt was then the native land of myſteries as well as of idolatry. Every god and goddeſs reſpectively had their myſteries; but as thoſe of Iſis and Oſiris were the moſt celebrated, they of courſe became principal objects of purſuit as well as of imitation to the neighbouring nations. Theſe, as is generally believed, were carried into Perſia by Zoroaſtres, or Zerduſht, by whom they were conſecrated to Mithras. On theſe we ſhall make ſome obſervations in the ſequel.—Orpheus imported them into Thrace; Cadmus brought them into Bœotia, where they were ſacred to Bacchus. Inachus eſtabliſhed them at Argos in honour of Juno, the ſame with Iſis (N); Cyniras in Cyprus, where they were dedicated to Venus. In Phrygia they were ſacred to Cybele, the mother of the gods.

Our learned readers, who will probably reflect that the Egyptians were in ancient times inhoſpitable to ſtrangers, will perhaps be ſurpriſed that this faſtidious and jealous people were ſo ready to communicate the arcana of their religion to foreigners.—But they will pleaſe recollect, that a great part of Greece was planted with colonies from Egypt, Phœnicia, Paleſtine, &c. This we could eaſily prove, did the bounds preſcribed us admit ſuch a digreſſion. Orpheus, if not an Egyptian, was at leaſt of oriental extraction. Inachus, Cadmus, and Melampus, are univerſally allowed to have been Egyptians. Erechtheus, in whoſe reign the Eleuſinian myſteries were eſtabliſhed, was an Egyptian by birth, or at leaſt ſprung from Egyptian anceſtors. The Egyptians, then, in thoſe early ages, did not view the Greeks in the light of aliens, but as a people nearly related either to themſelves or the Phœnicians, who were their brethren. Upon this connexion we imagine it was, that in later times moſt of the ſages of Greece,

---

(I) See an excellent deſcription of theſe ſubterraneous abodes, and of the proceſs of probation carried on there, in a French romance, entitled *The Life of Sethos.*

(K) Perſons who had deſcended into Trophonius's vault were ſaid to have been ſo terrified with ſhocking ſights, that they never laughed during the remainder of their lives.

(L) Theſe were ſtrolling poets like our minſtrels, who frequented the houſes of the great men of Greece, and entertained the company upon public occaſions with ſinging and tales of other times.

(M) Biſhop Warburton has, with much ingenuity, and a vaſt profuſion of reading, endeavoured to prove that Virgil borrowed the whole ſcenery of the ſixth Æneid from the ſources mentioned in the text.

(N) Iſis was the moon, and the original Juno was the ſame planet.

Greece, eſpecially of Athens, found ſo hoſpitable a reception among that people. They probably viewed them in the light of propagandi; apoſtles able and willing to diſſeminate their idolatrous rites. This obſervation, which might be ſupported by numberleſs authorities, did the nature of the preſent inquiry permit, will, we think, go a great way towards obviating the objection.

21
ysteries Mithras, echus, d Ceres, e moſt guſt.

Although, as has been obſerved, every particular deity had his own peculiar myſterious ſacred rites, yet of all others thoſe of Mithras, Bacchus (o), and Ceres, were deemed the moſt auguſt, and were moſt univerſally and moſt religiouſly celebrated. To theſe, therefore, we ſhall in a good meaſure confine ourſelves upon this occaſion. If our readers ſhall become intimately acquainted with theſe, they may readily diſpenſe with the knowledge of the reſt, which are, indeed, no more than ſtreams and emanations from theſe ſources. We ſhall then, in the firſt place, preſent to our readers a brief ſketch of the myſteries of Mithras.

22
ccount of e myſte- s of Mi- as.

Mithras, or, according to the Perſian, *Mihr*, was one of the great gods of the Aſiatics. His worſhip was for many ages confined to Perſia. Afterwards, however, it was propagated ſo far and wide, that ſome have imagined they had diſcovered veſtiges of it even in Gaul. *Mihr*, according to Dr Hyde *, ſignifies love, and likewiſe the *ſun*. If we might preſume to differ from ſo a reſpectable an authority, we ſhould conjecture that it is a cognate of the Hebrew word *muthir*, "excellentia, præſtantia." That there was an analogy between the Hebrew and old Perſian, is generally admitted by the learned. Be that as it may, Mithras was the ſun (p) among the Perſians; and in honour of that luminary this inſtitution was eſtabliſhed. Mithras, according to Plutarch (q), was the middle god between Oramaz and Ariman, the two ſupreme divinities of Perſia. But the fact is, the ſolar planet was the viſible emblem of Oramaz, the good genius of the Perſian tribes, and the ſame with the Oſiris of the Egyptians. From theſe people, ſome have imagined that Zoroaſtres (r), or Zerduſht, borrowed his myſteries of Mithras. To this opinion we cannot give our aſſent, becauſe the probationary trials to be undergone by the candidates among the former were much more ſavage and ſanguinary than among the latter.—Both, however, were inſtituted in honour of the ſame deity; and probably the ſcenes exhibited, and the information communicated in both, were analogous; a circumſtance which perhaps gave birth to the opinion above mentioned.

*Relig. et. Perſa- m.

The grand feſtival of Mithras was celebrated ſix days, in the middle of the month Mihr (s). Upon theſe days, it was lawful for the kings of Perſia to get drunk and dance. On this feſtival, we imagine, the candidates for initiation, having duly proved their vocation, were ſolemnly admitted to the participation of the myſteries.

Zoroaſtres (t) worſhipped Mithras, or the Sun, in a certain natural cave, which he formed into a temple, and filled up in a manner exactly mathematical. There Mithras was repreſented as preſiding over the lower world with all the pomp of royal magnificence. In it too were ſeen the ſymbols of Mithras and of the world, philoſophically and mathematically exhibited, to be contemplated and worſhipped. This deity was ſometimes repreſented as mounted on a bull, which he is breaking, and which he kills with a ſword. On ſome bas reliefs ſtill exiſting, he appears as a young man with his tiara turned upward, after the manner of the Perſian kings. He is clothed with a ſhort tunic and breeches, after the Perſian faſhion. Sometimes he wears a ſmall cloak. By his ſides are ſeen other human figures, with tiaras of the ſame faſhion on their heads, but without cloaks. One of theſe figures commonly holds in his one hand a torch lifted up; in the other, one turned downward. Sometimes over the cave are ſeen the chariots of the ſun and moon, and divers conſtellations, ſuch as cancer, ſcorpio, &c.

23
Probationary exerciſes previous to initiation.

In one of thoſe caves the ceremonies of initiation were performed; but before the candidate could be admitted, he was forced to undergo a courſe of probationary exerciſes, ſo numerous and ſo rigorous, that very few had courage and fortitude enough to go through them. He was obliged to live a life of virtue and abſtinence for the ſpace of ſeven years previous to the period of his initiation. Some months before it, he was obliged to ſubmit to a long and auſtere faſt, which continued fifty days. He was to retire ſeveral days to a deep and dark dungeon, where he was ſucceſſively expoſed to all the extremes of heat and cold. Meantime he frequently underwent the baſtinado, which the prieſts applied without mercy. Some ſay this fuſtigation continued two whole days, and was repeated no leſs than 15 times. In the courſe of theſe probationary exerciſes, the candidate was generally reduced to a ſkeleton: and we are told, that there have been ſeveral inſtances of perſons who have periſhed in the attempt.

Upon the eve of the initiation, the aſpirant was obliged to * brace on his armour, in order to encounter

* *Jul. Firmicus.*

(o) Bacchus was the Oſiris of the Egyptians, and Ceres was Iſis of the ſame people.

(p) Moſheim, in his notes on Cudworth's Intellectual Syſtem, p. 330. has taken much pains to prove that Mithras was a deified mortal; but we cannot agreee with that learned man in this point.

(q) Iſis and Oſiris, p. 369. l. 20. from the bottom. This philoſopher makes Zoroaſter, according to ſome, 5000 years prior to the Trojan war. This date is certainly extravagant. We cannot, however, agree, with ſome moderns, who make him contemporary with Darius Hyſtaſpes, the immediate ſucceſſor of Cambyſes, becauſe it contradicts all antiquity.

(r) M. Silohwette, Diſſer. v. p. 17. aſſerts that Zoroaſtes was initiated among the Egyptians.

(s) The month Mehr began September 30. and ended October 30.

(t) See Dr Hyde de Rel. vet. Perſ. pages 16, 17. Mr Bryant's Anal. vol. i. p. 232. Porphyr. de Antro Nymph. p. 254. This philoſopher often mentions the cave of Mithras, and always attributes the inſtitution of his rites to Zoroaſter.

ter giants and ſavage monſters. In thoſe ſpacious ſubterraneous manſions a mock hunting was exhibited. The prieſts and all the ſubordinate officers of the temple, transformed into lions, tygers, leopards, boars, wolves, and other ſavage creatures, aſſailed him with loud howlings, roaring, and yelling, and every inſtance of ferine fury. In thoſe mock combats, the hero was often in danger of being really worried, and always came off with bruiſes and wounds. Lampridius informs us, that when the emperor Commodus was initiated, he actually carried the joke too far, and butchered one of the prieſts who attacked him in the figure of a wild beaſt. The Perſians worſhipped Mithras or the Sun by a perpetual fire; hence the votary was obliged to undergo a fiery trial; that is, to paſs ſeven times through the ſacred fire, and each time to plunge himſelf into cold water. Some have made theſe probationary penances amount to 80: others have thought that they were in all only 8. As we find no good authority for either of theſe numbers, we think ourſelves at liberty to hazard the following conjecture: The number *ſeven* was deemed ſacred over all the eaſt. The Mithriac penances we imagine were either ſeven, or if they exceeded it, were regulated by ſeven repetitions of that number. The candidate having undergone all theſe torturing trials with becoming patience and fortitude, was declared a proper ſubject for initiation. But before his admiſſion he was obliged to bind himſelf by the moſt ſolemn oath, with horrible imprecations annexed, never to divulge any ſingle article of all that ſhould be communicated to him in the courſe of his initiation.

24 Oath of ſecrecy.

25 Revelations in the myſteries of Mithras.

What απορρητα or *ineffable ſecrets* were imparted to the initiated, it is impoſſible at this diſtance of time to diſcover with any tolerable degree of certainty. We may, however, reſt aſſured, that the moſt authentic tradition concerning the origin of the univerſe; the nature, attributes, perfections, and operations, of Oromaſd; the baleful influences of Ariman; and the benign effects of the government of Mithras, were unfolded and inculcated. The ſecret phenomena of nature, as far as they had been diſcovered by the Magi, were likewiſe exhibited; and the application of their effects, to aſtoniſh and delude the vulgar, were taught both in theory and practice. The exerciſe of public and private virtues was warmly recommended; and vice repreſented in the moſt odious and frightful colours. Both theſe injunctions were, we may ſuppoſe, enforced by a diſplay of the pleaſures of Elyſium and the pains of Tartarus, as has been obſerved above in deſcribing the myſteries of the Egyptians.

Thoſe initiations are mentioned by Lampridius in the life of Commodus, and likewiſe by Juſtin † and Tertullian ‡, who both flouriſhed in the ſecond century. The laſt of theſe two ſpeaks of a kind of baptiſm, which waſhed from the ſouls of the initiated all the ſtains which they had contracted during the courſe of their lives prior to their initiation. He at the ſame time mentions a particular mark which was imprinted upon them (U), of an offering of bread, and an emblem of the reſurrection; which particulars, however, he does not deſcribe in detail. In that offering, which was accompanied with a certain form of prayer, a veſſel of water was offered up with the bread. The ſame father elſewhere informs us, that there was preſented to the initiated a crown ſuſpended on the point of a ſword; but that they were taught to ſay, *Mithras is my crown.* By this anſwer was intimated, that they looked upon the ſervice of that deity as their chief honour and ornament.

After that the Teletæ (X) were finiſhed, the pupil was brought out of the cave or temple, and with great ſolemnity proclaimed a lion of Mithras (Y); a title which imported ſtrength and intrepid courage in the ſervice of the deity. They were now conſecrated to the god, and were ſuppoſed to be under his immediate protection; an idea which of courſe animated them to the moſt daring and dangerous enterpriſes.

The worſhip of Mithras was introduced into the Roman empire towards the end of the republic, where it made very rapid progreſs. When Chriſtianity began to make a figure in the empire, the champions for Paganiſm thought of propoſing to men the worſhip of this *power of benevolence*, in order to counterbalance or annihilate that worſhip which the Chriſtians paid to Jeſus Chriſt the true *Sun* of righteouſneſs. But this mode was ſoon aboliſhed, together with the other rites of Paganiſm. The Perſian grandees often affected names compounded with Mithras; hence Mithridates, Mithrobarzanes, &c. Hence, too, the precious ſtone called *Mithridat* †, which by the reflection of the ſun ſparkled with a variety of colours. There is likewiſe a certain pearl of many different colours, which they call *Mithras*. It is found among the mountains near the Red ſea; and when expoſed to the ſun, it ſparkles with a variety of dyes. We find likewiſe a king of Egypt of that name, who reigned at Heliopolis; who being commanded in a dream to erect an obeliſk to the ſolar deity, reared a moſt prodigious one in the neighbourhood of that city.

26 Mithras ſaid to have ſprung from a rock.

The votaries of Mithras pretended that he was ſprung from a rock, and that therefore the place where the myſterious ceremonies were communicated to the initiated was always a cave. Many different reaſons have been aſſigned for the origin of this rock-born deity, moſt of which appear to us unſatisfactory. If our readers will be obliging enough to accept of a ſimple and obvious conjecture, they may take the following:

A

† *Dial. cum Tryphone.*

‡ *De præſcript. adver. Hæret.*

† *Solinus*, cap. 10.

(U) In alluſion to this practice of imprinting a ſacred mark, probably on the forehead of the initiated, we find the injunction to the angel, Ezek. chap. ix. ver. 4. and the Revelation *paſſim*.

(X) The myſteries were called *Teletæ*, which imports, "the rites which confer perfection."

(Y) *Tertull. adv. Marc.* p. 55. The prieſts of Mithras were called the *lions of Mithras*, and his prieſteſſes *lioneſſes*; ſome ſay *hyænas*. The other inferior miniſters were called *eagles*, *hawks*, *ravens*, &c. and on their feſtivals they wore maſks correſponding to their titles, after the Egyptian manner, where the prieſts appeared at the ceremonies with maſks reſembling the heads of lions, apes, dogs, &c. a circumſtance which furniſhes a preſumption that the myſteries of Mithras were of Egyptian original.

A rock is the ſymbol of ſtrength and ſtability (Z); the dominion of Mithras, in the opinion of his votaries, was firm as a rock, and ſtable as the everlaſting hills. If our readers ſhould not admit the probability of this conjecture, we would beg leave to remit them to the learned Mr Bryant's *Analyſis of Mythology*, where they will find this point diſcuſſed with deep reſearch and wonderful ingenuity. Whatever may have been the origin of this opinion with relation to the birth of Mithras, it is certain that ſome reverence to rocks and caves was kept up a long time even after the eſtabliſhment of Chriſtianity. Hence the prohibition given to ſome of the proſelytes to that religion, that they ſhould no more preſume to offer up their prayers *ad petras*, at the rocks (A).

We ſhall conclude our account of the myſteries of Mithras, with a paſſage from M. Anquetil, to whom we are ſo much indebted for what knowledge we have of the Perſian theology, and in which the functions of that deity are briefly and comprehenſively delineated. "The peculiar functions of Mithras are to fight continually againſt Ahriman and the impure army of evil genii, whoſe conſtant employment is to ſcatter terror and deſolation over the univerſe; to protect the frame of nature from the demons and their productions. For this purpoſe he is furniſhed with a thouſand ears and a thouſand eyes, and traverſes the ſpace between heaven and earth: his hands armed with a club or mace. Mithras gives to the earth light and ſun: he traces a courſe for the waters: he gives to men corn, paſtures, and children; to the world virtuous kings and warriors; maintains harmony upon earth, watches over the law," &c. As the hiſtory of Mithras, and the nature of his myſteries, are not generally known, we imagined it would be agreeable to many of our readers to have the moſt important articles relating to that ſubject laid before them as it were in detail.

27
Myſteries of Bacchus.

We now proceed to the orgia or myſteries of Bacchus, which we ſhall introduce with a brief hiſtory of that deity. The original Dionyſus or Bacchus was the Oſiris of the Egyptians, which laſt was the Sun (B). Whether there was an Egyptian monarch of that name, as Diodorus Siculus affirms *, has no manner of connexion with the preſent diſquiſition. The Greek name of that deity is plainly oriental, being compounded of *di*, "bright," and *naſta* or *naſa*, in the Æolic dialect *nuſa*, "a prince." This name was imported from the eaſt by Orpheus, Cadmus, or by whoever elſe communicated the worſhip of Oſiris to the Greeks. That the Dionyſus of the Greeks was the ſame with the Oſiris of the Egyptians, is univerſally allowed. Herodotus tells us expreſsly †, that *Oſiris* is *Dionyſus* in the Greek language: Martianus Capellus, quoted above, expreſſes the very ſame idea ‡. The original Oſiris was then the ſun; but the Dionyſus or Bacchus of the Greeks was the ſame with the Oſiris of the Egyptians; therefore the Bacchus or Dionyſus of the Greeks was likewiſe the ſame luminary.

* Lib. i.

28
Bacchus the ſame with Oſiris.

† Lib. ii. cap. 144.

‡ Theol. Egyp. lib. ii. cap. 1.

The name *Oſiris* has much embarraſſed critics and etymologiſts. The learned Jablonſki §, inſtead of delineating the character, attributes, operations, adventures, exploits, and peculiar department aſſigned this deity by his votaries, has ſpent much of his pains on trying to inveſtigate the etymology of his name. If it be granted, which is highly probable, that the Hebrew and Egyptian tongues are cognate dialects, we ſhould imagine that it is actually the *Choſher* or *Oſhir* of the former language, which imports, "to make rich, to become rich." Indeed the words *Oſiris* and *Iſis* were not the vulgar names of the ſun and moon among the Egyptians, but only epithets importing their qualities. The name of the ſun among that people was *Phri* or *Phry*, and that of moon *Ioh*, whence the Greek *Io*. The term *Oſiris* was applied both to the ſun and to the river Nile; both which by their influence contributed reſpectively to enrich and fertilize the land of Egypt.

§ *Panth. Egyp.*

It was a general cuſtom among the orientals to denominate their princes and great men from their gods, demigods, heroes, &c. When the former were advanced to divine honours, they were in proceſs of time confounded with their archetypes. The original divinities were forgotten, and theſe upſtart deities uſurped their place and prerogatives. In the earlieſt periods of the Egyptian monarchy, there appeared two illuſtrious perſonages Oſiris and Iſis. Theſe were the children of Cronus; and being brother and ſiſter, they were joined in matrimony, according to the cuſtom of the Egyptians. As the brother and huſband had aſſumed the name of the *Sun*, ſo the ſiſter and conſort took that of *Iſis*, that is, "the woman ||," a name which the Egyptians applied both to the moon and to the earth, in conſequence of the ſimilarity of their nature, their mutual ſympathy, and congenial fecundity.

|| *Horapollo*, cap. 3.

29
Exploits of Oſiris.

Oſiris having left his conſort Iſis regent of the kingdom, with Hermes as her prime miniſter, and Hercules as general of her armies, quitted Egypt with a numerous body of troops, attended by companies of fauns (C), ſatyrs, ſinging women, muſicians, &c. and traverſed all Aſia to the eaſtern ocean. He then returned homeward through the Upper Aſia, Thrace, Pontus, Aſia Minor, Syria, and Paleſtine. Wherever he marched he conferred numberleſs benefits on the ſavage inhabitants. He taught the art of cultivating the ground, preſerving the fruits of the earth, and diſtinguiſhing the wholeſome and nutritive from the unwholeſome and poiſonous. He inſtructed them in the culture of the vine; and where vines could not be produced, he communicated to them the method of producing a fermented liquor from barley, very little inferior to wine itſelf. He built many cities in different

---

(Z) Our Saviour probably alludes to this emblem, when he talks of *building his church on a rock*; and adds, *that the gates of hell ſhould not prevail againſt it.*

(A) The Caledonian druids ſeem to have regarded certain ſtones with a ſuperſtitious veneration, in which the Catholics imitated them. There are in ſeveral places of Scotland large ſtones, which the vulgar call *lecre* ſtones, i. e. we imagine, *lecture*.

(B) See Macrob. lib. i. cap. 21. p. 247. bottom. Diogenes Laert. in proœmio, par. 10. Martian. Capel. lib. ii. Jablonſki, vol. i. lib. ii. 415. par. 3. Plut. Iſis et Oſir. *paſſim.*

(C) Men and women dreſſed in the habits of thoſe rural deities.

parts of the globe, planted numerous colonies (D), and wherever he directed his courſe inſtituted juſt and wholeſome laws, and eſtabliſhed the rites and ceremonies of religion, and left prieſts and catechiſts of his train to teach and inculcate the obſervance of them. In ſhort, he left everywhere laſting monuments of his progreſs, and at the ſame time of his generoſity and beneficence. Where he found the people docile and ſubmiſſive, he treated them with kindneſs and humanity: if any ſhowed themſelves obſtinate, he compelled them to ſubmit to his inſtitutions by force of arms.

30 His death.

At the end of three years, he returned to Egypt, where his brother Typhon, a wicked unnatural monſter, had been forming a conſpiracy againſt his life. This traiterous deſign he ſoon after accompliſhed in the following manner: He invited Oſiris, with ſome other perſons whom he had gained over, to an entertainment. When the repaſt was finiſhed, he produced a beautiful coffer, highly finiſhed, and adorned with ſtuds of gold; promiſing to beſtow it on the perſon whom it ſhould fit beſt. Oſiris was tempted to make the experiment. The conſpirators nailed down the cover upon him, and threw the coffer into the river. This coffer, which was now become the coffin of Oſiris, was, they tell us, wafted by the winds and waves to the neighbourhood of Byblus, a city of Phœnicia, where it was caſt on ſhore, and left by the waves at the foot of a tamarind tree.

31 Wanderings of Iſis in ſearch of his body.

Iſis in the mean time, diſconſolate and forlorn, attended by Anubis, was ranſacking every quarter in ſearch of her beloved Oſiris. At length being informed by her faithful attendant and guardian, that his body was lodged ſomewhere in the neighbourhood of Byblus, ſhe repaired to that city. There, they ſay, ſhe was introduced to the queen, and after (E) a variety of adventures ſhe recovered the corpſe of her huſband, which, of courſe, ſhe carried back with her to Egypt: but the miſchievous Typhon, ever on the watch, found her on the banks of the Nile; and having robbed her of her charge, cut the body into 14 parts, and ſcattered them up and down. Now, once more, according to the fable, Iſis ſet out in queſt of thoſe parts, all of which, only one excepted, ſhe found, and interred in the place where ſhe found them; and hence the many tombs of Oſiris in that country. Theſe tombs were denominated *tapoſins* by the natives. Many other fabulous adventures were aſcribed to thoſe two perſonages, which it is not our province to enumerate at preſent. If our readers ſhould wiſh to be more minutely informed on this ſubject, they may have recourſe to the authors mentioned in the laſt-quoted author, or to the learned Mr Bryant's Analyſis of Ancient Mythology, and M. Cour de Gebelin, where they will find matter enough to gratify their curioſity.

32 The myſteries of Iſis and Oſiris inſtituted in commemoration of thoſe adventures.

To commemorate thoſe adventures, the myſteries of Iſis and Oſiris were inſtituted; and from them both thoſe of Bacchus and Ceres, among the Greeks, were derived. Of the Egyptian ſolemnity, we have an exact epitome in one of the fathers of the church to the following purpoſe: "Here follows (ſays he) an epitome of the myſteries of Iſis and Oſiris. They deplore annually, with deep lamentations and ſhaved heads, the cataſtrophe of Oſiris over a buried ſtatue of that monarch. They beat their breaſts, mangle their arms, tear open the ſcars of their former wounds; that by annual lamentations the cataſtrophe of his miſerable and fatal death may be revived in their minds. When they have practiſed theſe things a certain number of days, then they pretend that they have found the remains of his mangled body; and having found them, their ſorrows are lulled aſleep, and they break out into immoderate joy." What maxims of morality, ſecrets of phyſiology, or phenomena of aſtronomy, were couched under this allegorical proceſs, is not our buſineſs to inveſtigate in this place. We ſhall only obſerve, that, in all probability, Oſiris and Iſis were ſovereigns of Egypt at a very early period; that they had conferred many ſignal benefits on their ſubjects, who, influenced by a ſenſe of gratitude, paid them divine honours after their deceaſe; that in proceſs of time they were confounded with the ſun and the moon; and that their adventures were at length magnified beyond all credibility, interlarded with fables and allegories, and employed in the myſteries as channels to convey a variety of inſtructions to the initiated.

33 Transferred to Byblus and Tyre, where Oſiris was called *Adonis* and *Bacchus*.

Be that as it may, it is certain that the very ſame mode of worſhip was eſtabliſhed at Byblus, and in after ages transferred to Tyre. The Mizraim and Chanaanim were nearly connected by blood, and their religious ceremonies were derived from the very ſame ſource. By what medium the worſhip of Oſiris at Abydus and Tyre was connected, we ſhall leave to others to explain; we ſhall only obſerve, that among the Phœnicians this deity obtained the names *Adonis* and *Bacchus*. The former is rather an (F) epithet than a name: the latter is evidently an alluſion to the weeping and lamentation (G) with which the rites were performed. We find another name of that divinity mentioned in Scripture (H); but that term is plainly of Egyptian original: we ſhall now proceed to the myſteries of Oſiris as they were celebrated among the Greeks and Thracians, under the name of the *Orgia of Dionyſus* or *Bacchus* †.

† *Diod. Sicul. Voſſius de Idol.*

Orpheus, the celebrated Thracian philoſopher, had travelled into Egypt in queſt of knowledge; and from that

---

(D) Many have thought this expedition fabulous; but the numberleſs monuments of Egyptian architecture, ſculpture, and ſtatuary, lately diſcovered in the eaſt, confirm it.

(E) For the conqueſts and adventures of Oſiris and Iſis, we muſt ſend our learned readers to Diod. Sic. Bibl. l. i. and Plut. Iſis et Oſiris, p. 256. et ſeq. which we have been obliged to abridge, in conſequence of the narrow limits preſcribed us.

(F) Adonis is evidently the Hebrew *Adoni*, "my lord," and imports the ſovereignty of the deity.

(G) Bacchus is derived from the Phœnician word *bahah*, "to weep." This was the name embraced by the Romans.

(H) Ezek. chap. viii. ver. 14. *Tammuz* is the name of one of the months of the Egyptian year.

34 And thence imported by Cadmus into Bœotia.

that country, according to the moſt authentic accounts, he imported the Bacchanalian rites and inſtitutions. Some have affirmed that this ſame Orpheus being intimately acquainted with the family of Cadmus, communicated theſe rites to them, and endeavoured to transfer them to the grandſon of that hero, which grandſon became afterwards the Grecian Bacchus. It is, however, we think much more probable, that thoſe rites were imported from Egypt or Phœnicia, by (I) Cadmus himſelf, who was a native of the former country, and is thought to have ſpent ſome time in the latter, before he emigrated in queſt of a ſettlement in Bœotia. It is ſaid that Semele, the daughter of Cadmus, and the mother of the Grecian Bacchus, was ſtruck with lightning at the very inſtant of his birth. The child was, in all probability, denominated *Bacchus* (K), from the ſorrow and lamentation this melancholy accident had occaſioned in the family. Cadmus, in order to conceal the diſhonour of his daughter, might, we imagine, convey away his infant grandſon to ſome of his relations in Phœnicia or Egypt. There he was educated and inſtructed in all the myſteries of Iſis and Oſiris, and at the ſame time initiated in all the magical or juggling tricks of the Egyptian prieſts and hierophants. Thus accompliſhed, when he arrived at manhood, he returned to Thebes with the traditional retinue of the original deity of the ſame name; and claimed divine honours accordingly. This claim, however, was not admitted without much oppoſition; Pentheus, another grandſon of Cadmus, was torn to pieces by the frantic Bacchanalians upon Mount Citheron, becauſe he attempted to interrupt them in celebrating the orgia. Some have thought that Cadmus loſt his kingdom for the ſame reaſon; but this we think is by no means probable: we ſhould rather imagine that the old prince was privy to the whole proceſs, and that it was originally planned by him, with a view to attract the veneration of his new ſubjects, by making them believe that there was a divinity in his family.

35 The actions of Oſiris attributed to the Grecian Bacchus.

Be that as it may, the vain-glorious Greeks attributed all the actions of the Egyptian hero to their new Bacchus; and according to their laudable practice, engaged him in numberleſs adventures in which his prototype had no ſhare. Moſt of thoſe are futile and unentertaining (L). The Greeks commonly adopted ſome oriental perſonage as the hero of their mythological rhapſodies. Him they naturalized and adopted into ſome Grecian family, and ſo he became their own. To him they aſcribed all the adventures and exploits of the oriental archetype from whom he was copied. Conſequently in the orgia (M), every thing was collected that had been imported from the eaſt relating to Oſiris; and to that farrago was joined all that the Grecian rhapſodiſts had thought fit to invent, in order to amuſe the credulous multitude. This, however, was not the whole of the misfortune: The adventures of Oſiris were deſcribed by the Egyptian hierophants, veiled with allegorical and hieroglyphical myſteries. Theſe the perſons who imported them into Greece did not thoroughly comprehend, or if they did, they were not inclined to communicate them ſound and unſophiſticated. Beſides, many oriental terms were retained, the import of which was in proceſs of time loſt or diſtorted. Hence the religious ceremonies of the Greeks became a medley of inconſiſtencies. The myſteries of Bacchus, in particular, were deeply tinctured with this meretricious colouring; the adventures of the Theban pretender were grafted upon thoſe of the Egyptian archetype, and out of this combination was formed a tiſſue of adventures diſgraceful to human nature, abſurd, and inconſiſtent. Indeed the younger or Theban Bacchus ſeems to have been a monſter of debauchery; whereas the Egyptian is repreſented as a perſon of an oppoſite character. Of courſe the myſteries of the former were attended with the moſt ſhocking abominations.

36 Myſteries of Bacchus ſpread into Greece, &c.

Theſe myſteries, as has been obſerved above, were firſt celebrated at Thebes the capital of Bœotia, under the auſpices of the family of Cadmus. From this country they gradually found their way into Greece, and all the neighbouring parts of Europe. They were celebrated once every three years (N), becauſe at the end of three years Oſiris returned from his Indian expedition. As the Greeks had impudently transferred the actions of the Egyptian hero to their upſtart divinity, the ſame period of time was obſerved for the celebration of thoſe rites in Greece that had been ordained for the ſame purpoſe in Egypt.

37 Proceſs of their celebration.

When the day appointed for the celebration of the orgia (O) approached, the prieſts iſſued a proclamation, enjoining all the initiated to equip themſelves according to the ritual, and attend the proceſſion on the

---

(I) Cadmus and Melampus, who were both Egyptians, introduced the Bacchanalia into Greece. The Egyptian or oriental name of Bacchus was *Dinuſi*, that is, "the prince of light." Cadmus had learned the name *Bacchus* from the Phœnicians.

(K) We have omitted the immenſe farrago of fable relating to the connexion between Jupiter and Semele as of little importance to our readers.

(L) Nonnus, an Egyptian of Pentapolis, has collected all the fabulous adventures of Bacchus, and exhibited them in a beautiful but irregular poem: To this we muſt refer our learned readers. Of the Dionyſiacs we have a moſt judicious ſketch, *Gebelin. Calend.* p. 553. et ſeq.

(M) The orgia belonged to all the Mydones, but to thoſe of Bacchus in a peculiar manner.

(N) Hence theſe orgia were called *Triteria*.

(O) According to Clem. Alexand. Cohort. page 12. Pott. the word *orgia* is derived from *orge*, which ſignifies "anger," and originated from the reſentment of Ceres againſt Jupiter, in conſequence of a moſt outrageous inſult he had offered her with ſucceſs. We ſhould rather imagine it derived from the Hebrew word *argoz*, ſignifying a "cheſt or coffer," alluding to the caſket which contained the ſacred ſymbols of the god.—The Egyptians or Phœnicians might write and pronounce, argoz, *orgoz*, or in ſome manner nearly reſembling *orgia*.

the day appointed. The votaries were to dreſs themſelves in coats of deer-ſkins, to looſe the fillets of their hair, to cover their legs with the ſame ſtuff with their coats, and to arm themſelves with thyrſi, which were a kind of ſpears wholly of wood entwined with leaves and twigs of the vine or ivy. It is ſaid that the Bacchanalians, eſpecially the Thracians, uſed often to quarrel and commit murder in their drunken revels; and that in order to prevent thoſe unlucky accidents, a law was enacted, that the votaries, inſtead of real ſpears, ſhould arm themſelves with thoſe ſham weapons which were comparatively inoffenſive. The ſtatue of the deity, which was always covered with vine or ivy leaves, was now taken down from its pedeſtal, and elevated on the ſhoulders of the prieſts. The cavalcade then proceeded nearly in the following manner:

Firſt of all, hymns were chanted in honour of Bacchus, who was called the *Power of dances, ſmiles, and jeſts;* while at the ſame time he was deemed equally qualified for the exploits of war and heroiſm. Horace, in ſome of his dithyrambic odes, has conciſely pointed out the ſubjects of thoſe Bacchanalian ſongs. In the collection of hymns fabulouſly attributed to Orpheus, we find ſeveral addreſſed to this deity (P), each under a different title, derived from the different appellations of the god. All theſe names are of oriental original, and might eaſily be explained, did the bounds preſcribed us admit of etymological diſquiſitions.

The hymn being finiſhed, the firſt diviſion of the votaries proceeded, carrying a pitcher of wine, with a bunch of the vine. Then followed the he-goat; an animal odious to Bacchus, becauſe he ravages the vines. The chanting the hymns, the ſacrificing the he-goat, and the revels, games, and diverſions, with which the celebration of thoſe rites was attended, gave birth to the dramatic poetry of the Greeks; as the perſons habited in the dreſs of Fauns, Sylvans, and Satyrs (Q), furniſhed the name of another ſpecies of poetry of a coarſer and more forbidding aſpect.

38 The myſterious coffer, with its contents.

Then appeared the myſterious coffer or baſket, containing the ſecret ſymbols of the deity. Theſe were the phallus (R), ſome grains of ſeſama, heads of poppies, pomegranates, dry ſtems, cakes baked of the meal of different kinds of corn, ſalt, carded wool, rolls of honey, and cheeſe; a child, a ſerpent (S), and a van (T). Such was the furniture of the ſacred coffer carried in the ſolemn Bacchanalian proceſſion. The inventory given by ſome of the fathers * of the church is ſomewhat different. They mention the dye, the ball, the top, the wheel, the apples, the looking-glaſs, and the fleece. The articles firſt mentioned ſeem to have been of Egyptian original; the laſt were certainly ſuperinduced by the Greeks, in alluſion to his being murdered and torn in pieces when he was a child by the machinations of Juno, who prevailed with the Titans to commit the horrid deed. Theſe laſt ſeem to have been memorials of his boyiſh playthings; for, ſays Maternus, "the Cretans †, in celebrating the rites of the child Bacchus, acted every thing that the dying boy either ſaid, or did, or ſuffered. They likewiſe (ſays he) tore a live bull in pieces with their teeth, in order to commemorate the diſmembering of the boy." For our part, we think, that if ſuch a beaſtly rite was practiſed, it was done in commemoration of the ſavage manner of life which had prevailed among men prior to the more humane diet invented and introduced by Iſis and Oſiris. Be that as it may, we learn from Porphyry ‡, that in the iſland of Chios they uſed to ſacrifice a man to Bacchus, and that they uſed to mangle and tear him limb from limb. This was no doubt practiſed in commemoration of the cataſtrophe mentioned above.

39 Human ſacrifices.

* Clem. Alexand.

† De Errore Prof. Gent.

‡ De Abſtinentia.

The orgia of this Pagan god were originally ſimple enough; but this unſophiſticated mode was of no long continuance, for riches ſoon introduced luxury, which quickly infected even the ceremonies of religion. On the day ſet apart for this ſolemnity, men and women crowned with ivy, their hair diſhevelled, and their bodies almoſt naked, ran about the ſtreets, roaring aloud *Evohe* (U) Bacche. In this rout were to be ſeen people intoxicated at once with wine and enthuſiaſm, dreſſed like Satyrs, Fauns, and Sileni, in ſuch ſcandalous poſtures and attitudes, with ſo little regard to modeſty and even common decency, that we are perſuaded our readers will readily enough forgive our omitting to deſcribe them. Next followed a company mounted upon aſſes, attended by Fauns, Bacchanals, Thyades, Mimallonides, Naiads, Tityri, &c. who made the adjacent places echo to their frantic ſhrieks and howlings. After this tumultuous herd were carried the ſtatues of Victory

40 Total contempt of decency.

(P) Theſe ſtand between the 41 and 52; one to Lenæus, or the preſſer; one to Libnites, or the winnower; one to Beſſareus, or the vintager; one to Sabazius the god of reſt; to Myſes, or the Mediator, &c.

(Q) Dacier, Caſaubon, and other French critics, have puzzled and perplexed themſelves to little purpoſe about the origin of this word, without conſidering that it was coeval to dramatic poetry.

(R) The phallus was highly reſpected by the Egyptians, and was uſed as the emblem of the fecundity of the human race.

(S) That reptile was in high veneration among the Egyptians. See Euſeb. Præp. Evang. lib. i. page 26. Steph. where we have a minute detail of the ſymbolical properties of that creature, according to Taautos the great legiſlator of that people.

(T) Servius in Georg. I. Virg. ver. 166. Myſtica *vannus* Iacchi. The van, ſays he, is an emblem of that purifying influence of the myſteries, by which the initiated were cleanſed from all their former pollutions, and qualified for commencing a holy courſe of life.

(U) Clem. Alexand. Cohort. page 11. Pott. derives this word from *Cheveh*, the mother of mankind, who, firſt opened the gate to that and every other error; but we are rather inclined to believe that it comes from the oriental word *Hevé*, which ſignifies a "ſerpent;" which among the Egyptians was ſacred to the ſun, and was likewiſe the emblem of life and immortality. It then imported a prayer to Bacchus for life, vigour, health, and every other bleſſing.

Victory and altars in form of vine-ſets, crowned with ivy, ſmoking with incenſe and other aromatics. Then appeared ſeveral chariots loaded with thyrſi, arms, garlands, caſks, pitchers, and other vaſes, tripods, and vans. The chariots were followed by young virgins of quality, who carried the baſkets and little boxes, which in general contained the myſterious articles above enumerated. Theſe, from their office, were called *ciſtophoræ*. The phallophori (x) followed them, with a chorus of itophallophori habited like Fauns, counterfeiting drunk perſons, ſinging in honour of Bacchus ſongs and catches ſuited to the occaſion. The proceſſion was cloſed by a troop of Bacchanalians crowned with ivy, interwoven with branches of yew and with ſerpents *. Upon ſome occaſions, at thoſe ſcandalous feſtivals, naked women whipped themſelves, and tore their ſkin in a moſt barbarous manner. The proceſſion terminated on Mount Citheron, when it ſet out from Thebes; and in other places, in ſome diſtant unfrequented deſert, where the votaries practiſed every ſpecies of debauchery with ſecrecy and impunity. Orpheus ſaw the degeneracy of thoſe ceremonies; and in endeavouring to reform them he probably loſt his life. Pentheus ſuffered in the like attempt, being torn in pieces by the Bacchanalians on Mount Citheron, among whom were his own mother and his aunts. The Greeks, who were an airy jovial people, ſeem to have paid little regard to the plaintive part of the orgia; or rather, we believe, they acted with howling and frantic exclamations, often enhanced by a combination of drunkenneſs, ecſtacy, and enthuſiaſtic fury.

* *Ovid. Met.*

41
Doctrines inculcated in the orgia.

What ſecrets, religious, moral, political, or phyſical, were communicated to the votaries, it is impoſſible to determine with any degree of certainty.—One thing we may admit, namely, that the doctrines diſcovered and inculcated in the orgia, were originally the very ſame which the apoſtles of the ſect had imbibed in Egypt and Phœnicia; and of which we have given a brief account near the beginning of this article. It is, however, probable, that the ſpurious or Theban Bacchus had ſuperadded a great deal of his own invention, which, we may believe, was not altogether ſo ſound and ſalubrious as the original doctrine. However that may be, the initiated were made to believe that they were to derive wonderful advantages from the participation of thoſe rites, both in this life and that which is to come. Of this, however, we ſhall talk more at length by and bye, in our account of the Eleuſinian myſteries.

To detail the etymology of the names of this Pagan deity, the fables relating to his birth, his education, his transformations, his wars, peregrinations, adventures, the various and multiform rites with which he was worſhipped, would ſwell this article to a moſt immoderate ſize. If any of our readers ſhould wiſh to be more minutely and more accurately acquainted with this ſubject, we muſt beg leave to remit them to Diod. Sic. Apollod. Bibl. Euripid. Bacchæ, Ariſtophanis Ranæ, Nonn. Dionyſ.; and among the moderns, to Ban. Mythol. Voſſ. de Orig. Idol. Monſ. Fourmont, Reflexions ſur l'origine des anciens peuples, Mr Bryant's Analyſ. and eſpecially to Monſ. Cour de Gebelin, Calendries ou Almanach. That prince of etymologiſts, in his account of the feſtival of Bacchus, has given a moſt acute and ingenious explication of the names and epithets of that deity. For our part, we have endeavoured to collect and exhibit ſuch as we judged moſt important, moſt entertaining, and moſt inſtructive, to the leſs enlightened claſſes of our readers.

42
Eleuſinian myſteries inſtituted in honour of Ceres.

We now proceed to the Eleuſinian myſteries, which, among the ancient Greeks and Romans, were treated with a ſuperior degree of awe and veneration. Theſe were inſtituted in honour of Ceres, the goddeſs of corn; who, according to the moſt authentic accounts, was the Iſis of the Egyptians. The myſteries of Oſiris and Iſis have been hinted at in the preceding part of this article. They were originally inſtituted in honour of the ſun and moon, and afterwards conſecrated to an Egyptian prince and princeſs; who, in conſequence of their merits, had been deified by that people. We know of no more exact and brilliant deſcription of the ceremonies of that goddeſs, in the moſt poliſhed ages of the Egyptian ſuperſtition, than what we meet with in the witty and florid Apuleius †, to which we muſt take the liberty to refer our more curious readers. Our buſineſs at preſent ſhall be to try to inveſtigate by what means, and upon what occaſion, thoſe myſteries were introduced into Attica, and eſtabliſhed at Eleuſis. A paſſage from Diodorus Siculus §, which we ſhall here tranſlate, will, we think, throw no inconſiderable light on that abſtruſe part of the ſubject.

† Lib. ix.

§ Lib. i.

43
On what occaſion introduced into Attica.

“ In like manner with him (Cecrops), ſays that judicious hiſtorian, they tell us, that Erechtheus, a prince of Egyptian extraction, once reigned at Athens. Of this fact they produce the following evidence: A ſcorching drought, during the reign of this prince, prevailed over almoſt all the habitable world, except Egypt; which, in conſequence of the humidity of its ſoil, was not affected by that calamity. The fruits of the earth were burnt up; and at the ſame time multitudes of people periſhed by famine. Erechtheus, upon this occaſion, as he was connected with Egypt, imported a vaſt quantity of grain from that country to Athens. The people, who had been relieved by his munificence, unanimouſly elected him king. Being inveſted with the government, he taught his ſubjects the myſteries of Ceres at Eleuſis, and the mode of celebrating the ſacred ceremonies, having transferred from Egypt the ritual for that purpoſe. In thoſe times the goddeſs is ſaid to have made her appearance at Athens three ſeveral times; becauſe, according to tradition, the fruits of the earth which bear her name were then imported into Attica. On this account the ſeeds and fruits of the earth were ſaid to be the invention of that deity. Now the Athenians themſelves acknowledge, that, in the reign of Erechtheus, the fruits of the earth having periſhed for want of rain, the arrival of Ceres in their country did actually happen, and that along with her the bleſſing of corn

---

(x) The phallus was the ſymbol of the fructifying power of Nature. The itophallus was the type of that power in act.

corn was reſtored to the earth. They tell us at the ſame time, that the teletæ and the myſteries of that goddeſs were then received and inſtituted at Eleuſis."

Here then we have the whole myſtery of the arrival of Ceres in Attica, and the inſtitution of her myſteries at Eleuſis, unveiled. The whole is evidently an oriental allegory. The fruits of the earth had been deſtroyed by a long courſe of drought: Egypt, by its peculiar ſituation, had been preſerved from that dreadful calamity. Erectheus, in conſequence of his relation to the Egyptians, imported from their country a quantity of grain, not only ſufficient for the conſumption of his own ſubjects, but alſo a great overplus to export to other parts of Greece, Sicily, Italy, Spain, &c. Triptolemus, another Egyptian, was appointed by Erechtheus to export this ſuperfluous ſtore. That hero, according to Pherecydes, was the ſon of Oceanus and Tellus, that is, of the ſea and the earth; becauſe his parents were not known, and becauſe he came to Eleuſis by ſea. The ſhip in which he ſailed, when he diſtributed his corn to the weſtern parts of the world, was decorated with the figure of a winged dragon: therefore, in the allegorical ſtyle of his country, he was ſaid to be wafted through the air in a chariot drawn by dragons. Thoſe creatures, every body knows, were held ſacred by the Egyptians.

Wherever Triptolemus diſpoſed of his corn, thither were extended the wanderings of Ceres. In order to elucidate this point, we muſt obſerve, that along with the grain imported from Egypt, Erechtheus, or Triptolemus, or both, tranſported into Attica a cargo of prieſts and prieſteſſes from the temples of Buſiris, a city which lay in the * centre of the Delta, where the goddeſs Iſis had a number of chapels erected for her worſhip. The preſidents of theſe ceremonies, like all other bigots, gladly laid hold on this opportunity of propagating their religious rites, and diſſeminating the worſhip of the deities of their country. That the Egyptian prieſts were zealous in propagating the dogmas of their ſuperſtition, is abundantly evident from the extenſive ſpreading of their rites and ceremonies over almoſt all Aſia and a conſiderable part of Europe. The Greek and Roman idolatry is known to have originated from them; and numberleſs monuments of their impious worſhip are ſtill extant in Perſia ‡, India, Japan, Tartary, &c. Our inference then is, that the worſhip of Iſis was introduced into every country where Triptolemus ſold or diſpoſed of his commodities.—Hence the wanderings of Ceres in ſearch of her daughter Proſerpine who is generally called *Core*. The famine occaſioned by the drought deſtroying the fruits of the ground, imports the loſs of Proſerpine. The reſtoration of the corn in various parts of the earth, by freſh ſupplies from Egypt from time to time, imports the wanderings of Ceres in queſt of Proſerpine. The whole proceſs is an oriental allegory. The diſappearing of the fruits of the earth, of which Proſerpine, or Perſephone †, or Pereſephone (Y), is the emblem, is the allegorical rape of that goddeſs. She was ſeized and carried off by Pluto, ſovereign of the infernal regions. The ſeed committed to the earth in that dry ſeaſon appeared no more, and was, conſequently, ſaid to dwell under ground with Pluto. It was then that Ceres, that is, corn imported from Egypt, ſet out in queſt of her daughter. Again, When the earth recovered her priſtine fertility, the Core, or maid, was found by her mother Ceres, that is, the earth; for Iſis, among the Egyptians, frequently ſignified the earth. The wanderings of Iſis in ſearch of Oſiris furniſhed the model for the peregrinations of Ceres.

* Herod. lib. i.

‡ *Aſiatic Reſearches*, vol. i. and ii.

† *Plutarch, Iſis et Oſir.*

44
Different names of Ceres.

Ceres, the Roman name of the goddeſs of corn, was unknown to the modern Greeks. They always denominated her *Damater* (Z), which is rather an epithet than a proper name. The Greeks, who always affected to paſs for originals, we think, ſuppreſſed the Egyptian name on purpoſe, to conceal the country of that deity. As a proof of the probability of this conjecture, it may be obſerved, that they metamorphoſed the wanderings of Iſis in ſearch of Oſiris into the peregrinations of Ceres in queſt of Proſerpine. The Romans who were leſs ambitious of the character of originality, retained one of her oriental names (AA). Ceres, ſays Diodorus, appeared thrice in Attica during the reign of Erechtheus; which ſeems to import, that fleets loaded with corn had thrice arrived in that country from Egypt during that period.

45
Contentions at Athens reſpecting Minerva and Neptune, the immediate cauſe of fixing the myſteries at Eleuſis.

Cecrops, the firſt king of Attica, had eſtabliſhed the worſhip of the Saitic Athena or Minerva in that region, and conſecrated his capital to that deity. Erectheus, in his turn, introduced the worſhip of Iſis, or Damater, who in all appearance was the tutelar deity of Buſiris his native city. The ſubjects of Cecrops were a colony of Saites, and readily embraced the worſhip of Minerva; but the aborigines of that diſtrict being accuſtomed to a maritime, perhaps to a piratical, courſe of life, were more inclined to conſecrate their city to Neptune the god of the ſea, and to conſtitute him their guardian and protector. Cecrops by a ſtratagem ſecured the preference to Minerva his favourite divinity. Erechtheus, in order to give equal importance to his patroneſs,

---

(Y) This word ſeems to be formed of two Hebrew terms, *pheri* "fruit," and *tzaphon*, or *tzephon*, "abſcondit, recondidit."

(Z) Damater is compounded of the Chaldaic particle *da*, "the," and *mater*, "mother." As Iſis often ſignified the earth, the Greeks naturally adopted that title; becauſe, according to them, that element is the mother of all living. In the very ſame manner they diſcarded the word *Juno*, an original title of the moon, and ſubſtituted *Hera*, which intimates "miſtreſs or lady."

(AA) According to ſome of the Latin etymologiſts, *Ceres*, or rather *Geres*, is derived from *gero*, "to bear, to carry," becauſe the earth bears all things; or becauſe that element is the general fruit-bearer. But as this term came to Italy immediately from the eaſt, and not by the medium of Greece, we would rather incline to adopt an oriental etymology. The Hebrew word *cheres* ſignifies *arare*, "to plough;" a name naturally applicable to the goddeſs of huſbandry.

patroneſs, had the addreſs to inſtitute the Eleuſinian myſteries; and to accompliſh his deſign laid hold on the opportunity above mentioned.

This appears to us the moſt probable account of the origin and inſtitution of the Eleuſinian myſteries; for which the Sicilian hiſtorian has indeed furniſhed the clue. We ſhall now proceed to detail ſome other circumſtances which attended the original inſtitution of theſe far-famed ceremonies.

46
rcum-
ances at-
nding the
ſt appear-
ce of Ce-
s in At-
ta.

The archprieſteſs who perſonated the newly imported deity was entertained by one Celeus †, who was either viceroy of that petty diſtrict of which Eleuſis was the capital, or ſome conſiderable perſonage in that city or its neighbourhood. Upon her immediate arrival, according to the fabulous relations of the Greeks, a farce was acted not altogether ſuitable to the character of a goddeſs whoſe myſteries were one day to be deemed ſo ſacred and auſtere. Theſe coarſe receptions, and other indecencies attending the firſt appearance of the goddeſs, that is, the Egyptian dame who aſſumed her character, were copied from the like unhallowed modes of behaviour practiſed on occaſion of the ſolemn proceſſions of her native country. Theſe ſcommata, or coarſe jokes, had an allegorical ſignification in Egypt; and among the moſt ancient Greeks the very ſame ſpirit was univerſally diffuſed by the oriental coloniſts who from time to time arrived and ſettled among them. In proceſs of time they abandoned the figurative and allegorical ſtyle, in conſequence of their acquaintance with philoſophy and abſtract reaſoning. In the ceremonies of religion, however, the ſame allegorical and typical repreſentations which had been imported from the eaſt were retained; but the Grecian hierophants in a ſhort time loſt every idea of their latent import, and religious, moral, or phyſical interpretation. Accordingly, this ſhameful rencounter between Ceres and Banbo (BB), or Jambe, was retained in the myſteries, though we think it was copied from Egypt, as was ſaid above, where even that obſcene action was probably an allegorical repreſentation of ſomething very different from what appeared to the Greeks.

† Apollod. bl. lib. iii. p 13.

47
eres and
acchus,
ho they
ere.

At the ſame time that Ceres arrived in Attica, Bacchus likewiſe made his appearance in that country. He was entertained by one Icarus; whom, as a reward for his hoſpitality, he inſtructed in the art of cultivating the vine, and the method of manufacturing wine. Thus it appears that both agriculture and the art of managing the vintage were introduced into Athens much about the ſame time. Ceres was no other than a prieſteſs of Iſis; Bacchus was no doubt a prieſt of Oſiris. The arrival of thoſe two perſonages from Egypt, with a number of inferior prieſts in their train, produced a memorable revolution in Athens, both with reſpect to life, manners, and religion. The ſacred rites of Iſis, afterwards ſo famous under the name of the Eleuſinian myſteries, date their inſtitution from this period.

When this company of propagandi arrived at Eleuſis, they were entertained by ſome of the moſt reſpectable perſons who then inhabited that diſtrict. Their names, according to Clem. Alexand. were Banbo, Dyſaulis, Triptolemus, Eumolpus, and Eubulus. From Eumolpus were deſcended a race of prieſts called Eumolpidæ, who figured at Athens many ages after. Triptolemus was an ox herd, Eumolpus a ſhepherd, and Eubulus a ſwine herd. Theſe were the firſt apoſtles of the Eleuſinian myſteries. They were inſtructed by the Egyptian miſſionaries; and they, in their turn, inſtructed their ſucceſſors. Erechtheus, or, as ſome ſay, Pandion, countenanced the ſeminary, and built a ſmall temple for its accommodation in Eleuſis, a city of Attica, a few miles weſt from Athens, and originally one of the twelve diſtricts into which that territory was divided. Here then we have arrived at the ſcene of thoſe renowned myſteries, which for the ſpace of near 2000 years were the pride of Athens and the wonder of the world.

48
Eleuſinian myſteries divided into greater and leſſer.

The myſteries were divided into the greater and leſſer. The latter were celebrated at Agræ, a ſmall town on the river Ilyſſus: the former were celebrated in the month which the Athenians called Boedromion (CC); the latter in the month Antheſterion (DD). The leſſer myſteries, according to the fabulous legends of the Greeks, were inſtituted in favour of the celebrated Hercules. That hero being commanded by Euryſtheus to bring up Cerberus from the infernal regions, was deſirous of being initiated in the Eleuſinian myſteries before he engaged in that perilous undertaking. He addreſſed himſelf to Eumolpus the hierophant for that purpoſe. There was a law among the Eleuſinians prohibiting the initiation of foreigners. The prieſt not daring to refuſe the benefit to Hercules, who was both a friend and benefactor to the Athenians, adviſed the hero to get himſelf adopted by a native of the place, and ſo to elude the force of the law. He was accordingly adopted by one Pyolius, and ſo was initiated in the leſſer myſteries, which were inſtituted for the firſt time upon that occaſion. This account has all the air of a fable. The leſſer myſteries were inſtituted by way of preparation for the greater.

49
Auſterities and rites previous to initiation.

The perſon who was to be initiated in the leſſer myſteries, as well as in the greater, was obliged to practiſe the virtue of chaſtity a conſiderable time before his admiſſion. Beſides, he was to bind himſelf by the moſt ſolemn vows not to divulge any part of the myſteries. At the ſame time, he was, according to the original inſtitution, to be a perſon of unblemiſhed moral character. Theſe were preliminaries indiſpenſably neceſſary in order to his admiſſion. A bull was ſacrificed to Jupiter, and the hide of that animal, called by a peculiar name (Διος Κωδιον) was carefully preſerved and carried to Eleuſis, where it was ſpread under the feet of the initiated. The candidate was then purified by bathing in the river Ilyſſus, by aſperſions with ſalt water or ſalt, with laurel, barley, and paſſing through

---

(BB) Apollod. Bib. ubi ſupra. Clem. Alexand. Cohort. page 17. where the ſtory is told with very little reſerve.

(CC) The third month of the Athenian year, anſwering to our September.

(DD) The eighth month, anſwering to our February; but Meurſius makes it November.

through the fire: all which rites were attended with incantations and other uſages equally inſignificant and ridiculous. Laſt of all, a young ſow was ſacrificed to Ceres; and this animal, according to the ritual, behoved to be with pigs; and before it was killed it was to be waſhed in Cantharus, one of the three harbours which formed the Piræus.

50 into the leſſer myſteries; of which

All theſe ceremonies duly performed, the candidate was carried into the hall appointed for the purpoſe of initiation. There he was taught the firſt elements of thoſe arcana which were afterwards to be more fully and more clearly revealed in the more auguſt myſteries of Eleuſis. The pupils at Agræ were called *Myſtæ*, which may intimate probationers; whereas thoſe of Eleuſis were denominated *Epoptæ*, importing that they ſaw as they were ſeen.

51 there were ſeveral ſtages, with long intervals between them.

The leſſer myſteries were divided into ſeveral ſtages, and candidates were admitted to them according to their quality and capacity reſpectively. Thoſe who were initiated in the loweſt were obliged to wait five years before they were admitted to the greater. Thoſe who had partaken of the ſecond kind underwent a noviciate of three years; thoſe who had been admitted to the third, one of two years; and thoſe who had gone through the fourth were admitted to the greater at the end of one year; which was the ſhorteſt period of probation a candidate for that honour could legally undergo. Such was the proceſs generally obſerved in adminiſtering the leſſer myſteries.

52 None but natives of Athens originally admitted to the greater myſteries.

With reſpect to the greater myſteries, it is probable that originally none but the natives of Attica were admitted to partake of them. In proceſs of time, however, the pale was extended ſo far and wide as to comprehend all who ſpoke the Greek language. All foreigners were debarred from thoſe ſacred rites. They tell us, however, that Hercules, Bacchus, Caſtor and Pollux, Æſculapius, and Hippocrates, were initiated in an extraordinary manner, from a regard to their high character and heroic exploits. All barbarians, too, were excluded; yet Anacharſis the Scythian was indulged that privilege, in conſequence of his reputation for ſcience and philoſophy. All perſons guilty of manſlaughter, though even accidentally or involuntarily, all magicians, enchanters; in a word, all impious and profane perſons, were expreſsly prohibited the benefit of this Pagan ſacrament. At laſt, however, the gate became wider, and crowds of people, of all nations, kindreds, and languages, provided their character was fair and irreproachable, ruſhed in by it. In proceſs of time the Athenians initiated even their infants; but this, we imagine, muſt have been a kind of luſtration or purification, from which it was ſuppoſed that they derived a kind of moral ablution from vice, and were thought to be under the peculiar protection of the goddeſs.

53 Celebration laſted nine days; but

The celebration of the myſteries began on the 15th day of the month Boedromion; and, according to moſt ancient authors, laſted nine days. Meurſius has enumerated the tranſactions of each day, which are much too numerous to fall within the compaſs of this article; we muſt therefore refer our curious reader to the author juſt mentioned. Some days before the commencement of the feſtival, the præcones, or public criers, invited all the initiated, and all the pretenders to that honour, to attend the feſtival, with clean hands and a pure heart, and the knowledge of the Greek language.

54 was performed only during the night.

On the evening of the 15th day of the month called *Boedromion* the initiations commenced. Our readers will obſerve, that all the moſt ſacred and ſolemn rites of the Pagan ſuperſtition were performed during the night: they were indeed generally works of darkneſs. On this day there was a ſolemn cavalcade of Athenian matrons from Athens to Eleuſis, in carriages drawn by oxen. In this proceſſion the ladies uſed to rally one another in pretty looſe terms, in imitation, we ſuppoſe, of the Iſiac proceſſion deſcribed by Herodotus, which has been mentioned above. The moſt remarkable object in this proceſſion was the Mundus Cereris, contained in a ſmall coffer or baſket. This was carried by a ſelect company of Athenian matrons, who, from their office, were ſtyled *Camphoræ*. In this coffer were lodged the comb of Ceres, her mirror, a ſerpentine figure, ſome wheat and barley, the pudenda of the two ſexes, and perhaps ſome other articles which we have not been able to diſcover. The proceſſion ended at the temple, where this ſacred charge was depoſited with the greateſt ſolemnity.

55 The Mundus Cereris.

We have no deſcription of the temple of Eleuſis upon record. Pauſanias intended to have deſcribed it; but ſays he was diverted from his deſign by a dream *. Strabo informs us that the myſtic ſanctuary was as large as a theatre, and that it was built by Ictinus †. In the porch, or outer part of this temple, the candidates were crowned with garlands of flowers, which they called *himera*, or “the deſirable.” They were at the ſame time dreſſed in new garments, which they continued to wear till they were quite worn out. They then waſhed their hands in a laver filled with holy water; a ceremony which intimated the purity of their hearts and hands. Before the doors were locked, one of the officers of the temple proclaimed with a loud voice a ſtern mandate, enjoining all the uninitiated to keep at a diſtance from the temple, and denouncing the moſt terrible menaces if any ſhould dare to diſturb or pry into the holy myſteries. Nor were theſe menaces without effect: for if any perſon was found to have crowded into the ſanctuary even through ignorance, he was put to death without mercy. Every precaution having been taken to ſecure ſecrecy, the initiatory ceremonies now began. But before we deſcribe theſe, we muſt lay before our readers a brief account of the miniſters and retainers of theſe ſecrets of paganiſm.

56 Dreſs of the candidates.

57 Care to keep the uninitiated at a diſtance.

58 The hierophant.

The chief miniſter of theſe far-famed myſteries was the hierophant. He was ſtyled *King*, and enjoyed that dignity during life, and was always by birth an Athenian. He preſided in the ſolemnity, as is evident from his title. This perſonage, as we learn from Euſebius, repreſented the Demiurgus, or Creator of the world. “Now in the myſteries of Eleuſis (ſays that father) the hierophant is dreſſed out in the figure of the demiurgus.” What this demiurgus was, we learn from the ſame writer. As this whole inſtitution was copied from the Egyptians, we may reſt aſſured that the figure of the Eleuſinian Demiurgus was borrowed from the ſame quarter. “As for the ſymbols of the Egyptians (ſays he, quoting from Porphyry ‡), they are of the following complexion. The Demiurgus, whom the Egyptians call *Cneph*, is figured

---

* Lib. ix.

† See *Eleuſis*.

‡ *Prep. Evan.*

as a man of an azure colour, ſhaded with black, holding in his right hand a ſceptre and in his left a girdle, and having on his head a royal wing or feather wreathed round." Such, we imagine, was the equipment of the Eleuſinian hierophant. This perſon was likewiſe ſtyled *Prophet.* He was to be of the family of the Eumolpidæ; was obliged to make a vow of perpetual chaſtity; and even his voice, hair, and attitude, were adjuſted to the ritual.

59
The dadu-hus.

The next miniſter was the daduchus, or torchbearer; who, according to the father above quoted, was attired like the ſun. This miniſter reſembled the ſun, becauſe that luminary was deemed the viſible type of the ſupreme Demiurgus, and his vicegerent in governing and arranging the affairs of this lower world.

60
The prieſts.

The third was the perſon who officiated at the altar. He was habited like the moon. His office was to implore the favour of the gods for all the initiated. We ſhould rather imagine, that the perſon at the altar, as he reſembled the moon, was intended to repreſent the goddeſs herſelf: for the Egyptian Iſis, who was the archetype of Ceres, was ſometimes the moon and ſometimes the earth.

61
The herald.

The ſacred herald was another principal actor in this ſolemn exhibition. His province was to recite every thing, that, according to the ritual, was to be communicated to the novices; and he probably repreſented Thyoth or Thoth, that is Hermes or Mercury, the interpreter of the gods.

62
The cura-ors, &c.

Beſides theſe, there were five epimeletæ or curators, of whom the king was one, who jointly directed the whole ceremonial. Laſtly, There were ten prieſts to offer the ſacrifices. There were no doubt many officers of inferior note employed upon theſe occaſions; but theſe were only inſignificant appendages, whoſe departments have not been tranſmitted to poſterity.

After this detail of the miniſters of this ſolemn ſervice, we return to the *myſtæ*, or candidates for initiation. Some of the fathers of the church † mention a hymn compoſed by the celebrated Orpheus, which was ſung by the myſtagogue or king upon that occaſion. This hymn appears to us one of thoſe ſpurious compoſitions which abounded in the firſt ages of Chriſtianity, and which the pious apologiſts often adopted without ſufficient examination. That ſome ſacred hymn was chanted upon that occaſion, we think highly probable; but that the one in queſtion was either compoſed by Orpheus, or uſed at the opening of theſe ceremonies, to us appears ſomewhat problematical.

Before the ceremony opened, a book was produced, which contained every thing relating to the teletæ. This was read over in the ears of the myſtæ; who were ordered to write out a copy of it for themſelves. This book was kept at Eleuſis in a ſacred repoſitory, formed by two ſtones exactly fitted to each other, and of a very large ſize. This repoſitory was called *petroma.* At the annual celebration of the greater myſteries, theſe ſtones were taken aſunder, and the book taken out; which, after being read to the myſtæ, was replaced in the ſame caſement.

63
The petro-na.

64
Commencement of the initiations.

The initiations began with a repreſentation of the wanderings of Ceres, and her bitter and loud lamentations for the loſs of her beloved daughter. Upon this occaſion, no doubt, a figure of that deity was diſplayed to the myſtæ, while loud lamentations echoed from every corner of the ſanctuary. One of the company having kindled a firebrand at the altar, and ſprung to a certain place in the temple, waving the torch with the utmoſt fury, a ſecond ſnatched it from him, roaring and waving it in the ſame frantic manner; and a third, fourth, &c. in the moſt rapid ſucceſſion. This was done to imitate Ceres, who was ſaid to have perluſtrated the globe of the earth with a flaming pipe in her hand, which ſhe had lighted at Mount Etna.

65
Queſtions put to the myſtæ.

When the pageant of the goddeſs was ſuppoſed to arrive at Eleuſis, a ſolemn pauſe enſued, and a few trifling queſtions were put to the myſtæ: What theſe queſtions were, is evident from the anſwers. "I have faſted; I have drunk the liquor; I have taken the contents out of the coffer; and having performed the ceremony, have put them into the hamper: I have taken them out of the hamper, and put them again in the coffer." The meaning of theſe anſwers, we conjecture, was this: "I have faſted, as Ceres faſted while in ſearch of her daughter; I have drunk off the wort as ſhe drank when given her by Banbo; I have performed what Ceres taught her firſt diſciples to perform, when ſhe committed to them the ſacred hamper and coffer." After theſe interrogatories, and the ſuitable reſponſes, the *mundus Cereris* was diſplayed before the eyes of the myſtæ, and the *myſtagogue* or hierophant, or perhaps the ſacred herald by his command, read a lecture on the allegorical import of thoſe ſacred ſymbols. This was heard with the moſt profound attention; and a ſolemn ſilence prevailed throughout the fane. Such was the firſt act of this religious farce, which perhaps conſiſted originally of nothing more.

66
Traditions reſpecting the origin of the univerſe, &c.

After the expoſition of the *mundus Cereris,* and the import of her wanderings, many traditions were communicated to the myſtæ concerning the origin of the univerſe and the nature of things. The doctrines delivered in the greater myſteries, ſays Clem. Alex. "relate to the nature of the univerſe. Here all inſtruction ends. Things are ſeen as they are; and nature, and the things of nature, are given to be comprehended." To the ſame purpoſe Cicero: "Which points being explained and reduced to the ſtandard of reaſon, the nature of things, rather than that of the gods, is diſcovered." The father of the univerſe, or the ſupreme demiurgus, was repreſented as forming the chaotic maſs into the four elements, and producing animals, vegetables, and all kinds of organized beings, out of thoſe materials. They ſay that they were informed of the ſecrets of the anomalies of the moon, and the eclipſes of the ſun and moon; and, according to Virgil,

Unde hominum genus, et pecudes, unde imber et ignes.

What ſyſtem of coſmogony thoſe hierophants adopted, is evident from the paſſage above quoted from Euſebius; and from the account immediately preceding, it was that of the moſt ancient Egyptians, and of the orientals in general. This coſmogony is beautifully and energetically exhibited in Plato's Timæus, and in the genuine ſpirit of poetry by Ovid in the beginning of his Metamorphoſes.

67
Exploits of the gods, and

The next ſcene exhibited upon the ſtage, on this ſolemn occaſion, conſiſted of the exploits and adventures of the gods, demigods, and heroes, who had from time to

---

† *Juſtin. Euſeb. Clem. Alex.*

to time, been advanced to divine honours. Theſe were diſplayed as paſſing before the myſtæ in pageants fabricated for that important purpoſe. This was the original mode among the Egyptians, and was no doubt followed by their Eleuſinian pupils. Theſe adventures were probably demonſtrated to have been allegorical, ſymbolical, hieroglyphical, &c. at leaſt they were exhibited in ſuch a favourable point of view as to diſpel thoſe abſurdities and inconſiſtencies with which they were ſophiſticated by the poets and the vulgar.

68 their origin.

With reſpect to the origin of thoſe factitious deities, it was diſcovered that they had been originally men who had been exalted to the rank of divinity, in conſequence of their heroic exploits, their uſeful inventions, their beneficent actions, &c. This is ſo clear from the two paſſages quoted from Cicero, by Biſhop Warburton †, that the fact cannot be contradicted. But that prelate has not informed us ſo preciſely, whether the myſtagogues repreſented them as nothing more than dead men, in their preſent ſtate, or as beings who were actually exiſting in a deified ſtate, and executing the functions aſſigned them in the rubric of Paganiſm. Another query naturally occurs; that is, to what purpoſe did the myſtagogues apply this communication? That the hierophants did actually repreſent thoſe deified mortals in the latter predicament, is obvious from another paſſage quoted from Cicero by the ſame prelate, which we ſhall tranſcribe as tranſlated by him: "What think you of thoſe who aſſert that valiant, or famous, or powerful men, have obtained divine honours after death; and that theſe are the very gods now become the objects of our worſhip, our prayers, and adoration? Euhemerus tells us, when theſe gods died, and where they lie buried. I forbear to ſpeak of the ſacred and auguſt rites of Eleuſis. I paſs by Samothrace and the myſteries of Lemnos, whoſe hidden rites are celebrated in darkneſs, and amidſt the thick ſhades of groves and foreſts." If, then, thoſe deified mortals were become the objects of worſhip and prayers, there can be no doubt of the belief of their deified exiſtence. The alluſion to the Eleuſinian and other Pagan myſteries towards the cloſe of the quotation, places the queſtion beyond the reach of controverſy. But though, according to this account, "there were gods many and lords many;" yet it is evident from the paſſage quoted from Euſebius in the preceding part of this article, that the unity of the Supreme Being was maintained, exhibited, and inculcated. This was the original doctrine of the hierophants of Egypt: It was maintained by Thales and all the retainers of the Ionian ſchool. It was the doctrine of Pythagoras, who probably gleaned it up in the country juſt mentioned, in connexion with many other dogmas which he had the aſſurance to claim as his own.

69 Unity of the ſupreme Being maintained in the myſteries.

70 Offices of the other gods.

But however the unity, and perhaps ſome of the moſt obvious attributes, of the Supreme Author of nature, might be illuſtrated and inculcated, the tribute of homage and veneration due to the ſubordinate divinities was by no means neglected. The initiated were taught to look to the *dii majorum gentium* with a ſuperior degree of awe and veneration, as beings endowed with an ineffable meaſure of power, wiſdom, purity, goodneſs, &c. Theſe were, if we may uſe the expreſſion, the prime favourites of the Monarch of the univerſe, who were admitted into his immediate preſence, and who received his beheſts from his own mouth, and communicated them to his ſubordinate officers, prefects, lieutenants, &c. Theſe they were exhorted to adore; to them they were to offer ſacrifices, prayers, and every other act of devotion, both on account of the excellency of their nature and the high rank they bore at the court of heaven. They were inſtructed to look up to hero gods and demigods, as being exalted to the high rank of governors of different parts of nature, as the immediate guardians and protectors of the human race; in ſhort, as gods near at hand, as prompters to a virtuous courſe, and aſſiſtants in it; as ready upon all occaſions to confer bleſſings upon the virtuous and deſerving. Such were the doctrines taught in the teletæ with reſpect to the nature of the Pagan divinities, and the worſhip and devotion enjoined to be offered them by the myſteries.

71 Excellent plan for accompliſhing the ends propoſed in the myſteries.

As the two principal ends propoſed by theſe initiations were the exerciſe of heroic virtues in men, and the practice of ſincere and uniform piety by the candidates for immortal happineſs, the hierophants had adopted a plan of operations excellently accommodated to both theſe purpoſes. The virtuous conduct and heroic exploits of the great men and demigods of early antiquity, were magnified by the moſt pompous eulogiums, enforced with ſuitable exhortations to animate the votaries to imitate ſo noble and alluring an example. But this was not all: the heroes and demigods themſelves were diſplayed in pageants, or vehicles of celeſtial light. Their honours, offices, habitations, attendants, and other appendages, in the capacity of demons, were exhibited with all the pomp and ſplendour that the ſacerdotal college were able to deviſe. The ſudden glare of mimic light, the melting muſic ſtealing upon the ear, the artificial thunders reverberated from the roof and walls of the temple, the appearance of fire and ethereal radiance, the vehicles of flame, the effigies of heroes and demons adorned with crowns of laurel emitting rays from every ſprig, the fragrant odours and aromatic gales which breathed from every quarter, all dexterouſly counterfeited by ſacerdotal mechaniſm, muſt have filled the imagination of the aſtoniſhed votaries with pictures at once tremendous and tranſporting: Add to this, that every thing was tranſacted in the dead of night amidſt a diſmal gloom; whence the moſt bright effulgence inſtantaneouſly burſt upon the ſight. By this arrangement the aſpirants to initiation were wonderfully animated to the practice of virtue while they lived, and inſpired with the hope of a bleſſed immortality when they died. At the ſame time, their awe and veneration for the gods of their country were wonderfully enhanced by reflecting on the appearances above deſcribed. Accordingly Strabo very judiciouſly obſerves, "that the myſtical ſecrecy of the ſacred rites preſerves the majeſty of the Deity, imitating its nature, which eſcapes our apprehenſion. For theſe reaſons, in celebrating the teletæ, the demons were introduced in their deified or glorified ſtate.

But as all the candidates for initiation might not aſpire to the rank of heroes and demigods, a more eaſy and a more attainable mode of conduct, in order to arrive at the palace of happineſs, behoved to be opened. Private virtues were inculcated, and theſe

---

† *Div. Leg.*

72
rivate vir-
ues incul-
ated in the
nyſteries,
y the doc-
rine of a
uture ſtate.

too were to meet a condign reward. But alas! this preſent life is too often a chequered ſcene, where virtue is depreſſed and trodden under foot, and vice lifts up its head and rides triumphant. It is a dictate of common ſenſe, that virtue ſhould ſooner or later emerge, and vice ſink into contempt and miſery. Here then the conductors of the myſteries, properly and naturally, adopted the doctrine of a future ſtate of rewards and puniſhments. The dogma of the immortality of the human ſoul was elucidated, and carefully and pathetically inculcated. This doctrine was likewiſe imported from Egypt; for Herodotus * informs us, "that the Egyptians were the firſt people who maintained the immortality of the human ſoul." The Egyptian immortality, however, according to him, was only the metempſychoſis or tranſmigration of ſouls. This was not the ſyſtem of the ancient Egyptians, nor indeed of the teletæ. In theſe, a metempſychoſis was admitted; but that was carried forward to a very diſtant period, to wit, to the grand Egyptian period of 36,000 years.

73
Emblems of
Elyſium
nd Tarta-
us.

As the myſtagogues well knew that the human mind is more powerfully affected by objects preſented to the eyes than by the moſt engaging inſtructions conveyed by the ear, they made the emblems of Elyſium and Tartarus paſs in review before the eyes of their novices. There the Elyſian ſcenes, ſo nobly deſcribed by the Roman poet, appeared in mimic ſplendour; and, on the other hand, the gloom of Tartarus, Charon's boat, the dog of hell, the Furies with treſſes of ſnakes, the tribunal of Minos and Rhadamanthus, &c. were diſplayed in all their terrific ſtate. Tantalus, Ixion, Siſyphus, the daughters of Danaus, &c. were repreſented in pageants before their eyes. Theſe exhibitions were accompanied with moſt horrible cries and howlings, thunders, lightning, and other objects of terror which we ſhall mention in their proper place.

74
The three
aws of
Triptole-
mus.

No contrivance could be better accommodated to animate the pupils to the practice of virtue on the one hand, or to deter them from indulging vicious paſſions on the other. It reſembled opening heaven and hell to a hardened ſinner. The practices inculcated in celebrating the myſteries are too numerous to be detailed in this imperfect ſketch. The worſhip of the gods was ſtrictly enjoined, as has been ſhown above. The three laws generally aſcribed to Triptolemus were inculcated, 1. To honour their parents; 2. To honour the gods with the firſt fruits of the earth; 3. Not to treat brute animals with cruelty. Theſe laws were imported from Egypt, and were communicated to the Eleuſinians by the original miſſionaries. Cicero makes the civilization of mankind one of the moſt beneficial effects of the Eleuſinian inſtitutions: "Nullum mihi, cum multo eximia divinaque videntur Athenæ tuæ peperiſſe; tum nihil melius illis myſteriis, quibus ex agreſti immanique vita, exculti ad humanitatem, et mitigati ſumus; initiaque, ut appellantur, ita revera principia vitæ cognovimus; neque ſolum cum lectitia vivendi rationem accepimus, ſed etiam cum ſpe meliore moriendi." Hence it is evident that the precepts of humanity and morality were warmly recommended in theſe inſtitutions. The virtue of humanity was extended, one may ſay, even to the brute creation, as appears from the laſt of Triptolemus's laws above quoted. Some articles were enjoined in the teletæ which may appear to us of leſs importance, which, however, in the ſymbolical ſtyle of the Egyptians, were abundantly ſignificant. The initiated were "commanded to abſtain from the fleſh of certain birds and fiſhes; from beans, from pomegranates and apples, which were deemed equally polluting. It was taught, that to touch the plant of aſparagus was as dangerous as the moſt deadly poiſon. Now, ſays Porphyry, whoever is verſed in the hiſtory of the *viſions*, knows for what reaſon they were commanded to abſtain from the fleſh of birds."

75
The initiated bound themſelves by oaths to obſerve the precepts of the myſteries.

The initiated then bound themſelves by dreadful oaths to obſerve moſt conſcientiouſly and to practiſe every precept tendered to them in the courſe of the teletæ; and at the ſame time never to divulge one article of all that had been heard or ſeen by them upon that occaſion. In this they were ſo exceedingly jealous, that Æſchylus the tragedian was in danger of capital puniſhment, for having only alluded to one of the Eleuſinian arcana in a tragedy of his; and one of the articles of indictment againſt Diagoras the Melian was, his having ſpoken diſreſpectfully of the myſteries, and diſſuaded people from partaking of them. It muſt then be allowed, that the inſtitution of the myſteries was of infinite advantage to the Pagan world. They were indeed a kind of ſacraments, by which the initiated bound themſelves by a ſolemn vow to practiſe piety towards the gods, juſtice and humanity towards their fellow men, and gentleneſs and tenderneſs towards the inoffenſive part of the brute creation. The Pagans themſelves were ſo thoroughly convinced of this fact, that in their diſputes with the apologiſts for Chriſtianity, they often appealed to the teletæ, and contraſted their maxims with the moſt ſublime doctrines of that heavenly inſtitution.

76
Horrible ſpectres and pleaſing ſcenes alternately exhibited.

In order to impreſs theſe maxims the more deeply upon the minds of the novices, and to fix their attention more ſtedfaſtly upon the lectures which were delivered them by the myſtagogue or the ſacred herald, a mechanical operation was played off at proper intervals during the courſe of the celebration. "Towards the end of the celebration (ſays Stobæus), the whole ſcene is terrible; all is trembling, ſhuddering, ſweat, and aſtoniſhment. Many horrible ſpectres are ſeen, and ſtrange cries and howlings uttered. Light ſucceeds darkneſs; and again the blackeſt darkneſs the moſt glaring light. Now appear open plains, flowery meads, and waving groves; where are ſeen dances and choruſes; and various holy phantaſies enchant the ſight. Melodious notes are heard from far, with all the ſublime ſymphony of the ſacred hymns. The pupil now is completely perfect, is initiated, becomes free, releaſed, and walks about with a crown on his head, and is admitted to bear a part in the ſacred rites." Ariſtides de Myſt. Eleuſ. calls Eleuſis "a kind of temple of the whole earth, and of all that man beholds done in the moſt dreadful and the moſt exhilarating manner. In what other place have the records of fable ſung of things more marvellous? or in what region upon earth have the objects preſented to the eye borne a more exact reſemblance to the ſounds which ſtrike the ear? What object of ſight have the numberleſs generations of men and women beheld comparable to theſe exhibited in the ineffable myſteries?" To the ſame purpoſe, Pletho, in the oracles of Zoroaſtres, informs us, "that

---

* *Lib.* ii.

"that frightful and ſhocking apparitions, in a variety of forms, uſed to be diſplayed to the myſtæ in the courſe of their initiation." And a little after, he adds, "that thunder and lightning and fire, and every thing terrible which might be held ſymbolical of the divine preſence, were introduced." Claudian, in his poem *De Rapta Proſerpina*, gives an elegant, though brief, deſcription of this phenomenon, which throws ſome light on the paſſages above quoted.

> *Jam mihi cernuntur trepidis delubra moveri*
> *Sedibus et clarum dis pergere culmina lucem,*
> *Adventum teſtata Dea, jam magnus ab imis*
> *Auditur fremitus terris, templumque remugit*
> *Cecropidum.*

77 A kind of baptiſmal ablution in the myſteries.

The ſight of thoſe appearances was called the *Antopſia*, or "the real preſence:" hence thoſe rites were ſometimes called *Epoptica*. The *Epoptæ* were actually initiated, and were admitted into the *Sanctum Sanctorum*, and bore a part in the ceremonial: whereas the *myſtæ*, who had only been initiated in the leſſer myſteries at Agræ, were obliged to take their ſtation in the porch of the temple. The candidates for initiation bathed themſelves in holy water, and put on new clothes, all of linen, which they continued to wear till they were quite torn, and then they were conſecrated to Ceres and Proſerpine. From the ceremony of bathing they were denominated *Hydrani*; and this again was a kind of baptiſmal ablution. Whether the phraſes of *waſhing away ſin, putting on the Lord Jeſus Chriſt, putting off the old man with his deeds, putting on a robe of righteouſneſs, being buried in baptiſm*, the words *myſtery, perfect, perfection*, which occur ſo frequently in the New Teſtament, eſpecially in the writings of the apoſtle St Paul, are borrowed from the Pagan myſteries, or from uſages current among the Jews, we leave to our more learned readers to determine.

78 The initiated declared perfect men.

The Epoptæ having ſuſtained all thoſe fiery trials, heard and ſeen every thing requiſite, taken upon them the vows and engagements above narrated, and, in a word, having ſhown themſelves good ſoldiers of Ceres and Proſerpine, were now declared *perfect men*. They might, like Cebes's *virtuous man*, travel wherever they choſe; thoſe wild beaſts (the human paſſions) which tyranniſe over the reſt of mankind, and often deſtroy them, had no longer dominion over them. They were now not only *perfect* but *regenerated* men. They were now crowned with laurel, as was ſaid above, and diſmiſſed with two barbarous words, Κογξ ὀμπαξ, *Konx ompax*, of which perhaps the hierophants themſelves did not comprehend the import. They had been introduced by the firſt Egyptian miſſionaries, and retained in the ſacra after their ſignification was loſt. This was a common practice among the Greeks. In the adminiſtration of their religious ceremonies, they retained many names of perſons, places, things, cuſtoms, &c. which had been introduced by the Phœnicians and Egyptians, from whom they borrowed their ſyſtem of idolatry. Theſe terms conſtituted the language of the gods, ſo often mentioned by the prince of poets. To us the words in queſtion appear to be Syriac, and to ſignify, *Be vigilant, be innocent*.

Numerous and important were the advantages ſuppoſed to redound to the initiated, from their being admitted to partake of the myſteries, both in this life and that which is to come. Firſt, They were highly honoured, and even revered by their contemporaries. Indeed, they were looked up to as a kind of ſacred perſons: they were, in reality, conſecrated to Ceres and Proſerpine. Secondly, They were obliged by their oath to practiſe every virtue, religious, moral, political, public, and private. Thirdly, They imagined, that ſound advice and happy meaſures of conduct were ſuggeſted to the initiated by the Eleuſinian goddeſſes. Accordingly, ſays Pericles the celebrated Athenian ſtateſman, "I am convinced, that the deities of Eleuſis inſpired me with this ſentiment, and that this ſtratagem was ſuggeſted by the principle of the myſtic rites." There is a beautiful paſſage in Ariſtophanes's * comedy of the Ranæ to the very ſame purpoſe, of which we ſhall ſubjoin the following periphraſis. It is ſung by the chorus of the initiated.

* Act i.

Let us to flow'ry meads repair,
  With deathleſs roſes blooming,
Whoſe balmy ſweets impregn the air,
  Both hills and dales perfuming.
Since fate benign our choir has join'd,
  We'll trip in myſtic meaſure;
In ſweeteſt harmony combin'd
  We'll quaff full draughts of pleaſure.
For us alone the pow'r of day
  A milder light diſpenſes;
And ſheds benign a mellow'd ray
  To cheer our raviſh'd ſenſes:
For we beheld the myſtic ſhow,
  And brav'd Eleuſis' dangers.
We do and know the deeds we owe
  To neighbours, friends, and ſtrangers.

Euripides, in his Bacchæ (E), introduces the chorus extolling the happineſs of thoſe who had been acquainted with God, by participating in the holy myſteries, and whoſe minds had been enlightened by the myſtical rites. They boaſt, "that they had led a holy and unblemiſhed life, from the time that they had been initiated in the ſacred rites of Jupiter Idæus, and from the time that they had relinquiſhed celebrating the nocturnal rites of Bacchus, and the banquets of raw fleſh torn off living animals." To this ſanctity of life they had no doubt engaged themſelves, when they were initiated in the myſteries of that god. The Eleuſinian Epoptæ derived the ſame advantages from their ſacramental engagements. Fourthly, The initiated were imagined to be the peculiar wards of the Eleuſinian goddeſſes. Theſe deities were ſuppoſed to watch over them, and often to avert impending danger, and to reſcue them when beſet with troubles.—Our readers will not imagine that the initiated reaped much benefit from the protection of his Eleuſinian tutelary deities; but it was ſufficient that they believed

---

(E) Act I. near the beginning, and in many other places.

ed the fact, and actually depended upon their interpoſition. Fifthly, The happy influences of the teletæ, were ſuppoſed to adminiſter conſolation to the Epoptæ in the hour of diſſolution; for, ſays Iſocrates, "Ceres beſtowed upon the Athenians two gifts of the greateſt importance; the fruits of the earth, which were the cauſe of our no longer leading a ſavage courſe of life; and the teletæ, for they who partake of theſe entertain more pleaſant hopes both at the end of life, and eternity afterwards." Another author * tells us, "that the initiated were not only often reſcued from many hardſhips in their lifetime, but at death entertained hopes that they ſhould be raiſed to a more happy condition." Sixthly, After death, in the Elyſian fields, they were to enjoy ſuperior degrees of felicity, and were to baſk in eternal ſunſhine, to quaff nectar, and feaſt upon ambroſia, &c.

* *Ariſtides,*
e Myſt.
Eleuſ.

79
ntereſted-
neſs of the
rieſts

The prieſts were not altogether diſintereſted in this ſalutary proceſs. They made their diſciples believe, that the ſouls of the uninitiated, when they arrived in the infernal regions, ſhould roll in mire and dirt, and with very great difficulty arrive at their deſtined manſion. Hence Plato introduces Socrates † obſerving, "that the ſages who introduced the teletæ had poſitively affirmed, that whatever ſoul ſhould arrive in the infernal manſions *unhouſell'd* and *unanneal'd*, ſhould lie there immerſed in mire and filth." And as to a future ſtate (ſays Ariſtides), "the initiated ſhall not roll in mire and grope in darkneſs; a fate which awaits the unholy and uninitiated." It is not hard to conceive with what a commanding influence ſuch doctrines as theſe muſt have operated on the generality of mankind.

Phædo.

80
Remarks of
Diogenes
nd Antiſ-
henes.

When the Athenians adviſed Diogenes to get himſelf initiated, and enforced their arguments with the above conſiderations, "It will be pretty enough (replied the philoſopher) to ſee Ageſilaus and Epaminondas wallowing in the mire, while the moſt contemptible raſcals who have been initiated are ſtrutting in the iſlands of bliſs."

When Antiſthenes was to be initiated in the Orphic myſteries, and the prieſt was boaſting of the many aſtoniſhing benefits which the initiated ſhould enjoy in a future ſtate ‡, "Why, forſooth, (ſays Antiſthenes), 'tis wonder your reverence don't e'en hang yourſelf in order to come at them the ſooner."

Diog.
aert.

81
All the
world
rowd to
leuſis.

When ſuch benefits were expected to be derived from the myſteries, no wonder if all the world crowded to the Eleuſinian ſtandard. After the Macedonian conqueſts, the hierophants abated much of their original ſtrictneſs. By the age of Cicero, Eleuſis was a temple whither all nations reſorted to partake of the benefits of that inſtitution. We find that almoſt all the great men of Rome were initiated. The hierophants, however, would not admit Nero on account of the profligacy of his character. Few others were refuſed that honour; even the children of the Athenians were admitted. But this, we think, was rather a luſtration or conſecration, than an initiation. Perhaps it paved the way for the more auguſt ceremony, as the Chriſtian baptiſm does among us for the other ſacrament.

82
Degenera-
y of the
nyſteries.

That this inſtitution gradually degenerated, can hardly be queſtioned; but how much, and in what points, we have not been able to inveſtigate. The fathers of the church, from whom that charge is chiefly to be collected, are not always to be truſted, eſpecially when they ſet themſelves to arraign the inſtitutions of Paganiſm. There were indeed ſeveral ancient authors, ſuch as Melanthius, Menander, Sotades, &c. who wrote purpoſely on the ſubject in queſtion; but their works are long ſince irrecoverably loſt. For this reaſon, modern writers, who have profeſſedly handled it, have not always been ſucceſsful in their reſearches. The two who have laboured moſt indefatigably, and perhaps moſt ſucceſsfully, in this field, are Meurſius and Warburton. The former, in his *Liber Singularis*, has collected every thing that can be gleaned from antiquity relating to the ceremonial of theſe inſtitutions, without, however, pointing out their original, or elucidating the end and import of their eſtabliſhment. The latter has drawn them into the vortex of a ſyſtem which has in many inſtances led him to aſcribe to them a higher degree of merit than we think they deſerve. Theſe inſtances we would willingly have noticed in our progreſs, had the limits preſcribed us admitted ſuch a diſcuſſion.

If we may believe Diodorus the Sicilian, theſe myſteries, which were celebrated with ſuch wonderful ſecrecy at Eleuſis, were communicated to all mankind among the Cretans. This, however, we think, is rather problematical. We imagine that excellent hiſtorian has confounded the myſteries of Cybele with thoſe of the Eleuſinian Ceres. Theſe two deities were undoubtedly one and the ſame, that is, the moon or the earth. Hence it is probable, that there was a ſtriking reſemblance between the ſacred myſteries of the Cretans and Eleuſinians.

83
Aboliſhed
by the emperor
Theodoſius.

This inſtitution continued in high reputation to the age of St Jerome, as appears from the following paſſage: "Hierophantæ quoque Athenienſium legant uſque hodie cicutæ ſorbitione caſtrari." The emperor Valentinianus intended to have ſuppreſſed them; but Zozimus *, informs us, that he was diverted from his deſign by the proconſul of Greece. At length Theodoſius the elder, by an imperial edict, prohibited the celebration of theſe as well as of all the other ſacra of Paganiſm. Theſe myſteries, inſtituted in the reign of Erechtheus, maintained their ground to the period juſt mentioned, that is, near 2000 years; during which ſpace, the celebration of them never had been interrupted but once. When Alexander the Great maſſacred the Thebans and razed their city, the Athenians were ſo much affected with this melancholy event, that they neglected the celebration of that feſtival.

* *Adverſ. Jovin.*

84
Other myſteries
among the
Pagans of
leſs celebrity.

There were almoſt numberleſs other myſterious inſtitutions among the ancient Pagans, of which thoſe ſketched above were the moſt celebrated. The Samothracian myſteries, inſtituted in honour of the Cabiri, were likewiſe of conſiderable celebrity, and were ſuppoſed to confer much the ſame bleſſings with the Eleuſinian, but were not of equal celebrity. The Cabiri were Phœnician and likewiſe Egyptian * deities. The learned Bochart has explained their origin, number, names, and ſome part of their worſhip. The Orphic myſteries were likewiſe famous among the Thracians. Orpheus learned them in Egypt, and they were nearly the ſame with the ſacra Bacchanalia of the Greeks. There were likewiſe the myſteries of

* *Sanchoniathon* and *Herodotus.*

of Jupiter Idæus in great requeſt among the Cretans, thoſe of the Magna Mater or Cybele, celebrated in Phrygia. To enumerate and detail all theſe would require a complete volume. We hope our readers will be fully ſatisfied with the ſpecimen exhibited above. We are convinced many things have been omitted which might have been inſerted, but we have collected the moſt curious and the moſt important.—Every one of the poſitions might have been authenticated by quotations from authors of the moſt undoubted credibility, but that proceſs would have ſwelled the article beyond all proportion.

Myſtical, Myſtics.

MYSTICAL, ſomething myſterious or allegorical. Some of the commentators on the ſacred writings, beſides a literal find alſo a myſtical meaning. The ſenſe of Scripture, ſay they, is either that immediately ſignified by the words and expreſſions in the common uſe of language; or it is mediate, ſublime, typical, and myſtical. The literal ſenſe they again divide into proper literal, which is contained in the words taken ſimply and properly; and metaphorical literal, where the words are to be taken in a figurative and metaphorical ſenſe. The myſtical ſenſe of ſcripture they divide into three kinds: the firſt correſponding to faith, and called *allegorical;* the ſecond to hope, called *anagogical;* and the third to charity, called the *tropological ſenſe.* And ſometimes they take the ſame word in Scripture in all the four ſenſes; thus the word *Jeruſalem* literally ſignifies the capital of Judea: allegorically, the church militant: tropologically, a believer: and anagogically, heaven. So, that paſſage in Geneſis, *let there be light, and there was light,* literally ſignifies corporeal light; by an allegory, the Meſſiah; in the tropological ſenſe, grace; and anagogically, beatitude, or the light of glory.

MYSTICS, *myſtici,* a kind of religious ſect, diſtinguiſhed by their profeſſing pure, ſublime, and perfect devotion, with an entire diſintereſted love of God, free from all ſelfiſh conſiderations.

The myſtics, to excuſe their fanatic ecſtaſies and amorous extravagancies, allege that paſſage of St Paul, *The Spirit prays in us by ſighs and groans that are unutterable.* Now, if the ſpirit, ſay they, pray in us, we muſt reſign ourſelves to its motions, and be ſwayed and guided by its impulſe, by remaining in a ſtate of mere inaction.

Paſſive contemplation is that ſtate of perfection to which the myſtics all aſpire.

The authors of this myſtic ſcience, which ſprung up towards the cloſe of the third century, are not known; but the principles from which it was formed are manifeſt. Its firſt promoters proceeded from the known doctrine of the Platonic ſchool, which was alſo adopted by Origen and his diſciples, that the divine nature was infuſed through all human ſouls, or that the faculty of reaſon, from which proceed the health and vigour of the mind, was an emanation from God into the human ſoul, and comprehended in it the principles and elements of all truth, human and divine. They denied that men could by labour or ſtudy excite this celeſtial flame in their breaſts; and therefore they diſapproved highly of the attempts of thoſe, who by definitions, abſtract theorems, and profound ſpeculations, endeavoured to form diſtinct notions of truth, and to diſcover its hidden nature. On the contrary, they maintained that ſilence, tranquillity, repoſe, and ſolitude, accompanied with ſuch acts as might tend to extenuate and exhauſt the body, were the means by which the hidden and internal word was excited to produce its latent virtues, and to inſtruct men in the knowledge of divine things. For thus they reaſoned; thoſe who behold with a noble contempt all human affairs, who turn away their eyes from terreſtrial vanities, and ſhut all the avenues of the outward ſenſes againſt the contagious influences of a material world, muſt neceſſarily return to God, when the ſpirit is thus diſengaged from the impediments that prevented that happy union. And in this bleſſed frame they not only enjoy inexpreſſible raptures from their communion with the Supreme Being, but alſo are inveſted with the ineſtimable privilege of contemplating truth undiſguiſed and uncorrupted in its native purity, while others behold it in a vitiated and deluſive form.

Myſtics || Mytelene.

The number of the myſtics increaſed in the fourth century, under the influence of the Grecian fanatic, who gave himſelf out for Dionyſius the Areopagite, diſciple of St Paul, and probably lived about this period; and by pretending to higher degrees of perfection than other Chriſtians, and practiſing greater auſterity, their cauſe gained ground, eſpecially in the eaſtern provinces, in the fifth century. A copy of the pretended works of Dionyſius was ſent by Balbus to Lewis the Meek, in the year 824, which kindled the holy flame of myſticiſm in the weſtern provinces, and filled the Latins with the moſt enthuſiaſtic admiration of this new religion.

In the twelfth century, theſe myſtics took the lead in their method of expounding Scripture; and by ſearching for myſteries and hidden meaning in the plaineſt expreſſions, forced the word of God into a conformity with their viſionary doctrines, their enthuſiaſtic feelings, and the ſyſtem of diſcipline which they had drawn from the excurſions of their irregular fancies. In the thirteenth century, they were the moſt formidable antagoniſts of the ſchoolmen; and towards the cloſe of the fourteenth, many of them reſided and propagated their tenets almoſt in every part of Europe. They had, in the fifteenth century, many perſons of diſtinguiſhed merit in their number: and in the ſixteenth century, previous to the Reformation, if any ſparks of real piety ſubſiſted under the deſpotic empire of ſuperſtition, they were only to be found among the myſtics.

The principles of this ſect were adopted by thoſe called *Quietiſts* in the ſeventeenth century, and, under different modifications, by the Quakers and Methodiſts.

MYSTRUM, a liquid meaſure among the ancients, containing the fourth part of the cyathus, and weighing two drachms and a half of oil, or two drachms two ſcruples of water or wine. It nearly anſwers to our ſpoonful.

MYTELENE. See METYLENE.

MYTHOLOGY

efinition. IS a term compounded of two Greek words, and in its original import it ſignifies any kind of fabulous doctrine : In its more appropriated ſenſe, it means thoſe fabulous details concerning the objects of worſhip which were invented and propagated by men who lived in the early ages of the world, and by them tranſmitted to ſucceeding generations, either by written records or by oral tradition.

As the theology and mythology of the ancients are almoſt inſeparably connected, it will be impoſſible for us to develope the latter, without often introducing ſome obſervations relating to the former. We muſt therefore entreat the indulgence of our readers, if upon many occaſions we would hazard a few ſtrictures on the names, characters, adventures, and functions of ſuch Pagan divinities as may have furniſhed materials for thoſe fabulous narrations which the nature of the ſubject may lead us to diſcuſs.

2 rigin of ble.

With reſpect to *fable*, it may be obſerved in general, that it is a creature of the human imagination, and derives its birth from that love of the *marvellous* which is in a manner congenial to the ſoul of man.—The appearances of nature which every day occur, objects, actions, and events, which ſucceed each other, by a kind of routine, are too familiar, too obvious, and unintereſting, either to gratify curioſity or to excite admiration. On the other hand, when the moſt common phenomena in nature or life are new modelled by the plaſtic power of a warm imagination ; when they are diverſified, compounded, embelliſhed ; or even arranged and moulded into forms which ſeldom or perhaps never occur in the ordinary courſe of things ;—novelty generates admiration, a paſſion always attended with delightful ſenſations. Here then we imagine we have diſcovered the very ſource of *fiction* and *fable*.—They originated from that powerful propenſity in our nature towards the *new* and *ſurpriſing*, animated by the delight with which the contemplation of them is generally attended.

Many circumſtances contributed to extend and eſtabliſh the empire of fable. The legiſlator laid hold on this bias of human nature, and of courſe employed *fable* and *fiction* as the moſt effectual means to civilize a rude, unpoliſhed world. The philoſopher, the theologiſt, the poet, the muſician, each in his turn, made uſe of this vehicle to convey his maxims and inſtructions to the ſavage tribes. They knew that *truth*, ſimple and unadorned, is not poſſeſſed of charms powerful enough to captivate the heart of man in his preſent corrupt and degenerate ſtate. This conſideration, which did indeed reſult from the character of their audience, naturally led them to employ fiction and allegory. From this was derived the allegorical taſte of the ancients, and eſpecially of the primary ſages of the eaſt.

3 ldneſs of e oriental ythology.

Though almoſt every nation on the face of the globe, however remote from the centre of population, however ſavage and averſe from cultivation, has fabricated and adopted its own ſyſtem of mythology ; the Orientals, however, have diſtinguiſhed themſelves in a peculiar manner, by the boldneſs, the inconſiſtency, and the extravagance of their mythology. The genial warmth of thoſe happy climes, the fertility of the ſoil, which afforded every neceſſary, every conveniency, and often every luxury of life, without depreſſing their ſpirits by laborious exertions ; the face of nature perpetually blooming around them, the ſkies ſmiling with uninterrupted ſerenity ; all contributed to inſpire the Orientals with a glow of fancy and a vigour of imagination rarely to be met with in leſs happy regions. Hence every object was ſwelled beyond its natural dimenſions. Nothing was great or little in moderation, but every ſentiment was heightened with incredible hyperbole. The magnificent, the ſublime, the vaſt, the enormous, the marvellous, firſt ſprung up, and were brought to maturity, in thoſe native regions of fable and fairy land. As nature, in the ordinary courſe of her operations, exhibited neither objects nor effects adequate to the extent of their romantic imaginations, they naturally deviated into the fields of fiction and fable. Of conſequence, the cuſtom of detailing fabulous adventures originated in the eaſt, and was from thence tranſplanted into the weſtern countries.

As the allegorical taſte of the eaſtern nations had ſprung from their propenſity to fable, and as that propenſity had in its turn originated from the love of the marvellous ; ſo did allegory in proceſs of time contribute its influence towards multiplying fables and fiction almoſt *in infinitum*. The latent import of the allegorical doctrines being in a few ages loſt and obliterated, what was originally a moral or theological tenet, aſſumed the air and habit of a perſonal adventure.

4 Propenſity to perſonification a ſource of eaſtern mythology.

The propenſity towards perſonification, almoſt univerſal among the orientals, was another fruitful ſource of fable and allegory. That the people of the eaſt were ſtrongly inclined to perſonify inanimate objects and abſtract ideas, we imagine will be readily granted, when it is conſidered, that in the formation of language they have generally annexed the affection of ſex to thoſe objects. Hence the diſtinction of grammatical genders, which is known to have originated in the eaſtern parts of the world. The practice of perſonifying virtues, vices, religious and moral affections, was neceſſary to ſupport that allegorical ſtyle which univerſally prevailed in thoſe countries. This mode of writing was in high reputation even in Europe ſome centuries ago ; and to it we are indebted for ſome of the moſt noble poetical compoſitions now extant in our own language. Thoſe productions, however, are but faint imitations of the original mode of writing ſtill current among the eaſtern nations. The Europeans derived this ſpecies of compoſition from the Mooriſh inhabitants of Spain, who imported it from Arabia, their original country.

5 The effects of hieroglyphic writing on mythology.

The general uſe of hieroglyphics in the eaſt, muſt have contributed largely towards extending the empire of mythology. As the import of the figures employed in this method of delineating the ſigns of ideas was in a great meaſure arbitrary, miſtakes muſt have

have been frequently committed in aſcertaining the notions which they were at the firſt intended to repreſent. When the developement of theſe arbitrary ſigns happened to be attended with uncommon difficulty, the expounders were obliged to have recourſe to conjecture. Thoſe conjectural expoſitions were for the moſt part tinctured with that bias towards the marvellous which univerſally prevailed among the primitive men. This we find is the caſe even at this day, when moderns attempt to develope the purport of emblematical figures, preſerved on ancient medals, entaglions, &c.

The wiſe men of the eaſt delighted in obſcure enigmatical ſentences. They ſeem to have diſdained every ſentiment obvious to vulgar apprehenſion. The words of the wiſe, and their dark ſayings, often occur in the moſt ancient records both ſacred and profane. The ſages of antiquity uſed to vie with each other for the prize of ſuperior wiſdom, by propounding riddles, and dark and myſterious queſtions, as ſubjects of inveſtigation. The conteſt between Solomon and Hiram, and that between Amaſis king of Egypt and Polycrates tyrant of Samos, are univerſally known.—As the import of thoſe enigmatical propoſitions was often abſolutely loſt, in ages when the art of writing was little known, and ſtill leſs practiſed, nothing remained but fancy and conjecture, which always verged towards the regions of fable. This then, we think, was another ſource of mythology.

6
Mythology reduced to a kind of ſyſtem in Egypt.

The Pagan prieſts, eſpecially in Egypt, were probably the firſt who reduced mythology to a kind of ſyſtem. The ſacerdotal tribe, among that people, were the grand depoſitories of learning as well as of religion. That order of men monopolized all the arts and ſciences. They ſeem to have formed a conſpiracy among themſelves, to preclude the laity from all the avenues of intellectual improvement. This plan was adopted with a view to keep the laity in ſubjection, and to enhance their own importance. To accompliſh this end, they contrived to perform all the miniſtrations of their religion in an unknown tongue, and to cover them with a thick veil of fable and allegory. The language of Ethiopia became their ſacred dialect, and hieroglyphics their ſacred character.—Egypt, of courſe, became a kind of fairy land, where all was jugglery, magic, and enchantment. The initiated alone were admitted to the knowledge of the occult myſtical exhibitions, which, in their hands, conſtituted the eſſence of their religion. From theſe the vulgar and profane were prohibited by the moſt rigorous penalties (ſee MYSTERIES). The Egyptians, and indeed all the ancients without exception, deemed the myſteries of religion too ſacred and ſolemn to be communicated to the herd of mankind, naked and unreſerved; a mode by which they imagined thoſe ſacred and ſublime oracles would have been defiled and degraded. "Procul, ô procul eſte profani—Odi profanum vulgus et arceo." Egypt was the land of graven images; allegory and mythology were the veil which concealed religion from the eyes of the vulgar; fable was the groundwork of that impenetrable covering.

7
In the earlieſt ages of the world mythology had no exiſtence.

In the earlieſt and moſt unpoliſhed ſtage of ſociety we cannot ſuppoſe fable to have exiſted among men. Fables are always *tales of other times*, but at this period other times did not reach far enough backward to afford thoſe fruits of the imagination ſufficient time to arrive at maturity. Fable requires a conſiderable ſpace of time to acquire credibility, and to riſe into reputation. Accordingly, we find that both the Chineſe and Egyptians, the two moſt ancient nations whoſe annals have reached our times, were altogether unacquainted with fabulous details in the moſt early and leaſt improved periods of their reſpective monarchies. It has been ſhown almoſt to a demonſtration, by a variety of learned men, that both the one and the other people, during ſome centuries after the general deluge, retained and practiſed the primitive Noachic religion, in which fable and fancy could find no place; all was genuine unſophiſticated truth.

8
Fabulous coſmogony, the firſt mythological details.

As ſoon as the authentic tradition concerning the origin of the univerſe was either in a good meaſure loſt, or at leaſt adulterated by the invention of men, fable and fiction began to prevail. The Egyptian *Thoth* or Thyoth, or Mercury Triſmegiſtus, and Moſchus the Phœnician, undertook to account for the formation and arrangement of the univerſe, upon principles purely mechanical. Here fable began to uſurp the place of genuine hiſtorical truth. Accordingly, we find that all the hiſtorians of antiquity, who have undertaken to give a general detail of the affairs of the world, have uſhered in their narration with a fabulous coſmogony. Here imagination ranged unconfined over the boundleſs extent of the primary chaos. To be convinced of the truth of this aſſertion, we need only look into Sanchoniathon's Coſmogony, Euſeb. Præp. Evang. l. 1. ſub init. and Diodorus Sic. l. 1. From this we ſuppoſe it will follow, that the firſt race of fables owed their birth to the erroneous opinions of the formation of the univerſe.

Having now endeavoured to point out the origin of mythology, or fabulous traditions, we ſhall proceed to lay before our readers a brief detail of the mythology of the moſt reſpectable nations of antiquity, following the natural order of their ſituation.

9
Chineſe mythology.

The Chineſe, if any credit be due to their own annals, or to the miſſionaries of the church of Rome, who pretend to have copied from them, were *the firſt of the nations*. Their fabulous records reach upwards many myriads of years before the Moſaic era of the creation. The events during that period of time, if any had been recorded, muſt have been fabulous as the period itſelf. Theſe, however, are buried in eternal oblivion. The miſſionaries, who are the only ſources of our information with relation to the earlieſt periods of the Chineſe hiſtory, repreſent thoſe people as having retained the religion of Noah many centuries after the foundation of their empire. Upon this ſuppoſition, their coſmogony muſt have been ſound and genuine, without the leaſt tincture of thoſe fabulous ingredients which have both diſguiſed and diſgraced the coſmogonies of moſt other nations.

10
Birth and inventions of Fohi.

According to the moſt authentic accounts, *Fohe* or *Fohi* laid the foundation of that empire about 4000 years ago. This emperor, according to the Chineſe, was conceived in a miraculous manner. His mother, ſay they, one day as ſhe was walking in a deſert place, was ſurrounded by a rainbow; and, being impregnated by this meteor, was in due time delivered of that celebrated legiſlator. This perſonage, like the Athenian Cecrops, was half a man and half a ſerpent.

His

His intellectual powers were truly hyperbolical. In one day he diſcovered 50 different ſpecies of poiſonous herbs. He taught his countrymen the whole art of agriculture in the ſpace of a very few years. He inſtructed them how to ſow five different ſorts of grain. He invented boats, and nets for fiſhing, the art of fabricating porcelain, the management of ſilk worms, the manufacturing of ſilk, &c. In a word, that wonderful perſonage was inſpired by Heaven with knowledge, which qualified him for compoſing that incomparable body of laws which are even at this day the wonder of the world. Our readers will admit, that this whole detail is fabulous and chimerical. The moſt learned part of them will readily obſerve, that the Chineſe, in aſcribing the invention of all the uſeful arts to their Fohi, are perfectly agreed with almoſt all the other nations of antiquity. The Indians aſcribe every invention to *Budha*, or *Viſhnou*, or *Foe;* the Perſians to *Zerduſht*, or *Zoroaſter;* the Chaldeans to their man of the ſea, whom they call *Oannes;* the Egyptians to *Thoth* or *Thyoth;* the Phœnicians to *Melicerta;* the Greeks to the family of the *Titans:* and the Scandinavians to *Odin*, &c.

11 Miraculous irth of onfucius.

About 551 years before the Chriſtian era, appeared the famous Chineſe philoſopher *Con-fu-tſe* or Confucius. Concerning the birth of this prince of philoſophers, the Chineſe have propagated the following legendary tale. His mother, walking in a ſolitary place, was impregnated by the vivifying influence of the heavens. The babe, thus produced, ſpake and reaſoned as ſoon as it was born. Confucius, however, wrought no miracles, performed no romantic exploits, but lived an auſtere aſcetic life, taught and inculcated the doctrines of pure morality, and died, remarkable only for ſuperior wiſdom, religious, moral, and political.

12 ao-kiun nd his octrines.

About the year of Chriſt 601, flouriſhed the ſectary *Lao-kiun*. His mother carried him 30 years in her womb, and was at laſt delivered of him under a plum-tree. This philoſopher was the Epicurus of the Chineſe. His diſciples, who were denominated *Fao-ſſe*, i. e. heavenly doctors, were the firſt who corrupted the religion of the Chineſe. They were addicted to magic, and introduced the worſhip of good and bad demons. Their doctrine was embraced by a long ſucceſſion of emperors. One of theſe princes, called *You-ti*, had been deprived by death of a favourite miſtreſs, whom he loved with the moſt extravagant paſſion. The emperor, by the magical ſkill of one of theſe doctors, obtained an interview with his deceaſed miſtreſs, a circumſtance which rivetted the whole order in the affection and eſteem of the deluded prince. Here our readers will obſerve the exact counterpart of the fable of Eurydice, ſo famous in the mythology of the Greeks and Romans. That ſuch a ſyſtem of religious principles muſt have abounded with mythological adventures is highly probable; but as the miſſionaries, to whom we are chiefly indebted for our information relating to the religion of the Chineſe, have not taken the pains to record them, we find it impoſſible to gratify the curioſity of our readers on that head.

13 ntroduc-ion of the vorſhip of *o*, and of he doc-rine of the netempſy-hoſis into China.

The worſhip of the idol Fo, or Foe, was tranſplanted from India into China about the 56th year of the Chriſtian era, upon the following occaſion. One of the doctors of the Fao-ſſe had promiſed a prince of the family of Tchou, and brother of the emperor Ming-ti, to make him enter into communion with the ſpirits. At his ſolicitation an ambaſſador was deſpatched into India, in order to inquire where the true religion was to be found. There had been a tradition, ſay the miſſionaries, ever ſince the age of Confucius, that the true religion was to be found in the weſt.—The ambaſſador ſtopt ſhort in India; and finding that the god Foe was in high reputation in that country, he collected ſeveral images of that deity painted on chintz, and with it 42 chapters of the canonical books of the Hindoos, which, together with the images, he laid on a white elephant, and tranſported into his native country. At the ſame time he imported from the ſame quarter the doctrine of the tranſmigration of ſouls, which is firmly believed in China to this day. The doctrine and worſhip of Foe, thus introduced, made a moſt rapid progreſs all over China, Japan, Siam, &c. The prieſts of Foe are called among the Siameſe *Talapoins;* by the Tartars, *Lamas;* by the Chineſe, *Ha-chang;* and by the people Japan, *Bonzes*. By this laſt appellation they are generally known in Europe.

14 The worſhippers of Fo great mythologiſts.

An infinitude of fables was invented and propagated by the diſciples of Foe, concerning the life and adventures of their maſter. If the earlier ages of the Chineſe hiſtory are barren of mythological incidents, the later periods, after the introduction of the worſhip of Foe, furniſh an inexhauſtible ſtore of miracles, monſters, fables, intrigue, exploits, and adventures, of the moſt villanous complexion. Indeed, moſt of them are ſo abſurd, ſo ridiculous, and at the ſame time ſo impious and profane, that we are convinced our readers will eaſily diſpenſe with a detail from which they could reap neither entertainment nor inſtruction. Such as may find themſelves dipoſed to rake into this abominable puddle, we muſt refer to the reverend fathers Du Halde, Couplet, Amiot, Kircher, and other members of the propaganda, in whoſe writings they will find wherewithal to ſatisfy, and even to ſurfeit, their appetite.

15 Hindoo mythology.

The Hindoos, like the other nations of the eaſt, for a long time retained the worſhip of the true God. At length, however, idolatry broke in, and, like an impetuous torrent, overwhelmed the country. Firſt of all, the genuine hiſtory of the origin of the univerſe was either utterly loſt, or diſguiſed under a variety of fictions and allegories. We are told that *Brimha*, the ſupreme divinity of the Hindoos, after three ſeveral efforts, at laſt ſucceeded in creating four perſons, whom he appointed to rule over all the inferior creatures.—Afterwards Brimha joined his efficient power with Biſhon and Rulder; and by their united exertions they produced ten men, whoſe general appellation is *Munies*, that is, the inſpired. The ſame being, according to another mythology, produced four other perſons, as imaginary as the former; one from his breaſt, one from his back, one from his lip, and one from his heart. Theſe children were denominated *Bangs;* the import of which word we cannot pretend to determine. According to another tradition, Brimha produced the Bramins from his mouth, to pray, to read, to inſtruct; the Chiltern from his arms, to draw the bow, to fight, to govern; the Bice from his belly or thighs, to nouriſh, to provide the neceſſaries of life by agriculture and commerce; the Soder from his feet, for ſubjection,

ſubjection, to ſerve, to labour, to travel. The reader will ſee at once, in theſe allegorical perſons, the four caſts or ſepts into which the Hindoo nations have, time immemorial, been divided. Theſe are ſome of their moſt celebrated mythological traditions with relation to the origin of the univerſe.

16
Hindoo traditions relating to the deluge, &c.

The Hindoos have likewiſe ſome mythological opinions which ſeem to relate to the general deluge. They tell us, that deſiring the preſervation of herds and of brahmans, of genii and of virtuous men, of *vedas* of law, and of precious things, the Lord of the univerſe aſſumes many bodily ſhapes; but though he pervades, like the air, a variety of beings, yet he is himſelf unvaried, ſince he has no quality in him ſubject to change. At the cloſe of the laſt *calpa*, there was a general deſtruction, occaſioned by the ſleep of Brahme, whence his creatures in different worlds were drowned in a vaſt ocean. Brahme being inclined to ſlumber after a lapſe of ſo many ages, the ſtrong demon *Hyagri-va*, came near him, and ſtole the *vedas* which had flowed from his lips. When *Heri*, the preſerver of the univerſe, diſcovered this deed of the prince of *Dainavas*, he took the ſhape of a minute fiſh called *Sap-hari*. After various transformations, and an enormous increaſe of ſize in each of them, the Lord of the univerſe loving the righteous man (A), who had ſtill adhered to him under all theſe various ſhapes, and intending to preſerve him from the ſea of deſtruction cauſed by the depravity of the age, thus told him how he was to act: "In ſeven days from the preſent time, O thou tamer of enemies! the three worlds will be plunged in an ocean of death; but in the midſt of the deſtroying waves a large veſſel ſent by me for thy uſe ſhall ſtand before thee." The remaining part of the mythology ſo nearly reſembles the Moſaic hiſtory of Noah and the general deluge, that the former may be a ſtrong confirmation of the truth of the latter. To dry up the waters of the deluge, the power of the Deity deſcends in the form of a *boar*, the ſymbol of ſtrength, to draw up and ſupport on his tuſks the whole earth, which had been ſunk beneath the ocean. Again, The ſame power is repreſented as a tortoiſe ſuſtaining the globe, which had been convulſed by the violent aſſaults of demons, while the gods charmed the ſea with the mountain *Mandar*, and forced it to diſgorge the ſacred things and animals, together with the water of life which it had ſwallowed. All theſe ſtories, we think, relate to the ſame event, ſhadowed by a moral, a metaphyſical, and an aſtronomical allegory; and all three ſeem connected with the hieroglyphical ſculptures of the old Egyptians.

The Hindoos divide the duration of the world into four *yugs* or *jugs*, or *jogues*, each conſiſting of a prodigious number of years. In each of thoſe periods, the age and ſtature of the human race have been gradually diminiſhed; and in each of them mankind has gradually declined in virtue and piety, as well as in age and ſtature. The preſent period they call the *Collæ*, i. e. the corrupt jogue, which they ſay is to laſt 400,000 years, of which near 5000 years are already paſt. In the laſt part of the preceding jogue, which they call the *dwa paar*, the age of man was contracted into 1000 years, as in the preſent it is confined to 100. From this proportional diminution of the length of the human life, our readers will probably infer, that the two laſt jogues bear a pretty near reſemblance to the Moſaic hiſtory of the age of the antediluvian and poſtdiluvian patriarchs; and that the two firſt are imaginary periods prior to the creation of the world, like thoſe of the Chineſe, Chaldeans, and Egyptians.

17
The world ſubject to various diſſolutions and reſuſcitations.

According to the mythology of the Hindoos, the ſyſtem of the world is ſubject to various diſſolutions and reſuſcitations. At the concluſion of the Collæ jogue, ſay they, a grand revolution will take place, when the ſolar ſyſtem will be conſumed by fire, and all the elements reduced to their original conſtituent atoms. Upon the back of theſe revolutions, Brimha, the ſupreme deity of the Hindoos, is ſometimes repreſented as a new born infant, with his toe in his mouth, floating on a camala or water flower, ſometimes only on a leaf of that plant, on the ſurface of the vaſt abyſs. At other times he is figured as coming forth of a winding ſhell: and again as blowing up the mundane foam with a pipe at his mouth. Some of theſe emblematical figures and attitudes, our learned readers will probably obſerve, nearly reſemble thoſe of the ancient Egyptians.

18
Birth, &c. of the god Fo.

But the vulgar religion of the ancient Hindoos was of a very different complexion, and opens a large field of mythological adventures. We have obſerved above, that the Fo or Foe of the Chineſe was imported from India; and now we ſhall give a brief detail of the mythological origin of that divinity. We have no certain account of the birth-place of this imaginary deity.— His followers relate, that he was born in one of the kingdoms of India near the line, and that his father was one of that country. His mother brought him into the world by the left ſide, and expired ſoon after her delivery. At the time of her conception, ſhe dreamed that ſhe had ſwallowed a white elephant; a circumſtance which is ſuppoſed to have given birth to the veneration which the kings of India have always ſhown for a white animal of that ſpecies. As ſoon as he was born, he had ſtrength enough to ſtand erect without aſſiſtance. He walked abroad at ſeven, and, pointing with one hand to the heavens, and with the other to the earth, he cried out, "In the heavens, and on the earth, there is no one but me who deſerves to be honoured." At the age of 30, he felt himſelf all on a ſudden filled with the divinity; and now he was metamorphoſed into Fo or Pagod, according to the expreſſion of the Hindoos. He had no ſooner declared himſelf a divinity, than he thought of propagating his doctrine, and proving his divine miſſion by miracles. The number of his diſciples was immenſe; and they ſoon ſpread his dogmas over all India, and even to the higher extremities of Aſia.

19
Doctrines of Fo derived from Egypt.

One of the principal doctrines which Fo and his diſciples propagated, was the metempſychoſis or tranſmigration of ſouls. This doctrine, ſome imagine, has given

---

(A) He was Sovereign of the world. His name was *Mana*, or Statgavrata; his patronymic name was *Vaiſvata*, or Child of the Sun.

given riſe to the multitude of idols reverenced in every country where the worſhip of Fo is eſtabliſhed. Quadrupeds, birds, reptiles, and the vileſt animals, had temples erected for them; becauſe, ſay they, the ſoul of the god, in his numerous tranſmigrations, may have at one time or other inhabited their bodies.

Both the doctrine of tranſmigration and of the worſhip of animals ſeems, however, to have been imported from Egypt into India. If the intercourſe between theſe two countries was begun at ſo early a period as ſome very late writers have endeavoured to prove, ſuch a ſuppoſition is by no means improbable. The doctrine of the tranſmigration of ſouls was early eſtabliſhed among the Egyptians. It was, indeed, the only idea they formed of the ſoul's immortality. The worſhip of animals among them ſeems to have been ſtill more ancient. If ſuch an intercourſe did actually exiſt, we may naturally ſuppoſe that colonies of Egyptian prieſts found their way into India, as they did afterwards into Aſia Minor, Italy, and Greece. That colonies of Egyptians did actually penetrate into that country, and ſettle there, many centuries before the Nativity, is a fact that cannot be called in queſtion, for reaſons which the bounds preſcribed us in this article will not allow us to enumerate. We ſhall only obſerve, that from the hieroglyphical repreſentations of the Egyptian deities ſeem to have originated thoſe monſtrous idols which from time immemorial have been worſhipped in India, China, Japan, Siam, and even in the remoteſt parts of Aſiatic Tartary.

10 The incarnations of Viſhnou.

Foe is often called *Budha*, or *Budda*, and ſometimes *Viſhnou;* perhaps, indeed, he may be diſtinguiſhed by many other names, according to the variety of dialects of the different nations among which his worſhip was eſtabliſhed. An infinitude of fables was propagated by his diſciples concerning him after his death. They pretended that their maſter was ſtill alive; that he had been already born 8000 times, and that he had ſucceſſively appeared under the figure of an ape, a lion, a dragon, an elephant, a boar, &c. Theſe were called the incarnations of Viſhnou. At length he was confounded with the ſupreme God; and all the titles, attributes, operations, perfections, and enſigns of the Moſt High were aſcribed to him. Sometimes he is called Amida, and repreſented with the head of a dog, and worſhipped as the guardian of mankind. He ſometimes appears as a princely perſonage, iſſuing from the mouth of a fiſh. At other times, he wears a lunette on his head, in which are ſeen cities, mountains, towers, trees, in ſhort, all that the world contains. Theſe transformations are evidently the children of allegorical or hieroglyphical emblems, and form an exact counterpart to the ſymbolical worſhip of the Egyptians.

The enormous maſs of mythological traditions which have in a manner deluged the vaſt continent of India, would fill many volumes: We have ſelected the preceding articles as a ſpecimen only, by which our readers may be qualified to judge of the reſt. If they find themſelves diſpoſed to indulge their curioſity at greater length, we muſt remit them to Thevenot's and Hamilton's Travels, to Monſ. Anquetil in his Zond Aveſta, Halhed's Introduction to his Tranſlation of the Code of Gentoo Laws, Col. Dow's Hiſtory of Hindoſtan, Groſe's Voyage to the Eaſt Indies, Aſiatic Reſearches, vol. i. and ii.

21 Perſian mythology.

The mythology of the Perſians is, if poſſible, ſtill more extravagant than that of the Hindoos. It ſuppoſes the world to have been repeatedly deſtroyed, and repeopled by creatures of different formation, who were ſucceſſively annihilated or baniſhed for their diſobedience to the ſupreme Being. The monſtrous griffin *Sinergh* tells the hero *Caherman* that ſhe had already lived to ſee the earth ſeven times filled with creatures, and ſeven times a perfect void: that before the creation of Adam, this globe was inhabited by a race of beings called *Peri* and *Dives*, whoſe characters formed a perfect contraſt. The Peri are deſcribed as beautiful and benevolent; the Dives as deformed, malevolent, and miſchievous, differing from infernal demons only in this, that they are not as yet confined to the pit of hell. They are for ever ranging over the world, to ſcatter diſcord and miſery among the ſons of men. The Peri nearly reſemble the fairies of Europe: and perhaps the Dives gave birth to the giants and magicians of the middle ages. The Peri and Dives wage inceſſant wars; and when the Dives make any of the Peri priſoners, they ſhut them up in iron cages, and hang them on the higheſt trees, to expoſe them to public view, and to the fury of every chilling blaſt.

22 *Peri* and *Dives.*

When the Peri are in danger of being overpowered by their foes, they ſolicit the aſſiſtance of ſome mortal hero; which produces a ſeries of mythological adventures, highly ornamental to the ſtrains of the Perſian bards, and which, at the ſame time, furniſhes an inexhauſtible fund of the moſt diverſified machinery.

One of the moſt celebrated adventurers in the mythology of Perſia is *Tahmuras*, one of their moſt ancient monarchs. This prince performs a variety of exploits, while he endeavours to recover the fairy Merjan. He attacks the Dive Demruſh in his own cave; where having vanquiſhed the giant or demon, he finds vaſt piles of hoarded wealth: theſe he carries off with the fair captive. The battles, labours, and adventures of Roſtan, another Perſian worthy, who lived many ages after the former, are celebrated by the Perſian bards with the ſame extravagance of hyperbole with which the labours of Hercules have been ſung by the poets of Greece and Rome.

23 Perſia the birth-place of chivalry and romance.

The adventures of the Perſian heroes breathe all the wildneſs of achievement recorded of the knights of Gothic romance. The doctrine of enchantments, transformations, &c. exhibited in both, is a characteriſtic ſymptom of one common original. Perſia is the genuine claſſic ground of eaſtern mythology, and the ſource of the ideas of chivalry and romance; from which they were propagated to the regions of Scandinavia, and indeed to the remoteſt corners of Europe towards the weſt.

Perhaps our readers may be of our opinion, when we offer it as a conjecture, that the tales of the war of the Peri and Dives originated from a vague tradition concerning good and bad angels: nor is it, in our opinion, improbable, that the fable of the wars between the gods and giants, ſo famous in the mythology of Greece and Italy, was imported into the former of theſe countries from the ſame quarter. For a more particular account of the Perſian mythology, our readers may conſult Dr

Hyde Relig. vet. Perſ. Medor. &c. D'Herbelot's Bibl. Orient. and Mr Richardſon's introduction to his Perſian and Arabic Dictionary.

24 Chaldean mythology.

The mythology of the Chaldeans, like that of the other nations of the eaſt, commences at a period myriads of years prior to the era of the Moſaic creation. Their coſmogony, exhibited by Beroſus, who was a prieſt of Belus, and deeply verſed in the antiquities of his country, is a piece of mythology of the moſt extravagant nature. It has been copied by Euſebius (Chron. lib. i. p. 5.); it is likewiſe to be found in Syncellus, copied from Alexander Polyhiſtor. According to this hiſtorian, there were at Babylon written records preſerved with the greateſt care, comprehending a period of fifteen myriads of years. Thoſe writings likewiſe contained a hiſtory of the heavens and the ſea, of the earth, and of the origin of mankind. "In the beginning (ſays Beroſus, copying from Oannes, of whom we ſhall give a brief account below) there was nothing but darkneſs and an abyſs of water, wherein reſided moſt hideous beings produced from a twofold principle. Men appeared with two wings; ſome with two and ſome with four faces. They had one body, but two heads; the one of a man, the other of a woman. Other human figures were to be ſeen, furniſhed with the legs and horns of goats. Some had the feet of horſes behind, but before were faſhioned like men, reſembling hippocentaurs." The remaining part of this mythology is much of the ſame complexion; indeed ſo extravagant, that we imagine our readers will readily enough diſpenſe with our tranſlating the ſequel. "Of all theſe (ſays the author) were preſerved delineations in the temple of Belus at Babylon. The perſon who was ſuppoſed to preſide over them was called *Omorea*. This word, in the Chaldean language, is *Thalath*, which the Greeks call Θαλασσα. but it more properly imports the moon. Matters being in this ſituation, *their* god (ſays Euſebius), *the* god (ſays Syncellus) came and cut the woman aſunder; and out of one half of her he formed the earth, and out of the other he made the heavens; and, at the ſame time, he deſtroyed the monſters of the abyſs." This whole mythology is an allegorical hiſtory copied from hieroglyphical repreſentations, the real purport of which could not be decyphered by the author. Such, in general, were the conſequences of the hieroglyphical ſtyle of writing.

25 Oannes the legiſlator of the Chaldeans.

Oannes, the great civilizer and legiſlator of the Chaldeans, according to Apollodorus, who copied from Beroſus, was an amphibious animal of a heterogeneous appearance. He was endowed with reaſon and a very uncommon acuteneſs of parts. His whole body reſembled a fiſh. Under the head of a fiſh he had alſo another head, and feet below ſimilar to thoſe of a man, which were ſubjoined to the tail of the fiſh. His voice and language were articulate and perfectly intelligible, and there was a figure of him ſtill extant in the days of Beroſus. He made his appearance in the Erythrean or Red ſea, where it borders upon Babylonia. This monſtrous being converſed with men by day; but at night he plunged into the ſea, and remained concealed in the water till next morning. He taught the Babylonians the uſe of letters, and the knowledge of all the arts and ſciences. He inſtructed them in the method of building houſes, conſtructing temples, and all other edifices. He taught them to compile laws and religious ceremonies, and explained to them the principles of mathematics, geometry, and aſtronomy. In a word he communicated to them every thing neceſſary, uſeful, and ornamental: and ſo univerſal were his inſtructions, that not one ſingle article had ever been added to them ſince the time they were firſt communicated. Helladius is of opinion that this ſtrange perſonage, whoever he was, came to be repreſented under the figure of a fiſh, not becauſe he was actually believed to be ſuch, but becauſe he was clothed with the ſkin of a ſeal. By this account our readers will ſee that the Babylonian Oannes is the exact counterpart of the Fohi of the Chineſe, and the Thyoth or the Mercury of Triſmegiſtus of the Egyptians. It is likewiſe apparent that the idea of the monſter compounded of the man and the fiſh has originated from ſome hieroglyphic of that form grafted upon the appearance of man. Some modern mythologiſts have been of opinion, that Oannes was actually Noah the great preacher of righteouſneſs; who, as ſome think, ſettled in Shinar or Chaldea after the deluge, and who, in conſequence of his connexion with that event, might be properly repreſented under the emblem of *the Man of the Sea*.

26 The nativity of the goddeſs of beauty and love.

The nativity of Venus, the goddeſs of beauty and love, is another piece of mythology famous among the Babylonians and Aſſyrians. An egg, ſay they, of a prodigious ſize, dropt from heaven into the river Euphrates. Some doves ſettled upon this egg, after that the fiſhes had rolled it to the bank. In a ſhort time this egg produced Venus, who was afterwards called *Dea Syria*, the Syrian goddeſs. In conſequence of this tradition (ſays Hyginus), pigeons and fiſhes became ſacred to this goddeſs among the Syrians, who always abſtained from eating the one or the other. Of this imaginary being we have a very exact and entertaining hiſtory in the treatiſe *De Dea Syria*, generally aſcribed to Lucian.

In this mythological tradition our readers will probably diſcover an alluſion to the celebrated *Mundane egg*; and at the ſame time the ſtory of the fiſhes will lead them to anticipate the connexion between the ſea and the moon. This ſame deity was the Atargatis of Aſcalon, deſcribed by Diodorus the Sicilian; the one half of her body a woman and the other a fiſh. This was no doubt a hieroglyphic figure of the moon, importing the influence of that planet upon the ſea and the ſex. The oriental name of this deity evidently points to the moon; for it is compounded of two Hebrew words (B), which import "the queen of the hoſt of heaven."

27 The fable of Semiramis.

The fable of Semiramis is nearly connected with the preceding one. Diodorus Siculus has preſerved the mythological hiſtory of this deity, which he and all the writers of antiquity have confounded with the Babylonian princeſs of the ſame name. That hiſtorian informs us, that the word *Semiramis*, in the Syrian dialect, ſignifies "a wild pigeon;" but we apprehend that this term was a name or epithet of the moon,

---

(B) *Ȧdar* or *Hadar*, "*magnificus*;" and *Gad*, "*exercitus turmi.*"

moon, as it is compounded of two words (c) of an import naturally applicable to the lunar planet. It was a general practice among the Orientals to denominate their ſacred animals from that deity to which they were conſecrated, Hence the moon being called *Semiramis*, and the pigeon being ſacred to her divinity, the latter was called by the name of the former.

As the bounds preſcribed this article render it impoſſible for us to do juſtice to this intereſting piece of mythology, we muſt beg leave to refer our readers for farther information to Diod. Sic. lib. ii. Hyginus Poet. Aſtron. Fab. 197. Pharnutus de Nat. Deor. Ovid. Metam. lib. iv. Athen. in Apol. Izetzes, Chil. ix. cap. 275. Seld. de Diis Syr. Syrit. ii. p. 183.

28 Ltle kwn of Abian mthology.

We ſhould now proceed to the mythology of the Arabians, the far greateſt part of which is, however, buried in the abyſs of ages; though, when, we reflect on the genius and character of that people, we muſt be convinced that they too, as well as the other nations of the eaſt, abounded in fabulous relations and romantic compoſitions. The natives of that country have always been enthuſiaſtically addicted to poetry, of which fable is the eſſence. Wherever the Muſes have erected their throne, fables and miracles have always appeared in their train. In the Koran we meet with frequent alluſions to well-known traditionary fables. Theſe had been tranſmitted from generation to generation by the bards and rhapſodiſts for the entertainment of the vulgar. In Arabia, from the earlieſt ages, it has always been one of the favourite entertainments of the common people, to aſſemble in the ſerene evenings around their tents, or on the platforms with which their houſes are generally covered, or in large halls erected for the purpoſe, in order to amuſe themſelves with traditional narrations of the moſt diſtinguiſhed actions of their moſt remote anceſtors. Oriental imagery always embelliſhed their romantic details. The glow of fancy, the love of the marvellous, the propenſity towards the hyperbolical and the vaſt, which conſtitute the eſſence of oriental deſcription, muſt ever have drawn the relation aſide into the devious regions of fiction and fairy land. The religion of Mahomet beat down the original fabric of idolatry and mythology together. The Arabian fables current in modern times are borrowed or imitated from Perſian compoſitions; Perſia being ſtill the grand nurſery of romance in the eaſt.

29 Eyptian mthology.

In Egypt we find idolatry, theology, and mythology, almoſt inſeparably blended together. The inhabitants of this region, too, as well as of others in the vicinity of the centre of population, adhered for ſeveral centuries to the worſhip of the true God. At laſt, however, conſcious of their own ignorance, impurity, imperfection, and total unfitneſs to approach an infinitely perfect Being, diſtant, as they imagined, and inviſible, they began to caſt about for ſome beings more exalted, and more perfect than themſelves, by whoſe mediation they might prefer their prayers to the ſupreme Majeſty of heaven. The luminaries of heaven, which they imagined were animated bodies, naturally preſented themſelves. Theſe were ſplendid and glorious beings. They were thought to partake of the divine nature: they were revered as the ſatraps, prefects, and repreſentatives of the ſupreme Lord of the univerſe. They were viſible, they were beneficent; they dwelt nearer to the gods, they were near at hand and always acceſſible. Theſe were, of courſe, employed as mediators and interceſſors between the ſupreme Divinity and his humble ſubjects of this lower world. Thus employed, they might claim a ſubordinate ſhare of worſhip, which was accordingly aſſigned them. In proceſs of time, however, that worſhip, which was originally addreſſed to the ſupreme Creator by the mediation of the heavenly bodies, was in a great meaſure forgotten, and the adoration of mankind ultimately terminated on thoſe illuſtrious creatures. To this circumſtance, we think, we may aſcribe the origin of that ſpecies of idolatry called *Zabiiſm*, or the worſhip of the hoſt of heaven, which overſpread the world early and almoſt univerſally. In Egypt this mode of worſhip was adopted in all its moſt abſurd and moſt enthuſiaſtic forms: and at the ſame time the moſt heterogeneous mythology appeared in its train. The mythology of the ancient Egyptians was ſo various and multiform, ſo complicated and ſo myſterious, that it would require many volumes even to give a ſuperficial account of its origin and progreſs, not only in its mother country, but even in many other parts of the eaſtern and weſtern world. Beſides, the idolatry and mythology of that wonderful country are ſo cloſely connected and ſo inſeparably blended together, that it is impoſſible to deſcribe the latter without at the ſame time developing the former. We hope, therefore, our readers will not be diſappointed, if, in a work of this nature, we touch only upon ſome of the leading or moſt intereſting articles of this complicated ſubject.

30 Origin of Zabiiſm.

31 Reign of gods and demigods, &c. in Egypt.

The Egyptians confounded the revolutions of the heavenly bodies with the reigns of their moſt early monarchs. Hence the incredible number of years included in the reign of their eight ſuperior gods, who, according to them, filled the Egyptian throne ſucceſſively in the moſt early periods of time. To theſe, according to their ſyſtem, ſucceeded twelve demigods, who likewiſe reigned an amazing number of years. Theſe imaginary reigns were no other than the periodical revolutions of the heavenly bodies preſerved in their almanacks, which might be carried back, and actually were carried back, at pleaſure. Hence the fabulous antiquity of that kingdom. The imaginary exploits and adventures of theſe gods and demigods furniſhed an inexhauſtible fund of mythological romances. To the demigods ſucceeded the kings of the cynic cycle, perſonages equally chimerical with the former. The import of this epithet has greatly perplexed critics and etymologiſts. We apprehend it is an oriental word importing *royal* dignity, elevation of rank. This appellation intimated, that the monarchs of that cycle, admitting that they actually exiſted, were more powerful and more highly revered than their ſucceſſors. After the princes of the cynic cycle comes another race, denominated *Nekyes*, a title likewiſe implying royal, ſplendid, glorious. Theſe cycles

---

(c) *Shem* or *Sem*, "a ſign," and *ramah*, "high."

32 Birth, exploits, and transformation of the gods.

cycles figure high in the mythological annals of the Egyptians, and have furniſhed materials for a variety of learned and ingenious diſquiſitions. The wars and adventures of Oſiris, Oris, Typhon, and other allegorical perſonages who figure in the Egyptian rubric; the wanderings of Iſis, the ſiſter and wife of Oſiris; the transformation of the gods into divers kinds of animals; their birth, education, peregrinations, and exploits;—compoſe a body of mythological fictions ſo various, ſo complicated, ſo ridiculous, and often ſo apparently abſurd, that all attempts to develope and explain them have hitherto proved unſucceſsful. All, or the greateſt part, of thoſe extravagant fables, are the offspring of hieroglyphical or allegorical emblems deviſed by the prieſts and ſages of that nation, with a view to conceal the myſteries of their religion from that claſs of men whom they ſtigmatized with the name of the uninitiated rabble.

33 Worſhip of brute animals, &c.

The worſhip of brute animals and of certain vegetables, univerſal among the Egyptians, was another exuberant ſource of mythological adventures. The Egyptian prieſts, many of whom were likewiſe profound philoſophers, obſerved, or pretended to obſerve, a kind of analogy between the qualities of certain animals and vegetables, and thoſe of ſome of their ſubordinate divinities. Such animals and vegetables they adopted, and conſecrated to the deities to whom they were ſuppoſed to bear this analogical reſemblance; and in proceſs of time they conſidered them as the viſible emblems of thoſe divinities to which they were conſecrated. By theſe the vulgar addreſſed their archetypes: in the ſame manner, as in other countries, pictures and ſtatues were employed for the very ſame purpoſe. The mob, in proceſs of time, forgetting the emblematical character of thoſe brutes and vegetables, addreſſed their devotion immediately to them; and of courſe theſe became the ultimate objects of vulgar adoration.

After that theſe objects, animate or inanimate, were conſecrated as the viſible ſymbols of the deities, it ſoon became faſhionable to make uſe of their figures to repreſent thoſe deities to which they were conſecrated. This practice was the natural conſequence of the hieroglyphical ſtyle which univerſally prevailed among the ancient Egyptians. Hence Jupiter Ammon was repreſented under the figure of a ram, Apis, under that of a cow, Oſiris of a bull, Pan of a goat, Thoth or Mercury of an ibis, Bubaſtis or Diana of a cat, &c. It was likewiſe a common practice among thoſe deluded people to dignify theſe objects, by giving them the names of thoſe deities which they repreſented. By this mode of dignifying theſe ſacred emblems, the veneration of the rabble was conſiderably enhanced, and the ardour of their devotion inflamed in proportion. From theſe two ſources, we think, are derived the fabulous transformation of the gods, ſo generally celebrated in the Egyptian mythology, and from it imported into Greece and Italy. In conſequence of this practice, their mythological ſyſtem was rendered at once enormous and unintelligible.

34 Mercury Triſmegiſtus the author of the Egyptian mythology.

Their Thoth, or Mercury Triſmegiſtus, was, in our opinion, the inventor of this unhappy ſyſtem. This perſonage, according to the Egyptians, was the original author of letters, geometry, aſtronomy, muſic, architecture; in a word, of all the elegant and uſeful arts, and of all the branches of ſcience and philoſophy. He it was who firſt diſcovered the analogy between the divine affections, influences, appearances, operations, and the correſponding properties, qualities, and inſtincts of certain animals, and the propriety of dedicating particular kinds of vegetables to the ſervice of particular deities.

The prieſts, whoſe province it was to expound the myſteries of that allegorical hieroglyphical religion, (ſee MYSTERIES), gradually loſt all knowledge of the primary import of the ſymbolical characters. To ſupply this defect, and at the ſame time to veil their own ignorance, the ſacerdotal inſtructors had recourſe to fable and fiction. They heaped fable upon fable, till their religion became an accumulated chaos of mythological abſurdities.

Two of the moſt learned and moſt acute of the ancient philoſophers have attempted a rational explication of the latent import of the Egyptian mythology; but both have failed in the attempt; nor have the moderns, who have laboured in the ſame department, performed their part with much better ſucceſs. Inſtead, therefore, of proſecuting this inexplicable ſubject, which would ſwell this article beyond all proportion, we muſt beg leave to refer thoſe who are deſirous of further information to the following authors, where they will find enough to gratify their curioſity, if not to inform their judgment: Herodotus, lib. ii. Diodorus Siculus, lib. i. Plut. Iſis et Oſiris; Jamblichus de Myſt. Egypt. Horapollo Hieroglyp. Egypt. Macrob. Sat. cap. 23. among the ancients; and among the moderns, Kircher's Oedip. Voſſ. de Orig. et Prog. Idol. Mr Bryant's Analyſis of Anc. Mythol. Monſ. Gebelin Monde Prim.; and above all, to the learned Jablonſki's Panth. Egyptiorum.

35 Phœnician mythology.

The elements of Phœnician mythology have been preſerved by Euſebius, Præp. Evang. ſub. init. In the large extract which that learned father hath copied from Philo Biblius's tranſlation of Sanchoniathon's Hiſtory of Phœnicia, we are furniſhed with ſeveral articles of mythology. Some of theſe throw conſiderable light on ſeveral paſſages of the ſacred hiſtory; and all of them are ſtrictly connected with the mythology of the Greeks and Romans. There we have preſerved a brief but entertaining detail of the fabulous adventures of Uranus, Cronus, Dagon, Thyoth or Mercury, probably the ſame with the Egyptian hero of that name. Here we find Muth or Pluto, Æphceſtus or Vulcan, Æſculapius, Nereus, Poſcedon or Neptune, &c. Aſtarte, or Venus Urania, makes a conſpicuous figure in the catalogue of Phœnician worthies; Pallas or Minerva is planted on the territory of Attica; in a word, all the branches of the family of the Titans, who in after ages figured in the rubric of the Greeks, are brought upon the ſtage, and their exploits and adventures briefly detailed.

36 Grecian mythology derived from Egypt and Phœnicia:

By comparing this fragment with the mythology of the Atlantidæ and that of the Cretans preſerved by Diodorus the Sicilian, lib. v. we think there is good reaſon to conclude, that the family of the Titans, the ſeveral branches of which ſeem to have been both the authors and objects of a great part of the Grecian idolatry, originally emigrated from Phœnicia. This conjecture will receive additional ſtrength, when it is conſidered, that almoſt all their names recorded in the fabulous records of Greece, may be eaſily traced up to a

Phœnician original. We agree with Herodotus, that a conſiderable part of the idolatry of Greece may have been borrowed from the Egyptians; at the ſame time, we imagine it highly probable, that the idolatry of the Egyptians and Phœnicians was, in its original conſtitution, nearly the ſame. Both ſyſtems were Sabiiſm, or the worſhip of the hoſt of heaven. The Pelaſgi, according to Herodotus, learned the names of the gods from the Egyptians; but in this conjecture he is certainly warped by his partiality for that people. Had thoſe names been imported from Egypt, they would no doubt have bewrayed their Egyptian original; whereas, every etymologiſt will be convinced that every one is of Phœnician extraction.

The adventures of Jupiter, Juno, Mercury, Apollo, Diana, Mars, Minerva or Pallas, Venus, Bacchus, Ceres, Proſerpine, Pluto, Neptune, and the other deſcendants and coadjutors of the ambitious family of the Titans, furniſh by far the greateſt part of the mythology of Greece. They left Phœnicia, we think, about the age of Moſes; they ſettled in Crete, a large and fertile iſland; from this region they made their way into Greece, which, according to the moſt authentic accounts, was at that time inhabited by a race of ſavages. The arts and inventions which they communicated to the natives; the myſteries of religion which they inculcated; the laws, cuſtoms, polity, and good order, which they eſtabliſhed; in ſhort, the bleſſings of humanity and civilization, which they everywhere diſſeminated, in proceſs of time inſpired the unpoliſhed inhabitants with a kind of divine admiration. Thoſe ambitious mortals improved this admiration into divine homage and adoration. The greater part of that worſhip, which had been formerly addreſſed to the luminaries of heaven, was now transferred to thoſe illuſtrious perſonages. They claimed and obtained divine honours from the deluded rabble of enthuſiaſtic Greeks. Hence ſprung an inexhauſtible fund of the moſt inconſiſtent and irreconcilable fictions.

37
Hence the inconſiſtent fictions of the Greek poets.

The foibles and frailties of the deified mortals were tranſmitted to poſterity, incorporated as it were with the pompous attributes of ſupreme divinity. Hence the heterogenous mixture of the mighty and the mean which checquers the characters of the heroes of the Iliad and Odyſſey. The Greeks adopted the oriental fables; the import of which they did not underſtand. Theſe they accommodated to heroes and illuſtrious perſonages, who had figured in their own country in the earlieſt periods. The labours of Hercules originated in Egypt, and evidently relate to the annual progreſs of the ſun in the zodiac, though the vain-glorious Greeks accommodated them to a hero of their own, the reputed ſon of Jupiter and Alcmena. The expedition of Oſiris they borrowed from the Egyptians, and transferred to their Bacchus, the ſon of Jupiter and Semele the daughter of Cadmus. The transformation and wanderings of Io are evidently tranſcribed from the Egyptian romance of the travels of Iſis in queſt of the body of Oſiris, or of the Phœnician Aſtarte, drawn from Sanchoniathon. *Io* or *Ioh* is in reality the Egyptian name of the moon, and Aſtarte was the name of the ſame planet among the Phœnicians. Both theſe fables are allegorical repreſentations of the anomalies of the lunar planet, or perhaps of the progreſs of the worſhip of that planet in different parts of the world. The fable of the conflagration occaſioned by Phaeton is clearly of oriental extraction, and alludes to an exceſſive drought which in the early periods of time ſcorched Ethiopia and the adjacent countries. The fabulous adventures of Perſeus are ſaid to have happened in the ſame regions, and are allegorical repreſentations of the influence of the ſolar luminary; for the original Perſeus was the ſun. The rape of Proſerpine and the wanderings of Ceres; the Eleuſinian myſteries; the orgia or ſacred rites of Bacchus; the rites and worſhip of the Cabiri—were imported from Egypt and Phœnicia; but ſtrangely garbled and disfigured by the hierophants of Greece. The gigantomachia, or war between the gods and the giants, and all the fabulous events and varieties of that war, form an exact counterpart to the battles of the Peri and Dives, celebrated in the romantic annals of Perſia.

38
The Greeks ignorant of oriental languages.

A conſiderable part of the mythology of the Greeks ſprung from their ignorance of the oriental languages. They diſdained to apply themſelves to the ſtudy of languages ſpoken by people whom, in the pride of their heart, they ſtigmatized with the epithet of *barbarians*. This averſion to every foreign dialect was highly detrimental to their progreſs in the ſciences. The ſame neglect or averſion has, we imagine, proved an irreparable injury to the republic of letters in all ſucceeding ages. The aoids, or ſtrolling bards, laid hold on thoſe oriental legends, which they ſophiſticated with their own additions and improvements, in order to accommodate them to the popular taſte. Theſe wonderful tales figured in their rhapſodical compoſitions, and were greedily ſwallowed down by the credulous vulgar. Thoſe fictions, as they rolled down, were conſtantly augmented with freſh materials, till in proceſs of time their original import was either forgotten or buried in impenetrable darkneſs. A multitude of theſe Heſiod has collected in his Theogonia, or Generation of the Gods, which unhappily became the religious creed of the illiterate part of the Greeks. Indeed fable was ſo cloſely interwoven with the religion of that airy volatile people, that it ſeems to have contaminated not only their religious and moral, but even their political tenets.

39
Oracle of Dodona.

The far-famed oracle of Dodona was copied from that of Ammon at Thebes in Egypt: The oracle of Apollo at Delphos was an emanation from the ſame ſource: The celebrated Apollo Pythius of the Greeks was no other than *Ob* or *Aub* of the Egyptians, who denominated the baſiliſk or royal ſnake *Ov Cai*, becauſe it was held ſacred to the ſun. *Ob* or *Aub* is ſtill retained in the Coptic dialect, and is one of the many names or epithets of that luminary. In ſhort, the ground-work of the Grecian mythology is to be traced in the eaſt. Only a ſmall part of it was fabricated in the country; and what was imported pure and genuine was miſerably ſophiſticated by the hands through which it paſſed, in order to give it a Grecian air, and to accommodate its ſtyle to the Grecian taſte. To enlarge upon this topic would be altogether ſuperfluous, as our learned readers muſt be well acquainted with it already, and the unlearned may without much trouble or expence furniſh themſelves with books upon that ſubject.

40
Roman mythology borrowed from Greece.

The Roman mythology was borrowed from the Greeks.

Greeks. That people had addicted themſelves for many centuries to the arts of war and civil polity. Science and philoſophy were either neglected or unknown. At laſt they conquered Greece, the native land of ſcience, and then "Græcia capta ferum victorem cepit arte et intulit agreſti Latio." This being the caſe, their mythology was, upon the whole, a tranſcript from that of Greece. They had indeed gleaned a few fables from the Pelaſgi and Hetruſcans, which, however, are of ſo little conſequence, that they are ſcarce worth the trouble of tranſcribing.

The mythology of the Celtic nations is in a good meaſure loſt. There may poſſibly ſtill remain ſome veſtiges of the Druidical ſuperſtition in the remoteſt parts of the Highlands and iſlands of Scotland; and perhaps in the uncivilized places of Ireland. Theſe, we preſume, would afford our readers but little entertainment, and ſtill leſs inſtruction. Inſtead therefore of giving a detail of thoſe unintereſting articles, we ſhall beg leave to refer our readers to Oſſian's Poems, and Col. Valency's Collections of Iriſh Antiquities, for ſatisfaction on that ſubject.

41 Mythology of the northern nations. The mythology of the northern nations, i. e. of the Norwegians, Danes, Swedes, Icelanders, &c. is uncommonly curious and entertaining. The Edda and Voluſpa contain a complete collection of fables which have not the ſmalleſt affinity with thoſe of the Greeks and Romans. They are wholly of an oriental complexion, and ſeem almoſt congenial with the tales of the Perſians above deſcribed. The Edda was compiled in Iceland in the 13th century. It is a kind of ſyſtem of the Scandinavian mythology: and has been reckoned, and we believe juſtly, a commentary on the Voluſpa, which was the Bible of the northern nations.

42 Odin or Woden. Odin or Othin, or Woden or Waden, was the ſupreme divinity of thoſe people. His exploits and adventures furniſh the far greateſt part of their mythological creed. That hero is ſuppoſed to have emigrated from the eaſt; but from what country or at what period is not certainly known. His achievements are magnified beyond all credibility. He is repreſented as the god of battles, and as ſlaughtering thouſands at a blow. His palace is called *Valhal:* it is ſituated in the city of Midgard, where, according to the fable, the ſouls of heroes who had bravely fallen in battle enjoy ſupreme felicity. They ſpend the day in mimic hunting matches, or imaginary combats. At night they aſſemble in the palace of Valhalla, where they feaſt on the moſt delicious viands, dreſſed and ſerved up by the *Valkyriæ*, virgins adorned with celeſtial charms, and fluſhed with the bloom of everlaſting youth. They ſolace themſelves with drinking mead out of the ſkulls of enemies whom they killed in their days of nature. Mead, it ſeems, was the nectar of the Scandinavian heroes.

43 The hell and devil of the Scandinavians. Sleepner, the horſe of Odin, is celebrated along with his maſter. Hela, the hell of the Scandinavians, affords a variety of fables equally ſhocking and heterogeneous. Loke, the evil genius or devil of the northern people, nearly reſembles the Typhon of the Egyptians. Signa or Sinna is the conſort of Loke; from this name the Engliſh word *ſin* is derived. The giants Weymur, Ferbanter, Belupher, and Hellunda, perform a variety of exploits, and are exhibited in the moſt frightful attitudes. One would be tempted to imagine, that they perform the exact counterpart of the giants of the Greek and Roman mythologiſts. Inſtead of glancing at theſe ridiculous and unintereſting fables, which is all that the limits preſcribed us would permit, we ſhall take the liberty to lay before our readers a brief account of the contents of the Voluſpa, which is indeed the text of the Scandinavian mythology.

The word *Voluſpa* imports, "the prophecy of Vola or Fola." This was, perhaps, a general name for the prophetic ladies of the north, as Sibyl was appropriated to women endowed with the like faculty in the ſouth. Certain it is, that the ancients generally connected madneſs with the prophetic faculty. Of this we have two celebrated examples: the one in Lycophron's Alexandra, and the other in the Sibyl of the Roman poet. The word *vola* ſignifies "mad or fooliſh;" whence the Engliſh words *fool, fooliſh, folly. Spa*, the latter part of the compoſition, ſignifies "to prophecy," and is ſtill current among the common people in Scotland, in the word *Spae*, which has nearly the ſame ſignification. 44 The Vol pa.

The Voluſpa conſiſts of between 200 and 300 lines. The propheteſs having impoſed ſilence on all intelligent beings, declares that ſhe is about to reveal the works of the Father of nature, the actions and operations of the gods, which no mortal ever knew before herſelf. She then begins with a deſcription of the chaos; and then proceeds to the formation of the world, the creation of the different ſpecies of its inhabitants, giants, men, and dwarfs. She then explains the employments of the fairies or deſtinies, whom the northern people call *nornies;* the functions of the deities, their moſt memorable adventures, their diſputes with Loke, and the vengeance that enſued. She at laſt concludes with a long and indeed animated deſcription of the final ſtate of the univerſe, and its diſſolution by a general conflagration.

In this cataſtrophe, Odin and all the rabble of the Pagan divinities, are to be confounded in the general ruin, no more to appear on the ſtage of the univerſe. Out of the ruins of the former world, according to the Voluſpa, a new one ſhall ſpring up, arrayed in all the bloom of celeſtial beauty.

Such is the doctrine exhibited in the fabulous Voluſpa. So congenial are ſome of the details therein delivered, eſpecially thoſe relating to the final diſſolution of the preſent ſyſtem, and the ſucceſſion of a new heaven and a new earth, that we find ourſelves ſtrongly inclined to ſuſpect, that the original fabricator of the work was a ſemipagan writer, much of the ſame complexion with the authors of the Sibylline oracles, and of ſome other apocryphal pieces which appeared in the world during the firſt ages of Chriſtianity.

In America, the only mythological countries muſt be Mexico and Peru. The other parts of that large continent were originally inhabited by ſavages, moſt of them as remote from religion as from civilization. The two vaſt empires of Mexico and Peru had exiſted about 400 years only before the Spaniſh invaſion. In neither of them was the uſe of letters underſtood; and of courſe the ancient opinions of the natives relating to the origin of the univerſe, the changes which ſucceeded, and every other monument of antiquity, were obliterated and loſt. Clavigero has indeed enumerated a vaſt canaille of ſanguinary gods worſhipped by the Mexicans; 45 Mythology of Mexico and Peru.

Mexicans; but produces nothing either entertaining or intereſting with reſpect to their mythology. The information to be derived from any other quarter is little to be depended upon. It paſſes through the hands of bigotted miſſionaries or other eccleſiaſtics, who were ſo deeply tinctured with fanaticiſm, that they viewed every action, every ſentiment, every cuſtom, every religious opinion and ceremony of thoſe half-civilized people, through a falſe medium. They often imagined they diſcovered reſemblances and analogies between the rites of thoſe ſavages and the dogmas of Chriſtianity, which nowhere exiſted but in their own heated imagination.

The only remarkable piece of mythology in the annals of the Peruvians, is the pretended extraction of Manco Capec the firſt Inca of Peru, and of Mama Ocolla his conſort. Theſe two illuſtrious perſonages appeared firſt on the banks of the lake Titiaca. They were perſons of a majeſtic ſtature, and clothed in decent garments. They declared themſelves to be the children of the Sun, ſent by their beneficent parent, who beheld with pity the miſeries of the human race, to inſtruct and to reclaim them. Thus we find theſe two legiſlators availed themſelves of a pretence which had often been employed in more civilized regions to the very ſame purpoſes. The idolatry of Peru was gentle and beneficent, that of Mexico gloomy and ſanguinary. Hence we may ſee, that every mode of ſuperſtition, where a divine revelation is not concerned, borrows its complexion from the characters of its profeſſors.

In the courſe of this article, our readers will obſerve, that we have not much enlarged upon the mythology of the Greeks and Romans; that ſubject we imagine to be ſo univerſally known by the learned, and ſo little valued by the vulgar, that a minute diſcuſſion of it would be altogether ſuperfluous. Beſides, we hope it will be remembered, that the narrowneſs of the limits preſcribed us would ſcarce admit of a more copious detail. We would flatter ourſelves, that in the courſe of our diſquiſition, we have thrown out a few reflections and obſervations, which may perhaps prove more acceptable to both deſcriptions of readers.

MYTILUS, the MUSSEL, a genus of animals, belonging to the order of vermes teſtacea. See CONCHOLOGY *Index*.

MYTTOTON, a coarſe kind of food, uſed by the labouring people among the Greeks, and ſometimes among the Romans. It was made of garlic, onions, eggs, cheeſe, oil, and vinegar, and reckoned very wholeſome.

MYUS, in *Ancient Geography*, one of the twelve towns of Ionia; ſeated on the Meander, at the diſtance of 30 ſtadia from the ſea. In Strabo's time it was incorporated with the Mileſians, on account of the paucity of inhabitants, from its being formerly overwhelmed with water: for which reaſon the Ionians conſigned its ſuffrage and religious ceremonies to the people of Miletus. Artaxerxes allotted this town to Themiſtocles, in order to furniſh his table with meat: Magneſia was to ſupport him in bread, and Lampſacus in wine. The town now lies in ruins.

MYXINE, the HAG; a genus of animals belonging to the order of vermes inteſtina. See HELMINTHOLOGY *Index*.

N.

N, A liquid conſonant, and the 13th letter of the Greek, Latin, Engliſh, &c. alphabets.

The *n* is a naſal conſonant: its ſound is that of a *d*, paſſed through the noſe; ſo that when the noſe is ſtopped by a cold, or the like, it is uſual to pronounce *d* for *n*. M. Abbé de Dangeau obſerves, that in the French, the *n* is frequently a mere naſal vowel, without any thing of the conſonant in it. He calls it the Sclavonic vowel. The Hebrews call their *n nun*, which ſignifies child, as being ſuppoſed the offspring of *m;* partly on account of the reſemblance of ſound, and partly on that of the figure. Thus from the *m*, by omitting the laſt column, is formed *n;* and thus from the capital N, by omitting the firſt column, is formed the Greek minuſcle ν. Hence for *biennies*, &c. the Latins frequently uſe *bimus*, &c. and the ſame people convert the Greek ν, at the end of a word, into an *m*, as φαρμακον, *pharmacum*, &c. See M.

N before *p*, *b*, and *m*, the Latins change into *m*, and frequently into *l* and *r;* as in *in-ludo*, *illudo; inrigo*, *irrigo*, &c.: in which they agree with the Hebrews, who, in lieu of *nun*, frequently double the following conſonants: and the Greeks do the ſame; as when for *Manlius*, they write Μαλλιος, &c. The Greeks alſo, before κ, γ, χ, ν, changed the ν into γ: in which they were followed by the ancient Romans: who, for *Angulus*, wrote *Aggulus;* for *anceps*, *agceps*, &c.

The Latins retrench the *n* from Greek nouns ending

ing in ων; as Λεων, *Leo*; Δρακων, *Draco*; on the contrary, the Greeks add it to the Latin ones ending in o; as Κατων, Νερων, *Cato*, *Nero*.

N, among the ancients, was a numeral letter, ſignifying 900; according to the verſe in Baronius,

N, quoque nongentos numero deſignat habendos.

And when a line was ſtruck over it, $\overline{N}$, nine thouſand. Among the ancient lawyers, *N. L.* ſtood for *non liquet*, i. e. the cauſe is not clear enough to paſs ſentence upon. N, or N°, in commerce, &c. is uſed as an abbreviation of *numero*, number.

NAARDA, Nearda, *Neerda*, or *Nehardea*, in *Ancient Geography*, a town ſituated on the confines of Meſopotamia and Babylonia; populous, and with a rich and extenſive territory, not eaſily to be attacked by an enemy, being ſurrounded on all ſides by the Euphrates and ſtrong walls (Joſephus). In the lower age the Jews had a celebrated ſchool there.

NAAS, a borough town of Ireland, in the county of Kildare and province of Leinſter. It is the ſhire town of that county, and alternately with Athy the aſſizes town. It is diſtant above 15 miles ſouth-weſt from Dublin, in N. Lat. 53. 10. W. Long. 6. 50. It gives title of viſcount to the family of Burke. This place was anciently the reſidence of the kings of Leinſter: the name ſignifies "the place of elders," for here the ſtates of that province aſſembled during the 6th, 7th, and 8th centuries, after the Naaſteighan of Carmen had been anathematized by the Chriſtian clergy. On the arrival of the Engliſh it was fortified; many caſtles were erected, the ruins of which are partly viſible; and parliaments were held there. At the foot of the mount or rath are the ruins of a houſe founded in 1484, for eremites of the order of St Auguſtin. In the 12th century the baron of Naas founded a priory dedicated to St John the Baptiſt, for Auguſtinian regular canons. In the centre of this town the family of Euſtace erected a monaſtery for Dominican friars, dedicated to St Euſtachius; and it appears that their poſſeſſions in Naas were granted them in the year 1355. This place was a ſtrong hold during the civil wars.

NABATENE, or Regio Nabatæorum, according to Jerome, compriſed all the country lying between the Euphrates and the Red ſea, and thus contained Arabia Deſerta, with a part of the Petræa: ſo called from Nabaioth, the firſt born of Iſmael. According to Diodorus, it was ſituated between Syria and Egypt. The people Nabatæi (1 Maccabees, Diodorus Siculus): inhabiting a deſert and barren country: they lived by plundering their neighbours, according to Diodorus. Nabathæus the epithet.

NABIS, tyrant of Sparta, reigned about 204 B. C.; and is reported to have exceeded all other tyrants ſo far, that, upon compariſon, he left the epithets of *gracious* and *merciful* to Dionyſius and Phalaris. He is ſaid to have contrived an inſtrument of torture in the form of a ſtatue of a beautiful woman, whoſe rich dreſs concealed a number of iron ſpikes in her boſom and arms. When any one therefore oppoſed his demands, he would ſay, "If I have not talents enough to prevail with you, perhaps my woman Apega may perſuade you." The ſtatue then appeared; which Nabis taking by the hand, led up to the perſon, who, being embraced by it, was thus tortured into compliance. To render his tyranny leſs unpopular, Nabis made an alliance with Flaminius the Roman general, and purſued with the moſt inveterate enmity the war which he had undertaken againſt the Achæans. He beſieged Gythium, and defeated Philopœmen in a naval battle. His triumph was ſhort, the general of the Achæans ſoon repaired his loſſes, and Nabis was defeated in an engagement, and killed as he attempted to ſave his life by flight, about 194 years before the Chriſtian era.

NABLOUS, a province of Syria, anciently celebrated under the name of the *kingdom of Samaria*. Its capital, likewiſe called *Nablous*, is ſituated near to Sichem on the ruins of the Niepolis of the Greeks, and is the reſidence of a ſheik, who is ſubordinate to the pacha of Damaſcus, from whom he farms the tribute of the province.

NABLUM, in Hebrew, *Nebel*, was an inſtrument of muſic among the Jews. It had ſtrings like the harp, and was played upon by both hands. Its form was that of a Greek Λ. In the Septuagint and Vulgate, it is called *noblum*, *pſalterion*, *lyra*; and ſometimes *cithara*.

NABO, or Nebo, in *Mythology*, a deity of the Babylonians, who poſſeſſed the next rank to Bel. It is mentioned by Iſaiah, chap. xlviii. Voſſius apprehends that Nabo was the moon, and Bel the ſun: but Grotius ſuppoſes that Nabo was ſome celebrated prophet of the country; which opinion is confirmed by the etymology of the name, ſignifying, according to Jerome, "one that preſides over prophecy."

NABOB, properly Navab, the plural of *Naib*, a deputy. As uſed in Bengal, it is the ſame as Nazim. It is a title alſo given to the wives and daughters of princes, as well as to the princes themſelves.

NABONASSAR, firſt king of the Chaldeans or Babylonians; memorable for the Jewiſh era which bears his name, which is generally fixed in 3257, beginning on Wedneſday, February 26th, in the 3967th of the Julian period, 747 years before Chriſt. The Babylonians revolting from the Medes, who had overthrown the Aſſyrian monarchy, did, under Nabonaſſar, found a dominion, which was much increaſed under Nebuchadnezzar. It is probable, that this Nabonaſſar is that Baladan in the ſecond of Kings, xx. 12. father of Merodach, who ſent ambaſſadors to Hezekiah. See 2 Chron. xxxii.

NABOPOLASSAR, king of Babylon: he joined with Aſtyages the Mede, to deſtroy the empire of Aſſyria; which having accompliſhed, they founded the two empires of the Medes under Aſtyages, and the Chaldeans under Nabopolaſſar, 627 B. C.

NABUCHADNEZZAR, or Nabuchodonosor II. king of Aſſyria, ſon of Nabopolaſſar, and ſtyled the *Great*, was aſſociated by his father in the empire, 607 B. C. and the following year he took Jehoiakim king of Judah priſoner, and propoſed to carry him and his ſubjects in captivity into Babylon; but upon his ſubmiſſion, and promiſing to hold his kingdom under Nabuchodonoſor, he was permitted to remain at Jeruſalem. In 603 B. C. Jehoiakim attempted to ſhake off the Aſſyrian yoke, but without ſucceſs; and this revolt brought on the general captivity. Nabuchadnezzar having ſubdued the Ethiopians, Arabians, Idumæans, Philiſtines, Syrians, Perſians, Medes, Aſſyrians,

ſyrians, and almoſt all Aſia; being puffed up with pride, cauſed a golden ſtatue to be ſet up, and commanded all to worſhip it; which Daniel's companions refuſing to do, they were caſt into the fiery furnace. But as he was admiring his own magnificence, by divine ſentence he was driven from men, and in the Scripture ſtyle is ſaid to have eaten graſs as oxen: i. e. he was ſeized with the diſeaſe called by the Greeks *lycanthropy*, which is a kind of madneſs that cauſes perſons to run into the fields and ſtreets in the night, and ſometimes to ſuppoſe themſelves to have the heads of oxen, or to be made of glaſs. At the end of ſeven years his reaſon returned to him, and he was reſtored to his throne and glory. He died 562 B. C. in the 43d year of his reign; in the 5th of which happened that eclipſe of the ſun mentioned by Ptolemy, which is the ſureſt foundation of the chronology of his reign.

NADIR, in *Aſtronomy*, that point of the heavens which is diametrically oppoſite to the zenith or point directly over our heads.

NÆNIA, the goddeſs of funerals at Rome. Her temple was without the gates of the city. The ſongs which were ſung at funerals were alſo called *nænia*. They were generally filled with the praiſes of the deceaſed; but ſometimes they were ſo unmeaning and improper, that the word became proverbial to ſignify nonſenſe.

NAERDEN, a ſtrong town of Holland, ſeated at the head of the canals of the province. The foundations of it were laid by William of Bavaria, in 1350. It was taken by the Spaniards in 1572, and by the French in 1672; but it was retaken by the prince of Orange the next year. It ſtands at the ſouth end of the Zuyder Zee, in E. Long. 5. 3. N. Lat. 51. 22.

NÆVIUS, Cneius, a famous poet of Campania, was bred a ſoldier; but quitted the profeſſion of arms, in order to apply himſelf to poetry, which he proſecuted with great diligence. He compoſed a hiſtory in verſe, and a great number of comedies: but it is ſaid that his firſt performance of this laſt kind ſo diſpleaſed Metellus on account of the ſatirical ſtrokes it contained, that he procured his being baniſhed from the city: on which he retired to Utica in Africa, where he at length died, 202 B. C. We have only ſome fragments left of his works.

There was another Nævius, a famous augur in the reign of Tarquin, who, to convince the king and the Romans of his preternatural power, cut a flint with a razor, and turned the ridicule of the populace to admiration. Tarquin rewarded his merit by erecting him a ſtatue in the comitium, which was ſtill in being in the age of Auguſtus. The razor and flint were buried near it under an altar, and it was uſual among the Romans to make witneſſes in civil cauſes ſwear near it. This miraculous event of cutting a flint with a razor, though believed by ſome writers, is treated as fabulous and improbable by Cicero, who himſelf had been augur.

NÆVUS, a mole on the ſkin, generally called a *mother's mark;* alſo the tumour known by the name of a *wen*.

All preternatural tumours on the ſkin, in the form of a wart or tubercle, are called *excreſcences;* by the Greeks they are called *acrothymia;* and when they are born with a perſon, they are called *nævi materni*, or *marks from the mother*. See Tumours, Surgery *Index*.

NAGERA, or Nagara, a town of Spain, in Old Caſtile, and the territory of Rioja, with the title of a duchy and fortreſs; famous for a battle fought in its neighbourhood in 1369. It is ſituated in a fertile country, on a brook called *Naſerilla*. W. Long. 2. 20. N. Lat. 42. 45.

NAGRACUT, a town of India, the capital of a kingdom of the ſame name in the dominions of the Great Mogul, with a rich temple to which the Indians go in pilgrimage. It is ſeated on the river Ravi. E. Long. 78. 10. N. Lat. 33. 12.

NAHUM, or the *Prophecy of* NAHUM, a canonical book of the Old Teſtament.

Nahum, the ſeventh of the 12 leſſer prophets, was a native of Elkoſhai, a little village of Galilee. The ſubject of his prophecy is the deſtruction of Nineveh, which he deſcribes in the moſt lively and pathetic manner; his ſtyle is bold and figurative, and cannot be exceeded by the moſt perfect maſters of oratory. This prophecy was verified at the ſiege of that city by Aſtyages, in the year of the world 3378, 622 years before Chriſt.

NAIADES, in fabulous hiſtory, certain inferior deities who preſided over rivers, ſprings, wells, and fountains. The Naiades generally inhabited the country, and reſorted to the woods or meadows near the ſtream over which they preſided. They are repreſented as young and beautiful virgins, often leaning upon an urn, from which flows a ſtream of water. Ægle was the faireſt of the Naiades, according to Virgil. Their name ſeems to be derived from ναειν, "to flow." They were held in great veneration among the ancients; and often ſacrifices of goats and lambs were offered to them, with libations of wine, honey, and oil. Sometimes they received only offerings of milk, fruit, and flowers.

NAIANT, in *Heraldry*, a term uſed in blazoning fiſhes, when borne in a horizontal poſture, as if ſwimming.

NAIAS, a genus of plants belonging to the diœcia claſs; and in the natural method ranking with thoſe of which the order is doubtful. See Botany *Index*.

NAID, the interior of the great deſert of Arabia, inhabited by a few ſcattered tribes of feeble and wretched Arabs. See Arabia.

NAIL, Unguis, in *Anatomy*, which ſee.

Nails, in building, &c. ſmall ſpikes of iron, braſs, &c. which being driven into wood, ſerve to bind ſeveral pieces together, or to faſten ſomething upon them.

Nails were made uſe of by the ancient Hebrews for cancelling bonds; and the ceremony was performed by ſtriking them through the writing. This ſeems to be alluded to in Scripture, where God is ſaid by our crucified Saviour to have "blotted out the hand-writing of ordinances that was againſt us, and to have taken it out of the way, nailing it to his croſs," Col. ii. 14. For the cauſe and ceremony of driving the annual nail, or *clavus annalis*, among the Romans, ſee *Annalis Clavus*.

Nail, is alſo a meaſure of length, containing the 16th part of a yard.

NAILING of Cannon. When circumſtances make it neceſſary to abandon cannon, or when the enemy's artillery are ſeized, and it is not however poſſible to take them away, it is proper to nail them up, in order to render them uſeleſs; which is done by driving a large nail or iron ſpike into the vent of a piece of artillery, to render it unſerviceable. There are various contrivances to force the nail out, as alſo ſundry machines invented for that purpoſe, but they have never been found of general uſe; ſo that the beſt method is to drill a new vent.

One Gaſper Vimercalus was the firſt who invented the nailing of cannon. He was a native of Bremen, and made uſe of his invention firſt in nailing up the artillery of Sigiſmund Malateſta.

NAIN, LEWIS SEBASTIAN DE, a French critic and hiſtorian, was the ſon of a maſter of the requeſts, and was born at Paris in 1637. At ten years old he went to ſchool at Port Royal, and became one of the beſt writers of that inſtitution. Sacy, his intimate friend and counſellor, prevailed with him in 1676 to receive the prieſthood; which it ſeems, his great humility would not before ſuffer him to aſpire to. This virtue he ſeems to have poſſeſſed in the extreme; ſo that Boſſuet, ſeeing one of his letters to Father Dami, with whom he had ſome little diſpute, beſought him merrily "not to be always upon his knees before his adverſary, but raiſe himſelf up now and then." He was ſolicited to puſh himſelf forward in the church, and Buzanval, biſhop of Beauvois, wiſhed to have him for his ſucceſſor; but Nain, regardleſs of dignities, wiſhed for nothing but retirement, ſo that he might indulge in the mortifications of a religious life and the indefatigable cultivation of letters. He died in 1698, aged 61. His principal works are, 1. Memoirs on the eccleſiaſtical hiſtory of the ſix firſt ages of the church, 16 vols. 4to. 2. The hiſtory of the emperors, 6 vols. 4to. Theſe works are deduced from original ſources, and compoſed with the utmoſt fidelity and accuracy.

NAIN, or **NAIM**, ſituated at the bottom of Mount Hermon on the north ſide, was anciently a city of the tribe of Iſſachar, in the province of Galilee. It was near the gates of this city that our Saviour reſtored to life the only ſon of a widow, and where he inſpired Mary Magdalen to come and mourn for her ſins at his feet. Theſe circumſtances alone make this place worthy of notice; for at preſent Nain is only a hamlet inhabited by Chriſtians, Mahometans, and Hebrews, where there is not a ſingle monument to attract the curioſity of the traveller.

NAIRES, NAHERS, or **NAYERS**, in modern hiſtory, a name which is given by the Malabarians to the military of their country, who form a very numerous claſs or tribe, out of which the ſovereigns of Malabar chooſe their body guard.

NAIRN, a county of Scotland, comprehending the weſtern part of the province of Murray. It is bounded on the north by the Murray frith, on the weſt and ſouth by Inverneſs, and on the eaſt by Elgin. The length is about 18 miles, and the breadth about 14. The air is temperate and ſalubrious, and the winter are remarkably mild. The face of the country is rough and mountainous; yet there are ſome fruitful valleys which produce good crops of oats and barley; but in general the country is much better adapted for paſturage. Here are alſo large woods of fir, and other trees, that afford ſhelter to the game, of which there is great plenty. The moſt remarkable ſtraths or valleys in this county, are Strathnairn, on the river of that name, in the ſouth-weſt part of the ſhire; and on the ſouth-eaſt ſide, Strathrin, on both ſides of Findhorn river. Nairn is well watered with ſtreams, rivulets, and lakes abounding with fiſh. In the ſouthern part there is a ſmall lake, called *Moy*. The greater part of the ſhire is peopled by the Fraſers, a warlike Highland clan, whoſe chief, the lord Lovat, loſt his life on the ſcaffold for having been concerned in the rebellion of 1745. Here are a great number of villages; but no towns of note except Nairn, ſuppoſed to be the *Tuæſis* of Ptolemy, ſituated at the mouth of the river which bears the ſame name; a royal borough, which gave the title of *lord* to an ancient family, forfeited in the rebellion of 1715. The harbour, which opened in the Murray frith, is now choked up with ſand; and the commerce of the town is too inconſiderable to deſerve notice. About four miles from Nairn ſtands the caſtle of Calder on the river of that name, belonging to a branch of the family of Campbell; and ſix miles to the north-weſt of Nairn, ſtands Fort George, built by order of the government, at a place called *Arderſier*, a ſmall iſthmus upon the Murray frith.

The following is the population of the pariſhes of this county, according to the Statiſtical Hiſtory of Scotland.

Pariſhes.	Population in 1755.	Population in 1790—1798.
Ardclach	1163	1186
Auldearn	1951	1406
Calder	882	1062
Nairn	1698	2400
	5694	6054
		5694
	Increaſe	360

Population in 1801, *including part of ſome other Pariſhes.*

Ardclach		1256
Auldearn		1401
Calder		1179
Croy (Nairn diviſion)		562
Moy	do.	34
Nairn	town	2215
Urquhart	(do.)	1610
		8257

NAISSANT, in *Heraldry*, is applied to any animal iſſuing out of the midſt of ſome ordinary, and ſhowing only his head, ſhoulders, fore feet, and legs, with the tip of his tail; the reſt of his body being hid in the ſhield, or ſome charge upon it: in which it differs from *iſſuant*, which denotes a living creature ariſing out of the bottom of any ordinary or charge.

NAISSUS, in *Ancient Geography*, a town of Dardania, a diſtrict of Mœſia Superior, ſaid to be the birthplace of Conſtantine the Great, which ſeems probable from his often reſiding at that place. *Naiſitani*, the

the people (Coin). Now called *Niſſa*, a city of Servia. E. Long. 23. N. Lat. 43.

NAKED SEEDS, in *Botany*, thoſe that are not encloſed in any pod or caſe.

NAKIB, in the oriental dignities, the name of an officer who is a deputy to the cadiliſkier, or, as he may be called, the lord high chancellor of Egypt, appointed by the grand ſignior. His office is to carry the ſtandard of Mahomet.

NAKOUS, an Egyptian muſical inſtrument, made like two plates of braſs, and of all ſizes, from two inches to a foot in diameter; they hold them by ſtrings faſtened to their middles, and ſtrike them together ſo as to beat time. They are uſed in the Coptic churches and in the Mahometan proceſſions.

NAMA, a genus of plants belonging to the pentandria claſs, and order digynia; and, in the natural method, ranking under the 13th order, *Succulentæ*. See BOTANY *Index*.

NAME, denotes a word whereby men have agreed to expreſs ſome idea; or which ſerves to denote or ſignify a thing or ſubject ſpoken of. See WORD.

This the grammarians uſually call a *noun*, *nomen*, though their noun is not of quite ſo much extent as our name. See NOUN.

Seneca, lib. ii. *de Beneficiis*, obſerves, that there are a great number of things which have no name; and which, therefore, we are forced to call by other borrowed names. *Ingens eſt* (ſays he) *rerum copia ſine nomine, quas cum propriis appellationibus ſignare non poſſumus, alienis accommodatis utimur:* which may ſhow why, in the courſe of this dictionary, we frequently give divers ſenſes to the ſame word.

Names are diſtinguiſhed into *proper* and *appellative*.

Proper NAMES, are thoſe which repreſent ſome individual thing or perſon, ſo as to diſtinguiſh it from all other things of the ſame ſpecies; as, *Socrates*, which repreſents a certain philoſopher.

Appellative or *General NAMES*, are thoſe which ſignify common ideas; or which are common to ſeveral individuals of the ſame ſpecies; as, *horſe*, *animal*, *man*, *oak*, &c.

Proper names are either called *Chriſtian*, as being given at baptiſm; or ſurnames: The firſt impoſed for diſtinction of perſons, anſwering to the Roman *prænomen;* the ſecond, for the diſtinction of families, anſwering to the *nomen* of the Romans, and the *patronymicum* of the Greeks.

Originally every perſon had but one name; as among the Jews, *Adam*, &c. among the Egyptians, *Buſiris;* among the Chaldees, *Ninus;* the Medes, *Aſtyages;* the Greeks, *Diomedes;* the Romans, *Romulus;* the Gauls, *Divitiacus;* the Germans, *Arioviſtus;* the Britons, *Caſſibelan;* the Engliſh, *Hengiſt*, &c. And thus of other nations, except the ſavages of Mount Atlas, whom Pliny and Marcellinus repreſent as *anonymi*, "nameleſs."

The Jews gave the name at the circumciſion, viz. eight days after the birth: the Romans, to females the ſame day, to males the ninth; at which time they held a feaſt, called *nominalia*.

Since Chriſtianity has obtained, moſt nations have followed the Jews, baptizing and giving the name on the eighth day after the birth; except our Engliſh anceſtors, who, till of late, baptized and gave the name on the birth day.

The firſt impoſition of names was founded on different views, among different people; the moſt common was to mark the good wiſhes of the parents, or to entitle the children to the good fortune a happy name ſeemed to promiſe. Hence, *Victor*, *Caſtor*, *Fauſtus*, *Statorius*, *Probus*, &c.

Accordingly, we find ſuch names, by Cicero called *bona nomina*, and by Tacitus *fauſta nomina*, were firſt enrolled and ranged in the Roman muſters; firſt called to ſerve at the ſacrifices, in the foundation of colonies, &c.—And, on the contrary, Livy calls Atrius Umber, *abominandi omnis nomen:* and Plautus, on occaſion of a perſon named *Lyco*, i. e. "greedy wolf," ſays;

> *Voſmet nunc facite conjecturam cæterum*
> *Quid id ſit hominis, cui* Lyco *nomen fiet.*

Hence, Plato recommends it to men to be careful in giving happy names; and the Pythagoreans taught expreſsly, that the minds, actions, and ſucceſſes of men, were according to their names, genius, and fate. Thus Panormitan, *ex bono nomine oritur bona præſumptio;* and the common proverb, *Bonum nomen bonum omen;* and hence the foundation of the onomomantia. See ONOMOMANTIA.

It is an obſervation deſerving attention, ſays the abbé Barthelemi, that the greater part of names found in Homer are marks of diſtinction. They were given in honour of the qualities moſt eſteemed in the heroic ages. From the word *polemos*, which ſignifies war, have been formed *Tlepolemus* and *Archepolemus*, the names of two heroes mentioned in the Iliad. The former name ſignifies *able to ſupport*, and the latter, *able to direct*, *the labours of war*. By adding to the word *mache*, or *battle*, certain prepoſitions and different parts of ſpeech, which modify the ſenſe in a manner always honourable, are compoſed the names *Amphimachus*, *Antimachus*, *Promachus*, *Telemachus*. Proceeding in the ſame way, with the word *honorea*, "ſtrength or intrepidity," they formed the names *Agapenor*, "he who eſteems valour;" *Agenor*, "he who directs it." From *thoes*, "ſwift," are derived, *Alcathoes*, *Panthoes*, *Perithoes*, &c. From *nous*, "mind or intelligence," come *Aſtynoes*, *Arſinoes*, *Autenoes*, &c. From *medes*, "counſel," *Agamedes*, *Eumedes*, *Lycomedes*, *Thraſymedes;* and from *clios*, "glory," *Amphicles*, *Agacles*, *Iphicles*, *Patroclus*, *Cleobulus*, with many others.

Hence Camden takes it for granted, that the names, in all nations and languages, are ſignificative, and not ſimple ſounds for mere diſtinction's ſake. This holds not only among the Jews, Greeks, Latins, &c. but even the Turks; among whom, Abdala ſignifies *God's ſervant*, Soliman, *peaceable;* Mahomet, *glorified*, &c. And the ſavages of Hiſpaniola, and throughout America, who, in their languages, name their children, *Gliſtering Light*, *Sun*, *Bright*, *Fine Gold*, &c.; and they of Congo, by the names of precious ſtones, flowers, &c.

To ſuppoſe names given without any meaning, however by the alteration of language their ſignification may be loſt, that learned author thinks is to reproach our anceſtors; and that contrary to the ſenſe of of all ancient writers. Porphyry notes, that the barbarous *names*, as he calls them, were very emphatical, and very conciſe: and accordingly it was eſteemed a duty to be φερωνυμοι, or *ſui nominis homines*: as Severus, Probus, and Aurelius, are called *ſui nominis imperatores*.

It was the uſual way of giving names, to wiſh the children might diſcharge their names. Thus when Gunthram king of France named Clotharius at the font, he ſaid, *Creſcat puer, et hujus ſit nominis executor*.

The ancient Britons, Camden ſays, generally took their names from colours, becauſe they painted themſelves; which names are now loſt, or remain hid among the Welſh. When they were ſubdued by the Romans, they took Roman names, ſome of which ſtill remain corrupted; though the greateſt part became extinct upon the admiſſion of the Engliſh Saxons, who introduced the German names, as *Cridda*, *Penda*, *Oſwald*, *Edward*, &c.—The Danes, too, brought with them their names; as *Suayne*, *Harold*, *Knute*, &c. The Normans, at the Conqueſt, brought in other German names, as originally uſing the German tongue; ſuch as *Robert*, *William*, *Richard*, *Henry*, *Hugh*, &c. after the ſame manner as the Greek names *Aſpaſius*, *Boethius*, *Symmachus*, &c. were introduced into Italy upon the diviſion of the empire. After the Conqueſt, our nation, which had ever been averſe to foreign names, as deeming them unlucky, began to take Hebrew names: as *Matthew*, *David*, *Sampſon*, &c. The various names anciently or at preſent obtaining among us, from what language or people ſoever borrowed, are explained by Camden in his Remains. As to the period when names began to be multiplied, and ſurnames introduced, &c. ſee SURNAME.

Of late years it has obtained among us to give ſurnames for Chriſtian names; which ſome diſlike, on account of the confuſion it may introduce. Camden relates it as an opinion, that the practice firſt began in the reign of Edward VI. by ſuch as would be godfathers, when they were more than half fathers. Upon which ſome were perſuaded to change their names at confirmation; which, it ſeems, is uſual in other countries.—Thus, two ſons of Henry II. of France, chriſtened *Alexander* and *Hercules*, changed them at confirmation into *Henry* and *Francis*. In monaſteries, the religious aſſume new names at their admittance, to ſhow they are about to lead a new life, and have renounced the world, their family, and even their name: v. g. ſiſter Mary *of the Incarnation*, brother Henry *of the Holy Sacrament*, &c. The popes alſo changed their names at their exaltation to the pontificate; a cuſtom firſt introduced by Pope Sergius, whoſe name till then, as Platina informs us, was *Swine's-ſnout*. But Onuphrius refers it to John XII. or XIII. and at the ſame time adds a different reaſon for it from that of Platina, viz. that it was done in imitation of St Peter and St Paul, who were firſt called *Simon* and *Saul*.

Among the ancients, thoſe deified by the Heathen conſecrations had new names given them; as Romulus was called *Quirinus*; Melicertes, *Portunus* or *Portumnus*, &c.

New names were alſo given in adoptions, and ſometimes by teſtament? thus L. Æmilius, adopted by Scipio, took the name of *Scipio Africanus*; and thus Auguſtus, who was at firſt called *C. Octavius Thurinus*, being adopted by the teſtament of Julius Cæſar into his name and family, took the name of *Caius Julius Cæſar Octavianus*.

Names were alſo changed at enfranchiſements into new cities. Thus Lucumo, at his firſt being made free of Rome, took the name *Lucius Tarquinius Priſcus*, &c.; and ſlaves when made free, uſually aſſumed their maſters names. Thoſe called to the equeſtrian order, if they had baſe names, were always new named, *nomine ingenuorum veterumque Romanorum*. And among the primitive Chriſtians, it was the practice to change the names of the catechumens: Thus the renegado Lucianus, till his baptiſm, was called *Lucius*.

Towards the middle of the 15th century, it was the fancy of the wits and learned men of the age, particularly in Italy, to change their baptiſmal names for claſſical ones. As Sannazarius, for inſtance, who altered his own plain name *Jacopo* to *Actius Syncerus*. Numbers did the ſame, and among the reſt Platina the hiſtorian at Rome, who, not without a ſolemn ceremonial, took the name of *Callimachus* inſtead of *Philip*. Pope Paul II. who reigned about that time, unluckily chanced to be ſuſpicious, illiterate, and heavy of comprehenſion. He had no idea that perſons could wiſh to alter their names unleſs they had ſome bad deſign, and actually ſcrupled not to employ impriſonment and other violent methods to diſcover the fancied myſtery. Platina was moſt cruelly tortured on this frivolous account: he had nothing to confeſs: ſo the pope, after endeavouring in vain to convict him of hereſy, ſedition, &c. releaſed him after a long impriſonment.

NAMPTWICH, or NANTWICH, a town of Cheſhire in England, ſituated on the river Weever, 14 miles S. E. from Cheſter, and 162 miles from London. It lies in the Vale Royal, and is one of the largeſt and beſt built towns in the county, the ſtreets being very regular, and adorned with many gentlemen's houſes. The inhabitants amounting in 1801 to 3463, trade in corn, cattle, cheeſe, fine white ſalt, and ſhoes. It is governed by a conſtable, &c. who are guardians of the ſalt ſprings. It is divided into two equal parts by the Weever, which is navigable to Winsford bridge. The Cheſter canal, terminates in a large baſon near this place. In this town were ſeveral religious foundations, now no more. The church is a handſome pile of building in the form of a croſs, with an octangular tower in the middle.

NAMUR, a province of the Netherlands, lying between the rivers Sambre and Maeſe; bounded on the north by Brabant, on the eaſt and ſouth by the biſhopric of Liege, and on the weſt by Hainault. It is pretty fertile; has ſeveral foreſts, marble quarries, and mines of iron, lead, and pit coal; and is about 30 miles long and 20 broad. Namur is the capital town.

NAMUR, a large, rich, and very ſtrong town of the Netherlands, capital of the county of Namur, with a ſtrong caſtle, ſeveral forts, and a biſhop's ſee. The moſt conſiderable forts are, Fort William, Fort Maeſe, Fort Coquelet, and Fort Eſpinor. The caſtle is built in the middle of the town, on a craggy rock. It was beſieged by King William in 1695, who took it in the ſight of an army of 100,000 French, though there were 16,000 men in the garriſon. It was ceded to the houſe of Auſtria in 1713, but taken by the French in 1746;

and reſtored by the treaty of Aix-la-Chapelle. It was again taken by the French in 1792, who evacuated it the following year, and retook it in 1794. It is ſituated between two mountains at the confluence of the rivers Maeſe and Sambre, in E. Long. 4. 57. N. Lat. 50. 25.

NAN-TCHANG-FOU, the capital of Kiang-ſi, a province of China. This city has no trade but that of porcelain, which is made in the neighbourhood of Jaotcheou. It is the reſidence of a viceroy, and comprehends in its diſtrict eight cities; ſeven of which are of the third claſs, and only one of the ſecond. So much of the country is cultivated, that the paſtures left are ſcarcely ſufficiently for the flocks.

NANCI, a town of France, in the department of Meurthe, ſituated on the river Meuſe, in the centre of the province. It is divided into the Old and New Towns. The firſt, though irregularly built, is very populous, and contains the ducal palace: the ſtreets of the New Town are as ſtraight as a line, adorned with handſome buildings, and a very fine ſquare. The primatial church is a magnificent ſtructure, and in that of the Cordeliers are the tombs of the ancient dukes. The two towns are ſeparated by a canal; and the new town was very well fortified, but the king of France demoliſhed the fortifications. It has been taken and retaken ſeveral times; particularly by the French, to whom it was ceded in 1736, to enjoy it after the death of Staniſlaus. E. Long. 6. 17. N. Lat. 48. 41.

NANCOWRY, or SOWRY, one of the Nicobar iſlands, lying at the entrance of the bay of Bengal. See NICOBAR.

NANI, JOHN BAPTIST, was born in 1616. His father was procurator of St Mark, and ambaſſador from Venice to Rome. He was educated with attention, and made conſiderable improvement. Urban VIII. a juſt valuer of merit, ſoon perceived that of young Nani. He was admitted into the college of ſenators in 1641, and was ſhortly after nominated ambaſſador in France, where he ſignalized himſelf by his compliant manners. He procured conſiderable ſuccours for the war of Candia againſt the Turks; and became, after his return to Venice, ſuperintendant of the war office and of finances. He was afterwards ambaſſador to the empire: where he rendered thoſe ſervices to this country which, as a zealous and intelligent citizen, he was well qualified to diſcharge. He was again ſent into France in 1660 to ſolicit freſh ſuccours for Candia; and on his return was appointed procurator of St Mark. He died November 5. 1768, at the age of 63, much regretted by his countrymen. The ſenate had appointed him to write the Hiſtory of the Republic; which he executed to the ſatisfaction of the Venetians, although the work was leſs admired by foreigners, who were not proper judges of the accuracy with which he ſtated the facts, of the purity of his diction, nor of the ſimplicity of his ſtyle; although it muſt be acknowledged that his narrative is much interrupted by too frequent parentheſes. In writing his hiſtory of Venice he has given an univerſal hiſtory of his times, eſpecially with reſpect to the affairs of the French in Italy. This hiſtory, which is continued from 1613 to 1671, was printed at Venice in 2 vols 4to, in the years 1662 and 1679.

NAN-KING, a city of China, and capital of the province of Kiang-nan, is ſaid to have been formerly one of the moſt beautiful and flouriſhing cities in the world. When the Chineſe ſpeak of its extent, they ſay, if two horſemen ſhould go out by the ſame gate, and ride round it on full ſpeed, taking different directions, they would not meet before night. This account is evidently exaggerated; but it is certain, that Nanking ſurpaſſes in extent all the other cities of China. We are aſſured that its walls are five leagues and a half in circumference.

This city is ſituated at the diſtance of a league from the river Yang-tſe-kiang: it is of an irregular figure; the mountains which are within its circumference having prevented its being built on a regular plan. It was formerly the imperial city; for this reaſon it was called *Nan-King*, which ſignifies, the Southern Court;" but ſince the ſix grand tribunals have been tranſferred from hence to Peking, it is called *Kiang-ning* in all the public acts.

Nan-king has loſt much of its ancient ſplendour: it had formerly a magnificent palace, no veſtige of which is now to be ſeen; an obſervatory at preſent neglected, temples, tombs of the emperors, and other ſuperb monuments, of which nothing remains but the remembrance. A third of the city is deſerted, but the reſt is well inhabited. Some quarters of it are extremely populous and full of buſineſs; particularly the manufacture of a ſpecies of cotton cloth, of which great quantities are imported into Europe under the name of *Nankin*. The ſtreets are not ſo broad as thoſe of Peking; they are, however, very beautiful, well paved, and bordered with rich ſhops.

In this city reſides one of thoſe great mandarins called *Tſong-gtou*, who takes cognizance of all important affairs, not only of both the governments of the province, but alſo of thoſe of the province of Kiang-ſi. The Tartars have a numerous garriſon here, commanded by a general of their own nation; and they occupy a quarter of the city, ſeparated from the reſt by a plain wall.

The palaces of the mandarins, whether Chineſe or Tartars, are in this city neither larger nor better built than thoſe in the capital cities of other provinces. Here are no public edifices correſponding to the reputation of ſo celebrated a city, excepting its gates, which are very beautiful, and ſome temples, among which is the famous porcelain tower. It is 200 feet high, and divided into nine ſtories by plain boards within, and without by cornices and ſmall projections covered with green varniſhed tiles. There is an aſcent of 40 ſteps to the firſt ſtory; between each of the others there are 21.

The breadth and depth of the river Yang-tſe-kiang formerly rendered the port of Nan-king very commodious; but at preſent large barks, or rather Chineſe junks, never enter it: whether it be that it is ſhut up by ſand banks, or that the entrance of it has been forbid, in order that navigators may inſenſibly loſe all knowledge of it.

In the months of April and May a great number of excellent fiſh are caught in this river near the city, which are ſent to court; they are covered with ice, and tranſported in that manner by barks kept entirely on purpoſe. Although this city is more than 200 leagues from Peking, theſe boats make ſuch expedition, that they arrive there in eight or nine days. This city, though the capital of the province, has under its particular juriſdiction only eight cities of the third claſs. The number of its inhabitants is ſaid to be 1,000,000. without comprehending the garriſon of 40,000 men. E. Long. 119. 25. N. Lat. 32. 46.

NANSIO, an iſland of the Archipelago, a little to the north of the iſland of Santorino, 16 miles in circumference; but has no harbour. The mountains are nothing but bare rocks, and there are not ſprings ſufficient to water the fields. There is a vaſt number of partridges, whoſe eggs they deſtroy every year to preſerve the corn, and yet vaſt numbers of them are always produced. The ruins of the temple of Apollo are yet to be ſeen, and conſiſt chiefly of marble columns. E. Long. 26. 20. N. Lat. 36. 15.

NANTES, an ancient, rich, and very conſiderable town of France, in the department of Lower Loire, with a biſhop's ſee, an univerſity, and a mint. It is one of the moſt conſiderable places in the kingdom; contains the richeſt merchants; and was formerly the reſidence of the dukes of Bretagne, where they built a very ſtrong caſtle on the ſide of the river, and which is ſtrongly fortified. There are ſeveral pariſhes, and a great many religious houſes; and the cathedral contains the tombs of the ancient dukes. There are ſeveral fine bridges over the river Loire, which is navigable. The ſuburbs are ſo large, on account of the number of people that come from all parts to ſettle here, that they exceed the city. The Spaniards trade here in wine, fine wool, iron, ſilk, oil, oranges, and lemons; and they carry back cloth, ſtuffs, corn, and hard ware. The Dutch ſend ſalt fiſh, and all ſorts of ſpices; and in return have wine and brandy. The Swedes bring copper; and the Engliſh, lead, tin, &c. It was in this place that Henry IV. promulgated the famous edict in 1598, called the *Edict of Nantes*, and which was revoked in 1685. Nantes was anciently, like almoſt every conſiderable city in Europe, very ſtrongly fortified. Peter de Dreux, one of the dukes of Bretagne, ſurrounded it with walls, which have only been demoliſhed within theſe few years. The bridge is an object of curioſity. It is near a mile and a half in length, being continued acroſs all the little iſlands in the Loire, from north to ſouth. The territory of Nantes lies on both ſides the Loire, and feeds a great number of cattle. Large veſſels can come no higher than Port Launai, which is 12 miles from Nantes. W. Long. 1. 45. N. Lat. 47. 13.

NANTWICH. See NAMPTWICH.

NAPÆA, a genus of plants belonging to the polyadelphia claſs; and in the natural method ranking under the 37th order, *Columniferæ*. See BOTANY *Index*.

NAPHTHA, an inflammable ſubſtance of the bituminous kind. See CHEMISTRY and MINERALOGY.

NAPHTHALI, or NEPHTHALI (Joſh. xix.), one of the tribes of Iſrael; having Zabulon on the ſouth, Aſher on the weſt, the Jordan on the eaſt, and on the north Antilibanus.

NAPIER, JOHN, baron of Merchiſton in Scotland, inventor of the logarithms, was the eldeſt ſon of Sir Archibald Napier of Merchiſton, and born in the year 1550. Having given early diſcoveries of great natural parts, his father was careful to have them cultivated by a liberal education. After going through the ordinary courſes of philoſophy at the univerſity of St Andrew's, he made the tour of France, Italy, and Germany. Upon his return to his native country, his literature and other fine accompliſhments ſoon rendered him conſpicuous, and might have raiſed him to the higheſt offices of the ſtate: but declining all civil employments, and the buſtle of the court, he retired from the world to purſue literary reſearches, in which he made an uncommon progreſs, ſo as to have favoured mankind with ſundry uſeful diſcoveries. He applied himſelf chiefly to the ſtudy of mathematics; but at the ſame time did not neglect that of the Holy Scriptures. In both theſe he hath diſcovered the moſt extenſive knowledge and profound penetration. His eſſay upon the book of the Apocalypſe, indicates the moſt acute inveſtigation, and an uncommon ſtrength of judgment; though time hath diſcovered, that his calculations concerning particular events hath proceeded upon fallacious data. This work has been printed abroad in ſeveral languages; particularly in French at Rochelle in the year 1593, 8vo, announced in the title, as reviſed by himſelf. Nothing, ſays Lord Buchan, could be more agreeable to the Rochellers or to the Huguenots of France at this time, than the author's annunciation of the pope as antichriſt, which in this book he has endeavoured to ſet forth with much zeal and erudition. But what has principally rendered his name famous, was his great and fortunate diſcovery of logarithms in trigonometry, by which the eaſe and expedition in calculation have ſo wonderfully aſſiſted the ſcience of aſtronomy and the arts of practical geometry and navigation. That he had begun about the year 1593 the train of inquiry which led him to that great achievement in arithmetic, appears from a letter to Crugerus from Kepler in the year 1624; wherein, mentioning the *Canon Mirificus*, he writes thus; "Nihil autem ſupra Neperianam rationem eſſe puto: etſi Scotus quidem literis ad Tychonem, anno 1564, ſcriptis jam ſpem fecit Canonis illius mirifici;" which alluſion agrees with the idle ſtory mentioned by Wood in his *Athenæ Oxon.* and explains it in a way perfectly conſonant to the rights of Napier as the inventor.

When Napier had communicated to Mr Henry Briggs, mathematical profeſſor in Greſham college, his wonderful canon for the logarithms, that learned profeſſor ſet himſelf to apply the rules in his *Imitatio Nepeirea*; and in a letter to Archbiſhop Uſher in the year 1615, he writes thus: "Napier, baron of Merchiſton, hath ſet my head and hands at work with his new and admirable logarithms. I hope to ſee him this ſummer, if it pleaſe God; for I never ſaw a book which pleaſed me better, and made me more wonder." The following paſſage from the life of Lilly the aſtrologer is quoted by Lord Buchan, as giving a picturesque view of the meeting betwixt Briggs and the inventor of the logarithms at Merchiſton near Edinburgh. "I will acquant you (ſays Lilly) with one memorable ſtory related unto me by John Marr, an excellent mathematician and geometrician, whom I conceive you remember. He was ſervant to King James I. and Charles I. When Merchiſton firſt publiſhed his logarithms, Mr Briggs, then reader of the aſtronomy lectures at Greſham college in London, was ſo much ſurpriſed with admiration of them, that he could have no quietneſs in himſelf until he had ſeen that noble perſon whoſe

whoſe only invention they were: he acquaints John Marr therewith, who went into Scotland before Mr Briggs, purpoſely to be there when theſe two ſo learned perſons ſhould meet. Mr Briggs appoints a certain day when to meet at Edinburgh; but failing thereof, Merchiſton was fearful he would not come. It happened one day as John Marr and the baron Napier were ſpeaking of Mr Briggs; 'Ah, John (ſaid Merchiſton), Mr Briggs will not come.' At the very inſtant one knocks at the gate: John Marr haſted down, and it proved to be Mr Briggs to his great contentment. He brings Mr Briggs up to the baron's chamber, where almoſt one quarter of an hour was ſpent, each beholding the other with admiration before one word was ſpoken. At laſt Mr Briggs began; 'Sir, I have undertaken this long journey purpoſely to ſee your perſon, and to know by what engine of wit or ingenuity you came firſt to think of this moſt excellent help into aſtronomy, viz. the logarithms; but, Sir, being by you found out, I wonder nobody elſe found it out before, when now being known it appears ſo eaſy.' He was nobly entertained by Baron Napier; and every ſummer after that, during the laird's being alive, this venerable man, Mr Briggs, went purpoſely to Scotland to viſit him."

Earl of Buchan's Account of the Writings and Inventions of Napier of Merchiſton.

There is a paſſage in the life of Tycho Brahe by Gaſſendi, which may miſlead an attentive reader to ſuppoſe that Napier's method had been explored by Herwart at Hoenburg: It is in Gaſſendi's Obſervations on a Letter from Tycho to Herwart of the laſt day of Auguſt 1599. "Dixit Hervartus nihil morari ſe ſolvendi cujuſquam trianguli difficultatem; ſolere ſe enim multiplicationum, ac diviſionum vice additiones ſolum, ſubtractiones 93 uſurpare (quod ut fieri poſſet, docuit poſtmodum ſuo logarithmorum Canone Neperus)." But Herwart here alludes to this work afterwards publiſhed in the year 1610, which ſolves triangles by proſtaphæreſis; a mode totally different from that of the logarithms.

Kepler dedicated his *Ephemerides*, to Napier, which were publiſhed in the year 1617; and it appears from many paſſages in his letter about this time, that he held Napier to be the greateſt man of his age in the particular department to which he applied his abilities. "And indeed (ſays our noble biographer), if we conſider that Napier's diſcovery was not like thoſe of Kepler or of Newton, connected with any analogies or coincidences which might have led him to it, but the fruit of unaſſiſted reaſon and ſcience, we ſhall be vindicated in placing him in one of the higheſt niches in the temple of Fame. Kepler had made many unſucceſsful attempts to diſcover his canon for the periodic motions of the planets, and hit upon it at laſt, as he himſelf candidly owns, on the 15th of May 1618; and Newton applied the palpable tendency of heavy bodies to the earth to the ſyſtem of the univerſe in general; but Napier ſought out his admirable rules by a ſlow ſcientific progreſs, ariſing from the gradual evolution of truth."

The laſt literary exertion of this eminent perſon was the publication of his *Rabdalogy and Promptuary* in the year 1617, which he dedicated to the Chancellor Seton; and ſoon after died at Merchiſton on the 3d of April O. S. of the ſame year, in the 68th year of his age and 23d of his happy invention.—The particular titles of his works publiſhed are: 1. A plain diſcovery of the Revelation of St John 2. *Mirifici ipſius canonis conſtructio et logarithmorum, ad naturales ipſorum numeros habitudines.* 3. *Appendix de alia atque præſtantiore logarithmorum ſpecie conſtituenda, in qua ſcilicet unitas logarithmus eſt.* 4. *Rhabdologiæ, ſeu numerationis per virgulas, libri duo.* 5. *Propoſitiones quædam eminentiſſimæ, ad triangula ſphærica mira facultate reſolvenda.* To which may be added, 6. His Letter to Anthony Bacon (the original of which is in the archbiſhop's library at Lambeth), entitled, "Secret inventions, profitable and neceſſary in theſe days for the defence of this iſland, and withſtanding ſtrangers enemies to God's truth and religion;" which the earl of Buchan has cauſed to be printed in the Appendix to his Account of Napier's Writings. This letter is dated June 2. 1596, about which time it appears the author had ſet himſelf to explore his logarithmic canon.

This eminent perſon was twice married. By his firſt wife, who was a daughter of Sir James Stirling of Keir, he had only one ſon named Archibald, who ſucceeded to the eſtate. By his ſecond wife, a daughter of Sir James Chiſholm of Cromlix, he had a numerous iſſue.—*Archibald Napier*, the only ſon of the firſt marriage, was a perſon of fine parts and learning. Having more a turn to public buſineſs than his father had, he was raiſed to be a privy counſellor by James VI. under whoſe reign he alſo held the offices of treaſurer-depute, juſtice-clerk, and ſenator of the college of juſtice. By Charles I. he was raiſed to the peerage by the title of *Lord Napier*.

NAPIER's Rods, or *Bones*, an inſtrument invented by Baron Napier, whereby the multiplication and diviſion of large numbers is much facilitated.

As to the Conſtruction of Napier's Rods: Suppoſe the common table of multiplication to be made upon a plate of metal, ivory, or paſteboard, and then conceive the ſeveral columns (ſtanding downwards from the digits on the head) to be cut aſunder; and theſe are what we call *Napier's rods of multiplication.* But then there muſt be a good number of each; for as many times as any figure is in the multiplicand, ſo many rods of that ſpecies (i. e. with that figure on the top of it) muſt we have; though ſix rods of each ſpecies will be ſufficient for any example in common affairs: there muſt be alſo as many rods of 0's.

But before we explain the way of uſing theſe rods, there is another thing to be known, viz. that the figures on every rod are written in an order different from that in the table. Thus the little ſquare ſpace or diviſion in which the ſeveral products of every column are written, is divided into two parts by a line acroſs from the upper angle on the right to the lower on the left; and if the product is a digit, it is ſet in the lower diviſion; if it has two places, the firſt is ſet in the lower, and the ſecond in the upper diviſion; but the ſpaces on the top are not divided; alſo there is a rod of digits, not divided, which is called the *index rod*, and of this we need but one ſingle rod. See the figure of all the different rods, and the index, ſeparate from one another, in Plate CCCLXIX. fig. 1.

Multiplication by Napier's Rods. Firſt lay down the index rod; then on the right of it ſet a rod, whoſe top is the figure in the higheſt place of the multiplicand; next to this again, ſet the rod whoſe top is the next figure of the multiplicand; and ſo on in order to the firſt figure. Then is your multiplicand tabulated for all the nine digits; for in the ſame line of ſquares ſtanding againſt every figure of the index rod, you have the product of that figure; and therefore you have no more to do but to transfer the products and ſum them. But in taking out theſe products from the rods, the order in which the figures ſtand obliges you to a very eaſy and ſmall addition; thus, begin to take out the figure in the lower part, or units place, of the ſquare of the firſt rod on the right; add the figure on the upper part of this rod to that in the lower part of the next, and ſo on; which may be done as faſt as you can look on them. To make this practice as clear as poſſible, take the following example.

Example: To multiply 4768 by 385. Having ſet the rods together for the number 4768 (fig. 2.) againſt 5 in the index, I find this number by adding according to the rule, - - 23840

Againſt 8, this number - - 38144

Againſt 3, this number - - 14304

Total product - - - 1835680

To make the uſe of the rods yet more regular and eaſy, they are kept in a flat ſquare box, whoſe breadth is that of ten rods, and the length that of one rod, as thick as to hold ſix (or as many as you pleaſe), the capacity of the box being divided into ten cells, for the different ſpecies of rods. When the rods are put up in the box (each ſpecies in its own cell diſtinguiſhed by the firſt figure of the rod ſet before it on the face of the box near the top), as much of every rod ſtands without the box as ſhows the firſt figure of that rod: alſo, upon one of the flat ſides without and near the edge, upon the left hand, the index rod is fixed; and along the foot there is a ſmall ledge; ſo that the rods when applied are laid upon this ſide, and ſupported by the ledge, which makes the practice very eaſy; but in caſe the multiplicand ſhould have more than nine places, that upper face of the box may be made broader. Some make the rods with four different faces, and figures on each for different purpoſes.

Diviſion by Napier's Rods. Firſt tabulate your diviſor; then you have it multiplied by all the digits, out of which you may chooſe ſuch convenient diviſors as will be next leſs to the figures in the dividend, and write the index anſwering in the quotient, and ſo continually till the work is done. Thus 2179788, divided by 6123, gives in the quotient 356.

Having tabulated the diviſor 6123, you ſee that 6123 cannot be had in 2179; therefore take five places, and on the rods find a number that is equal or next leſs to 21797, which is 18369; that is, 3 times the diviſor; wherefore ſet 3 in the quotient, and ſubtract 18369 from the figures above, and there will remain 3428; to which add 8, the next figure of the dividend, and ſeek again on the rods for it, or the next leſs, which you will find to be five times; therefore ſet 5 in the quotient, and ſubtract 30615 from 34288, and there will remain 3673; to which add 8, the laſt figure in the dividend, and finding it to be juſt ſix times the diviſor, ſet ſix in the quotient.

```
6123)2179788(356
     18369..
     -----
      34288
      30615
      -----
       36738
       36738
       -----
           0
```

NAPLES, a kingdom of Italy, comprehending the ancient countries of Samnium, Campania, Apulia, and Magna Græcia. It is bounded on all ſides by the Mediterranean and Adriatic, except on the north eaſt, where it terminates on the Eccleſiaſtical ſtate. Its greateſt length from ſouth-eaſt to north-weſt is about 280 Engliſh miles; and its breadth from north-eaſt to ſouth-weſt, from 96 to 120.

The ancient hiſtory of this country falls under the articles ROME and ITALY; the preſent ſtate of it, as well as of the reſt of Italy, is owing to the conqueſts of Charlemagne. When that monarch put an end to the kingdom of the Lombards, he obliged the dukes of Friuli, Spoletto, and Benevento, to acknowledge him as king of Italy; but allowed them to exerciſe the ſame power and authority which they had enjoyed before his conqueſt. Of theſe three dukedoms Benevento was by far the moſt powerful and extenſive, as it comprehended almoſt all the preſent kingdom of Naples; that part of Farther Calabria beyond the rivers Savuto and Peto, a few maritime cities in Hither Calabria, with the city of Acripoli, and the promontory in its neighbourhood called *Capo di Licoſa*: and laſtly, the dukedoms of Gaeta, Naples, and Amalfi, which were very inconſiderable, and extended along the ſhore only about 100 miles, and were interrupted by the Gaſtaldate or county of Capua.

1 Extent of the duchy of Benevento.

2 Arechis duke of Benevento revolts from Charlemagne.

This flouriſhing and extenſive dukedom was at this time governed by Arechis, who had married one of the daughters of the laſt king of the Lombards, and had ſubmitted, and taken the oath of allegiance to the emperor Charles. However, a few years after, he renounced his allegiance to the Franks, declared himſelf an independent ſovereign, and was acknowledged as ſuch by all the inhabitants of his duchy. To ſtrengthen himſelf againſt Pepin king of Italy, who reſided at Ravenna, he enlarged and fortified the city of Benevento, and likewiſe built Salerno on the ſea coaſt, ſurrounding it with a very ſtrong and high wall. He engaged in ſeveral wars with the Greeks, whom he ſometimes obliged to give him hoſtages; but having invaded the territories of the pope, whom Pepin could not aſſiſt, Charlemagne was prevailed on to return to Italy. Arechis, unable to oppoſe ſuch a formidable enemy, ſent his eldeſt ſon, Romuald, to Rome, with an offer of ſubmiſſion: but, at the inſtigation of the pope, Charles refuſed the offer, and detained his ſon priſoner; after which he ravaged the country, and made himſelf maſter of Capua. Other deputies, however, proved more ſucceſsful; and, in the year 787, a peace was concluded on theſe conditions: That Arechis and the Beneventans ſhould renew their allegiance to the Franks; that he ſhould pay a yearly tribute to Pepin; deliver up all his treaſure; and give

give his ſon Grimoald and his daughter Adelgiſa, with twelve others, as hoſtages for his fidelity: however, after many entreaties, Adelgiſa was reſtored to her father.

3
mits.

4
volts a
ond
e.

Charles had no ſooner left Italy, than Arechis forgot all his engagements, and began to negotiate with Irene, empreſs of Conſtantinople, and her ſon Conſtantine, for expelling the Franks out of Italy. For himſelf, he deſired the honour of patriciate, and the dukedom of Naples with all its dependencies; and, in return, promiſed to acknowledge the Greek emperor as his ſovereign, and to live after the manner of the Greeks. He required, however, to be ſupported by a Greek army; and that his brother-in-law Adalgiſus, ſon to Deſiderius the laſt king of the Lombards, ſhould be ſent over into Italy, to raiſe a party among his countrymen. Theſe conditions were readily accepted, on condition that Prince Romuald ſhould be ſent as an hoſtage; ambaſſadors were ſent to Naples with the enſigns of the Patrician order, namely the mantle of cloth of gold, the ſword, the comb, and the ſandals: but before the ceremony could be performed, Prince Romuald died, and ſoon after him his father; whoſe death was ſuppoſed to have been haſtened by that of his ſon.

After the death of Arechis, the Beneventans ſent a moſt ſubmiſſive embaſſy to Charlemagne, entreating him to ſend them Grimoald, the late king's ſon, and only lawful heir to his crown; threatening at the ſame time to revolt if their prince was denied them. Charles readily granted their requeſt, and allowed Grimoald to depart, after he had agreed to the following conditions, viz. That he ſhould oblige the Lombards to ſhave their beards; that, in writings, and on money, the name of the king ſhould be put before that of the prince; and that he ſhould cauſe the walls of Salerno, Acerenza, and Conſia, to be entirely demoliſhed.—

5
moald
tinues
ſome
faith-
to the
nks.

The new king was received by his ſubjects with the utmoſt joy: and for ſome time continued faithful to his engagements, excepting only the laſt article, which he either neglected or eluded. So far, however, was he from aſſiſting the Greeks, that he gave notice of their machinations to Pepin king of Italy; raiſed an army to oppoſe his uncle Adalgiſus; and being joined by Hildebrand duke of Spoletto, and Vinigiſe the general of Pepin, he attacked the Greeks in Calabria ſoon after they had landed, entirely defeated and took his uncle priſoner, and, as is ſaid, put him to a cruel death. Yet in a ſhort time Grimoald contracted an alliance with the Greek emperor by marrying his neice Wanzia; and in the fifth year of his reign a war broke out between him and Pepin, which continued for twelve years; at the end of which time a truce was concluded. Grimoald ſurvived this pacification only three years, and was ſucceeded by his treaſurer Grimoald II. who ſubmitted to Charlemagne after the death of Pepin; and from this time the Beneventans were looked upon as tributaries of the weſtern emperors. As yet, however, the city of Naples did not own allegiance to the dukes of Benevento, but was held by the eaſtern emperors; and frequent wars took place between the Beneventans and Neapolitans. This happened to be the caſe when Grimoald II. aſcended the throne. He concluded a peace with them; which, however, was of no long continuance; for Theodore, governor of Naples, having granted protections to Dauferius a noble Beneventan, who had been concerned in a conſpiracy againſt his prince, Grimoald marched againſt the city of Naples, and inveſted it by ſea and land. Theodore ſtill refuſed to deliver up the traitor, and a general engagement both by land and ſea was the conſequence; in which the Neapolitans were defeated with ſo great ſlaughter, that the ſea was ſtained with their blood for more than ſeven days. Theodore then conſented to deliver up Dauferius, with 8000 crowns for the expence of the war; and Grimoald not only pardoned Dauferius, but received him into favour: The traitor, however, reflecting on the heinouſneſs of his crime, was ſeized with remorſe; and went a pilgrimage to the holy land, carrying a large ſtone in his mouth, by way of penance, which he never took out but at his meals.

6
Is murdered, and ſucceeded by Sico.

In the year 821, Grimoald was murdered by Radelchis count of Conſia, and Sico Gaſtald of Acerenza, the latter of whom ſucceeded to the dukedom of Benevento. Radelchis being ſoon after ſeized with remorſe, became a monk; while Sico aſſociated his ſon Sicardo with him in the government; and both, being of an ambitious and reſtleſs diſpoſition, ſought a pretence for attacking the Neapolitans. This was ſoon found, and the city was inveſted by ſea and land. The walls were furiouſly battered; and part of them being beat down, Sico prepared for a general aſſault. Stephen, at that time duke of Naples, pretended to ſubmit; but, that he might prevent the city from being pillaged, entreated Sico to put off his entry till the morning, and in the mean time ſent out his mother and his two children as hoſtages. Sico conſented to his requeſt; but next morning found the breach built up, and the Neapolitans prepared for their defence. Exaſperated at their perfidy, he renewed his attacks with vigour, but without any ſucceſs; the beſieged defending themſelves with the utmoſt obſtinacy. At laſt, perceiving that they ſhould not be able to hold out much longer, they conſented to a peace on the following conditions, viz. That the Neapolitans ſhould pay an annual tribute to the princes of Benevento, and conſent to the tranſporting of the body of St Januarius from his church without the walls of Naples to Benevento. Theſe conditions being ratified, Sico returned with great honour to Benevento; but ſoon after renewed the war, under pretence that the Neapolitans had neglected to pay the ſtipulated ſum; and hoſtilities continued till his death, which happened in 833.

7
Naples beſieged by Sico;

8
and by his ſucceſſor Sicardo.

Sico was ſucceeded in the government of Benevento by his ſon Sicardo, who had married the daughter of Dauferius; and being influenced by the evil counſels of Roffrid's his wife's brother, oppreſſed his ſubjects to ſuch a degree that they conſpired againſt his life. He beſieged Naples with a powerful army, and took poſſeſſion of Acerra and Atella, both of which he fortified. But Bonus, the Neapolitan duke, defended himſelf ſo vigorouſly, that the Beneventans were obliged to retire, and even to abandon Acerra and Atella, the fortifications of which were immediately demoliſhed. At laſt Sicardo agreed to a peace for five years, on the interceſſion of Lothaire, emperor and king of Italy; but his chief motive was thought to have been the fear of the Saracens, whom the duke of Naples had called over from Africa to his aſſiſtance; for no ſooner were they

they ſent back than Sicardo attempted to delay the concluſion of the treaty; but the emperor interpoſing his authority, a peace was concluded in the year 836, after the war had continued, with very little intermiſſion, for 16 years.

9
The Saracens called in by the duke of Naples.

Soon after the concluſion of this peace, the Saracens landed at Brindiſi; and having made themſelves maſters of the place, ravaged all the neighbouring country. Sicardo marched againſt them with a numerous army; but the Saracens having dug a great number of ditches which they ſlightly covered over, found means to draw the Beneventans in among them, whereby they were repulſed with great loſs. However, Sicardo, having reinforced his army, marched again to attack them; but the Saracens, deſpairing of ſucceſs, pillaged and burnt Brindiſi, and then retired with their booty, and a great many captives to Sicily. Sicardo, then, without any apparent provocation, attacked the city of Amalfi, levelled its walls with the ground, carried off all its wealth, and the body of its tutelar ſaint Triphomen. A great many of the inhabitants were tranſported to Salerno; and by promoting alliances between the inhabitants of both places, he endeavoured to unite Amalfi to his own principality as firmly as poſſible.

During all theſe tranſactions, Sicardo had tyrannized over his ſubjects in ſuch a manner, that at laſt he became intolerable. Among other acts of injuſtice, he impriſoned his own brother Siconolphus; compelled him to turn prieſt; and afterwards ſent him bound to Tarento, where he cauſed him to be ſhut up in an old tower that had been built for a ciſtern. By ſuch acts of tyranny his nobles were provoked to conſpire againſt him; and in the year 839 he was murdered in his tent.

10
Sicardo murdered by Radelchis, which brings on a civil war.

On the death of Sicardo, Radelchis, his ſecretary or treaſurer, was unanimouſly elected prince of Benevento; but Siconolphus, the laſt king's brother, having regained his liberty, formed a great party againſt the new prince. Radelchis did not fail to oppoſe him with a formidable army; and a moſt ruinous civil war enſued. Both parties by turns called in the Saracens; and theſe treacherous allies acted ſometimes againſt one, and ſometimes againſt the other; or, turned their arms againſt both, as ſeemed moſt ſuitable to their own intereſt. Thus the war continued with the utmoſt animoſity for 12 years, during which time the principality was almoſt entirely ruined; till at laſt the emperor Lewis interpoſed, and obliged the competitors to agree to a partition of the principality. By this treaty, Radelchis promiſed to acknowledge Siconolphus and his ſucceſſors as lawful princes of the principality of Salerno, which was declared to contain Tarento, Latiano, Caſſano, Coſſenzo, Laino, Lucadia, Conſia, Montella, Rota, Salerno, Sarno, Cirateriurn, Furculo, Capua, Feano, Sora, and the half of the Gaſtaldate of Acerenza, where it joins Latiano and Conſia. The boundary betwixt Benevento and Capua was fixed at St Angelo ad Cerros; Alli Peregrini was made the boundary betwixt Benevento and Salerno, and Staffilo betwixt Benevento and Conſia. The monaſteries of Monte Caſſino and St Vincent were declared to be immediately under the protection of the emperor: both princes ſtipulated that no hoſtilities ſhould be committed by either againſt the ſubjects of each other; and promiſed to join their forces in order to drive out the Saracens. Soon after this pacification, however, both Radelchis and Siconolphus died, the former appointing his ſon Radelgarius, or Radelcar, to ſucceed him; and the latter leaving an infant ſon, Sico, to the care of his godfather, Peter.

11
The principality divided.

12
Unſucceſsful war with the Saracens.

The war with the Saracens proved very unſucceſsful: neither the united efforts of the princes, nor the aſſiſtance of the emperor Lewis himſelf, being able to expel the infidels; and in 854, Adelgiſe the ſecond ſon of Radelchis, who had now ſucceeded, on the death of his brother Radelcar, to the principality of Benevento, was obliged to pay them an annual ſubſidy. Two years after, Lando, count of Capua, revolted from the prince of Salerno, and could not be reduced. In the mean time, Sico, the lawful prince of Salerno, had been poiſoned by Count Lando, and the principality uſurped by Ademarius, the ſon of Peter above mentioned; but in 861, Ademarius himſelf was ſeized and impriſoned by Gauferius, the ſon of Dauferius formerly mentioned. This was occaſioned by his cruelty and rapaciouſneſs, which entirely alienated the hearts of his ſubjects from him, and encouraged Gauferius to become the head of the conſpirators. The Saracens in the mean time committed terrible ravages throughout the Beneventan territories; which at laſt obliged Adelgiſe to enter into an alliance with Gauferius, and both together ſent a moſt humble embaſſy to the emperor Lewis, requeſting him to take them under his protection. About the ſame time an embaſſy arrived from Conſtantinople, propoſing a junction of the forces of the eaſtern and weſtern empires againſt the infidels; upon which Lewis gave orders for aſſembling a formidable army. But in the mean time Adelgiſe fell off from his alliance, and made peace with the Saracens; nay, according to ſome, he encouraged them in their incurſions, and it was at his deſire that they invaded the duchy of Capua, and afterwards that of Naples, which they ravaged in a moſt barbarous manner. The Neapolitans, in conjunction with the duke of Spoletto and the count of Marſi, endeavoured to oppoſe them; but being defeated, the Saracens continued their ravages with redoubled fury, and retired to Bari, which was their capital city, with an immenſe booty.

In 866, Lewis arrived at Sora with his army: and having marched to Capua, was there joined by Landulph, the biſhop and count, with a body of Capuans: but Landulph ſoon after perſuading his countrymen to deſert, Lewis marched againſt that city, which he took after a ſiege of three months, and almoſt totally deſtroyed. In the end of the year he was joined by Gauferius with his quota of troops, having ordered the eyes of Ardemarius to be put out in his abſence. Lewis confirmed him in the principality, and marched with his army to Benevento, where Adelgiſe received him with great reſpect. Having reduced ſome inconſiderable places belonging to the Saracens, Lewis ſoon after inveſted Bari; but as the Saracens received continual ſupplies from their countrymen ſettled in Sicily, and beſides were protected by the Neapolitans, he could not reduce the place till the year 871, though he had received conſiderable aſſiſtance from his brother Lotharius, and the Greek emperor had ſent him a fleet of

13 Th y are at ſt expe d,

14 bu ſoon re n.

200 ſail. The expulſion of the Saracens was completed the ſame year by the taking of Tarento; after which the emperor returned with great glory to Benevento, reſolving next to carry his arms into Sicily, and expel the infidels from thence alſo. But his future ſchemes of conqueſt were fruſtrated by a quarrel between him and Adelgiſe. The latter, pretending to have been inſulted by the empreſs, and oppreſſed by the French, ſeized the emperor himſelf, and kept him priſoner for 40 days. His impriſonment would probably have been of much longer continuance, had not a body of Saracens arrived from Africa, who, being joined by ſuch of their countrymen as had concealed themſelves in Italy, laid ſiege to Salerno with an army of 30,000 men, ravaging the neighbouring country at the ſame time with the utmoſt barbarity. By this new invaſion Adelgiſe was ſo much alarmed, that he ſet the emperor at liberty, but firſt obliged him to ſwear that he would not revenge the inſult that had been offered him, and that he would never return to Benevento. Lewis having then joined his forces to thoſe of the prince of Salerno, ſoon obliged the Saracens to raiſe the ſiege of Salerno; but though they were prevented from taking that city, they entirely deſtroyed the inhabitants of Calabria, leaving it, according to the expreſſion of one of the hiſtorians of that time, "as deſolate as it was at the flood."

15 T pope b mes th r tributa .

In the year 873, Lewis being abſolved from his oath by the pope, went to Benevento, and was reconciled to Adelgiſe; but ſoon after this reconciliation he died, and the Saracens continued their ravages to ſuch a degree that the inhabitants of Bari were conſtrained to deliver up their city to the Greeks. At the ſame time the Salernitans, Neapolitans, Cajetans, and Amalfitans, having made peace with the Saracens, were compelled to agree to their propoſal of invading the territories of the Roman pontiff. His holineſs exerted himſelf to the utmoſt, both with ſpiritual and temporal weapons, in order to defend his right; but was at laſt reduced to the neceſſity of becoming a tributary to the infidels, and promiſing to pay them a large ſum annually.

In the mean time, all Italy was thrown into the greateſt confuſion by the death of Charles the Bald, who died of poiſon at Pavia, as he was coming to the pope's aſſiſtance. Sergius duke of Naples continued a firm friend to the infidels; nor could he be detached from their intereſts even by the thunder of a papal excommunication: but unluckily happening to fall into the hands of his brother Athanaſius biſhop of Naples, the zeal of that prelate prompted him to put out his eyes, and ſend him a cloſe priſoner to Rome; for which the higheſt encomiums were beſtowed on him by the holy father.

In 876, Adelgiſe was murdered by two of his nephews; one of whom, by name *Guideris*, ſeized the principality. About the ſame time Landulph biſhop of Capua dying, a civil war enſued among his children, though their father's dominions had been divided among them according to his will. The princes of Salerno and Benevento, the duke of Spoletto, and Gregory the Greek governor of Bari and Otranto, took different ſides in the quarrel, as they thought moſt proper; and to complete the confuſion, the new biſhop was expelled, and his brother, though a layman, choſen to that office, and even conſecrated by the pope, who wrote to Gauferius, forbidding him to attack Capua under pain of excommunication. But though Gauferius was, in general, obedient to the pope's commands, he proved refractory in this particular, and laid ſiege to Capua for two years ſucceſſively.

Thus the Capuan territories were reduced to the moſt miſerable ſituation; being obliged to maintain at the ſame time the armies of the prince of Benevento and the duke of Spoletto. The Saracens, in the mean time, took the opportunity of ſtrengthening themſelves in Italy; and Athanaſius, notwithſtanding the great commendations he had received from the pope for putting out his brother's eyes, conſented to enter into an alliance with them, in conjunction with whom he ravaged the territories of the pope, as well as thoſe of Benevento and Spoletto, plundering all the churches, monaſteries, towns, and villages, through which they paſſed. At the ſame time the prince of Salerno was obliged to grant them a ſettlement in the neighbourhood of his capital; the duke of Gaeta invited them to his aſſiſtance, being oppreſſed by the count of Capua; and even the pope himſelf was obliged to make peace with them, and to grant them a ſettlement on the north ſide of the Carigliano, where they fortified themſelves, and continued for more than 40 years.

To put a ſtop to the confuſion which reigned in Italy, the pope now thought proper to reſtore the biſhop of Capua, who had been expelled, but allowed his brother to reſide in the city, and govern one half of the dioceſe; but notwithſtanding this partition, the civil diſſenſions continued with the utmoſt violence, the neareſt relations murdering or baniſhing each other, according as the fortune of the one or the other prevailed. Athanaſius, notwithſtanding all the pope's remonſtrances, continued his alliance with the Saracens; in conjunction with whom he ravaged the territory of Benevento, and fomented the diviſions in Capua, in hopes of being able to make a conqueſt of it. At laſt his holineſs thought proper to iſſue a ſentence of excommunication againſt him: but this attached him to the Saracens more than ever: inſomuch that he ſent to Suchaim, king of the Saracens in Sicily, deſiring him to come over and command a great body of his countrymen who had ſettled at the foot of Mount Veſuvius. Suchaim accepted the invitation, and immediately turned his arms againſt Athanaſius; allowing his troops to live at diſcretion in the territory of Naples, where they raviſhed the women, and plundered the inhabitants. Theſe calamities were, by the ſuperſtitious Neapolitans, imagined to be a conſequence of the ſentence of excommunication; and therefore they uſed their utmoſt endeavours to perſuade the prelate to conclude a league with ſome Chriſtian prince, and renounce all connexion with the infidels. In this they at laſt proved ſucceſsful, and Athanaſius concluded an alliance with Guaimarius prince of Salerno; in conſequence of which the Saracens were obliged to quit the Neapolitan territories, and retire to Agropoli. Athanaſius then directed his force againſt Capua, of which he made himſelf maſter in the year 882. The Saracens, however, ſtill continued their incurſions, and ravaged ſeveral provinces in ſuch a manner, that they became entirely deſolate.

Theſe confuſions continued for a long time; during which

16 The Saracens almoſt entirely cut off.

which the Greeks found an opportunity of making themſelves maſters of Benevento, and well nigh became maſters alſo of Salerno; but in this they failed through the treachery of the biſhop, and in the year 896 they were totally expelled by the biſhop, four years after they had become maſters of it. In 915 the Saracens received ſuch an overthrow at Carigliano, that ſcarce one of them remained. However, a new body ſoon arrived from Africa, and infeſted the ſea coaſts for ſome time longer. A war alſo enſued between Landulph and the Greeks; which concluded diſadvantageouſly for the former, who was obliged to ſubmit to the emperor of Conſtantinople in 943.

In 961, Otho the Great, king of Germany, invaded Italy with a powerful army againſt Berengarius III. and, marching to Rome, received the imperial crown from the hands of the pope. In 964, he erected Capua into a principality, received homage from the other princes of Lombardy, and formed a deſign of recovering Puglia and Calabria from the Greeks. But in this laſt ſcheme he failed; and after various hoſtilities a treaty was concluded, and the young princeſs Theophania married to Otho's ſon, afterwards emperor.

17 The Normans firſt known in Italy.

All this time the Saracens continued their incurſions; and the Greeks had gained ground ſo much, that they were now in poſſeſſion of two-thirds of the preſent kingdom of Naples; but in the year 1002 or 1003, the Normans firſt began to be remarkable in Italy. They had, about a century before, embraced Chriſtianity, and become very zealous in all the ſuperſtitions which were then practiſed. They were particularly zealous in viſiting ſacred places, eſpecially Rome, and the holy ſepulchre at Jeruſalem; and being naturally of a very martial diſpoſition, they forced through great bodies of Greeks and Saracens who oppoſed their paſſage. About this time 40, or, as others write, 100, of theſe Normans, returning from Jeruſalem by ſea, landed at Salerno in the habit of pilgrims, where they were honourably received by Guaimarius. During their reſidence at Salerno, a great body of Saracens landed, and inveſted the city. Guaimarius, not being in a condition to oppoſe the invaders by force, was preparing to pay them a large ſum of money, which they demanded, when the Normans propoſed to attack them; and, having got arms and horſes from the prince, they engaged the infidels with ſuch fury and bravery, that they entirely defeated them, and obliged them to fly to their ſhips. By this complete victory Guaimarius was filled with ſuch admiration of the valour of theſe ſtrangers, that he entreated them to remain in his country; offering them lands, and the moſt honourable employments: but not being able to prevail with them to ſtay in Italy, or even accept of his preſents; at their departure he ſent ſome ambaſſadors with them to Normandy, in veſſels loaded with exquiſite fruits, rich furniture for horſes, &c. in order to allure the valiant Normans to leave their own country. This kind invitation encouraged a Norman chief, named *Oſmond Drengot*, to ſettle in Italy about the year 1015; having killed another lord in a duel, which obliged him to leave his own country, in order to avoid the reſentment of his ſovereign, Robert duke of Normandy. In the mean time, the city of Bari had revolted from the Greeks, and choſen one Mello for their leader, whoſe wife and children happened ſoon after to fall into the hands of their enemies, and were ſent priſoners to Conſtantinople. No ſooner, therefore, did Mello hear of the arrival of theſe adventurers, than he engaged them to aſſiſt him; and having drawn together a conſiderable army, defeated the Greeks with great ſlaughter, and obliged them to abandon their camp. In this engagement the Normans diſtinguiſhed themſelves by their bravery; and the news of their ſucceſs ſoon brought from Normandy an innumerable multitude of their countrymen, with their wives and children. By this reinforcement, Mello gained two other victories, took a great many towns, and obliged the Greeks to abandon a large territory; but, in 1019, they were utterly defeated, and every thing recovered by the Greeks. The Greek general, Bajanus, continued to go on with ſuch ſurpriſing ſucceſs, that he almoſt entirely re-eſtabliſhed the affairs of his countrymen in Italy, and made a diſtinct province of the weſtern part of Puglia, which he called *Capatanata*, and which to this day retains the name of *Capitanata*. His great progreſs at laſt alarmed the emperors of Germany; and, in 1027, Pandulphus prince of Capua made himſelf maſter of Naples; but was obliged, three years afterwards, to leave it, by the Normans, who built the city of Averſa, which was now erected into a county. In conſequence of this piece of good fortune, great numbers of Norman adventurers migrated into Italy; among whom were William, Drogo, and Umbert, three of the ſons of Tancred duke of Hautville; from whoſe poſterity thoſe princes were deſcended, who firſt conquered the iſland of Sicily from the Saracens, and formed the preſent kingdom of Naples.

18 They return and defeat the Greeks,

19 but are at laſt defeated by them.

20 The Normans paſs over into Sicily.

In 1040, the Greek emperor Michael Paleologus, in order to ſecure the affection of his fickle ſubjects, undertook the conqueſt of Italy from the Saracens, and for that purpoſe ſent a general named *Michael Maniacus* into Sicily. This commander, hearing of the great reputation of the Normans, ſent to Guaimarius, prince of Salerno, entreating him to grant him ſome of thoſe warriors. His requeſt was moſt willingly hearkened to by the prince of Salerno, who, to encourage the Normans to engage in the expedition, promiſed them ſome additional rewards beſides the emperor's pay. William, Drogo, and Umbert, accordingly marched from Salerno with 300 of their countrymen; and, paſſing over into Sicily, diſtinguiſhed themſelves moſt remarkably in the conqueſt of that iſland. Maniacus acknowledged, that the recovery of Meſſina was chiefly owing to their valour; and William with his Normans gained a complete victory over the Saracens before Syracuſe, where he killed the governor of the city in ſingle combat. Maniacus made himſelf maſter of Syracuſe, and almoſt entirely reduced the whole iſland; but, being accuſed of treaſon, was next year carried priſoner to Conſtantinople. His ſucceſſor Doceanus, being a man of no abilities, quickly loſt the whole iſland except Meſſina, and treated his Norman auxiliaries with the utmoſt contempt. He would not allow them any ſhare of the booty; and even cauſed one Ardoin, a noble Lombard, and aſſociate and interpreter of the Normans, to be whipped round the camp, becauſe he refuſed to part with the horſe of a Saracen whom he had ſlain in ſingle combat. The conſequences of this tyrannical behaviour were very fatal to the Greeks.

21 Their conqueſt.

Greeks. Ardoin ſoon after obtained leave to return to Italy under a pretence of a vow, and all the Normans embarked at night along with him; but inſtead of going to Rome, Ardoin went immediately to Averſa, where he perſuaded Count Rainulphus, ſovereign of that province, to join with him in the deſign he had formed of attacking the Greek provinces in Italy, which he ſhowed him would be an eaſy conqueſt, as the inhabitants ſubmitted with great reluctance to the Greeks, and the provinces were at that time almoſt entirely defenceleſs. Rainulphus approved of the ſcheme, and raiſed 300 ſoldiers, whom he ſent under 12 officers to join the other Normans under the ſons of Tancred; and made an agreement with Ardoin, that the conqueſts ſhould be equally divided among the chief leaders. Their firſt enterpriſe was the reduction of Melphis, one of the ſtrongeſt cities in Puglia, which preſently ſurrendered; and they increaſed its fortifications ſo much, that it thenceforth became impregnable. Soon after this they made themſelves maſters of Venoſa, Aſcoli, and Lavello, with very little oppoſition. Doceanus, alarmed with the rapidity of their conqueſts, immediately left Sicily, and marched with his army into Puglia, where he attacked the invaders near the river Oliviento; but after a fierce engagement, he was obliged to retire with conſiderable loſs. The Greeks were ſoon after defeated a ſecond time at Cannæ; and in a third engagement, which happened near the river Ofanto, the army of Doceanus was entirely routed, and he himſelf obliged to fly to Bari. On this bad ſucceſs Doceanus was ordered to return to his command in Sicily, and another general was ſent with an army into Puglia. This new commander, however, had no better ſucceſs than his predeceſſor; for his army was entirely defeated in an engagement with the Normans, and he himſelf taken priſoner. Atenulphus, brother to one of the princes of Benevento on whom the Normans had conferred the chief command, ſet at liberty the captive general without conſulting them, on receiving from him a conſiderable ſum of money. With this the Normans were ſo much diſpleaſed that they deprived Atenulphus of his command, and beſtowed it on Argyrus ſon to the late Mello, who had eſcaped from Conſtantinople, and now aſſumed the title of *duke and prince of Italy*. Before this time alſo Maniacus, whom we have formerly mentioned, had returned to Italy; and to ſtrike the greater terror into the revolted cities, had executed a number of people of all ages and ſexes with great inhumanity. Soon after this Maniacus openly rebelled againſt the Greek emperor Conſtantinus, and prevailed upon his own army to proclaim him emperor, beginning hoſtilities immediately againſt the Greek cities. Argyrus at the ſame time took Giovenazzo and beſieged Trani, and ſoon after beſieged Maniacus himſelf in Tarento; but he, being afraid of falling into the hands of the Normans, fled to Otranto, and from thence to Bulgaria, where, being entirely defeated by one of the emperor's generals, he was taken priſoner, and had his head ſtruck off.

22 Great numbers of them maſſacred.

23 They are confirmed by the Pope in all their conqueſts.

The Normans having now conquered the greateſt part of Puglia, proceeded to make a diviſion of their conqueſt, in which, after each commander had got his proper ſhare, the city of Melfis was left common to all, and appropriated as a place for aſſembling to conſult about the moſt important affairs of the nation. Argyrus alone was neglected in this diviſion; but he, having gained the favour of the emperor by expelling the rebel Maniacus from Italy, was by him created duke of Bari, on purpoſe to check the power of the Normans, with the title of *prince and duke of Puglia*. The Normans, however, were too powerful to be much awed by Argyrus, and behaved with great inſolence to the neighbouring princes; but as they could not be expelled by force, and were confirmed in their conqueſts by Henry II. emperor of Germany in 1047, the Greek emperor attempted to get rid of them, by ſending Argyrus with large ſums of money to bribe them to enter into his ſervice againſt the Perſians. But they, perceiving the ſnare, replied that they were reſolved not to leave Italy unleſs they were expelled by force: upon which Argyrus made uſe of the ſame money in bribing the Puglians to aſſaſſinate theſe invaders. This brought on a maſſacre, in which greater numbers of Normans periſhed than had fallen in all the late wars. Argyrus attempted to take advantage of the confuſion produced by this maſſacre, but was defeated; after which he had recourſe to Pope Leo, beſeeching him to deliver Italy from theſe cruel tyrants: but this ſcheme proved ſtill more unſucceſsful than the others had been; for the pope himſelf was defeated and taken priſoner; and, in conſequence of the reſpect ſhowed him by the Normans, granted them, as a fief of the holy ſee, all the conqueſts they had made or ſhould make in Calabria and Sicily.

24 Sicily conquered by Robert Guiſcard.

Soon after this, the Norman power became extremely formidable; the famous Robert Guiſcard aſcended the throne in 1056. He made great progreſs in the conqueſt of Calabria, and reduced moſt of the cities which held out for the Greeks in theſe parts. About the ſame time the counts of Capua were expelled from their territory; and the abbot Deſiderius mentions his having ſeen the children of Landulphus V. the laſt count, going about as vagabonds, and begging for their ſupport. The pope alarmed by theſe conqueſts, excommunicated the Normans in wholeſale, pretending that they had ſeized ſome of the territories belonging to the church; but by the pretended ſubmiſſion of Robert, he not only was perſuaded to take off the ſentence of excommunication, but to inveſt him with the provinces of Apulia, Calabria, and Sicily. After this, he continued the war againſt the Greeks with great ſucceſs. In 1071, in conjunction with his brother Roger, he conquered the iſland of Sicily, and gave the inveſtiture of the whole iſland to him with the title of *count*, reſerving to himſelf only the half of Palermo, Meſſina, and the valley of Demona. The like ſucceſs attended his arms againſt Salerno in 1074; but after this, having unadviſedly taken ſome places from the pope, he again fell under the ſentence of excommunication; yet he was reconciled to him in 1080, and received a ſecond time the inveſtiture of all his dominions. The next year he undertook an expedition againſt the Greeks; and though the emperor was aſſiſted by a Venetian fleet, Robert made himſelf maſter of the iſland of Corfu, reduced Durazzo, and great part of Romania; inſomuch that by the ſucceſs of his arms, and his near approach to Conſtantinople, he ſtruck an univerſal terror among the Greeks. But while Robert was thus extending his conqueſts, he was alarmed by the news of a formidable rebellion in Italy, and that the emperor Henry had taken the city of Rome, and cloſely ſhut up the pope in the caſtle of St Angelo. Robert, therefore, leaving the command of the army to his ſon Boemund, returned to Italy, where he immediately diſperſed the rebels, and releaſed the pope, while his ſon gained a conſiderable victory over the Greeks. After this Robert made great preparations for another expedition into Greece, in order to ſecond his ſon Boemund. Alexius Comnenus, who was about this time declared emperor by the Greek army, being aſſiſted by the Venetian fleet, endeavoured to oppoſe his paſſage; but was entirely defeated, with the loſs of a great many galleys. But a final ſtop was now put to his enterpriſes by his death, which happened in the iſland of Corfu in 1085.

Though the power of the Normans was thus thoroughly eſtabliſhed in Italy and Sicily, and though the prince of Benevento was in 1130 inveſted by the pope with the title of king of Sicily, yet by reaſon of the civil diſſenſions which took place among themſelves, and the general confuſion which reigned in Italy in thoſe ages, they were obliged, notwithſtanding all their valour, to ſubmit to the emperor in 1195. By him the Sicilians were treated with ſo great cruelty, that the empreſs Conſtantia was induced to conſpire againſt him in 1197, took him priſoner, and releaſed him only on condition of his ſending off his army immediately for the Holy Land. This was complied with; but the emperor did not long ſurvive the reconciliation, being poiſoned, as was ſuppoſed, by order of the empreſs.

25
And by the emperor of Germany.

In 1254 the pope claimed the kingdom as a fief devolved on the church in conſequence of a ſentence of depoſition pronounced againſt King Frederick at the council of Lyons; and, in 1263, the kingdom was, in conſequence of this right, conferred on Charles count of Anjou. After much contention and bloodſhed, the French thus became maſters of Sicily and Naples. Their government was inſupportably tyrannical; and at the ſame time the haughtineſs of their king ſo provoked the pope, that he reſolved to humble him.—Charles had reſolved on an expedition againſt Conſtantinople; and for this purpoſe had fitted out a fleet of 100 galleys, 30 large ſhips, 200 tranſports, beſides many other ſmaller veſſels, on board of which he intended to embark 10,000 horſe, and a numerous army of foot. This formidable armament greatly alarmed the emperor Michael Paleologus; for which reaſon he entered into a negotiation with John di Procida, a noble Salernitan, lord of the iſle of Procida in the bay of Naples, who had formed a ſcheme for a general revolt in the iſland of Sicily. John, though a nobleman, was alſo a phyſician, and had been counſellor to two former princes, and even to King Charles himſelf; but being ſtripped of his eſtate by the king under pretence of treaſon, and his wife being debauched by the French, he retired to Conſtantia queen of Arragon, where he was created a baron of the kingdom of Valencia, by her huſband King Peter, and lord of Luxen, Benizzano, and Palma. As he was greatly exaſperated againſt the French, he employed many ſpies both in Puglia and Sicily; and being informed that the Sicilians were totally diſaffected to the French, he came to the iſland in diſguiſe, and concerted a plan with the moſt powerful of the malecontents for a revolution in favour of Conſtantia, though ſhe derived her right only as being the daughter of a former uſurper named *Manfred*. Procida then ſet out for Conſtantinople, where in ſome private conferences with the emperor, he perſuaded him, that the moſt probable means of defeating Charles's ſcheme was by aſſiſting the Spaniards and Sicilian malecontents. Paleologus accordingly granted him a large ſum of money, and on his departure ſent one of his ſecretaries along with him, who, landing in Sicily, had a conference with the chief conſpirators. John, having received letters from them, diſguiſed himſelf in the habit of a Franciſcan, and went to Suriano in the neighbourhood of Rome. As he well knew the enmity which ſubſiſted between the pope and King Charles, he diſcloſed his deſign to his holineſs; who readily entered into his meaſures, wrote to Peter to haſten his armament, promiſing him the inveſtiture of the iſland as ſoon as he had taken poſſeſſion of it; and, by refuſing the aſſiſtance he had promiſed to Charles, obliged him for the preſent to delay his expedition. In the beginning of the year 1280, Procida returned to Arragon, and by ſhowing the letters from the pope and Sicilian barons, prevailed on Peter to embark in his deſign, by aſſuring him of the aſſiſtance of Paleologus. This king of Arragon accordingly prepared a formidable fleet under pretence of invading Africa, and is even ſaid to have received 20,000 ducats from Charles, in order to aſſiſt him in his preparations.

26
The French become maſters of Sicily and Naples.

But while John went on thus ſucceſsfully with his ſcheme, all his meaſures were in danger of being broke by the death of Pope Nicholas. The new pope, Martin IV. was entirely in the intereſt of Charles, on whom, in 1281, he conferred the ſenatorial dignity of Rome. Procida, however, ſtill reſolved to proſecute his ſcheme; and, leaving Italy, had another conference with the conſpirators in Sicily; after which, he again went to Conſtantinople, and obtained from Paleologus 30,000 ounces of gold, with which he immediately returned to Arragon. The death of Nicholas had damped the ardour of Peter; but, being urged with great earneſtneſs by John, he again renewed his preparations; which alarmed the pope and the king of France. In conſequence of this they ſent a meſſage to him, deſiring to know againſt what Saracens he deſigned to employ his armament. In this particular Peter refuſed to ſatiſfy them; upon which they earneſtly counſelled Charles to guard againſt an invaſion: but he neglected their advice, being wholly intent on his eaſtern expedition, and encouraged by a revolt which had happened in Greece; and to facilitate his expedition, he prevailed on the pope to excommunicate the Greeks, on pretence that they had broken ſome of the articles of union concluded at the council of Lyons a few years before. Peter in the mean time continued his preparations with great diligence, intending to put to ſea the following ſummer. Procida had returned to Palermo, to wait for a favourable opportunity of putting his deſign in execution, which was ſoon afforded him by the French. On Eaſter Monday, March 30. 1282, the chief conſpirators had aſſembled at Palermo; and, after dinner, both the Palermitans and French went in a grand proceſſion to the church of Monreale, about three miles without the city. While they were ſporting

27
They are maſſacred.

ſporting in the fields, a bride happened to paſs by with her train, who being obſerved by one Drochettus, a Frenchman, he ran to her, and began to uſe her in a rude manner, under pretence of ſearching for concealed arms. A young Sicilian, exaſperated at this affront, ſtabbed him with his own ſword; and a tumult enſuing, 200 French were immediately murdered. The enraged populace then ran to the city, crying out, "Let the French die, Let the French die;" and, without diſtinction of age or ſex, ſlaughtered all of that nation they could find, even ſuch as had fled to the churches. The conſpirators then left Palermo, and excited the inhabitants to murder the French all over the iſland, excepting in Meſſina, which city at firſt refuſed to be concerned in the revolt. But, being invited by the Palermitans to throw off the French yoke, a few weeks after, the citizens in a tumultuous manner deſtroyed ſome of the French; and pulling down the arms of King Charles, and erecting thoſe of the city, choſe one Baldwin for their governor, who ſaved the remaining French from the fury of the populace, and allowed them to tranſport themſelves, with their wives and children to Italy. Eight thouſand perſons are ſaid to have been murdered on this occaſion.

Immediately after this maſſacre, the Sicilians offered their allegiance to the king of Arragon; who accepted of the invitation, and landed with his forces at Trapani. From thence he went to Palermo, where he was crowned king of Sicily with great ſolemnity, and Charles left the iſland with precipitation. The day after he landed his army in Italy, the Arragonian fleet arrived, took 29 of his galleys, and the next day burnt 80 tranſports in preſence of his army. Soon after this Charles ſent an embaſſy to Peter, accuſing him of perfidy, in invading his dominions in time of peace; and, according to ſome, challenged him at the ſame time to decide the matter by ſingle combat. Others ſay that the challenge was given by Peter. Certain it is, however, that a challenge was given, and to appearance accepted: but Peter determined to employ much more effectual means in ſupport of his pretenſions than truſting to a duel; and therefore puſhed on his operations moſt vigorouſly, while his adverſary trifled away his time: and thus he at laſt became maſter of the conteſted kingdom; which, however, he did not long enjoy, dying about the end of the year 1285.

By his will, Peter left the kingdom of Arragon to his eldeſt ſon Alphonſus, and Sicily to Don James his other ſon, who was alſo to ſucceed to the kingdom of Arragon in caſe Alphonſus ſhould die without male iſſue. Accordingly, Don James was ſolemnly crowned at Palermo the 2d of February 1286. In 1295, however, he deſerted them, and tamely reſigned up his right to Charles, ſon to him above mentioned, in a manner perhaps unparalleled. On his reſignation the Sicilians conferred the crown upon his brother Don Frederic: after which the war continued with great violence till the year 1303, when a peace was concluded, and the kingdoms of Naples and Sicily formally disjoined; Frederic being allowed to keep the latter, under the name of *Trinacria;* and Charles being confirmed in the poſſeſſion of the former, which he quietly enjoyed till his death in 1309.

28
The kingdoms of Naples and Sicily diſjoined.

Naples continued to be governed by its own kings till the beginning of the 16th century, when the kings of France and Spain contended for the ſovereignty of this country. Frederic, at that time king of Naples, reſigned the ſovereignty to Louis XII. on being created duke of Anjou, and receiving an annual penſion of 30,000 ducats. But, in 1504, the French were entirely defeated by the Spaniards, and obliged to evacuate the kingdom; and the following year Louis renounced all pretenſions to the crown, which from this time hath remained almoſt conſtantly in the hands of the Spaniards.

29
The Spaniards become maſters of Naples.

The government of the Spaniards proved no leſs oppreſſive to the Neapolitans than that of others had been. The kings of Spain ſet no bounds to their exactions, and of conſequence the people were loaded with all manner of taxes; even the moſt indiſpenſable neceſſaries of life not being exempted. In 1647, a new tax was laid on fruit; which the people looked upon as the moſt grievous oppreſſion, the chief part of their ſubſiſtence, during the ſummer months, being fruit, which in the kingdom of Naples is very plentiful and delicious. The edict for collecting the new duty was no ſooner publiſhed, than the people began to murmur in a tumultuous manner; and when the viceroy came abroad, they ſurrounded his coach, bawling out to have their grievances redreſſed. They were encouraged in their ſedition, by the news that the citizens of Palermo had actually revolted on account of the impoſition of new duties. The viceroy, therefore, apprehenſive of greater diſorders, began to think of taking off the tax; but thoſe who farmed the tax having bribed ſome of his favourites, he was by their means perſuaded not to aboliſh it. The indignation of the people, who had ſuſpected his intention, was now greatly increaſed, eſpecially as they were privately excited by ſeveral malecontents. The farmers of the revenue, and all thoſe concerned in raiſing the taxes, had incurred the hatred and deteſtation of the people, particularly of Tommaſo Aniello, commonly called *Maſſaniello of Amalfi*, a fiſherman, whoſe wife, having been diſcovered in ſmuggling a ſmall quantity of meal, was impriſoned, and condemned to pay a fine of 100 ducats.

30
A general revolt.

31
Account of Maſſaniello.

Maſſaniello, a few years before, had come to Naples from Amalfi, where his father had been a fiſherman. At this time he was about 24 years of age, and the father of four children. He was of a middle ſtature, and an agreeable aſpect; was diſtinguiſhed for his boldneſs, activity, and integrity: and had a great influence with his companions, by whom he was beloved and eſteemed. As he was obliged even to ſell his furniture to pay the heavy fine, he had conceived an implacable hatred againſt the farmers of the taxes, and was alſo moved with compaſſion for the miſerable ſtate of the city and kingdom. He therefore formed a deſign, with ſome of his companions, to raiſe a tumult in the market place on the feſtival-day of the Carmelites, uſually celebrated about the middle of July, when between 500 and 600 youths entertain the people by a mock fight; one half of them, in the character of Turks, defending a wooden caſtle, which is attacked and ſtormed by the other half in the character of Chriſtians. Maſſaniello being appointed captain of one of theſe parties, and one Pione, who was privy to his deſign, commanding the other, for ſeveral weeks before the feſtival they were very diligent in reviewing and training their followers, who were armed with ſticks and reeds; but a ſmall and unforeſeen accident tempted them to begin their enterpriſe without waiting for the feſtival.

On the 7th of July a diſpute happening in the market-place betwixt the tax-gatherers and ſome gardeners of Pozzuolo who had brought ſome figs into the city, whether the buyer or ſeller ſhould pay the duty; after the tumult had continued ſeveral hours, Maſſaniello, who was preſent with his company, excited the mob to pillage the office built in the market for receiving the duty, and to drive away the officers with ſtones. The elect of the people, who, by deciding againſt the gardeners, had increaſed the tumult, ran to the palace, and informed the viceroy, who moſt imprudently neglected all means of putting a ſtop to the commotion. Maſſaniello, in the mean time, being joined by great numbers of people, ordered his young troop to ſet fire to all the offices for the taxes through the city; which command being executed with deſpatch, he then conducted them directly to the palace, where the viceroy, inſtead of ordering his Spaniſh and German guards to diſperſe them, encouraged their inſolence by timidly granting their demands. As they ruſhed into the palace in a furious manner, he eſcaped by a private door, and endeavoured to ſave himſelf in *Caſtel del Ovo;* but being overtaken by the rioters in the ſtreets, he was trampled upon by them, and pulled by the hair and whiſkers. However, by throwing ſome handfuls of gold among them, he again eſcaped, and took ſanctuary in a convent of Minims, where, being joined by the archbiſhop of Naples, Cardinal Filomarini, and ſeveral nobles, by their advice he ſigned a billet, by which he aboliſhed all taxes upon proviſions. As a means to quell the tumult, he likewiſe deſired the cardinal to offer Maſſaniello a penſion of 2400 crowns, who generouſly rejected the bribe; and declared, that if the viceroy would keep his word, he would find them obedient ſubjects.

It was now expected that the tumult would ceaſe; but Maſſaniello, upon his return to the market-place, being joined by ſeveral malecontents, among whom were Genuino and one Peronne, who had formerly been a captain of the Sbirri, he was adviſed by them to order the houſes of thoſe concerned in raiſing the tax to be burned; which were accordingly in a few days reduced to aſhes, with all their rich furniture. Maſſaniello being now abſolute maſter of the whole city, and being joined by great numbers of people of deſperate fortunes, he required the viceroy, who had retired to the *Caſtel Nuovo*, to aboliſh all the taxes, and to deliver up the writ of exemption granted by Charles V. This new demand greatly embarraſſed the viceroy; but to appeaſe the people, he drew up a falſe deed in letters of gold, and ſent it to them by their favourite the duke of Matalone, who had before been in confinement. The fraud, however, being diſcovered, the duke was pulled from his horſe and maltreated by the mob, and at length committed as a priſoner to Peronne. This accident, to the great joy of the viceroy, enraged the people againſt the nobility, ſeveral of whom they killed, burnt the houſes of others, and threatened to extirpate them all. Maſſaniello, in the mean time, tattered and half naked, commanded his followers, who were now well armed, and reckoned about 100,000 men, with a moſt abſolute ſway. He ate and ſlept little, gave his orders with great preciſion and judgement, appeared full of moderation, without ambition and intereſted views. But the duke of Matalone having procured his liberty by bribing Peronne, the viceroy imitated his example, and ſecretly corrupted Genuino to betray his chief. A conſpiracy was accordingly formed againſt Maſſaniello by Matalone and Peronne; the duke, who was equally exaſperated againſt the viceroy, propoſing, that after his death his brother D. Joſeph ſhould head the rebels.

Maſſaniello in the mean time, by means of the cardinal archbiſhop, was negotiating a general peace and accommodation; but while both parties were aſſembling in the convent of the Carmelites, the banditti hired by Matalone made an unſucceſsful attempt upon Maſſaniello's life. His followers immediately killed 150 of them. Peronne and D. Joſeph being diſcovered to be concerned in the conſpiracy, were likewiſe put to death, and the duke with great difficulty eſcaped. Maſſaniello by this conſpiracy was rendered more ſuſpicious and ſevere. He began to abuſe his power by putting ſeveral perſons to death upon ſlight pretences; and, to force the viceroy to an accommodation, he cut off all communication with the caſtles, which were unprovided with proviſion and ammunition.—The viceroy likewiſe being afraid leſt the French ſhould take advantage of the commotion, earneſtly deſired to agree to a treaty; which was accordingly concluded on the fifth day of the inſurrection, by the mediation of the archbiſhop. By the treaty it was ſtipulated, that all duties impoſed ſince the time of Charles V. ſhould be aboliſhed; that the writ of exemption granted by that emperor ſhould be delivered to the people; that for the future no new taxes ſhould be impoſed; that the vote of the elect of the people ſhould be equal to the votes of the nobility; that an act of oblivion ſhould be granted for all that was paſt; and that the people ſhould continue in arms under Maſſaniello till the ratification of the treaty by the king.

32
A treaty concluded between Maſſaniello and the viceroy.

By this treaty, no leſs than 10,000 perſons who fattened upon the blood of the public were ruined.—The people when it was ſolemnly publiſhed, manifeſted an extreme joy, believing they had now recovered all their ancient rights and privileges. Maſſaniello, at the deſire of the viceroy, went to the palace to viſit him, accompanied by the archbiſhop, who was obliged to threaten him with excommunication, before he would conſent to lay aſide his rags and aſſume a magnificent dreſs. He was received by the duke with the greateſt demonſtrations of reſpect and friendſhip, while the ducheſs entertained his wife, and preſented her with a robe of cloth of ſilver, and ſome jewels.—The viceroy, to preſerve ſome ſhadow of authority, appointed him captain-general; and at his departure made him a preſent of a golden chain of great value, which with great difficulty he was prevailed upon to accept; but yielded at length to the entreaties of the cardinal. Next day, in conſequence of the commiſſion granted him by the viceroy, he began to exerciſe all the functions of ſovereign authority; and having cauſed a ſcaffold to be erected in one of the ſtreets, and ſe-

33
Maſſaniello appointed captain-general.

veral gibbets, he judged all crimes, whether civil or military, in the laſt reſort; and ordered the guilty to be immediately put to death, which was the puniſhment he aſſigned to all offences. Though he neglected all forms of law, and even frequently judged by phyſiognomy, yet he is ſaid not to have overlooked any criminal, or puniſhed any innocent perſon.

His grandeur and proſperity were of very ſhort continuance; for his mind becoming diſtracted and delirious for two or three days, he committed a great many mad and extravagant actions; and on the 18th of July he was aſſaſſinated with the conſent of the viceroy.

34
Is aſſaſſinated.

The tumult did not end with the death of Maſſaniello: on the contrary, the people now expelled the Spaniards from moſt of the cities throughout the kingdom; and this general inſurrection being the ſubject of diſcourſe at Rome, the duke of Guiſe, who happened then to be at the pope's court, took the opportunity, at the inſtigation of his holineſs, to offer his ſervice to the Neapolitans againſt the Spaniards. The duke was prompted by his ambition to engage in this enterpriſe, eſpecially as he himſelf had ſome diſtant pretenſions to the crown. The Spaniards in the mean time made a vigorous attack on the city; but were repulſed by the people, who now formally renounced their allegiance to them. In a ſhort time, however, their city being ſurpriſed by the new viceroy, the count d'Oniate, and the duke of Guiſe himſelf taken priſoner, the people returned to their allegiance; and thus all the attempts of the French on Naples were fruſtrated. From that time the Spaniards continued in peaceable poſſeſſion of the kingdom till the year 1707, when it was taken from them by Prince Eugene. It was formally ceded to the emperor by the treaty of Raſtadt in 1713; but was recovered by the Spaniards in 1734, and the king of Spain's eldeſt ſon is now king of Naples and Sicily. For a particular account of theſe revolutions, ſee the articles SPAIN and SICILY.

35
The people return to their allegiance.

36
Climate, produce, &c. of Naples.

The climate of Naples is extremely hot, eſpecially in July, Auguſt, and September. In winter there is ſeldom any ice or ſnow, except on the mountains.—On account of its fertility, it is juſtly termed an earthly paradiſe; for it abounds with all ſorts of grain, the fineſt fruit and garden productions of every kind, with rice, flax, oil, and wine, in the greateſt plenty and perfection. It affords alſo ſaffron, manna, alum, vitriol, ſulphur, rock cryſtal, marble, and ſeveral ſorts of minerals, together with fine wool, and ſilk. The horſes of this country are famous, and the flocks and herds very numerous. Beſides theſe products, of which a conſiderable part is exported, there are manufactures of ſnuff, ſoap, and glaſs ware. Waiſtcoats, caps, ſtockings, and gloves, are alſo made of the hair or filaments of a ſhell fiſh, which are warmer than thoſe of wool, and of a beautiful gloſſy green. In this kingdom likewiſe is found that called the *Phrygian ſtone*, or *pietra fungifera*, which, being laid in a damp ſhady place, will yield muſhrooms, ſometimes of a very large ſize, eſpecially if the ſtone is ſprinkled with hot water. See AGARICUS.

As to the mountains of this country, the principal are the Apennines, which traverſe it from ſouth to north; and Mount Veſuvius, which, as is well known, is a noted volcano, five Italian miles from Naples. The ſide of this mountain next the ſea yields wine, particularly the two famed wines called *Vino Greco* and *Lachrymæ Chriſti*. One of the greateſt inconveniencies to which this kingdom is expoſed is earthquakes, which the eruptions of Mount Veſuvius contribute, in ſome meaſure, to prevent. Another inconveniency, which, however, is common to it with other hot countries, is the great number of reptiles and inſects, of which ſome are very poiſonous.

37
Religion.

With reſpect to religion, it is on a very bad footing here. The number of convents and monaſteries is aſtoniſhing. It is ſaid, the clergy and convents poſſeſs two thirds of the whole kingdom: nay, ſome maintain, that were the kingdom divided into five parts, four would be found in the hands of the church. Notwithſtanding this power and influence of the clergy, they have not been able hitherto to get the inquiſition eſtabliſhed here. In the year 1731, meaſures were taken for leſſening the number of convents; and lately the order of Jeſuits hath been ſuppreſſed. The papal bulls cannot be made public without the king's permiſſion; nor are Proteſtants compelled to kneel in the churches, or at meeting the hoſt; and in Lent they can very eaſily procure fleſh meat. In the year 1740, the Jews were allowed to ſettle in the kingdom during the term of 50 years, and ſeveral privileges were granted them during that period; at the expiration of which, the grant was ſuppoſed to be renewed, unleſs they were expreſsly ordered to quit the country.

38
Revenue, &c.

The revenue of the kingdom is generally computed at 3,000,000 of crowns: but, as Mr Addiſon obſerves, there is no country in Europe which pays greater taxes, and where, at the ſame time, the public is leſs the better for them, moſt of them going to the enriching of the private perſons to whom they are mortgaged.

The military force of this kingdom is ſaid to conſiſt of about 30,000 men, of which the Swiſs regiments are the beſt. As to the marine, it conſiſts only of a few galleys. The only order here is that of St Januarius, which was inſtituted by Don Carlos in the year 1738.

The king of Naples, or of the two Sicilies, is an hereditary monarch. The high colleges are, the council of ſtate, the privy council, the treaſury, the Sicily council, the council of war, &c. This kingdom is a papal fief; and the king, in acknowledgement of the pope's feudal right, ſends him every year a white palfry, and a purſe of 6000 ducats. The title of the king's eldeſt ſon is *prince of Calabria*. The number both of the high and low nobility in the kingdom of Naples is very great. "I am aſſured (ſays Dr Moore *) that the king of Naples counts among his ſubjects 100 perſons with the title of prince, and a ſtill greater with that of duke. Six or ſeven of theſe have eſtates which produce from 10 to 12 or 13,000l. a-year; a conſiderable number have fortunes of about half that value; and the annual revenue of many is not above 1000l. or 2000l. The inferior orders of the nobility are much poorer. Many counts and marquiſſes have not above 300l. or 400l. a-year of paternal eſtate; many have ſtill leſs; and not a few enjoy the title without any eſtate whatever. Theſe nobles, however, are exceſſively fond of ſplendour and ſhow, which appears in the brilliancy of their equipages, the number of their attendants, the richneſs of their dreſs, and the

---

* *View of Society, &c in Italy.*

grandeur of their titles. The fineſt carriages are painted, gilt, varniſhed, and lined, in a richer and more beautiful manner than has yet become faſhionable either in England or in France. They are often drawn by ſix and ſometimes by eight horſes. Before the carriage, it is the mode to have two running footmen, and behind three or four ſervants in the richeſt liveries. The ladies and gentlemen within the coaches glitter in all the brilliancy of lace, embroidery, and jewels.—This finery is not confined to the perſons within and without the coaches; it is extended to the horſes, whoſe heads, manes, and tails, are ornamented with the rareſt plumage, and ſet off with ribbons and artificial flowers."

We ſhall mention a circumſtance from which an idea may be formed of the grandeur of a Neapolitan palace, and the number of domeſtics which ſome of the nobility retain. "I dined (continues our author) at the prince Iacci's, where we paſſed through 12 or 13 large rooms before we arrived at the dining room. There were 36 perſons at table ſerved by the prince's domeſtics, and each gueſt had a footman behind his chair, while other domeſtics belonging to the prince remained in the adjacent rooms and in the hall. No eſtate in England could ſupport ſuch a number of ſervants, paid and fed as Engliſh ſervants are; but in Naples the wages are very moderate indeed, and the greater number of men ſervants, belonging to the firſt families, give their attendance through the day only, and find beds and proviſions for themſelves. It muſt be remembered alſo, that few of the nobles give any entertainments; and thoſe who do not are ſaid to live very ſparingly; ſo that the whole of their revenue, whatever it may be, is expended on articles of ſhow."

In the kingdom of Naples, the hereditary juriſdiction of the nobles over their vaſſals ſubſiſts in the full rigour of the feudal government. The peaſants therefore are poor; and it depends entirely on the perſonal character of the maſter, whether their poverty be not the leaſt of their grievances. As this power is too often abuſed, the importance of the nobility depends in a great meaſure on the favour of the king, who, under pretence of any offence, can confine them to their eſtates, or impriſon them at pleaſure. Unleſs this prince were ſo very impolitic as to diſguſt all the nobility at once, and ſo unite the whole body againſt him, he has little to fear from their reſentment. Even in caſe of ſuch an union, as the nobles have loſt the affection of their vaſſals, what could they do in oppoſition to a ſtanding army of 30,000 men, entirely devoted to the crown? The government of Naples, therefore, is in fact a deſpotic monarchy, though ſomething like the form of a feudal conſtitution in its ancient purity is ſtill kept up by the biennial ſummons of the general aſſembly. This convention, which conſiſts of the nobility and commons, is called together every two years, to deliberate on the cuſtomary free gift to the crown.

The inhabitants of this country have at all times borne but an indifferent character among other nations. "From the few hints dropped by the claſſic authors, we collect that the ancient Neapolitans were a race of epicures, of a ſoft indolent turn, averſe from martial exerciſes, paſſionately fond of theatrical amuſements and muſic, expert in all the refined arts that adminiſter to the caprices of luxury, extravagant in their expreſſions and geſtures, and dupes to various ſorts of ſuperſtition. If we make allowance for a quantity of northern blood which has joined the original Grecian ſtream, and imparted a roughneſs not yet worn off by the mildneſs of the climate, we ſhall find the modern Neapolitans very like the ancient.—Proviſions being here plentiful and cheap, the lower claſs of people work but little. Their delight is to baſk in the ſun, and do nothing. Perſons of a middle rank frequent places of public reſort; and very few of any rank attend to their proper buſineſs with the zeal and activity we are wont to meet with in the profeſſional men of colder countries. Gluttony is a predominant vice, while inſtances of ebriety are comparatively rare. In the female ſex, the paſſion for finery is almoſt ſuperior to every other; and, though chaſtity is not the characteriſtic virtue of the country, Mr Swinburne doubts * whether a Neapolitan woman would not nine times out of ten prefer a preſent to a lover. That furious jealouſy for which the nation was once ſo remarkable, is now greatly abated. The breach of the conjugal vow ſometimes occaſions quarrels and aſſaſſinations among people of an inferior ſtation; and in the metropolis, aſſaſſinations are often perpetrated from much leſs cogent motives. Of theſe vices, many are doubtleſs owing to that ſlavery and oppreſſion under which they groan, and to a radical defect in the adminiſtration of juſtice, though the kingdom is divided into 12 provinces or juriſdictions.

Such was the former ſtate of Naples. But being ſeized by the emperor of France, he affirmed, "the Neapolitan dynaſty has ceaſed to reign: its exiſtence is incompatible with the repoſe of Europe, and the honour of our crown." By virtue of a decree which paſſed in the month of March 1806, the emperor Napoleon conferred the kingdom of Naples on his brother Joſeph, now king of Spain, and his legitimate heirs male, reſerving to that prince the rights aſſured to him by the conſtitutions of the empire, in providing always that the crown of France and that of Naples ſhall never be united upon the ſame head. Murat ſucceeded Joſeph as king of Naples.

NAPLES, anciently *Parthenope*, afterwards *Neapolis*, the capital of the kingdom of that name in Italy, lies in the province called *Terra di Lavora*, which is the richeſt and beſt inhabited of the whole kingdom, and comprehends a part of the ancient Campania Felix or the Happy. This city is fabled to owe its foundation to a Syren, and to have received its ancient name from its ſupernatural foundreſs. Whatever be its origin, it is the firſt for neatneſs, and the ſecond for extent, of all the cities in Italy. It was formerly a place of ſtrength; but its walls at preſent being of no real defence, its ſafety depends of courſe upon the force of its armies. It is moſt advantageouſly ſituated, having a delicious country on one ſide, and a noble bay of the Mediterranean on the other, with an excellent harbour. The circumference, including the ſuburbs, is ſaid not to be leſs than 18 Italian miles, and the number of the inhabitants therein little leſs than 400,000. The houſes are of ſtone, flat roofed, and generally lofty and uniform; but many of them have balconies, with lattice windows. The ſtreets are well paved; but they are not lighted at night, and in the day time are diſfigured, in many places, by ſtalls, on which proviſions are expoſed to ſale. Here are a great number of fine churches,

---

* *Travels in the two Sicilies.*

churches, convents, fountains, and palaces of the nobility, many of whom conſtantly reſide here. It is uſual to walk on the tops of the houſes in the evenings, to breathe the ſweet cool air, after a hot ſultry day. The climate here is ſo mild and warm, even in the winter, that plenty of green peaſe, artichokes, aſparagus, and other vegetables, may be had ſo early as the beginning of the new year, and even all the winter. This city ſwarms with monks and nuns of all ſorts, to ſuch a degree, that there are no leſs than 19 convents of the Dominicans alone, 18 of the Franciſcans, 8 of the Auguſtines, and an equal proportion of the reſt. The magnificence of many of the churches exceeds imagination. In a cloiſter of the Carthuſian monaſtery is a crucifix, ſaid to be done by Michael Angelo, of inimitable workmanſhip.

To repel hoſtile attempts by ſea, which from its ſituation, maritime powers might be tempted to make, Naples has, to the weſt, the Caſtel del Ovo, a confuſed pile of ancient buildings, and ſome modern batteries. The rock upon which this fortreſs ſtands was originally called *Megara*, then *Lucullanum ;* and was conſidered as a place of ſtrength ſo early as the year 475. Along the line of the ſhore towards the eaſt are ſome batteries on the points of land, the baſtions of the arſenal, and above it the lofty wall of the Caſtel Nuovo. This laſt fortreſs has been the uſual refuge of the ſovereigns and viceroys in all civil wars and tumults ; for which reaſon they have long fixed their reſidence near its walls. A blockhouſe and batteries defend the mouth of the harbour, and at the eaſtern extremity of the town is the Torrione de Carmine, better known by the figure it made in Maſſaniello's rebellion than by its extent or military ſtrength. The caſtle of St Elmo commands Naples in every direction, and is in reality calculated rather to annoy and awe the citizens than to defend them from foreign invaders. The city is indeed far from being ſecure againſt a bombardment ; for the ſea is ſo deep, that a large veſſel may come up to the very mole in defiance of the blockhouſe and batteries, &c. Pictures, ſtatues, and antiquities, are not ſo common in Naples as might be expected in ſo great and ancient a city, many of the moſt valuable pieces having been ſent to Spain by the viceroys. The bay is one of the fineſt in the world, being almoſt of a round figure, about 30 miles in diameter, and three parts of it ſheltered with a noble circuit of woods and mountains. The city ſtands in the boſom of this bay, in as pleaſant a ſituation, perhaps, as is in the world. Mr Keyſler ſays, they reckon about 18,000 *donne libere*, or courtezans, in the city ; and Dr Moore computes the number of *lazzaroni* or blackguards at above 30,000. The greater part of theſe wretches have no dwelling houſes, but ſleep every night under porticos, piazzas, or any kind of ſhelter they can find. Thoſe of them who have wives and children, live in the ſuburbs of Naples near Peuſilippo, in huts, or in caverns or chambers dug out of that mountain. They are generally repreſented as a lazy, licentious, and turbulent ſet of people, as indeed by far the greater part of the rabble are, who prefer begging or robbing, or running errands, to any fixed and permanent employment. Yet there are in Naples ſome flouriſhing manufactures, particularly of ſilk ſtockings, ſoap, ſnuff-boxes of tortoiſe ſhells and the lava of Mount Veſuvius, tables, and ornamental furniture of marble. The city is ſupplied with a vaſt quantity of water, by means of a very coſtly aqueduct, from the foot of Mount Veſuvius. Mr Addiſon ſays, it is incredible how great a multitude of retainers to the law there are in Naples, who find continual employment from the fiery temper of the inhabitants. There are five piazzas or ſquares in the city, appropriated to the nobility, viz. thoſe called *Capuana*, *Nido*, *Montagna*, *Porto*, and *Porta Nova*. Of all the palaces, that of the king is not only the moſt magnificent, but alſo in the beſt ſtyle of architecture. The cathedral, though Gothic, is a very grand ſplendid edifice. It is here that the head and blood of St Januarius, the tutelary ſaint of Naples, are kept, the latter in two glaſs or cryſtal vials. The pretended liquefaction of the dried blood, as ſoon as brought near the head of the ſaint, is a thing well known ; Mr Addiſon ſays, it is one of the moſt bungling tricks he ever ſaw. The harbour is ſpacious, and kept in good repair. It is fortified with a mole, which runs about a quarter of a mile into the ſea, and at the extremity has a high lanthorn to direct ſhips ſafely into the harbour. Luxury here is reſtrained by ſevere ſumptuary laws, and the women are more cloſely confined than in any other city of Italy. Here is an univerſity and two academies of wits, the one called *Gli Ardenti*, and the other *Gli Otioſi*. The nunnery for ladies of quality is ſaid to be the largeſt in the whole world, containing no leſs than 350 nuns, beſides ſervants. The Mount of Piety, or the office for advancing money to the poor, on pledges, at a low intereſt, or without any, has an income of upwards of 50,000 ducats. The arſenal is ſaid to contain arms for 50,000 men. The walls of the city conſiſt of hard black quarry ſtones, called *piperno*. Inſtead of ice, vaſt quantities of ſnow are uſed for cooling their liquors, not ſo much as water being drank without it ; ſo that, it is ſaid, a ſcarcity of it would as ſoon occaſion a mutiny as a dearth of corn or proviſions. Certain perſons, who farm the monopoly of it from the government, ſupply the city all the year round from a mountain about 18 miles off, at ſo much the pound. In the beginning of 1799, it was taken by a body of French troops under General Championet. The ſtreets of this city were lighted for the firſt time on the 16th December, 1806. Naples ſtands 110 miles ſouth-eaſt from Rome, 164 north-eaſt from Palermo in Sicily, 217 ſouth-eaſt from Florence, and 300 from Venice. E. Long. 14. 20. N. Lat. 40. 55.

NARBO, in *Ancient Geography*, a town of the Volſcæ Tectoſages, called alſo *Narbo Martius*, from the Legio Martia, the colony led thither 59 years before the conſulate of Cæſar, (Velleius) ; increaſed with a colony of the Ducamani or tenth legion by Cæſar. An ancient trading town on the Atax, which diſcharges itſelf into the ſea through the Lacus Rubreſus, or Rubrenſis. Capital of Gallia Narbonenſis ; ſurnamed *Colonia Julia Paterna*, from Julius Cæſar, the father of Auguſtus by adoption. Now called *Narbonne*, a city of Languedoc.

NARBONNE, is a city of France, in the department of Aude, with an archbiſhop's ſee, and is particularly famous for its honey. It is ſeated on a canal cut from the river Aude, which being but three miles from the ſea, veſſels come up it laden with merchandiſe, which renders

renders it a place of ſome trade. But though it pretends to the moſt remote antiquity under the Celtic kings, in ages anterior even to the Roman conqueſts, which under theſe latter maſters gave its name to all *Gallia Narbonenſis*, and was a colony of the firſt conſideration, it is now dwindled to a wretched ſolitary town, containing ſcarce 8000 inhabitants, of whom three-fourths are prieſts and women. The ſtreets and buildings are mean and ruinous; it has indeed a communication with the Mediterranean, from which Narbonne is only about three leagues diſtant, by means of a ſmall river which interſects the place; but their commerce is very limited, and chiefly conſiſts in grain which they export to Cette and Marſeilles. No marks of Roman magnificence remain, except ſeveral inſcriptions in different parts of the city. It is divided into the city and the town, which are joined together by a bridge, with houſes on each ſide, in which the richeſt merchants live. There are ſeveral churches and convents; the metropolitan church has a handſome ſteeple. E. Long. 3. 6. N. Lat. 43. 11.

NARCISSUS, in fabulous hiſtory, the ſon of the river Cephiſſus and Liriope the daughter of Oceanus, was a youth of great beauty. Tireſias foretold that he ſhould live till he ſaw himſelf. He deſpiſed all the nymphs of the country; and made Echo languiſh till ſhe became a mere ſound, by refuſing to return her paſſion: but one day coming weary and fatigued from the chaſe, he ſtopped on the bank of a fountain to quench his thirſt: when, ſeeing his own form in the water, he became ſo in love with the ſhadowy image, that he languiſhed till he died. On which the gods, being moved at his death, changed him into the flower which bears his name.

NARCISSUS, a genus of plants belonging to the hexandria claſs; and in the natural method ranking under the 9th order, *Spathaceæ*. See BOTANY *Index*.

NARCOTICS, in *Medicine*, ſoporiferous drugs, which bring on a ſtupefaction. Among narcotics the moſt eminent are thoſe uſually prepared for medicinal uſes from the poppy, eſpecially opium; as alſo all thoſe prepared from mandragoras, hyoſcyamus, ſtramonium and datura. See MATERIA MEDICA *Index*.

NARDO, a pretty populous town in the kingdom of Naples, and in the Terra d'Otranto, with the title of a duchy and a biſhop's ſee. E. Long. 18. 27. N. Lat. 43. 28.

In this little city are 8000 inhabitants. The ſteeple of its cathedral is built in a very uncommon but ſhowy ſtyle of Gothic architecture. Luco Giordano and Solimeni have adorned the church with ſome agreeable paintings. This place was a part of the Balzo eſtate. The Aquavivas were the next poſſeſſors: they are thought to have come from the Marca di Ancona. In 1401, in conſideration of their relationſhip to Pope Boniface IX. Laudiſlaus erected their manor of Atri into a dukedom, an honour till then ſeldom granted to any but princes of the blood royal. Claudius Aquaviva, a famous general of the Jeſuits, who died in 1615, was of this family.

NARDUS, a genus of plants belonging to the triandria claſs; and in the natural method ranking under the 4th order, *Gramina*. See BOTANY *Index*.

This plant was highly valued by the ancients, both as an article of luxury and medicine. The *unguentum nardinum*, was uſed at baths and feaſts as a favourite perfume. Its value is evident from that paſſage of Scripture, were our Saviour's head was anointed with a box of it, with which Judas found fault. From a paſſage in Horace, it appears that this ointment was ſo valuable among the Romans, that as much as could be contained in a ſmall box of precious ſtone was conſidered as a ſort of equivalent for a large veſſel of wine, and a proper quota for a gueſt to contribute at an entertainment, according to the ancient cuſtom:

> ———*Nardo vina merebere,*
> *Nardi parvus onyx eliciet cadum.*

NAREA, the moſt ſoutherly province of the empire of Abyſſinia; a kingdom ſtill governed by its own princes, who have the title of *Beneros*. Its territory was formerly more extenſive than at preſent, the Galla having almoſt quite ſurrounded it, eſpecially on the ſouth-eaſt and north. The country to the weſt is the moſt unknown part of Africa; the kingdom itſelf ſtands like a fortified place in the middle of a plain, being a high and mountainous country. A great many rivers, riſing in the fourth and fifth degrees of north latitude, ſpread themſelves over the level part of the country, and fill it with marſhes all the way from ſouth by eaſt to north or north-weſt.—Theſe marſhes are bounded by mountains, of which thoſe neareſt the marſhes are overgrown with coffee trees, the largeſt, if not the only ones, which grow in this country. The kingdom of Narea Proper is interſperſed with ſmall, unwholeſome, but very fertile valleys. The mountainous country of Caffa adjoins immediately to Narea, and is ſaid to be governed by a ſeparate prince; but the Galla having ſettled themſelves in all the flat ground to the very edge of the marſhes, have in a great meaſure cut off the communication with Abyſſinia for a long time paſt. The Nareans who inhabit the mountainous country have the lighteſt complexion of any people in Abyſſinia; but thoſe who inhabit the borders of the marſhes are perfectly black, and have the features and woolly heads of negroes; but the mountaineers of Narea, and much more thoſe of Caffa, are fair complexioned, more ſo than even the Neapolitans or Sicilians. It is ſaid that ſnow has been ſeen to lie on ſome of the mountains of Caffa; but Mr Bruce imagines this to be a miſtake, and thinks that it muſt have been hail.

Narea abounds with cattle, grain, and all kinds of proviſions, both in the high and low country. The medium of commerce is gold, which they ſell by weight; but the principal articles of trade are coarſe cotton cloths, antimony, beads, and incenſe, which are carried from this country to the kingdom of Angola, and the parts of the African continent towards the Atlantic. The people are exceedingly brave; and though they have been driven out of the low country by multitudes of Galla, they now bid them defiance, and drive them from their frontiers whenever they come too near. The Narean priſoners taken in theſe ſkirmiſhes are ſold to the Mahometan merchants at Gondar; and at Conſtantinople, Cairo, or in India, the women are more eſteemed than thoſe of any other part of the world. Both ſexes have a cheerful kind diſpoſition, and attach themſelves inviolably to their maſters, if properly treated. The people of Narea and Caffa ſpeak a language peculiar to themſelves.

NARRATION, in oratory, poetry, and hiſtory, a recital or rehearſal of a fact as it happened, or as it is ſuppoſed to have happened. See ORATORY, N° 26. 123.

Concerning NARRATION *and Deſcription* we have the following rules and obſervations in the Elements of Criticiſm.

1. The firſt rule is, That in hiſtory the reflections ought to be chaſte and ſolid; for while the mind is intent upon truth, it is little diſpoſed to the operation of the imagination. Strada's Belgic hiſtory is full of poetical images, which being diſcordant with the ſubject, are unpleaſant; and they have a ſtill worſe effect by giving an air of fiction to a genuine hiſtory. Such flowers ought to be ſcattered with a ſparing hand, even in epic poetry; and at no rate are they proper till the reader be warmed, and by an enlivened imagination be prepared to reliſh them: in that ſtate of mind, they are agreeable; but while we are ſedate and attentive to an hiſtorical chain of facts, we reject with diſdain every fiction.

2. Vida, following Horace, recommends a modeſt commencement of an epic poem; giving for a reaſon that the writer ought to huſband his fire. Beſides bold thoughts and figures are never reliſhed till the mind be heated and thoroughly engaged, which is not the reader's caſe at the commencement. Homer introduces not a ſingle ſimile in the firſt book of the Iliad, nor in the firſt book of the Odyſſey. On the other hand, Shakeſpeare begins one of his plays with a ſentiment too bold for the moſt heated imagination:

Bedford. Hung be the heav'ns with black, yield day to night!
Comets, importing change of times and ſtates,
Brandiſh your cryſtal treſſes in the ſky,
And with them ſcourge the bad revolting ſtars,
That have conſented unto Henry's death!
Henry the Fifth, too famous to live long!
England ne'er loſt a king of ſo much worth.
Firſt part Henry VI.

The paſſage with which Strada begins his hiſtory, is too poetical for a ſubject of that kind; and at any rate too high for the beginning of a grave performance.

3. A third rule or obſervation is, That where the ſubject is intended for entertainment ſolely, not for inſtruction, a thing ought to be deſcribed as it appears, not as it is in reality. In running, for example, the impulſe upon the ground is proportioned in ſome degree to the celerity of motion; though in appearance it is otherwiſe, for a perſon in ſwift motion ſeems to ſkim the ground, and ſcarcely to touch it. Virgil, with great taſte, deſcribes quick running according to appearance; and raiſes an image far more lively than by adhering ſcrupulouſly to truth:

Hos ſuper advenit Volſca de gente Camilla,
Agmen agens equitum, et florentes ære catervas,
Bellatrix: non illa colo calathiſve Minervæ
Fœmineas aſſueta manus; ſed prælia virgo
Dura pati curſuque pedum prævertere ventos.
Illa vel intactæ ſegetis per ſumma volaret
Gramina, nec teneras curſu læſiſſet ariſtas:
Vel mare per medium, fluctu ſuſpenſa tumenti,
Ferret iter, celeres nec tingeret æquore plantas.
Æneid, vii. 803.

4. In narration as well as in deſcription, objects ought to be painted ſo accurately as to form in the mind of the reader diſtinct and lively images. Every uſeleſs circumſtance ought indeed to be ſuppreſſed, becauſe every ſuch circumſtance loads the narration; but if a circumſtance be neceſſary, however ſlight, it cannot be deſcribed too minutely. The force of language conſiſts in raiſing complete images, which have the effect to tranſport the reader as by magic into the very place of the important action, and to convert him as it were into a ſpectator, beholding every thing that paſſes. The narrative in an epic poem ought to rival a picture in the livelineſs and accuracy of its repreſentations: no circumſtance muſt be omitted that tends to make a complete image; becauſe an imperfect image as well as any other imperfect conception, is cold and unintereſting. We ſhall illuſtrate this rule by ſeveral examples, giving the firſt place to a beautiful paſſage from Virgil:

Qualis *populeâ* mœrens Philomela ſub umbrâ
Amiſſos queritur fœtus, quos durus *arator*
Obſervans nido *implumes* detraxit.
Georg. lib. iv. 511.

The poplar, ploughman, and unfledged young, though not eſſential in the deſcription, tend to make a complete image, and upon that account are an embelliſhment.

Again:

Hic viridem Æneas *frondenti ex ilice* metam
Conſtituit, ſignum nautis. *Æneid*, v. 129.

Horace addreſſing to Fortune:

Te pauper ambit ſollicita prece
Ruris colonus: te dominam æquoris,
Quicumque Bithynâ laceſſit
Carpathium pelagus carinâ.
Carm. lib. i. ode 35.

—— Illum ex mœnibus hoſticis
Matrona bellantis tyranni
Proſpiciens, et adulta virgo,
Suſpiret: Eheu, ne rudis agminum
Sponſus laceſſat regius aſperum
Tactu leonem, quem cruenta
Per medias rapit ira cædes.
Carm. lib. iii. ode 2.

Shakeſpeare ſays, “You may as well go about to turn the ſun to ice by fanning in his face with a *peacock's* feather.” The peacock's feather, not to mention the beauty of the object, completes the image: an accurate image cannot be formed of that fanciful operation, without conceiving a particular feather; and one is at a loſs when this is neglected in the deſcription. Again, “The rogues ſlighted me into the river with as little remorſe, as they would have drown'd a bitch's blind puppies, fifteen i' th' litter.”

Old Lady. You would not be a queen?
Anne. No, not for all the riches under heaven.
Old Lady. 'Tis ſtrange: a threepence bow'd would hire me, old as I am, to queen it.
Henry VIII. act ii. ſc. 5.

In the following paſſage, the action, with all its material al circumſtances, is repreſented ſo much to the life, that it would ſcarce appear more diſtinct to a real ſpectator; and it is the manner of deſcription that contributes greatly to the ſublimity of the paſſage—

> He ſpake; and, to confirm his words, out flew
> Millions of flaming ſwords, drawn from the thighs
> Of mighty cherubim; the ſudden blaze
> Far round illumin'd hell: highly they rag'd
> Againſt the Higheſt, and fierce with graſped arms,
> Claſh'd on their ſounding ſhields the din of war,
> Hurling defiance toward the vault of heav'n.
> MILTON, book i.

The following paſſage from Shakeſpeare falls not much ſhort of that now mentioned in particularity of deſcription:

> O you hard hearts! ye cruel men of Rome!
> Knew you not Pompey? Many a time and oft
> Have you climb'd up to walls and battlements,
> To towers and windows, yea, to chimney tops,
> Your infants in your arms, and there have ſat
> The live-long day with patient expectation
> To ſee great Pompey paſs the ſtreets of Rome;
> And when you ſaw his chariot but appear,
> Have you not made an univerſal ſhout,
> That Tyber trembled underneath his banks,
> To hear the replication of your ſounds,
> Made in his concave ſhore?
> *Julius Cæſar*, act i. ſc. 1.

The following paſſage is ſcarcely inferior to either of thoſe mentioned:

" Far before the reſt, the ſon of Oſſian comes: bright in the ſmiles of youth, fair as the firſt beams of the ſun. His long hair waves on his back: his dark brow is half beneath his helmet. The ſword hangs looſe on the hero's ſide; and his ſpear glitters as he moves. I fled from his terrible eye, king of high Temora. *Fingal.*

The Henriade of Voltaire errs greatly againſt the foregoing rule: every incident is touched in a ſummary way, without ever deſcending to circumſtances. This manner is good in a general hiſtory, the purpoſe of which is to record important tranſactions: but in a fable it is cold and uninteresting; becauſe it is impracticable to form diſtinct images of perſons or things repreſented in a manner ſo ſuperficial.

It is obſerved above, that every uſeleſs circumſtance ought to be ſuppreſſed. The crowding ſuch circumſtances is, on the one hand, not leſs to be avoided than the conciſeneſs for which Voltaire is blamed, on the other. In the Æneid, Barce, the nurſe of Sichæus, whom we never hear of before nor after, is introduced for a purpoſe not more important than to call Anna to her ſiſter Dido: and that it might not be thought unjuſt in Dido, even in this trivial circumſtance, to prefer her huſband's nurſe before her own, the poet takes care to inform his reader, that Dido's nurſe was dead. To this may be oppoſed a beautiful paſſage in the ſame book, where, after Dido's laſt ſpeech, the poet, without detaining his readers by deſcribing the manner of her death, haſtens to the lamentation of her attendants:

> Dixerat: atque illam media inter talia ferro
> Collapſam aſpiciunt comites, enſemque cruore
> Spumantem, ſparſaſque manus. It clamor ad alta
> Atria; concuſſam bacchatur fama per urbem;
> Lamentis gemituque, et fœmineo ululatu
> Tecta fremunt, reſonat magnis plangoribus æther.
> Lib. iv. 663.

As an appendix to the foregoing rule, may be added the following obſervation, That to make a ſudden and ſtrong impreſſion, ſome ſingle circumſtance, happily ſelected, has more power than the moſt laboured deſcription. Macbeth, mentioning to his lady ſome voices he heard while he was murdering the King, ſays,

> There's one did laugh in's ſleep, and one cry'd
> Murder!
> They wak'd each other; and I ſtood and heard
> them:
> But they did ſay their prayers, and addreſs them
> Again to ſleep.
> *Lady.* There are two lodg'd together.
> *Macbeth.* One cry'd, God bleſs us! and, Amen!
> the other;
> As they had ſeen me with theſe hangman's hands,
> Liſtening their fear. I could not ſay, Amen,
> When they did ſay, God bleſs us.
> *Lady.* Conſider it not ſo deeply.
> *Macbeth.* But wherefore could not I pronounce
> Amen!
> I had moſt need of bleſſing, and Amen
> Stuck in my throat.
> *Lady.* Theſe deeds muſt not be thought
> After theſe ways; ſo, it will make us mad.
> *Macbeth.* Methought, I heard a voice cry,
> Sleep no more!
> Macbeth doth murder ſleep, &c. Act ii. ſc. 2.

Deſcribing Prince Henry:

> I ſaw young Harry, with his beaver on,
> His cuiſſes on his thighs, gallantly arm'd,
> Riſe from the ground like feather'd Mercury;
> And vaulted with ſuch eaſe into his ſeat,
> As if an angel dropt down from the clouds,
> To turn and wind a fiery Pegaſus,
> And witch the world with noble horſemanſhip.
> *Firſt Part Henry IV.* act iii. ſc. 3.

> *King Henry.* Lord Cardinal, if thou think'ſt on
> Heaven's bliſs,
> Hold up thy hand, make ſignal of thy hope.
> He dies, and makes no ſign!
> *Second Part Henry VI.* act iii. ſc. 3.

The ſame author, ſpeaking ludicrouſly of an army debilitated with diſeaſes, ſays,

" Half of them dare not ſhake the ſnow from off their caſſocks, leſt they ſhake themſelves to pieces."

" I have ſeen the walls of Balclutha, but they were deſolate. The flames had reſounded in the halls: and the voice of the people is heard no more. The ſtream of Clutha was removed from its place by the fall of the walls. The thiſtle ſhook there its lonely head: the moſs whiſtled to the wind. The fox looked out from the windows: and the rank graſs of the wall waved round

round his head. Deſolate is the dwelling of Morna: ſilence is in the houſe of her fathers." *Fingal.*

To draw a character is the maſter ſtroke of deſcription. In this Tacitus excels; his portraits are natural and lively, not a feature wanting or miſplaced. Shakeſpeare, however, exceeds Tacitus in livelineſs; ſome characteriſtical circumſtance being generally invented or laid hold of, which paints more to the life than many words. The following inſtances will explain our meaning, and at the ſame time prove our obſervation to be juſt.

> Why ſhould a man, whoſe blood is warm within,
> Sit like his grandſire cut in alabaſter?
> Sleep when he wakes, and creep into the jaundice,
> By being peeviſh? I tell thee what, Anthonio,
> (I love thee, and it is my love that ſpeaks),
> There are a ſort of men, whoſe viſages
> Do cream and mantle like a ſtanding pond;
> And do a wilful ſtillneſs entertain,
> With purpoſe to be dreſs'd in an opinion
> Of wiſdom, gravity, profound conceit;
> As who ſhould ſay, I am Sir Oracle,
> And when I ope my lips, let no dog bark!
> O my Anthonio! I do know of thoſe,
> That therefore only are reputed wiſe,
> For ſaying nothing.
>
> *Merchant of Venice*, act i. ſc. 1.

Again:

"Gratiano ſpeaks an infinite deal of nothing, more than any man in all Venice: his reaſons are two grains of wheat hid in two buſhels of chaff; you ſhall ſeek all day ere you find them; and when you have them, they are not worth the ſearch." *Ibid.*

In the following paſſage a character is completed by a ſingle ſtroke:

Shallow. O the mad days that I have ſpent; and to ſee how many of mine old acquaintance are dead.
Silence. We ſhall all follow, couſin.
Shallow. Certain, 'tis certain, very ſure, very ſure; Death (as the Pſalmiſt ſaith) is certain to all: all ſhall die. How a good yoke of bullocks at Stamford fair?
Slender. Truly couſin, I was not there.
Shallow. Death is certain. Is old *Double* of your town living yet?
Silence. Dead, Sir.
Shallow. Dead! ſee, ſee: he drew a good bow: and dead. He ſhot a fine ſhot. How a ſcore of ewes now?
Silence. Thereafter as they be. A ſcore of good ewes may be worth ten pounds.
Shallow. And is old *Double* dead?

Second part Henry IV. act iii. ſc. 2.

Deſcribing a jealous huſband:

"Neither preſs, coffer, cheſt, trunk, well, vault, but he hath an abſtract for the remembrance of ſuch places, and goes to them by his note. There is no hiding you in the houſe." *Merry Wives of Windſor*, act iv. ſc. 3.

Congreve has an inimitable ſtroke of this kind in his comedy of *Love for Love:*

Ben Legend. Well, father, and how do all at home? how does brother Dick, and brother Val.
Sir Sampſon. Dick, body o' me, Dick has been dead theſe two years. I writ you word when you were at Leghorn.
Ben. Meſs, that's true; marry I had forgot. Dick's dead, as you ſay. Act iii. ſc. 6.

Falſtaff ſpeaking of Ancient Piſtol:

"He's no ſwaggerer, hoſteſs; a tame cheater i'faith: you may ſtroak him as gently as a puppy greyhound; he will not ſwagger with a Barbary hen, if her feathers turn back in any ſhow of reſiſtance."

Second part Henry IV. act ii. ſc. 4.

Oſſian, among his other excellencies, is eminently ſucceſsful in drawing characters; and he never fails to delight his reader with the beautiful attitudes of his heroes. Take the following inſtances:

"O Oſcar! bend the ſtrong in arm; but ſpare the feeble hand. Be thou a ſtream of many tides againſt the foes of thy people; but like the gale that moves the graſs to thoſe who aſk thine aid.—So Trenmor lived; ſuch Trathal was; and ſuch has Fingal been. My arm was the ſupport of the injured; and the weak reſted behind the lightning of my ſteel."

"We heard the voice of joy on the coaſt, and we thought that the mighty Cathmor came. Cathmor the friend of ſtrangers! the brother of red-haired Cairbar! But their ſouls were not the ſame; for the light of heaven was on the boſom of Cathmor. His towers roſe on the banks of Atha: ſeven paths led to his halls: ſeven chiefs ſtood on theſe paths, and called the ſtranger to the feaſt. But Cathmor dwelt in the wood to avoid the voice of praiſe."

"Dermid and Oſcar were one: they reaped the battle together. Their friendſhip was ſtrong as their ſteel; and death walked between them to the field. They ruſh on the foe like two rocks falling from the brow of Ardven. Their ſwords are ſtained with the blood of the valiant: warriors faint at their name. Who is equal to Oſcar but Dermid? who to Dermid but Oſcar?

"Son of Comhal, replied the chief, the ſtrength of Morni's arm has failed: I attempted to draw the ſword of my youth, but it remains in its place: I throw the ſpear, but it falls ſhort of the mark: and I feel the weight of my ſhield. We decay like the graſs of the mountain, and our ſtrength returns no more. I have a ſon, O Fingal! his ſoul has delighted in the actions of Morni's youth; but his ſword has not been fitted againſt the foe, neither has his fame begun. I come with him to battle, to direct his arm. His renown will be a ſun to my ſoul, in the dark hour of my departure. O that the name of *Morni* were forgot among the people! that the heroes would only ſay, *Behold the father of Gaul.*"

Some writers, through heat of imagination, fall into contradiction; ſome are guilty of downright abſurdities; and ſome even rave like madmen. Againſt ſuch capital errors one cannot be more effectually warned than by collecting inſtances; and the firſt ſhall be of a contradiction, the moſt venial of all. Virgil ſpeaking of Neptune,

Interea magno miſceri murmure pontum,
Emiſſamque hyemem ſenſit Neptunus, et imis
Stagna refuſa vadis ; *graviter commotus*, et alto
Proſpiciens, ſummâ *placidum* caput extulit undâ.
Æneid, i. 128.

Again :

When firſt young Maro, in his boundleſs mind,
A work t'outlaſt *immortal* Rome deſign'd.
Eſſay on Criticiſm, 30.

The following examples are of abſurdities.

"Alii pulſis é tormento catenis diſcerpti ſectique, dimidiato corpore pugnabant ſibi ſuperſtites, ac peremptæ partis ultores." STRADA, *Dec.* ii. 2.

Il pover huomo, che non ſen' era accorto,
Andava combattendo, ed era morto. *Berni.*

He fled, but flying, left his life behind.
Iliad, xi. 443.

Full through his neck the weighty falchion ſped :
Along the pavement roll'd the mutt'ring head.
Odyſſey, xxii. 365.

The laſt article is of raving like one mad. Cleopatra ſpeaking to the aſpic,

————————Welcome, thou kind deceiver,
Thou beſt of thieves ; who, with an eaſy key,
Doſt open life, and unperceiv'd by us
Ev'n ſteal us from ourſelves ; diſcharging ſo
Death's dreadful office, better than himſelf ;
Touching our limbs ſo gently into ſlumber,
That Death ſtands by, deceiv'd by his own image,
And thinks himſelf but ſleep.
DRYDEN, *All for Love*, act v.

Having diſcuſſed what obſervations occurred upon the thoughts or things expreſſed, we proceed to what more peculiarly concerns the language or verbal dreſs. As words are intimately connected with the ideas they repreſent, the emotions raiſed by the ſound and by the ſenſe ought to be concordant. An elevated ſubject requires an elevated ſtyle ; what is familiar, ought to be familiarly expreſſed : a ſubject that is ſerious and important, ought to be clothed in plain nervous language : a deſcription, on the other hand, addreſſed to the imagination, is ſuſceptible of the higheſt ornaments that ſounding words and figurative expreſſion can beſtow upon it.

We ſhall give a few examples of the foregoing rules. A poet of any genius is not apt to dreſs a high ſubject in low words ; and yet blemiſhes of that kind are found even in claſſical works. Horace, obſerving that men are ſatisfied with themſelves, but ſeldom with their condition, introduces Jupiter indulging to each his own choice :

Jam faciam quod vultis ; eris tu, qui modo miles,
Mercator ; tu, conſultus modo, ruſticus : hinc vos,
Vos hinc, mutatis diſcedite partibus. eia,
Quid ? ſtatis ? nolint. atqui licet eſſe beatis.
Quid cauſæ eſt, merito quin illis *Jupiter ambas*
Iratus buccas inflet, neque ſe fore poſthac
Tam facilem dicat, votis ut præbeat aurem ?
Sat. i. 16.

Jupiter in wrath puffing up both cheeks, is a low and even ludicrous expreſſion, far from ſuitable to the gravity and importance of the ſubject : every one muſt feel the diſcordance. The following couplet, ſinking far below the ſubject, is no leſs ludicrous :

Not one looks backward, onward ſtill he goes,
Yet ne'er looks forward farther than his noſe.
Eſſay on Man, ep. iv. 223.

On the other hand, to raiſe the expreſſion above the tone of the ſubject, is a fault than which none is more common. Take the following inſtances :

Orcan le plus fidéle à ſervir ſes deſſeins,
Ne ſous le ciel brûlant des plus noirs Africains.
Bajazet, act iii. ſc. 8.

Les ómbres par trois fois ont obſcurci les cieux
Depuis que le ſommeil n'eſt entré dans vos yeux ;
Et le jour a trois fois chaſſé la nuit obſcure
Depuis que votre corps languit ſans nourriture.
Phædra, act i. ſc. 3.

Aſſueris. Ce mortel, qui montra tant de zéle pour moi, Vit-il encore ?
Aſaph.——Il voit l'aſtre qui vous éclaire.
Eſther, act ii. ſc. 3.

Oui, c'eſt Agamemnon, c'eſt ton roi qui t'eveille ;
Viens, reconnois la voix qui frappe ton oreille.
Iphigenie.

No jocund health that Denmark drinks to-day,
But the great cannon to the clouds ſhall tell ;
And the king's rowſe the heav'n ſhall bruit again,
Reſpeaking earthly thunder.
Hamlet, act i. ſc. 2.

————————In the inner room
I ſpy a winking lamp, that weakly ſtrikes
The ambient air, ſcarce kindling into light.
SOUTHERNE, *Fate of Capua*, act iii.

In the Funeral Orations of the biſhop of Meaux, the following paſſages are raiſed far above the tone of the ſubject ;

"L'Ocean etonné de ſe voir traverſé tant de fois, en des appareils ſi divers, et pour des cauſes ſi differentes, &c." Pag. 6.

"Grande reine, je ſatisfais à vos plus tendres deſirs, quand je célébre ce monarque ; et ſon cœur qui n'a jamais vêcu que pour lui, s'eveille, tout poudre qu'il eſt, et devient ſenſible, même ſous ce drap mortuaire, au nom d'un epoux ſi cher." Pag. 32.

The following paſſage, intended, one would imagine, as a receipt to boil water, is altogether burleſque by the laboured elevation of the diction :

A maſſy cauldron of ſtupendous frame
They brought, and plac'd it o'er the riſing flame :
Then heap the lighted wood ; the flame divides
Beneath the vaſe, and climbs around the ſides :
In its wide womb they pour the ruſhing ſtream :
The boiling water bubbles to the brim.
Iliad, xviii. 405.

In a paſſage at the beginning of the 4th book of Telemachus, one feels a ſudden bound upward without preparation, which accords not with the ſubject :

"Calypſo, qui avoit éte juſq' à ce moment immobile et tranſporteé de plaiſir en écoutant les aventures de Télémaque, l'interrompit pour lui faire prendre quelque repôs. Il eſt tems, lui dit-elle, que vous alliez goûter la douceur du ſommeil aprés tant de travaux. Vous n'avez rien à craindre ici; tout vous eſt favorable. Abandonnez vous donc à la joie. Goutez la paix, et tous les autres dons des dieux dont vous allez être comblé. Demain, *quand l'Aurore avec ſes doigts de rôſes entr'ouvrira les portes dorées de l'Orient, et que les chevaux du ſoleil, ſortant de l'onde amére, répandront les flames du jour, pour chaſſer devant eux toutes les etoiles du ciel*, nous reprendrons, mon cher Télémaque, l'hiſtoire de vos malheurs."

This obviouſly is copied from a ſimilar paſſage in the Æneid, which ought not to have been copied, becauſe he lies open to the ſame cenſure; but the force of authority is great:

> At regina gravi jamdudum ſaucia cura,
> Vulnus alit venis, et cœco carpitur igni.
> Multa viri virtus animo, multuſque recurſat
> Gentis honos: hærent infixi pectore vultus,
> Verbaque: nec placidam membris dat cura quietem.
> *Poſtera Phœbea luſtrabat lampade terras,*
> *Humentemque Aurora polo dimoverat umbram;*
> Cum ſic unanimem alloquitur maleſana ſororem.
> Lib. iv. 1.

The language of Homer is ſuited to his ſubject, not leſs accurately than the actions and ſentiments of his heroes are to their characters. Virgil, in that particular, falls ſhort of perfection: his language is ſtately throughout; and though he deſcends at times to the ſimpleſt branches of cookery, roaſting and boiling for example, yet he never relaxes a moment from the high tone.—In adjuſting his language to his ſubject, no writer equals Swift. We can recollect but one exception, which at the ſame time is far from being groſs: The Journal of a modern Lady is compoſed in a ſtyle blending ſprightlineſs with familiarity, perfectly ſuited to the ſubject: in one paſſage, however, the poet, deviating from that ſtyle, takes a tone above his ſubject. The paſſage we have in view begins l. 116. But *let me now a while ſurvey*, &c. and ends at l. 135.

It is proper to be obſerved upon this head, that writers of inferior rank are continually upon the ſtretch to enliven and enforce their ſubject by exaggeration and ſuperlatives. This unluckily has an effect contrary to what is intended; the reader, diſguſted with language that ſwells above the ſubject, is led by contraſt to think more meanly of the ſubject than it may poſſibly deſerve. A man of prudence, beſide, will be no leſs careful to huſband his ſtrength in writing than in walking; a writer, too liberal of ſuperlatives, exhauſts his whole ſtock upon ordinary incidents, and reſerves no ſhare to expreſs, with greater energy, matters of importance.

Many writers of that kind abound ſo in epithets, as if poetry conſiſted entirely in high ſounding words. Take the following inſtance:

> When black brow'd night her duſky mantle ſpread,
> And wrapt in ſolemn gloom the ſable ſky;
> When ſoothing ſleep her opiate dews had ſhed,
> And ſeal'd in ſilken ſlumbers every eye:
> My waking thought admits no balmy reſt,
> Nor the ſweet bliſs of ſoft oblivion ſhare;
> But watchful woe diſtracts my aching breaſt,
> My heart the ſubject of corroding care:
> From haunts of men with wandering ſteps and ſlow
> I ſolitary ſteal, and ſoothe my penſive woe.

Here every ſubſtantive is faithfully attended by ſome tumid epithet.

We proceed to a ſecond remark, not leſs important than the former. No perſon of reflection but muſt be ſenſible, that an incident makes a ſtronger impreſſion on an eye witneſs, than when heard at ſecond hand. Writers of genius, ſenſible that the eye is the beſt avenue to the heart, repreſent every thing as paſſing in our ſight; and, from readers or hearers, transform us as it were into ſpectators: a ſkilful writer conceals himſelf, and preſents his perſonages: in a word, every thing becomes dramatic as much as poſſible. Plutarch, *de gloria Athenienſium*, obſerves, that Thucydides makes his reader a ſpectator, and inſpires him with the ſame paſſions as if he were an eye witneſs.

In the fine arts, it is a rule to put the capital objects in the ſtrongeſt point of view; and even to preſent them oftener than once, where it can be done. In hiſtory painting, the principal figure is placed in the front, and in the beſt light: an equeſtrian ſtatue is placed in a centre of ſtreets, that it may be ſeen from many places at once. In no compoſition is there greater opportunity for this rule than in writing:

> ———Sequitur pulcherrimus Aſtur,
> Aſtur equo fidens et verſicoloribus armis.
> *Æneid*, x. 180.

> ———Full many a lady
> I've ey'd with beſt regard, and many a time
> Th' harmony of their tongues hath into bondage
> Brought my too diligent ear: for ſeveral virtues
> Have I lik'd ſeveral women: never any
> With ſo full ſoul, but ſome defect in her
> Did quarrel with the nobleſt grace ſhe ow'd,
> And put it to the foil. But you, O you,
> So perfect, and ſo peerleſs, are created
> Of every creature's beſt. *Tempeſt*, act iii. ſc. 1.

> *Orlando.*———Whate'er you are
> That, in the deſert inacceſſible,
> Under the ſhade of melancholy boughs,
> Loſe and neglect the creeping hours of time;
> If ever you have look'd on better days;
> If ever been where bells have knoll'd to church;
> If ever ſat at any good man's feaſt;
> If ever from your eyelids wip'd a tear,
> And known what 'tis to pity, and be pity'd;
> Let gentleneſs my ſtrong enforcement be,
> In the which hope I bluſh, and hide my ſword.
> *Duke ſen.* True is it that we have ſeen better days;
> And have with holy bell been knoll'd to church;
> And ſat at good men's feaſts; and wip'd our eyes
> Of drops that ſacred pity had engender'd;
> And therefore ſit you down in gentleneſs,
> And take upon command what help we have,
> That to your wanting may be miniſt'red.
> *As you like it.*

> With thee converſing I forget all time;
> All ſeaſons and their change, all pleaſe alike.

Sweet is the breath of morn, her riſing ſweet,
With charm of earlieſt birds; pleaſant the ſun
When firſt on this delightful land he ſpreads
His orient beams on herbs, tree, fruit, and flow'r
Gliſt'ring with dew; fragrant the fertile earth
After ſoft ſhow'rs; and ſweet the coming on
Of grateful ev'ning mild, the ſilent night
With this her ſolemn bird, and this fair moon,
And theſe the gems of heav'n, her ſtarry train:
But neither breath of morn, when ſhe aſcends
With charm of earlieſt birds, nor riſing ſun
On this delightful land, nor herb, fruit, flow'r,
Gliſt'ring with dew, nor fragrance after ſhow'rs,
Nor grateful ev'ning mild, nor ſilent night,
With this her ſolemn bird, nor walk by moon,
Or glittering ſtar light, without thee is ſweet.
Paradiſe Loſt, book iv. l. 634.

"What mean ye, that ye uſe this proverb, The fathers have eaten ſour grapes, and the children's teeth are ſet on edge? As I live, ſaith the Lord God, ye ſhall not have occaſion to uſe this proverb in Iſrael. If a man keep my judgments to deal truly, he is juſt, he ſhall ſurely live. But if he be a robber, a ſhedder of blood: if he have eaten upon the mountains, and defiled his neighbour's wife: if he have oppreſſed the poor and needy, have ſpoiled by violence, have not reſtored the pledge, have lift up his eyes to idols, have given forth upon uſury, and have taken increaſe: ſhall he live? he ſhall not live: he ſhall ſurely die; and his blood ſhall be upon him. Now, lo, if he beget a ſon, that ſeeth all his father's ſins, and conſidereth, and doth not ſuch like; that hath not eaten upon the mountains, hath not lift up his eyes to idols, nor defiled his neighbour's wife, hath not oppreſſed any, nor withheld the pledge, neither hath ſpoiled by violence, but hath given his bread to the hungry, and covered the naked with a garment: that hath not received uſury nor increaſe, that hath executed my judgments, and walked in my ſtatutes: he ſhall not die for the iniquity of his father; he ſhall ſurely live. The ſoul that ſinneth, it ſhall die; the ſon ſhall not bear the iniquity of the father, neither ſhall the father bear the iniquity of the ſon; the righteouſneſs of the righteous ſhall be upon him, and the wickedneſs of the wicked ſhall be upon him. Have I any pleaſure that the wicked ſhould die, ſaith the Lord God; and not that he ſhould return from his ways, and live?" *Ezekiel* xvii.

A conciſe comprehenſive ſtyle is a great ornament in narration; and a ſuperfluity of unneceſſary words, not leſs than of circumſtances, a great nuiſance. A judicious ſelection of the ſtriking circumſtances, clothed in a nervous ſtyle, is delightful. In this ſtyle, Tacitus excels all writers, ancient and modern. Inſtances are numberleſs: take the following ſpecimen:

"Crebra hinc prælia, et ſæpius in modum latrocinii: per ſaltus, per paludes; ut cuique fors aut virtus: temere, proviſo, ob iram, ob prædam, juſſu, et aliquando ignaris ducibus." *Annal.* lib. xii. § 39.

After Tacitus, Oſſian in that reſpect juſtly merits the place of diſtinction. One cannot go wrong for examples in any part of the book.

If a conciſe or nervous ſtyle by a beauty, tautology muſt be a blemiſh; and yet writers, fettered by verſe, are not ſufficiently careful to avoid this ſlovenly practice: they may be pitied, but they cannot be juſtified. Take for a ſpecimen the following inſtances, from the beſt poet, for verſification at leaſt, that England has to boaſt of:

High on his helm celeſtial lightnings play,
His beamy ſhield emits a living ray;
Th' unweary'd blaze inceſſant ſtreams ſupplies,
Like the red ſtar that fires the autumnal ſkies.
Iliad. 5.

Strength and omnipotence inveſt thy throne.
Ibid. 576.

So ſilent fountains, from a rock's tall head,
In ſable ſtreams ſoft trickling waters ſhed.
Ibid. ix. 19.

His clanging armour rung. *Ibid.* xii. 94.

Fear on their cheek, and horror in their eye.
Ibid. xv. 4.

The blaze of armour flaſh'd againſt the day.
Ibid. xvii. 736.

As when the piercing blaſts of Boreas blow.
Ibid. xix. 380.

And like the moon, the broad refulgent ſhield
Blaz'd with long rays, and gleam'd athwart the field.
Ibid. xix. 402.

No—could our ſwiftneſs o'er the winds prevail,
Or beat the pinions of the weſtern gale,
All were in vain—— *Ibid.* xix. 604.

The humid ſweat from every pore deſcends.
Ibid. xxiii. 829.

We cloſe this article with a curious inquiry. An object, however ugly to the ſight, is far from being ſo when repreſented by colours or by words. What is the cauſe of this difference? With reſpect to painting, the cauſe is obvious: a good picture, whatever the ſubject be, is agreeable by the pleaſure we take in imitation; and this pleaſure overbalancing the diſagreeableneſs of the ſubject, makes the picture upon the whole agreeable. With reſpect to the deſcription of an ugly object, the cauſe follows. To connect individuals in the ſocial ſtate, no particular contributes more than language, by the power it poſſeſſes of an expeditious communication of thought, and a lively repreſentation of tranſactions. But nature hath not been ſatisfied to recommend language by its utility merely: independent of utility, it is made ſuſceptible of many beauties, which are directly felt, without any intervening reflection. And this unfolds the myſtery; for the pleaſure of language is ſo great, as in a lively deſcription to overbalance the diſagreeableneſs of the image raiſed by it. This, however, is no encouragement to chooſe a diſagreeable ſubject; for the pleaſure is incomparably greater where the ſubject and the deſcription are both of them agreeable.

The following deſcription is upon the whole agreeable, though the ſubject deſcribed is in itſelf diſmal:

Nine times the ſpace that meaſures day and night
To mortal men, he with his horrid crew

Lay vanquiſhed, rolling in the fiery gulf,
Confounded though immortal! but his doom
Reſerv'd him to more wrath; for now the thought
Both of loſt happineſs and laſting pain
Torments him: round he throws his baleful eyes
That witneſs'd huge affliction and diſmay,
Mix'd with obdurate pride and ſtedfaſt hate.
At once as far as angels ken he views
The diſmal ſituation waſte and wild:
A dungeon horrible, on all ſides round
As one great furnace flamed; yet from thoſe flames
No light, but rather darkneſs viſible
Serv'd only to diſcover ſights of wo,
Regions of ſorrow, doleful ſhades, where peace
And reſt can never dwell, hope never comes
That comes to all; but torture without end
Still urges, and a fiery deluge, fed
With ever-burning ſulphur unconſum'd!
Such place eternal juſtice had prepar'd
For thoſe rebellious. *Paradiſe Loſt*, book i. 50.

An unmanly depreſſion of ſpirits in time of danger is not an agreeable ſight; and yet a fine deſcription or repreſentation of it will be reliſhed:

K. Richard. What muſt the king do now? muſt he ſubmit?
The king ſhall do it: muſt he be depos'd?
The king ſhall be contented: muſt he loſe
The name of king? o' God's name let it go:
I'll give my jewels for a ſet of beads;
My gorgeous palace, for a hermitage;
My gay apparel, for an almſman's gown;
My figur'd goblets, for a diſh of wood;
My ſceptre, for a palmer's walking-ſtaff;
My ſubjects, for a pair of carved ſaints;
And my large kingdom, for a little grave;
A little, little, grave,——an obſcure grave.
Or I'll be buried in the king's highway;
Some way of common tread, where ſubjects feet
May hourly trample on their ſovereign's head;
For on my heart they tread now, whilſt I live;
And, bury'd once, why not upon my head?
Richard II. act iii. ſc. 6.

Objects that ſtrike terror in a ſpectator, have in poetry and painting a fine effect. The picture, by raiſing a ſlight emotion of terror, agitates the mind; and in that condition every beauty makes a deep impreſſion. May not contraſt heighten the pleaſure, by oppoſing our preſent ſecurity to the danger of encountering the object repreſented.

————————The other ſhape,
If ſhape it might be call'd that ſhape had none
Diſtinguiſhable in member, joint, or limb;
Or ſubſtance might be call'd that ſhadow ſeem'd,
For each ſeem'd either; black it ſtood as night,
Fierce as ten furies, terrible as hell,
And ſhook a dreadful dart. *Par. Loſt*, book ii. 666.

——————Now ſtorming fury roſe,
And clamour ſuch as heard in heaven till now
Was never: arms on armour claſhing bray'd
Horrible diſcord, and the madding wheels
Of brazen chariots rage; dire was the noiſe
Of conflict; overhead the diſmal hiſs
Of fiery darts in flaming volleys flew,
And flying vaulted either hoſt with fire.
So under fiery cope together ruſh'd
Both battles main, with ruinous aſſault
And unextinguiſhable rage: all heaven
Reſounded, and had earth been then, all earth
Had to her centre ſhook. *Ibid*, book vi. 207.

Ghoſt.————But that I am forbid
To tell the ſecrets of my priſon-houſe,
I could a tale unfold, whoſe lighteſt word
Would harrow up thy ſoul, freeze thy young blood,
Make thy two eyes, like ſtars ſtart from their ſpheres,
Thy knotty and combined locks to part,
And each particular hair to ſtand on end,
Like quills upon the fretful porcupine:
But this eternal blazon muſt not be
To ears of fleſh and blood. *Hamlet*, act i. ſc. 8.

Gratiano. Poor Deſdemona! I'm glad thy father's dead:
Thy match was mortal to him; and pure grief
Shore his old thread in twain. Did he live now,
This ſight would make him do a deſp'rate turn:
Yea, curſe his better angel from his ſide,
And fall to reprobation. *Othello*, act v. ſc. 8.

Objects of horror muſt be excepted from the foregoing theory; for no deſcription, however lively, is ſufficient to overbalance the diſguſt raiſed even by the idea of ſuch objects. Every thing horrible ought therefore to be avoided in a deſcription.

NARSES, the eunuch who rivalled Beliſarius in heroiſm under the reign of the emperor Juſtinian, emerged from obſcurity A. D. 538. From the domeſtic ſervice of the palace, and the adminiſtration of the private revenue, he was ſuddenly exalted to the head of an army. He is ranked among the few eunuchs who have reſcued that unhappy name from the contempt and hatred of mankind. A feeble diminutive body concealed the ſoul of a ſtateſman and a warrior. His youth had been employed in the management of the loom and diſtaff, in the cares of the houſehold, and the ſervice of female luxury; but, while his hands were buſy, he ſecretly exerciſed the faculties of a vigorous and diſcerning mind. A ſtranger to the ſchools and the camp, he ſtudied in the palace to diſſemble, to flatter, and to perſuade; and as ſoon as he approached the perſon of the emperor, Juſtinian liſtened with ſurpriſe and pleaſure to the manly counſels of his chamberlain and private treaſurer. The talents of Narſes were tried and improved in frequent embaſſies; he led an army into Italy, acquired a practical knowledge of the war and the country, and preſumed to ſtrive with the genius of Beliſarius. Twelve years after his return, the eunuch was choſen to achieve the conqueſt which had been left imperfect by the firſt of the Roman generals. Inſtead of being dazzled by vanity or emulation, he ſeriouſly declared, that unleſs he were armed with an adequate force, he would never conſent to riſk his own glory and that of his ſovereign. Juſtinian granted to the favourite what he might have denied to the hero: the Gothic war was rekindled from its aſhes, and the preparations were not unworthy of the ancient majeſty of the empire.

Narſes defeated the Goths, the Franks, and the Alamanni;

Alamanni; the Italian cities opened their gates to the conqueror; he entered the capital in triumph; and having eſtabliſhed the ſeat of his government at Ravenna, continued 15 years to govern Italy under the title of *Exarch*.

His virtues, we are told, were ſtained with avarice; and in this provincial reign he accumulated a treaſure of gold and ſilver which ſurpaſſed the modeſty of a private fortune. His government was oppreſſive or unpopular; and the general diſcontent was expreſſed with freedom by the deputies of Rome. Before the throne of Juſtinian they boldly declared, that their Gothic ſervitude had been more tolerable than the deſpotiſm of a Greek eunuch; and that unleſs their tyrant were inſtantly removed, they would conſult their own happineſs in the choice of a maſter. Thus was his diſgrace the effect of the people's diſaffection; and his death, though in the extreme period of old age, was unſeaſonable and premature, ſince his genius alone could have repaired the laſt and fatal error of his life. He died about the year 567, and, as ſome ſay, at the advanced age of 95; but this does not appear very probable. See Gibbon's Rom. Hiſt. vol. iv. 4to edit. p. 194, 298, &c.

NARVA, a ſtrong town of the Ruſſian empire, in Livonia, with a caſtle and a harbour. It was taken by the Muſcovites from the Danes in 1558, by the Swedes in 1581, and they defeated the Muſcovites near it in 1700; but it was retaken by the Ruſſians in 1704 by ſtorm, and the inhabitants ſent to Aſtracan. It is ſeated on the river Narva, 95 miles ſouth-weſt of Wiburg, and 172 north-eaſt of Riga. E. Long. 29. 0. N. Lat. 59. 8.

NARWAL, a genus of whales. See MONODON, CETOLOGY *Index*.

NASSAU-SIEGEN, a ſmall principality of Germany in the Weſterwalde, is in general a mountainous woody country, with ſome arable and paſture ground, and a good breed of cattle. Its manufactures are chiefly thoſe of iron and ſteel, having an iron mine in the neighbourhood of Siegen. Count John the Younger, in 1626, embraced the Roman Catholic religion, and endeavoured to introduce it into the country; but the principality, upon the extinction of the line of Naſſau-Siegen in 1743, falling to the line of Naſſau-Dietz, and therein to the prince of Orange, hereditary ſtadtholder of the United Provinces, the Proteſtants were delivered from their apprehenſions of Popiſh tyranny and bigotry. The prince, on account of theſe territories, has a ſeat and voice at the diets of the empire and circle in the college of princes. His aſſeſſment in the matricula for Naſſau-Siegen is 773 florins monthly; and towards the maintenance of the chamber judicatory, 50 rixdollars, ſix kruitzers and a half, each term. The revenue of this principality is eſtimated at 100,000 rixdollars.

NASSAU-Dillenbourg, a principality of Germany, ſituated near the former. It has not much arable land, but plenty of wood, good quarries of ſtone, ſome ſilver and vitriol, copper and lead, with ſtore of iron, for the working and ſmelting of which there are many forges and founderies in the country; and by theſe, and the ſale of their iron, the inhabitants chiefly ſubſiſt. Calviniſm is the religion of the principality, which contains five towns and two boroughs, and belongs entirely to William V. prince of Orange, and hereditary ſtadtholder of the United Provinces, whoſe father ſucceeded to a part of it in 1739 on the death of Prince Chriſtian, and to the reſt in 1743 on the death of Prince William Hyacynth of Siegen. The prince, on account of this principality alſo and Dietz, has a ſeat and voice in the college of princes, at the diets of the empire and circle. His aſſeſſment in the matricula, for Naſſau-Dillenbourg, is 102 florins monthly; and to the chamber judicatory, 59 rixdollars ſix and half kruitzers, each term. His revenue from this principality is computed at above 130,000 florins.

NASSAU-Hadamar, a country of Germany, which, till the year 1711, had princes of its own; but now belongs wholly to William V. prince of Orange.

NASSAU, prince of Orange. See MAURICE.

NATES, in *Anatomy*, a term expreſſing thoſe two fleſhy exterior parts of the body, vulgarly called the *buttocks*. See ANATOMY.

NATES Cerebri, are two circular protuberances of the brain, ſituated on the back ſide of the medulla oblongata, near the cerebellum.

NATION, a collective term, uſed for a conſiderable number of people inhabiting a certain extent of land, confined within fixed limits, and under the ſame government.

NATIONAL DEBT: the money owing by government.

Our limits permit us to give but a very general ſketch of this ſubject: However, as it is of conſiderable importance to every inhabitant of theſe kingdoms, we ſhall endeavour to give as clear and comprehenſive a view of it as the bounds neceſſarily preſcribed us will admit. In order to this, it may not be improper to refer back to the times that have gone before us, that we may the better diſcover the nature of public revenues, the manner of their expenditure, and the cauſes of public debt.

In that rude ſtate of ſociety which precedes the extenſion of commerce and the improvements of manufactures, when thoſe expenſive luxuries which commerce and manufactures can alone introduce, are altogether unknown; the perſon who poſſeſſes a large revenue can ſpend or enjoy that revenue in no other way than by maintaining nearly as many people as it can maintain. Among our feudal anceſtors, the long time during which eſtates uſed to continue in the ſame family, ſufficiently demonſtrates the general diſpoſition of people to live within their income. Though the ruſtic hoſpitality conſtantly exerciſed by the great landholders may not to us in the preſent times ſeem conſiſtent with that order which we are apt to conſider as inſeparably connected with good economy, yet we muſt certainly allow them to have been at leaſt ſo far frugal as not commonly to have ſpent their whole income. Some part of this money, perhaps, they ſpent in purchaſing the few objects of vanity and luxury with which the circumſtances of the times could furniſh them: but ſome part of it they ſeem commonly to have hoarded. They could not well indeed do any thing elſe but hoard whatever money they ſaved. To trade was diſgraceful to a gentleman; and to lend money at intereſt, which at that time was conſidered as uſury and prohibited by law, would have been ſtill more ſo.

Smith's Wealth of Nations.

The ſame diſpoſition to ſave and to hoard prevailed in the ſovereign as well as in the ſubjects. Among nations to whom commerce and manufactures are little known, the ſovereign is in a ſituation which naturally diſpoſes him to the parſimony requiſite for accumulation. In that ſituation the expence even of a ſovereign cannot be directed by that vanity which delights in the gaudy finery of a court. The ignorance of the times affords but few of the trinkets in which that finery conſiſts. Standing armies are not then neceſſary; ſo that the expence even of a ſovereign, like that of any other great lord, can be employed in ſcarce any thing but bounty to his tenants and hoſpitality to his retainers. But bounty and hoſpitality very ſeldom lead to extravagance: though vanity almoſt always does. All the ancient ſovereigns of Europe accordingly had treaſures. Every Tartar chief in the preſent times is ſaid to have one.

In a commercial country abounding with every ſort of expenſive luxury, the ſovereign, in the ſame manner as almoſt all the great proprietors in his dominions, naturally ſpends a great part of his revenue in purchaſing thoſe luxuries. His own and the neighbouring countries ſupply him abundantly with all the coſtly trinkets which compoſe the ſplendid but inſignificant pageantry of a court. His ordinary expence becomes equal to his ordinary revenue, and it is well if it does not frequently exceed it. The amaſſing of treaſure can no longer be expected: and when extraordinary exigencies require extraordinary expences, he muſt neceſſarily call upon his ſubjects for an extraordinary aid. The late king of Pruſſia and his father are the only great princes of Europe who, ſince the death of Henry IV. of France in 1610, are ſuppoſed to have amaſſed any conſiderable treaſure. The parſimony which leads to accumulation has become almoſt as rare in republican as in monarchical governments. The Italian republics, the United Provinces of the Netherlands, are all in debt. The canton of Berne is the ſingle republic in Europe which has amaſſed any conſiderable treaſure. The other Swiſs republics have not. The taſte for ſome ſort of pageantry, for ſplendid buildings at leaſt and other public ornaments, frequently prevails as much in the apparently ſober ſenate houſe of a little republic as in the diſſipated court of the greateſt king.

The want of parſimony in time of peace impoſes the neceſſity of contracting debt in time of war. When war comes, there is no money in the treaſury but what is neceſſary for carrying on the ordinary expence of the peace eſtabliſhment. In war an eſtabliſhment of three or four times that expence becomes neceſſary for the defence of the ſtate, and conſequently a revenue three or four times greater than the peace revenue. Suppoſing that the ſovereign ſhould have what he ſcarce ever has, the immediate means of augmenting his revenue in proportion to the augmentation of his expence; yet ſtill the produce of the taxes from which this increaſe of revenue muſt be drawn, will not begin to come into the treaſury till perhaps ten or twelve months after they are impoſed. But the moment in which war begins, or rather the moment in which it appears likely to begin, the army muſt be augmented, the fleets muſt be fitted out, the garriſoned towns muſt be put into a poſture of defence: that army, that fleet, thoſe garriſoned towns, muſt be furniſhed with arms, ammunition, and proviſions. An immediate and great expence muſt be incurred in that moment of immediate danger, which will not wait for the gradual and ſlow returns of the new taxes. In this exigency government can have no other reſources but in borrowing.

The ſame commercial ſtate of ſociety which, by the operation of moral cauſes, brings government in this manner into the neceſſity of borrowing, produces in the ſubjects both an ability and an inclination to lend. If it commonly brings along with it the neceſſity of borrowing, it likewiſe brings along with it the facility of doing ſo.

A country abounding with merchants and manufacturers, neceſſarily abounds with a ſet of people through whoſe hands not only their own capitals, but the capitals of all thoſe who either lend them money or truſt them with goods, paſs as frequently or more frequently than the revenue of a private man, who without trade or buſineſs lives upon his income, paſſes through his hands. The revenue of ſuch a man can regularly paſs through his hands only once in a year. But the whole amount of the capital and credit of a merchant who deals in a trade of which the returns are very quick may ſometimes paſs through his hands two, three, or four times in a year. A country abounding with merchants and manufactures, therefore, neceſſarily abounds with a ſet of people, who have it at all times in their power to advance, if they chooſe to do ſo, a very large ſum of money to government. Hence the ability in the ſubjects of a commercial ſtate to lend.

Blackſt. Commen.

The progreſs of the enormous debts which at preſent oppreſs, and will in the long-run probably ruin, all the great nations of Europe, has been pretty uniform. In England, after the Revolution, when new connexions with Europe introduced a new ſyſtem of foreign politics, the expences of the nation not only in ſettling the new eſtabliſhment, but in maintaining long wars, as principals, on the continent, for the ſecurity of the Dutch barrier, reducing the French monarchy, ſettling the Spaniſh ſucceſſion, ſupporting the houſe of Auſtria, maintaining the liberties of the Germanic body, and other purpoſes, increaſed to an unuſual degree: inſomuch that it was not thought adviſeable to raiſe all the expences of any one year by taxes to be levied within that year, leſt the unaccuſtomed weight of them ſhould create murmurs among the people. It was therefore the policy of the times to anticipate the revenues of their poſterity, by borrowing immenſe ſums for the current ſervice of the ſtate, and to lay no more taxes upon the ſubject than would ſuffice to pay the annual intereſt of the ſums ſo borrowed; by this means converting the principal debt into a new ſpecies of property, transferable from one man to another at any time and in any quantity. This ſyſtem indeed ſeems to have had its original in the ſtate of Florence, A. D. 1344; which government then owed about 60,000l. ſterling; and being unable to pay it, formed the principal into an aggregate ſum, called metaphorically a *mount* or *bank*, the ſhares whereof were transferable like our ſtocks, with intereſt at 5 per cent. the prices varying according to the exigencies of the ſtate.

ſtate. This laid the foundation of what is called the *national debt;* for a few long annuities created in the reign of Charles II. will hardly deſerve that name.

Nations, like private men, have generally begun to borrow upon what may be called *perſonal credit,* without aſſigning or mortgaging any particular fund for the payment of the debt; and when this reſource has failed them, they have gone on to borrow upon aſſignments or mortgages of particular funds.

What is called the *unfunded debt of Great Britain.* is contracted in the former of thoſe two ways. It conſiſts partly in a debt which bears, or is ſuppoſed to bear, no intereſt; and which reſembles the debts that a private man contracts upon account; and partly in a debt which bears intereſt, and which reſembles what a private man contracts upon his bill or promiſſory note. The debts which are due either for extraordinary ſervices, or for ſervices either not provided for or not paid at the time when they are performed; part of the extraordinaries of the army, navy, and ordnance, the arrears of ſubſidies to foreign princes, thoſe of ſeamen's wages, &c. uſually conſtitute a debt of the firſt kind. Navy and exchequer bills, which are iſſued ſometimes in payment of a part of ſuch debts and ſometimes for other purpoſes, conſtitute a debt of the ſecond kind; exchequer bills bearing intereſt from the day on which they are iſſued, and navy bills ſix months after they are iſſued. The bank of England, either by voluntarily diſcounting thoſe bills at their current value, or by agreeing with government for certain conſiderations to circulate exchequer bills, that is, to receive them at par, paying the intereſt which happens to be due upon them, keeps up their value, and facilitates their circulation, and thereby frequently enables government to contract a very large debt of this kind. During the great recoinage in King William's time, when the bank of England thought proper to put a ſtop to its uſual tranſactions, exchequer bills and tallies are ſaid to have ſold from 25 to 60 per cent. diſcount owing partly, no doubt, to the ſuppoſed inſtability of the new government eſtabliſhed by the Revolution, but partly too to the want of the ſupport of the bank of England.

When this reſource is exhauſted, and it becomes neceſſary, in order to raiſe money, to aſſign or mortgage ſome particular branch of the public revenue for the payment of the debt, government has upon different occaſions done this in two different ways. Sometimes it has made this aſſignment or mortgage for a ſhort period of time only, a year or a few years, for example; and ſometimes for perpetuity. In the one caſe, the fund was ſuppoſed ſufficient to pay within the limited time both principal and intereſt of the money borrowed: In the other, it was ſuppoſed ſufficient to pay the intereſt only, or a perpetual annuity equivalent to the intereſt; government being at liberty to redeem at any time this annuity upon paying back the principal ſum borrowed. When money was raiſed in the one way, it was ſaid to be raiſed *by anticipation;* when in the other, *by perpetual funding,* or, more ſhortly, *by funding.*

In the reign of King William, when the debt began to be amaſſed, and during a great part of that of Queen Anne, before we had become ſo familiar as we are now with the practice of perpetual funding, the greater part of the new taxes were impoſed but for a ſhort period of time (for four, five, ſix, or ſeven years only), and a great part of the grants of every year conſiſted in loans upon anticipation of the produce of thoſe taxes. The produce being frequently inſufficient for paying within the limited term the principal and intereſt of the money borrowed, deficiencies aroſe; to make good which it became neceſſary to prolong the term.

On the 31ſt of December 1697, the funded and unfunded debts amounted to 21,515,742l. 13s. $8\frac{1}{2}$d.; at the ſame time, in 1714, they were 53,681,076l. 5s. $6\frac{1}{12}$d. In 1755, before the breaking out of the war, they amounted to 72,289,673l.; and on the 5th of January 1763, at the concluſion of the peace, they had accumulated to 122,603,336l. 8s. $2\frac{1}{4}$d. of funded debt, and of unfunded 13,027,589l. 2s. 2d. more. In 1775, they were very nearly 130 millions; and the laſt American war added upwards of 120 millions more to that enormous ſum: to pay the intereſt of which, and the charges of management, amounting annually to nearly eight millions and a half, the extraordinary revenues elſewhere enumerated * (excepting only the land-tax and annual malt tax) are in the firſt place mortgaged and made perpetual by parliament. Perpetual we ſay; but ſtill redeemable by the ſame authority that impoſed them: which, if it at any time can pay off the capital, will aboliſh thoſe taxes which are raiſed to diſcharge the intereſt.

By this means, then, the quantity of property in the kingdom is greatly increaſed in idea compared with former times; yet, if we coolly conſider it, not at all increaſed in reality. We may boaſt of large fortunes, and quantities of money in the funds. But where does this money exiſt? It exiſts only in name, in paper, in public faith, in parliamentary ſecurity: and that is undoubtedly ſufficient for the creditors of the public to rely on. But then what is the pledge which the public faith has pawned for the ſecurity of theſe debts? The land, the trade, and the perſonal induſtry of the ſubject; from which the money muſt ariſe that ſupplies the ſeveral taxes. In theſe, therefore, and theſe only, the property of the public creditors does really and intrinſically exiſt; and of courſe the land, the trade, and the perſonal induſtry of individuals, are diminiſhed in their true value juſt ſo much as they are pledged to anſwer. If A's income amounts to 100l. per annum; and he is ſo far indebted to B, that he pays him 50l. per annum for his intereſt; one half of the value of A's property is transferred to B the creditor. The creditor's property exiſts in the demand which he has upon the debtor, and nowhere elſe; and the debtor is only a truſtee to his creditor for one half of the value of his income. In ſhort, the property of a creditor of the public conſiſts in a certain portion of the national taxes; by how much therefore he is the richer, by ſo much the nation, which pays theſe taxes, is the poorer.

The only advantage that can reſult to a nation from public debts, is the increaſe of circulation, by multiplying the caſh of the kingdom, and creating a new ſpecies of currency, aſſignable at any time and in any quantity; always therefore ready to be employed in any beneficial undertaking, by means of this its transferable quality; and yet producing ſome profit even when

* See *Revenue.*

when it lies idle and unemployed. A certain proportion of debt ſeems to be highly uſeful to a trading people; but what that proportion is, it is not for us to determine. This much is indiſputably certain, that the preſent magnitude of our national encumbrances very far exceeds all calculations of commercial benefit, and is productive of the greateſt inconveniences. For, firſt, The enormous taxes that are raiſed upon the neceſſaries of life for the payment of the intereſt of this debt, are a hurt both to trade and manufactures, by raiſing the price as well of the artificer's ſubſiſtence as of the raw material, and of courſe, in a much greater proportion, the price of the commodity itſelf. Nay, the very increaſe of paper circulation itſelf, when extended beyond what is requiſite for commerce or foreign exchange, has a natural tendency to increaſe the price of proviſions as well as of all other merchandiſe. For as its effect is to multiply the caſh of the kingdom, and this to ſuch an extent that much muſt remain unemployed, that caſh (which is the univerſal meaſure of the reſpective values of all other commodities) muſt neceſſarily ſink in its own value, and every thing grow comparatively dearer. Secondly, If part of this debt be owing to foreigners, either they draw out of the kingdom annually a conſiderable quantity of ſpecie for the intereſt; or elſe it is made an argument to grant them unreaſonable privileges in order to induce them to reſide here. Thirdly, If the whole be owing to ſubjects only, it is then charging the active and induſtrious ſubject, who pays his ſhare of the taxes to maintain the indolent and idle creditor who receives them. Laſtly, and principally, It weakens the internal ſtrength of a ſtate, by anticipating thoſe reſources which ſhould be reſerved to defend it in caſe of neceſſity. The intereſt we now pay for our debts would undoubtedly be ſufficient to maintain the moſt vigorous war that any national motives could poſſibly require. If indeed our anceſtors in King William's time had annually paid, ſo long as their exigencies laſted, a far leſs ſum than we now annually raiſe upon their accounts, they would not in time of war have borne ſo great burdens as they have bequeathed to and ſettled upon their poſterity in time of peace; and might have been eaſed the inſtant the exigence was over.

On the whole, then, the national debt is undoubtedly a ſubject of vaſt importance, and as ſuch it has been always conſidered; for much has been ſaid and written upon it, and many ſchemes have been propoſed at various times and by various perſons for gradually removing it, it being conſidered by the moſt judicious as a moſt pernicious encumbrance to a commercial country. Some, we are aware, think it of vaſt utility; but this opinion is too excentric, and in our eſtimation too feebly ſupported, to be convincing. The public debt is indiſputably a great grievance; and every lover of his country muſt ſurely wiſh to ſee it removed: the period, however, when this bleſſing ſhall take place, if indeed it ever arrive, muſt at leaſt be very diſtant.

We refer ſuch as wiſh for farther information on this intereſting topic to thoſe who have treated of it at full length, as Smith in his Wealth of Nations, and Sir John Sinclair in his Hiſtory of the Revenue. The writings of Dr Price likewiſe deſerve conſiderable attention, eſpecially as one of his plans for the reduction of the debt has in fact been adopted, and in conſequence eſtabliſhed, by the legiſlature: His three plans may be found in a pamphlet by William Morgan, entitled, A Review of Dr Price's Writings on the Subject of the Finances of this Kingdom.

NATIVITY, or NATAL DAY, the day of a perſon's birth. The word *nativity* is chiefly uſed in ſpeaking of the ſaints; as, the nativity of St John the Baptiſt, &c. But when we ſay *the* Nativity, it is underſtood of that of Jeſus Chriſt, or the feaſt of Chriſtmas.

NATIVITY, *nativitas*, in ancient law books, ſignifies bondage or ſervitude.

NATIVITY, in *Aſtrology*, the theme or figure of the heavens, and particularly of the twelve houſes, at the moment when a perſon was born; called alſo the *horoſcope.*

Caſting the nativity, or by calculation ſeeking to know how long the queen ſhould live, &c. was made felony, an. 23 Eliz. c. 2.

NATIVO HABENDO, in *Law*, a writ directed to the ſheriff, for a lord who claimed inheritance in any villain, when a villain was run away from him, for the apprehending and reſtoring him to the lord.

NATIX, in *Natural Hiſtory*, a name given by ſome old writers to the *nerita.*

NATOLIA, the modern name of the Leſſer Aſia, being the moſt weſterly part of Turkey in Aſia, and conſiſting of a large peninſula, which extends from the river Euphrates as far as the Archipelago, the ſea of Marmora, the ſtraits of Gallipoli and of Conſtantinople, which ſeparate it from Europe on the weſt. It is bounded on the north by the Black ſea, and on the ſouth by the Mediterranean.

NATRIX, in *Zoology*, the name of the common or water-ſnake, called alſo *torquata*, from the ring about its neck. See OPHIOLOGY *Index.*

NATRUM, or NATRON, the nitre of the ancients, one of the fixed alkalies. See SODA, CHEMISTRY *Index.*

It is found in great abundance in many parts of Aſia, where the natives ſweep it up from the ſurface of the ground, and call it *ſoap earth.* The earlieſt account we have of it is in the Scriptures, where we find that the ſalt called *nitre* in thoſe times would ferment with vinegar, and poſſeſſed a deterſive quality, ſo that it was uſed in baths and in waſhing. Solomon compares the ſinging of ſongs with a heavy heart, to the contrariety of vinegar and nitre: and Jeremiah ſays, that if the ſinner waſh himſelf with nitre, his ſin is not cleanſed off. Theſe are properties that perfectly agree with this ſalt, but not at all with our ſaltpetre, which is the nitre of the moderns.

NATTER-JACK, a ſpecies of RANA, which ſee, ERPETOLOGY *Index.*

NATURAL, in general, ſomething that relates to nature. See NATURE.

NATURAL Children, are thoſe born out of lawful wedlock See BASTARD.

NATURAL Functions, are thoſe actions whereby the aliments are changed and aſſimilated ſo as to become a part of the body.

NATURAL, in *Heraldry*, is uſed where animals, fruits, flowers, &c. are blazoned with the colours they naturally have, though different from the common colours of heraldry: and this is to prevent their armories being accuſed of falſity, when blazoned with the names of colours unknown in heraldry.

NATURAL Note, in *Muſic*, is uſed in oppoſition to flat and ſharp notes, which are called *artificial notes*. See NOTE, SCALE, &c.

NATURAL is alſo uſed for ſomething coming immediately out of the hands of nature: in which ſenſe it ſtands oppoſed to *factitious* or artificial, which ſignifies ſomething wrought by art. See ARTIFICIAL.

Biſhop Wilkins obſerves, that there appears a world of difference between natural and artificial things, when viewed with microſcopes. The firſt ever appear adorned with all imaginable elegance and beauty; the latter, though the moſt curious in their kind, infinitely rude and unhewn: the fineſt needle appears a rough bar of iron; and the moſt accurate engraving or emboſſment, as if done with a mattock or a trowel.

NATURAL Beauty, or the beauty of natural objects, is that quality or thoſe qualities in the works of nature, or more properly of God, which are calculated to excite pleaſing ſenſations in the minds of all ſuch perſons of true taſte as attentively obſerve them. It will not, we truſt, be deemed improper or impertinent, therefore, to introduce a few obſervations on this ſubject, previous to our treating of natural hiſtory.—To many, it is hoped, it will appear to be a very proper introduction to that important article. "That ſenſibility to beauty, which, when cultivated and improved, we term taſte, is univerſally diffuſed through the human ſpecies †; and it is moſt uniform with reſpect to thoſe objects, which being out of our power, are not liable to variation from accident, caprice, or faſhion. The verdant lawn, the ſhady grove, the variegated landſcape, the boundleſs ocean, and the ſtarry firmament, are contemplated with pleaſure by every attentive beholder. But the emotions of different ſpectators, though ſimilar in kind, differ widely in degree; and to reliſh with full delight the enchanting ſcenes of nature, the mind muſt be uncorrupted by avarice, ſenſuality, or ambition; quick in her ſenſibilities; elevated in her ſentiments; and devout in her affections. He who poſſeſſes ſuch exalted powers of perception and enjoyment, may almoſt ſay, with the poet,

I care not, Fortune! what you me deny;
You cannot rob me of free Nature's grace;
You cannot ſhut the windows of the ſky,
Through which Aurora ſhows her bright'ning face;
You cannot bar my conſtant feet to trace
The woods and lawns, by living ſtream, at eve:
Let health my nerves and finer fibres brace,
And I their toys to the great children leave:
Of fancy, reaſon, virtue, nought can me bereave.

"Perhaps ſuch ardent enthuſiaſm may not be compatible with the neceſſary toils and active offices which Providence has aſſigned to the generality of men. But there are none to whom ſome portion of it may not prove advantageous: and if it were cheriſhed by each individual, in that degree which is conſiſtent with the indiſpenſable duties of his ſtation, the felicity of human life would be conſiderably augmented. From this ſource, the refined and vivid pleaſures of the imagination are almoſt entirely derived: and the elegant arts owe their choiceſt beauties to a taſte for the contemplation of nature. Painting and ſculpture are expreſs imitations of viſible objects; and where would be the charms of poetry, if diveſted of the imagery and embelliſhments which ſhe borrows from rural ſcenes? Painters, ſtatuaries, and poets, therefore, are always ambitious to acknowledge themſelves the pupils of nature; and as their ſkill increaſes, they grow more and more delighted with every view of the animal and vegetable world. But the pleaſure reſulting from admiration is tranſient; and to cultivate taſte, without regard to its influence on the paſſions and affections, 'is to rear a tree for its bloſſoms, which is capable of yielding the richeſt and moſt valuable fruit.' Phyſical and moral beauty bear ſo intimate a relation to each other, that they may be conſidered as different gradations in the ſcale of excellence; and the knowledge and reliſh of the former ſhould be deemed only a ſtep to the nobler and more permanent enjoyments of the latter.

"Whoever has viſited the Leaſowes, in Warwickſhire, muſt have felt the force and propriety of an inſcription which meets the eye at the entrance into thoſe delightful grounds.

Would you then taſte the tranquil ſcene?
Be ſure your boſoms be ſerene:
Devoid of hate, devoid of ſtrife,
Devoid of all that poiſons life:
And much it 'vails you, in their place,
To graft the love of human race.

"Now ſuch ſcenes contribute powerfully to inſpire that ſerenity which is neceſſary to enjoy and to heighten their beauties. By a ſecret contagion, the ſoul catches the harmony which ſhe contemplates; and the frame within aſſimilates itſelf to that which is without. For,

Who can forbear to ſmile with Nature? Can
The ſtormy paſſions in the boſom roll,
While every gale is peace, and every grove
Is melody?

"In this ſtate of ſweet compoſure, we become ſuſceptible of virtuous impreſſions, from almoſt every ſurrounding object. The patient ox is viewed with generous complacency; the guileleſs ſheep with pity; and the playful lamb raiſes emotions of tenderneſs and love. We rejoice with the horſe, in his liberty and exemption from toil, while he ranges at large through enamelled paſtures; and the frolics of the colt would afford unmixed delight, did we not recollect the bondage which he is ſoon to undergo. We are charmed with the ſong of birds, ſoothed with the buzz of inſects, and pleaſed with the ſportive motions of fiſhes, becauſe theſe are expreſſions of enjoyment; and we exult in the felicity of the whole animated creation. Thus an equal and extenſive benevolence is called forth into exertion; and having felt a common intereſt in the gratifications of inferior beings, we ſhall be no longer indifferent to their ſufferings, or become wantonly inſtrumental in producing them.

"It ſeems to be the intention of Providence, that the lower order of animals ſhould be ſubſervient to the comfort, convenience, and ſuſtenance of man. But his right of dominion extends no farther; and if this right be exerciſed with mildneſs, humanity, and juſtice, the ſubjects of his power will be no leſs benefited

---

† Dr Percival's *Moral and Literary Diſſertations.*

ed than himſelf. For various ſpecies of living creatures are annually multiplied by human art, improved in their perceptive powers by human culture, and plentifully fed by human induſtry. The relation, therefore, is reciprocal between ſuch animals and man; and he may ſupply his own wants by the uſe of their labour, the produce of their bodies, and even the ſacrifice of their lives, whilſt he co-operates with all-gracious Heaven in promoting happineſs, the great end of exiſtence.

“ But though it be true, that partial evil, with reſpect to different orders of ſenſitive beings, may be univerſal good; and that it is a wiſe and benevolent inſtitution of nature, to make deſtruction itſelf, within certain limitations, the cauſe of an increaſe of life and enjoyment; yet a generous perſon will extend his compaſſionate regards to every individual that ſuffers for his ſake: and whilſt he ſighs

Even for the kid or lamb that parts its life
Beneath the bloody knife,

he will naturally be ſolicitous to mitigate pain, both in duration and degree, by the gentleſt modes of inflicting it.

“ We are inclined to believe, however, that this ſenſe of humanity would ſoon be obliterated, and that the heart would grow callous to every ſoft impreſſion, were it not for the benignant influence of the ſmiling face of nature. The count de Lauzun, when impriſoned by Louis XIV. in the caſtle of Pignerol, amuſed himſelf during a long period of time with catching flies, and delivering them to be devoured by a rapacious ſpider. Such an entertainment was equally ſingular and cruel: and inconſiſtent, we believe, with his former character, and his ſubſequent turn of mind. But his cell had no window, and received only a glimmering light from an aperture in the roof. In leſs unfavourable circumſtances, may we not preſume, that inſtead of ſporting with miſery, he would have releaſed the agonizing flies, and bid them enjoy that freedom of which he himſelf was bereaved?

“ But the taſte for natural beauty is ſubſervient to higher purpoſes than thoſe which have been enumerated; and the cultivation of it not only refines and humanizes, but dignifies and exalts the affections. It elevates them to the admiration and love of that Being who is the author of all that is fair, ſublime, and good in the creation. Scepticiſm and irreligion are hardly compatible with the ſenſibility of heart which ariſes from a juſt and lively reliſh of the wiſdom, harmony, and order ſubſiſting in the world around us: and emotions of piety muſt ſpring up ſpontaneouſly in the boſom that is in uniſon with all animated nature. Actuated by this divine inſpiration, man finds a fane in every grove; and, glowing with devout fervour, he joins his ſong to the univerſal chorus, or muſes the praiſe of the Almighty, in more expreſſive ſilence. Thus they

“ Whom Nature's works can charm, with God himſelf
Hold converſe: grow familiar, day by day,
With his conceptions; act upon his plan;
And form to his the reliſh of their ſouls.”

On the whole, then, it certainly appears, that the advantages reſulting from a taſte for natural beauties are great and important: it is equally certain, that as it is uſeful, ſo it is a continual ſource of real enjoyment; for a more rational pleaſure cannot poſſibly occupy the attention or captivate the affections of mankind, than that which ariſes from a due conſideration of the works of nature. Pleaſure, we know, is a neceſſary ingredient in human life, in order in ſome meaſure to counterbalance the pains, the evils, and liſtleſſneſſes, which are at times perhaps unavoidable, and in order to render life tolerable. It is the part then of the moraliſt, and it has been frequently his buſineſs, to point out and recommend ſuch pleaſures as are highly gratifying, and are yet perfectly innocent. The Spectator, whoſe works will be admired as long as the language in which they are written is underſtood, recommends ſtrongly and elegantly the pleaſure of a garden; and a later writer †, of no common degree of merit, and of very conſiderable fame, has an eſſay on the ſame ſubject, from which we ſhall ſelect a few obſervations, and ſo conclude the article. “ Not he alone (ſays this elegant writer) is to be eſteemed a benefactor to mankind, who makes an uſeful diſcovery; but he alſo who can point out and recommend an innocent pleaſure. Of this kind are the pleaſures ariſing from the obſervation of nature; and they are highly agreeable to every taſte uncorrupted by vicious indulgence. Rural ſcenes of almoſt every kind are delightful to the mind of man. But the misfortune is, that the greater part are hurried on in the career of life with too great rapidity to be able to give attention to that which ſolicits no paſſion. The darkeſt habitation in the dirtieſt ſtreet of the metropolis, where money can be earned, has greater charms with many than the groves of Hagley.

“ The patron of refined pleaſure, the elegant Epicurus, fixed the ſeat of his enjoyment in a garden. He was of opinion, that a tranquil ſpot, furniſhed with the united ſweets of art and nature, was the beſt adapted to delicate repoſe. And even the ſeverer philoſophers of antiquity were wont to diſcourſe in the ſhade of a ſpreading tree, in ſome cultivated plantation. It is obvious, on intuition, that nature often intended ſolely to pleaſe the eye in her vegetable productions. She decorates the floweret that ſprings beneath our feet in all the perfections of external beauty. She has clothed the garden with a conſtant ſucceſſion of various hues. Even the leaves of the tree undergo a pleaſing viciſſitude. The freſh verdure which they exhibit in the ſpring, the various ſhades which they aſſume in ſummer, the yellow and ruſſet tinge of autumn, and the nakedneſs of winter, afford a conſtant pleaſure to a lively imagination. From the ſnowdrop to the moſs roſe the flower garden diſplays an infinite variety of ſhape and colour. The taſte of the floriſt has been ridiculed as trifling; yet ſurely without reaſon. Did nature bring forth the tulip and the lily, the roſe and the honeyſuckle, to be neglected by the haughty pretender to ſuperior reaſon? To omit a ſingle ſocial duty for the cultivation of a polyanthus were ridiculous as well as criminal; but to paſs by the beauties laviſhed before us, without obſerving them, is no leſs ingratitude than ſtupidity. A bad heart finds little amuſement but in a communication with the active world, where ſcope is given for the indulgence of

---

† Dr Knox.

Natural Beauty.

malignant paſſions ; but an amiable diſpoſition is commonly known by a taſte for the beauties of the animal and the vegetable creation." In ſhort, ſince the world was made for our uſe, ſince the beauties of nature are alike diſplayed before all men, and ſince they are unqueſtionably an inexhauſtible fund of innocent amuſement ; that ſubject muſt be of vaſt importance which enables us to reliſh them properly.

NATURAL HISTORY.

1 Definition.

THE objects of nature may be conſidered under two points of view ; 1ſt, With reſpect to their form, ſtructure, habits, and individual properties when viewed in a ſtate of inactivity ; 2dly, With reſpect to the mutual changes which they produce when made to act on each other. Hence the ſtudy of nature may be divided into two parts, Natural History and Natural Science ; the former conſidering bodies in comparatively an inactive ſtate, the latter in a ſtate of mutual action.

Natural History, then, is that part of natural knowledge which teaches us to diſtinguiſh and deſcribe the objects of nature, to examine their appearance, ſtructure, properties and uſes, and to collect, preſerve, and arrange them (A).

2 Immenſity of nature's works.

I. When we take a general ſurvey of the objects with which we are ſurrounded, we are bewildered amidſt the number and variety that are every where preſented to our view. The air, the woods, the fields, the waters, teem with myriads of animals ; a large proportion of the earth's ſurface is covered with a green mantle of luxuriant herbage, interſperſed with plants and flowers of a thouſand varied tints ; and when we ſearch below this, when we explore the cloud-capt mountain, the gloomy mine, the ſequeſtered cavern, or the rocky cliff, we diſcover a great variety of mineral ſubſtances, either piled into irregular maſſes, or lying in uniform beds or layers, diſpoſed in veins or ſeams, or ſcattered at random through the other ſtony matters.

To the caſual obſerver, the number and variety of theſe objects would appear almoſt infinite. He would conſider it equally impoſſible to enumerate them as to number the ſtars, or count the ſands on the ſea ſhore. This idea, however, ariſes from his ſeeing them in confuſion and diſorder. The naturaliſt, by ſeparating them into thoſe groups or claſſes, in which they often naturally preſent themſelves, has ſucceeded not only in diſtinguiſhing the ſeveral kinds from each other, but even in gueſſing pretty accurately at the number of ſpecies that have hitherto been diſcovered.

There are two objects which ſhould principally occupy the attention of the naturaliſt : 1ſt, To claſſify natural ſubſtances ; 2dly, To examine their ſtructure.

3 Claſſification.

The number of natural productions being confeſſedly very great, it is neceſſary to find out ſome means of diſtinguiſhing them from each other, and of recognizing them on ſeeing them anew. Theſe means are the peculiarities, or the aſſemblages of peculiarities, that excluſively belong to each body. Now there is ſcarcely any ſubſtance that has a ſimple character, that is, which can be diſtinguiſhed from every other ſubſtance by any one of its properties ſingly. It is only by the combination of ſeveral of theſe properties that we can diſtinguiſh an object from others which reſemble it in poſſeſſing ſome one or more of thoſe very properties ; and the more numerous the ſpecies we compare, the more neceſſary it becomes to bring their properties together, in order to aſſign to each a character that may diſtinguiſh it from the reſt. Hence to diſtinguiſh a ſpecies, conſidered independently from all others that exiſt in nature, it is neceſſary to expreſs in its character almoſt the whole of its properties, and the more of theſe we take into the character, the more complete will be our deſcription of the object. But no man can acquire a ſufficiently accurate knowledge of all natural objects to enable him to give a complete deſcription of them : human life is too ſhort to admit of the completion of ſuch a taſk. All that can be expected from our limited faculties is to acquire a general knowledge of natural objects, confining our principal attention to ſuch as poſſeſs ſome ſtriking qualities, or appear convertible to the uſeful purpoſes of life.

4 *Methods and ſyſtems.*

To gain this end, two modes of procedure have been adopted by naturaliſts. According to the firſt mode, we employ characters that proceed by degrees from particulars to generals. We begin by comparing together a certain number of ſpecies that bear the neareſt relation to each other. In drawing the characters of theſe ſpecies, it is requiſite to expreſs only thoſe differences, which, on a ſuppoſition that they are the moſt nearly related, form but a ſmall part of their properties ; a number of ſpecies thus brought together conſtitutes what is called a *genus* or *tribe*.

The

(A) Some writers divide natural hiſtory into *general* and *particular*, which are thus defined by Cuvier. *General natural hiſtory* conſiders under a ſingle point of view, all natural bodies, and the common reſult of all their actions in the great whole of nature. It determines the laws of coexiſtence of their properties ; it eſtabliſhes the degrees of reſemblance that exiſt between different bodies, and claſſes them according to theſe degrees. The *Particular natural hiſtory* of any body, to be perfect, ſhould comprehend, 1ſt, The deſcription of all the ſenſible properties of that body, and of all its parts ; 2d, The mutual relations of theſe parts, the motions which they produce, and the changes which they undergo while they remain united ; 3d, The active and paſſive relations of this body with every other body in the univerſe ; and 4th, The explanation of all theſe phenomena. See *Tableau Elementaire d'Hiſtoire Naturelle.*

The remainder of theſe properties which are common to all the ſpecies of the genus combine to form the character, or rather the deſcription, of the genus, diſtinguiſhing it from all thoſe which might be formed by bringing together other ſpecies; but the number of theſe common properties being ſtill very conſiderable, we repeat the ſame means in order to reduce the characters of the *genera* to ſmaller terms. We compare together only thoſe genera which moſt nearly reſemble each other, and the generic characters now employed muſt only expreſs thoſe differences which form but a ſmall part of their common properties. Thoſe properties, which are common to all the genera, compoſe a character that diſtinguiſhes this aſſemblage or group from all other groups or genera. Such an aſſemblage of genera is called an *order*.

Repeating the ſame operation, and bringing together ſuch orders as are moſt nearly allied, we form a more general aſſemblage, called a *claſs;* and again uniting a certain number of claſſes, we form a higher diviſion, to which naturaliſts have given the name of *kingdom:* this chain of diviſions in which the higher links comprehend the lower, forms what is called a *method*. The other mode of procedure is to riſe gradually from generals to particulars, beginning with the ſlighteſt and moſt obvious differences, thus forming the firſt diviſion or kingdom; dividing each kingdom into claſſes, each claſs into orders, each order into genera, each genus into ſpecies, and each ſpecies into varieties. This deſcending ſeries conſtitutes what is called a *ſyſtem*, and is that which has been generally adopted by naturaliſts.

5
Illuſtration.

To illuſtrate this ſyſtematical claſſification of natural objects, let us ſelect a familiar example. Among the various creatures that paſs under our obſervation, a great number are poſſeſſed of life, of ſenſation, and voluntary motion; theſe we call *animals*, and of theſe we form the *animal kingdom*. On examining various groups of animals, we find that many have four extremities, and ſuckle their young by means of teats; theſe we call *quadrupeds* or *mammalia*. We have thus formed a *claſs of animals*. Again we find that of the mammalia ſome have hoofed feet and blunt fore-teeth, and feed almoſt entirely on vegetables. Theſe will conſtitute an order of the claſs of mammalia, to which Linnæus has given the name of *belluæ*. Of this order a certain number of animals agree in having ſix fore-teeth in both jaws, and form a genus or tribe diſtinguiſhed by this particular from the other animals of the ſame order, and commonly called the *horſe* tribe. Laſtly, In this tribe we find one ſpecies that has ſolid hoofs, a tail briſtly at the end, an upright mane, and a black croſs on the ſhoulder of the male. This ſpecies is the common *aſs*.

6
Diviſion of nature into kingdoms examined.

In framing an artificial ſyſtem of natural hiſtory, moſt writers have agreed on the diviſion of natural bodies into kingdoms, proceeding on the ſuppoſition that thoſe marks which are to diſtinguiſh the objects of one kingdom from thoſe of another are ſufficiently fixed and certain.

Let us examine for a little how far this ſuppoſition agrees with nature's works as we find them.

The diviſion of natural objects commonly adopted is into three kingdoms; the animal, vegetable, and mineral kingdoms. This diviſion has been almoſt univerſally received as perfectly conſiſtent with nature; and is by moſt perſons thought to be ſo clear and diſtinct, that they ſuppoſe it impoſſible to miſtake in referring any particular object to its proper kingdom. This ariſes from their having noticed only ſuch objects as bear evident marks of the diviſion to which they belong; but if we draw their attention to a variety of other individuals, they will acknowledge themſelves to be incompetent to the deciſion, or will erroneouſly refer to one diviſion, what has, after accurate examination, been determined to belong to another.

There is one whole claſs of productions, called *zoophytes* by naturaliſts, which ſeem to form the connecting links between the different kingdoms. They are animals of the polypus kind, moſtly covered with a calcareous cruſt, differing little in compoſition from the ſhells of lobſters, ſhrimps, and other ſhell-fiſh, and formed like them from an exudation or ſecretion on the ſurface of their bodies. Theſe polypi are connected together by thouſands, or even millions, and aſſume a great variety of appearances according to their arrangement: the ſame ſpecies, however, always aſſuming the ſame, or very nearly the ſame appearance. Some are connected together in form of ſtem and branches, as the *fluſtræ*, *ſertulariæ*, *corallines* and others; many of which have their offspring in the egg ſtate attached to them, and ſo ſituated as to bear exact reſemblance to the ſeed-veſſels of plants. Theſe are altogether ſo like to many of the ſea-plants, as to be generally confounded with them, under the title of ſea-weeds; but the attentive naturaliſt may, by examining them in their natural ſtate, perceive the tentacula or feelers of each polypus extended in its ſearch for food, and haſtily retracting within its ſhell upon the leaſt alarm. Many of this deſcription are found attached to oyſters or other ſhell-fiſh; and often to ſtones and pebbles which are covered or occaſionally wetted by the ſea.

Other zoophytes aſſume leſs regular figures, and are much more firm and ſolid, reſembling the productions of the mineral kingdom. Madrepores and millepores, called often *brainſtones*, are of this kind. At firſt ſight they look very like ſtones and pebbles, or like pieces of chalk or marble, but on an accurate inſpection, any one may perceive marks of an organic ſtructure; and when they are in a recent ſtate, may detect the inhabitants of their numerous cells.

The above examples would ſuffice to prove, how inſufficient is either a haſty examination or the judging by ſimilarity of appearance, for determining to what kingdom of nature any particular object belongs. But there are many other productions to which few perſons could without heſitation aſſign their places: For inſtance, where would we arrange the green powdery ſubſtance ſo common on paling; the ſpotted and ſtreaked appearance on ſtones; the mould on cheeſe, or the green jelly-like matter that floats on the ſurface of the ſtagnant waters? Naturaliſts in general have aſſigned theſe productions to the vegetable kingdom; but Sennebier and a few others have maintained that ſome of them are animals.

According to ſome writers, the moſt philoſophical notion which we can form on this ſubject is, that the diviſion of natural objects into kingdoms is artificial, and that Nature, acknowledging no ſuch bonds, paſſes imperceptibly from the animal to the vegetable, and from the

the vegetable to the mineral world, without defining where one ceaſes or where the next begins.

As the appearances of natural productions are inſufficient, ſo are their properties and powers, for determining which are animals or which vegetables, according to the received acceptation of the terms. If locomotion is allowed to be the characteriſtic of an animal, where ſhall we place the oyſter, or the zoophytes of which we have juſt been ſpeaking, or where ſome ſpecies of *ulva* and *conferva*, plants that ſwim about detached in water? If feeling or ſenſation be the teſt, who ſhall decide, that the ſenſitive plant (*mimoſa pudica*), poſſeſſes it not? and who determine that the *leaves* of the fly-trap, (*Dionæa muſcipula*), when they contract, and catch the fly as ſoon as it alights, do not feel the deſpoiler that comes to rob it of its honey? *

Though theſe and ſimilar objections may certainly be made to the artificial diviſion of nature's works into kingdoms, yet it is convenient to have ſuch a diviſion; and even the very difficulty of eſtabliſhing to which kingdom any object belongs, is an additional ſpur to the genius and induſtry of the naturaliſt.

7 Diviſion of natural bodies into *organized* and *inorganic*.

The moſt natural diviſion of the works of nature is that which diſtinguiſhes them into organized and *inorganic* bodies; and on the whole, we have ſeen no attempt to eſtabliſh the differences between theſe ſo ſucceſsful as that adopted by M. Dumeril in his late ſcientific work, *Traité Elementaire d'Hiſtoire Naturelle.* "Some objects, ſays he, as animals and plants, have formerly conſtituted a part of other individuals, ſimilar to themſelves, from which they have been ſeparated at a certain period, under the form of eggs, of germs, or of little living creatures; and their exiſtence is evidently owing to this generation; they are *born.* Others, on the contrary, as ſtones, ſalts, water, may be formed by certain circumſtances, and even by ourſelves at pleaſure. They have not neceſſarily made a part of other ſimilar bodies; their exiſtence ſeems to depend on certain fortuitous circumſtances, that have produced the approximation of their conſtituent principles, and their origin might be referred to attraction. Theſe bodies are *formed.* Vegetables and animals, in increaſing their ſize, only develope themſelves. Whatever may be their minuteneſs, we ſhall, on a careful examination, find them already formed, with their parts requiring only to be evolved. Their increaſe proceeds from within outwards by *intus-ſuſception.* Stones, and a great many other bodies, are augmented only by the ſame matter from which they are produced; their growth takes place always from without, by a ſort of aggregation.

"As the increaſe of the bodies which compoſe theſe two great ſubdiviſions is not alike in both, a duration very different ought to be the reſult of this diſſimilarity. In fact, minerals are ſuſceptible of indefinite increaſe, and their end is always indeterminate; it is vague, and depends on the circumſtances under which they are placed. Plants and animals ought, from the ſame circumſtances which favoured their developement, to ſtop when their extenſion has been carried to the higheſt degree, ſo that the end or death of theſe bodies is fixed and neceſſary.

"The maſſes in which ſtones and other ſimilar bodies generally preſent themſelves, are angular, inſulated, and very variable in their ſize. The individuals which we call plants and animals, have always, and neceſſarily, a form that is conſtant, for the moſt part rounded and ſymmetrical, and their extenſion is limited within certain bounds.

"There is this great difference between theſe bodies; that thoſe which increaſe by aggregation may be divided into molecules, or parts infinitely ſmall, bearing a very near reſemblance to the maſs from which they were taken; while in thoſe which develope themſelves, no portion can be taken away and exiſt by itſelf, at leaſt unleſs it develope new parts, which replace thoſe that are wanting.

"The bodies which do not develope themſelves, are in general formed of fluids or ſolids which remain conſtantly in the ſame points; they are compoſed of very few elements, which may be ſeparated and again reunited. The bodies which develope themſelves, on the contrary, are eſſentially compoſed of ſolids and fluids, which are always changing, and in a ſtate of renovation; they have always, and from neceſſity, more or leſs conſiſtence, they are penetrated and augmented by fluids, and after being decompoſed they can never be formed again ſuch as they were before *."

8 Diviſion of natural hiſtory.

For the more convenient ſtudy of natural hiſtory, the whole ſubject may be divided into five great branches, viz. Meteorology, Hydrography, Mineralogy, Botany, and Zoology.

9 Meteorology.

1. Meteorology includes the deſcription of all thoſe phenomena which take place in the atmoſphere that ſurrounds our globe. In the preſent work it is conſidered under the articles METEOROLOGY, METEOROLITE, *Atmoſpheric* ELECTRICITY, CLOUD, MOON, *Influence of*, &c.

10 Hydrography.

2. Hydrography comprehends the natural hiſtory of the ſea, of rivers, lakes, and other collections of water that make up ſo large a part of the earth. Much of this ſubject will be found treated of under the article RIVER, and various parts of it have been diſcuſſed under CHEMISTRY and MINERALOGY.

11 Mineralogy.

3. Mineralogy is that part of the ſubject which treats of the ſolid inorganic bodies that are found on the ſurface or in the bowels of the earth. It has been conſidered under the articles GEOLOGY and MINERALOGY.

12 Botany.

4. Botany comprehends the natural hiſtory of vegetables. See BOTANY.

13 Zoology.

5. Zoology includes the natural hiſtory of all animated beings, and is ſubdivided into many ſubordinate claſſes.

Theſe claſſes are different in number and denomination, according to the different ſyſtems of naturaliſts. Linnè, whom we have principally followed in this work, has arranged animals under ſix claſſes: viz. 1. *Mammalia*, or thoſe animals which ſuckle their young at *mammæ* or paps; ſee MAN, MAMMALIA and CETOLOGY. 2. *Aves*, or birds; ſee ORNITHOLOGY. 3. *Amphibia*, or thoſe animals which can live either on land or in water; ſee ERPETOLOGY and OPHIOLOGY. 4. *Piſces*, or fiſhes; ſee ICHTHYOLOGY. 5. *Inſecta*, or inſects; ſee ENTOMOLOGY. And 6. *Vermes*, or worms; ſee HELMINTHOLOGY and CONCHOLOGY.

14 Cuvier's arrangement.

Later naturaliſts have divided animals into a greater number of claſſes, and have ſubdivided theſe differently. Of theſe arrangements, that of M. Cuvier ſeems the moſt deſerving of notice. After conſidering man, whom he very properly diſtinguiſhes from the other mammalia by allotting to him a ſeparate book, he divides the reſt of

---

* *Skrimſhire's Eſſays on Natural Hiſtory*, vol. i.

* *Dumeril Traité Elem.* tom. i. p. 5.

of the animal kingdom into nine claſſes, viz. MAMMIFEROUS animals, BIRDS, REPTILES, FISHES, MOLLUSCA, WORMS, CRUSTACEOUS animals, INSECTS and ZOOPHYTES.

We have already given an outline of four of theſe claſſes, viz. of the MAMMIFEROUS animals, under MAMMALIA, and of MOLLUSCA, WORMS and ZOOPHYTES, under HELMINTHOLOGY. To complete our view of Cuvier's arrangement, we ſhall here add an outline of the remaining five claſſes.

15
Of birds.

Cuvier divides birds into five orders, viz. RAPACIOUS birds or ACCIPITRES, PASSERINE birds, CLIMBERS or SCANSORES, GALLINACEOUS birds, WADERS or GRALLÆ, and ANSERINE birds.

1. The RAPACIOUS birds have ſhort feet, toes furniſhed with ſtrong claws, and a hooked bill. They are ſubdivided into three ſections; viz. *Nudicolles*, having the head and part of the neck without feathers; containing the vulture tribe. *Plumicolles*, having the head covered with feathers and a cere at the baſe of the bill, containing the falcon tribe; including *Griffons*, *Eagles*, *Sparrow-hawks*, *Buzzards*, *Kites* and *Falcons*. *Nycterides*, having the head flattened backward from the front and the eyes directed forward; containing the *owl* tribe.

2. The PASSERINE birds are diſtinguiſhed by having four toes, three before and one behind, with the external toes wholly or partially united. They are ſubdivided into ſeven ſections: viz. *Creniroſtres*, having the bill grooved towards the end of the mandible; containing the Shrikes, Flycatchers, Thruſhes, Chatterers and Tanagers. *Dentiroſtres*, having a bill with notched edges; containing the Plant-clippers, Motmots, and Hornbills. *Pleniroſtres*, having the bill ſtraight, ſtrong, compreſſed and without a groove; containing the Grakles, Crows, Rollers, and Birds of Paradiſe. *Coniroſtres*, having the bill conical; containing the Orioles, Stares, Groſbeaks, Sparrows, and Buntings. *Sabuliroſtres*, having the bill ſlender like an awl; containing the Titmice, Manakins, Larks, and Wagtails. *Planiroſtres*, having the bill ſhort, flattened horizontally, and opening very wide; containing the Swallows and Goat-ſuckers. *Tenuiroſtres*, having the bill ſlender, elongated and ſolid; containing the Nuthatches, Creepers, Humming birds, Hoopoes, Bee-eaters, King's-fiſhers and Todys.

3. The CLIMBERS have two toes before and two behind. They are ſubdivided into two ſections; viz. *Cuneiroſtres*, having a ſlender bill; containing Jacamars, Wood-peckers, Wry-necks, and Cuckoos. *Leviroſtres*, having the bill thick and light; containing the Anis, Touracoes, Muſophages, Curucuis, Barbets, Toucans, and Parrots.

4. The GALLINACEOUS birds have the front toes united at their baſe by a ſhort membrane. They are ſubdivided into two ſections, viz. *Alectrides*, having common wings fitted for flying; containing the Pigeons, Grouſe, Peacocks, Pheaſants, Pintados, Turkeys, Curaſſows, Guans, Buſtards. *Brevipennes*, having wings too ſhort for flight; containing the Oſtrich, Caſſowary and Dodo tribes.

5. The WADERS have elevated and naked tarſi and the two outer toes united. They are ſubdivided into five ſections, viz. *Breviroſtres*, having the bill ſhort and thick; containing the Trumpeters, Screamers, Secretaries, Boat-bills, and Flamingos. *Cultriroſtres*, having the bill long, ſtrong, and like a knife; containing the Herons, Jabirus and Ibiſſes. *Latiroſtres*; having the bill long, weak, and flattened horizontally; containing the Spoonbills. *Longiroſtres*, having the bill ſlender, long and weak; containing the Avoſets, Plovers, Lapwings, Phalaropes, and Woodcocks. *Preſſiroſtres*, having the bill middle ſized and compreſſed, containing the Oyſter-Catchers, Rails, Coots and Jacanas.

6. The ANSERINE birds have the toes united by broad membranes. They are ſubdivided into four ſections, viz. *Pennipedes*, having all the four toes united; containing the Pelicans, Tropic birds and Darters. *Macropteres*, having the thumb free, the bill not indented, and very long wings; containing the Terns, Gulls, Skimmers, Petrels and Albatroſſes. *Serriroſtres*, having the thumb free, the bill broad and ſerrated, and wings of a moderate ſize; containing the Ducks and Merganſers. *Brachypteres*, having the thumb either free or wanting, the bill not ſerrated, and the wings very ſhort, containing the Grebes, Auks and Manchots.

16
Of reptiles.

The AMPHIBIA or REPTILES are divided into two orders, as follows.

1. Thoſe that have a heart with two auricles. This order is ſubdivided into two ſections, viz. *Chelonia*, having a back ſhell and the jaws inveſted with horn, containing the Tortoiſe tribe, including Turtles and Tortoiſes. *Sauria*, having a ſcaly body and teeth; containing the Lizard tribe, including the Crocodiles, Guanas, Dragons, Lizards, Skinks, and ſome others.

2. Thoſe that have a heart with one auricle. This order is alſo ſubdivided into two ſections, viz. *Ophidia*, having a ſcaly body, no feet, and always without branchiæ; containing the tribes of Anguis, Amphiſbæna, Cæcilia, Acrocordon, Angaha, Coluber or *Snake*, Boa, and Crotalus or *Rattle-Snake*. *Batrachia*, having a naked ſkin, feet and branchiæ in the young animals; containing the Frogs, Salamanders, and (according to Cuvier's original tables) the Siren.

17
Of fiſhes.

The fiſhes are divided into two orders, CARTILAGINOUS and BONY fiſhes.

1. Thoſe which have a Cartilaginous ſkeleton are divided into two ſections, viz. *Chondropterygii*, with fixed branchiæ; containing the Lampreys, Hags, Rays, Dog-fiſh and Sea-monſters. *Branchioſtegi*, with free branchiæ; containing the tribes Batrachus or *American Toad-fiſh*, Polyodon, Accipenſer or *Sturgeons*, Pegaſus, Syngnathus or *Pipe-fiſh*, Centriſcus or *Bellows-fiſh*, Baliſtes or *Horned-fiſh*, Oſtracion or *Trunk-fiſh*, Tetraodon or *Sun-fiſh*, Ovoides, Mola or *Moles*. Diodon or *Porcupine-fiſh*, Lophius or *Frog-fiſh*, and Cyclopterus or *Lump-fiſh*.

2. The fiſhes with a bony ſkeleton are ſubdivided into four ſections, viz. *Apodes*, having no ventral fins; containing the tribes of Muræna or *Eels*, Gymnothorax, Synbranchus, Sphagebranchus, Gymnotus or *Electric-eels*, Trichiurus, Gymneterus, Ophidium, Ammodytes, or *Sand-eels*; Anarrhichas, or *Sea-wolves*; and Xiphias or *Sword-fiſh*. *Jugulares*, having the ventral fins ſituated before the pectoral; containing the Haddocks, Blennys, Hunch-back, Dragonets, Sea-dragons, and Star-gazers, *Thoracici*, with the ventral fins ſituated below the pectoral; containing the Bull-heads, Scorpions, Gurnards, Gobys, Surmullets, Mackerel, Stickle-backs, Long-tails, Lonchiurus, Johnes, Sciænes, Dorees, Stromateus, Theuthis, Chætodon, Dorados,

Bodians, Holocentrus, Lutiens, Perches, Anthias, Epinclephus, Wraſſes, Breams, Scares, Flounders, Sea-ſerpents, Lepidopus, and Remoras. *Abdominales*, with the ventral fins ſituated behind the pectoral; containing the Mormyrus, Carps, Mullets, Flying-fiſh, Polynemus, Herrings, Atherines, Argentines, Salmons, Pikes, Loches, Anablapes, Silurus, Platyſomatus, Armed-fiſh, Cuiraſs-fiſh, Amia, Acanthonotus, and Fiſtularia, or *Tobacco-pipe-fiſh*.

18 Of cruſtacea.

The CRUSTACEA are divided into two orders, as follows:

1. *Monoculi*, containing the tribes of Limulus, Calygus, Apus, Cyclops, and Polyphemus.

2. *Ecreviſſes*, or *Crabs*, containing the tribes of Cancer, Inachus, Pagurus, Aſtacus, Palinurus, Scyllarus, and Squilla.

19 Of inſects.

The INSECTS are diſtributed by Cuvier under two general orders, viz. Thoſe with jaws, and thoſe without jaws.

1. *Inſects* with jaws are arranged under five ſections, viz. GNATHAPTERA, NEUROPTERA, HYMENOPTERA, COLEOPTERA, and ORTHOPTERA. The GNATHAPTERA, have no wings, and are ſubdivided into *Polygnathes*, having ſeveral pairs of jaws, containing the tribes of Phyſodes, Oniſcus, and Cymothoa; *Millepedes*, with two jaws and feet at each ring of the body, containing the tribes of Julus and Scolopendra; *Araneides*, having the head joined to the corſelets, eight feet, and abdomen without feet; *Seticaudes*, having the head diſtinct, ſix feet, and abdomen terminated by ſilken threads; *Ricinus*, with the head diſtinct, ſix feet, and the abdomen naked. The NEUROPTERA have four reticulated wings, and are ſubdivided into *Odonates*, having the mouth covered with the lip, and the wings extended during repoſe; *Tectipennes*, with the mouth ſalient, and wings hidden below the body during repoſe; *Agnathes*, with a very ſmall mouth, and no mandibles. The HYMENOPTERA have four veined wings, and of theſe ſome have the abdomen joined to the thorax by a pedicle; as the *Mellites*, having the lip prolonged into a trunk; the *Duplipennes*, having the upper wings folded lengthwiſe; the *Chryſides*, having the antennæ bent, and the abdomen hollow below; the *Anthophiles*, with the antennæ filiform, wings not folded, abdomen round, and lips ſhort; the *Trouiſſeurs*, with ſetaceous antennæ, of 12 or 13 joints, rolling up ſpirally; the *Myrmeges*, with ſetaceous bent antennæ, and a rounded abdomen; the *Inſectirodes*, with bent antennæ of 30 joints, and a prominent ſting; *Cynipes*, with filiform antennæ and a ſpiral ſting. Others of this ſection have the abdomen ſeſſile as the *Uroceri*, with palpæ ſcarcely apparent, and a very prominent ſting, and the *Tenthredos* with very prominent palpæ and a ſerrated ſting. The COLEOPTERA have four wings, the uppermoſt of which are hard, and the lower fold tranſverſely: they have either ſix palpæ, as the *Carnaſſiers*, with filiform or ſetaceous antennæ; or four palpæ; and of theſe latter ſome have the tarſus five-jointed, as the *Lamellicornes*, with clavated antennæ, having the club lamellated; the *Clavicornes*, with the antennæ either perfoliated or ſolid; the *Brachelyteres*, with moniliform antennæ and ſhort elytra; the *Woodpiercers*, with filiform antennæ and hard elytra; and the *Apalytres*, with filiform antennæ and ſoft elytra. Others have the tarſi four or five-jointed; as the *Lucifuges*, with variable antennæ and hard elytra; and the *Bliſtering-flies*, with variable antennæ and ſoft elytra. Others again have the tarſi four-jointed; as the *Roſtricornes*, with antennæ on the beak; the *Wood-eaters*, with ſetiform antennæ; the *Teretiforms*, with clavated antennæ, and a body often cylindrical, and the club ſolid; the *Planiforms*, with granulated antennæ and a flattened body; and the *Herbivori*, with filiform or moniliform antennæ and a ſwollen body. A few have the tarſi three-jointed, as the *Coccinellæ*. The ORTHOPTERA have four wings, the upper hard and the lower folded longitudinally. They include the *Forficulæ*, having the anus terminated by a forceps; the *Blattæ*, with a flattened body and the head retiring below the corſelet; the *Mantis* and *Spectres*, with a very long corſelet; and the *Leapers*, with cylindrical body and long hinder legs formed for jumping.

2. The INSECTS without jaws are ſubdivided into HEMIPTERA, LEPIDOTERA, DIPTERA, and APTERA. The HEMIPTERA have four wings frequently croſſed, and a jointed beak; and include the *Frontiroſtres*, having the beak riſing from the fore part of the head; the *Colliroſtres*, with the beak appearing to grow from the neck; and the *Planipennes*, with the wings not croſſed and ſpreading. The LEPIDOPTERA have four wings covered with ſcales and a ſpiral trunk; they include the *Butterflies*, with the antennæ terminated by a ſolid maſs; the *Heſperiæ*, with the antennæ curved at their extremity; the *Fuſicornes*, with the antennæ ſwelling towards the middle, and the *Seticornes*, with ſetaceous antennæ. The DIPTERA have only two wings; and include the *Hydromies*, with filiform or plumoſe antennæ and a trunk; the *Sarcoſtomes*, with a fleſhy retractile trunk, terminated by two lips; the *Scleroſtomes*, with very ſhort antennæ, a horned projecting ſucker, but no trunk; and the *Gad flies*, with ſhort antennæ, and neither ſucker nor trunk. The APTERA have no wings: they include the *Paraſitical* inſects, or *Fleas*, *Lice*, and *Mites*.

20 The notion of a chain of beings examined.

It is not ſurpriſing that naturaliſts of taſte and genius, from the gradation that ſeems to take place among the works of nature, ſhould have been led to form the notion that there exiſts in nature a regular ſeries or *chain* of beings, the links of which, if we could diſcover them all, would be found to reſemble each other ſo nearly, as only to exhibit to the ſuperficial obſerver a few ſhades of difference. *Natura non per ſaltum movet*, has become a ſort of axiom in natural hiſtory.

The notion of a *chain* of *being* is alluring, and does not want arguments in its favour. The Eſquimaux Indian, or the inhabitant of Terra del Fuego, ſeems ſcarcely ſuperior in form, and very little in intellect, to the Oran Otan; the *Platypus*, the flying *Lemur*, flying Squirrels, and, ſtill more, the Bats, appear to form the connecting links between quadrupeds and birds; while the Seals, the *Walruſſes*, and the whole order of *Cete*, connect the former with the fiſhes. In this latter claſs, the Flying Fiſh, in its capability of ſupporting itſelf in the air, ſeems to approach the feathered tribes, while ſome of theſe, as the Penguins, in their habits and manner of life, bear ſome diſtant reſemblance to fiſhes. Again, the Siren and the Eels ſo nearly reſemble each other, that it has been diſputed whether the former ſhould be reckoned among the *Amphibia* or the *Fiſhes*; while one ſpecies of Lizard, (*Lacerta lumbricoides*), is ſo like an earth-worm, as apparently to connect the *Amphibia* and the *Vermes*. Farther, the diminutive Humming-bird (*Trochilus exilis*), and the Humble

Humble Bee, (*Apis terreſtris*), are ſo nearly alike, both in ſize and manner of life, as to form no very exceptionable links of union between the birds and inſects.

If we compare the vegetable tribes with ſome of the inferior claſſes of animals, we ſhall perceive many points of reſemblance, which may ſeem to indicate a continuance of the ſame chain. Beſides the *Mimoſa pudica* and *Dionæa muſcipula*, already mentioned, the *Hedyſarum gyrans*, or moving plant, is a remarkable inſtance of the mobility of vegetables; the carrion flower (*Stapelia hirſuta*), and ſome ſpecies of *morel*, bear the odour of putrid animal ſubſtances; while on the other hand, the *Mantis ſiccifolia* might be miſtaken for a dried leaf; ſeveral ſpecies of *Pennatula* (ſea pens) and *Sertularia*, for ferns; the *Madrepora fungites* (muſhroom madrepore), for a petrified muſhroom; and the *Tubularia magnifica*, and *Actiniæ*, when expanded, for the moſt beautiful full-blown flowers.

Laſtly, on comparing the mineral kingdom with the claſſes of organized beings, we find ſeveral ſo nearly reſembling ſtones, as ſcarcely to be diſtinguiſhed from them.

Though the view which we have given above, of the circumſtances that have led naturaliſts to form the idea of a regular chain of beings, is ſpecious; it will not bear the ſcrutiny of a ſtrict examination. The reſemblances which we have pointed out, are more apparent than real; and anatomy and chemiſtry, added to a more accurate acquaintance with the works of nature, have proved, that thoſe links which, to ſuperficial obſervers, appear moſt allied, are yet ſeparated by conſiderable chaſms. In fact, if we were to admit theſe reſemblances as ever ſo accurate, they would lead us to form, not one chain, but many.

21 Number of ſpecies in nature.

It muſt be conſidered as a very difficult, though a very curious problem, to aſcertain the number of ſpecies at preſent known throughout the ſeveral ſubdiviſions of nature. From the different modes in which different naturaliſts have diſtributed the objects of their reſearch, and from the additions that are perpetually made to our knowledge, it may be impoſſible to fix the preciſe number of known ſpecies at any given time; but we may make a tolerably near approximation to the truth; and this we ſhall now attempt, going through the ſeveral *kingdoms*, *claſſes*, and *orders*, as they have been treated of in the former parts of this work.

22 Animals.

I. IN THE ANIMAL KINGDOM.

A. Man,		5 ſpecies.
B. Mammalia.		
1. Primates,	100*	
2. Bruta,	30*	
3. Feræ,	184*	
4. Glires,	124*	
5. Pecora,	82*	
6. Belluæ,	13*	
7. Cete,	25†	
		558 ſpecies.
C. Birds.		
1. Accipitres,	259	
2. Picæ,	757	
3. Anſeres,	279	
4. Grallæ,	346	
5. Gallinæ,	127	
6. Paſſeres,	1038	
		2806 ‡
D. Amphibia.		
1. Reptiles,	176	
2. Serpents,	225	
		401 §
E. Fishes.		
1. Apodes,	40	
2. Jugulares,	52	
3. Thoracici,	443	
4. Abdominales,	200	
5. Brancheoſtegi,	82	
6. Chondropterigii,	70	
		887 **
F. Insects.		
1. Coleoptera,	5011	
2. Hemiptera,	1687	
3. Lepidoptera,	2900	
4. Neuroptera,	1097	
5. Hymenoptera,	1573	
6. Diptera,	1026	
7. Aptera,	744	
		14,038 ††
G. Worms.		
1. Inteſtina,	406‡‡	
2. Molluſca,	433‡‡	
3. Teſtacea,	2672*	
4. Zoophyta,	489‡‡	
5. Infuſoria,	229‡‡	
		4229

* See *Mammalia.*

† See *Cetology.*

‡ *Turton.*

§ See *Erpetology.*

** *Turton.*

†† *Turton.*

‡‡ See *Helminthology.*

* See *Conchology.*

So that the number of ſpecies in this kingdom may be eſtimated at about 22,924, or in round numbers about 23,000 (B).

23 Vegetables.

II. IN THE VEGETABLE KINGDOM.

A. Monandria.		
1. Monogynia,	73	
2. Digynia,	10	
		83 ſpecies.
B. Diandria.		
1. Monogynia,	374	
2. Digynia,	5	
3. Trigynia,	52	
		431
C. Triandria.		
1. Monogynia,	477	
2. Digynia,	546	
3. Trigynia,	32	
		1055

(B) The numbers here given differ in ſeveral inſtances from thoſe which we have ſeen in ſome late works on this ſubject. Thus, M. La Cépède, in a note to the diſcourſe delivered by him at the cloſe of his courſe of Natural Hiſtory, ſtates the numbers of ſome claſſes as follows: *Mammalia*, 416 ſpecies; *Birds*, 2534; *Reptiles*, 125; *Serpents*, 180; *Fiſhes*, 992; in all 4247.

Claſſification.

D. TETRANDRIA.		
1. Monogynia,	527	
2. Digynia,	14	
3. Trigynia,	521	
4. Tetragynia,	51	
		593 ſpecies.
E. PENTANDRIA.		
1. Monogynia,	1537	
2. Digynia,	652	
3. Trigynia,	121	
4. Tetragynia,	8	
5. Pentagynia,	173	
6. Decagynia,	1	
7. Polygynia,	2	
		2494
F. HEXANDRIA.		
1. Monogynia,	699	
2. Digynia,	5	
3. Trigynia,	69	
4. Hexagynia,	2	
5. Polygynia,	10	
		785
G. HEPTANDRIA.		
1. Monogynia,	25	
2. Digynia,	3	
3. Tetragynia,	2	
4. Heptagynia,	1	
		31
H. OCTANDRIA.		
1. Monogynia,	377	
2. Digynia,	11	
3. Trigynia,	95	
4. Tetragynia,	10	
		493
I. ENNEANDRIA.		
1. Monogynia,	40	
2. Trigynia,	8	
3. Hexagynia,	1	
		49
K. DECANDRIA,		
1. Monogynia,	452	
2. Digynia,	131	
3. Trigynia,	142	
4. Pentagynia,	205	
5. Decagynia,	7	
		937
L. DODECANDRIA.		
1. Monogynia,	100	
2. Digynia,	6	
3. Trigynia,	138	
4. Tetragynia,	7	
5. Pentagynia,	6	
6. Dodecagynia,	14	
		271 ſpecies.
M. ICOSANDRIA.		
1. Monogynia,	133	
2. Digynia,	16	
3. Trigynia,	4	
4. Pentagynia,	102	
5. Polygynia,	91	
		346
N. POLYANDRIA.		
1. Monogynia,	259	
2 Digynia,	11	
3. Trigynia,	31	
4. Tetragynia,	20	
5. Pentagynia,	12	
6. Polygynia,	231	
		564 ſpecies.
O. DIDYNAMIA.		
1. Gymnoſpermia,	441	
2. Angioſpermia,	640	
		1081
P. TETRADYNAMIA.		
1. Siliculoſæ,	168	
2 Siliquoſ æ,	258	
		426
Q. MONADELPHIA.		
1. Triandria,	17	
2. Pentandria,	134	
3. Heptandria,	120	
4. Octandria,	2	
5. Decandria,	51	
6. Endecandria,	4	
7. Dodecandria,	33	
8. Polyandria,	331	
		692
R. DIADELPHIA.		
1. Pentandria,	1	
2. Hexandria,	15	
3. Octandria,	42	
4. Decandria,	652	710
S. POLYADELPHIA.		
1. Pentandria,	3	
2. Dodecandria,	3	
3. Icoſandria,	4	
4. Polyandria,	55	
		65
T. SYNGENESIA.		
1. Polygamia Æqualis,	439	
2. Pol. Superflua,	441	
3. Pol. Fruſtranea,	116	
4. Pol. Neceſſaria,	97	
5. Pol. Segregata,	22	
6. Monogamia,	88	
		1194
V. GYNANDRIA.		
1. Diandria,	155	
2. Triandria,	6	
3. Tetrandria,	1	
4. Pentandria,	42	
5. Hexandria,	23	
6. Octandria,	1	
7. Decandria,	7	
8. Dodecandria,	1	
9. Polyandria,	50	
		286
U. MONOECIA.		
1. Monandria,	16	
2. Diandria,	8	
3. Triandria,	99	
4. Tetrandria,	49	
5. Pentandria,	41	
6. Hexandria,	4	
7. Heptandria,	1	
8. Polyandria,	52	
9. Monadelphia,	78	

10. Syngeneſia,

Claſſification.

Claſſification.

10. Syngeneſia,	46	
11. Gynandria,	4	
		398 ſpecies.

W. Dioecia.		
1. Monandria,	1	
2. Diandria,	36	
3. Triandria,	17	
4. Tetrandria,	21	
5. Pentandria,	19	
6. Hexandria,	33	
7. Octandria,	7	
8. Enneandria,	4	
9. Decandria,	7	
10. Dodecandria,	14	
11. Polyandria,	19	
12. Monadelphia,	26	
13. Syngeneſia,	5	
14. Gynandria,	9	
		219

X. Polygamia.		
1. Monœcia,	181	
2. Diœcia,	26	
3. Triœcia,	16	
		223 ſpecies.

Y. Cryptogamia.		
1. Filices,	267	
2. Muſci,	268	
3. Algæ,	467	
4. Fungi,	465	
		1467
Z. Palmae,		14
		Total, 14,807 (c).

24 Minerals.

III. IN THE MINERAL KINGDOM.

Minerals are divided into four great claſſes, viz. Earths and Stones, Salts, Combustibles, and Metallic Ores.

A. Earths and Stones.		
1. Diamond genus,	1	
2. Zircon,	2	
3. Siliceous,	62	
4. Argillaceous,	29	
5. Magneſian,	17	
6. Calcareous,	22	
7. Barytic,	2	
8. Strontian,	2	
		137 ſpecies.

B. Salts.		
1. Sulphates,	6	
2. Nitrates,	1	
3. Muriates,	3	
4. Carbonates,	2	
5. Borates,	2	
6. Fluates,	1	
		15

Objects and utility of Natural Hiſtory.

C. Combustibles.		
1. Sulphur,	1	
2. Bituminous,	6	
3. Graphite,	2	
		9
D. Metallic Ores are divided into 24 genera, each metal forming a genus,		106
	Total,	267 ſpecies*.

Hence, taking the whole number of known animals at 23,000, that of vegetables at 50,000 and that of minerals 267, the whole number of known ſpecies of natural objects will be 73,267.

25 Hints for ſtudying. II. Though the claſſification of natural bodies is of the higheſt importance towards making us acquainted with unknown ſpecies, and diſtinguiſhing them from thoſe which we already know; this alone is not ſufficient to form a naturaliſt. His principal object ſhould be to learn the habits, manners, and uſes of the objects which he is ſtudying; and he may perhaps be aſſiſted in this object by the following obſervations.

26 Zoology. 1. In *Zoology*, or the natural hiſtory of the animal kingdom, it is neceſſary to aſcertain both the diſtinctive characters of each individual animal, and its peculiar habits, properties and uſes.

The naturaliſt firſt learns that the ſheep, for inſtance, is in the claſs mammalia, being one of thoſe animals that ſuckle their young; in the order pecora, becauſe it is hoofed, and has no cutting teeth in the upper jaw; and that it is diſtinguiſhed from other animals of the ſame order, by its having ſeveral blunt wedge-like inciſive fore-teeth in the lower jaw only, hollow reclined horns, and no tuſks.

This information would ſatisfy many, who call themſelves naturaliſts; but it is far from being all that is required; the philoſophical inveſtigator of Nature inquires into its habits; as its food, its period of geſtation, its ſeaſon of lambing, the weather and climate moſt ſuited to its health and vigour. He endeavours to learn what produces the difference in its fleece, whether climate, food, or ſome peculiarity in the breed; and is anxious to aſcertain what variety is moſt diſpoſed to fatten, and what food effects this ſpeedily; with many other very uſeful particulars.

The information of the firſt kind is of conſequence, and even neceſſary in many caſes; but that of the latter is moſt uſeful.

If a traveller diſcovers an animal poſſeſſing any uſeful property, or producing any uſeful drug, if he have not the firſt kind of information, he gives ſo confuſed and inaccurate a deſcription of it, that others, miſtaking the animal, diſcredit the author's account, and the world loſes the benefit of his diſcovery.

27 Botany; and 2. *Botany*, or the natural hiſtory of the vegetable kingdom, in the uſual acceptation of the term, implies only

---

* See *Mineralogy*.

(c) This number, drawn from the article Botany, compared with the three firſt volumes of Wildenow's edition of the *Species Plantarum*, and with Perſoon's edition of the *Systema Vegetabilium*, of Linné, is certainly very far below the truth. Many years ago, the number of known ſpecies was reckoned at above twenty thouſand, and there is reaſon to believe that it exceeds fifty thouſand.

Objects and utility of Natural Hiſtory.

only the knowledge of the diſtinctive characters of plants; and he who knows the greateſt number, and is moſt accurate in determining the different ſpecies, is accounted the beſt botaniſt.

This however conſtitutes but a ſmall part of the ſcience; there is another diſtinct department, which may properly be termed the philoſophy of botany, which is both more intereſting and more uſeful. This includes the knowledge of the ſtructure, or the anatomy of plants; and the knowledge of the uſes, or functions of their various parts, as of the leaves, the bark, the pith, the roots, the juices, &c.; which is called the phyſiology of plants. It includes alſo an acquaintance with the ſoil and climate adapted to different vegetables, their mode of propagation, and the various uſes to which their ſeveral parts or productions may be applied.

Botany, in the firſt ſenſe, which may be called practical botany, is ſubſervient, and abſolutely neceſſary to the ſtudy of the philoſophy of botany; for no one that is unacquainted with the claſſification of plants can either convey to others his own information, or himſelf receive the benefit of that of others, reſpecting either the ſtructure and economy or the habits and the uſes of ſuch plants, as may have been inveſtigated.

If medical virtues are diſcovered in any vegetable production; without the accuracy of the practical botaniſt, to aſcertain and deſcribe the particular plant which affords it, the diſcovery is often loſt; or perhaps, what is worſe, the virtues are attributed to a different plant, and it is only by repeated failures, and in ſome caſes after much miſchief, that the error is detected.

It is evident that the ſame may happen to the agriculturiſt, the dyer, or any other artizan, who has diſcovered in the vegetable kingdom the means of improving his art, but has not botanical knowledge ſufficient to give an accurate character of the plant, to which he is indebted for his diſcovery.

28 Mineralogy.

3. In *Mineralogy*, or the natural hiſtory of the mineral kingdom, almoſt half the ſtudents are of that claſs, who content themſelves with collecting, and being able to arrange ſyſtematically the minerals they meet with. But in this department of natural hiſtory, as well as the other two, which we have conſidered, ſomething more than arrangement is required.

It is the man who can analyze, and ſeparate the component parts of mineral productions; who knows the art of aſſaying, and who knows *à priori* the probable ſite of a quarry, or a mine, and can tell the direction of a ſtratum of coal, or of marble, that we may call a mineralogiſt.

The natural hiſtory of the mineral kingdom includes geology, or the data upon which are founded the different theories of the formation of the earth. It includes the knowledge of thoſe facts, upon which the art of mining, and the art of ſeparating and purifying metals, is founded; and its object is to teach likewiſe the properties of thoſe metals, as well as of the earths, and other mineral productions, when ſeparated and in their ſimple ſtate.

29 Utility of the ſtudy.

With reſpect to *the utility of the ſtudy of natural hiſtory*, we have unavoidably given many inſtances of it, in conſidering the object of the ſcience. We need therefore add but few others.

Objects and utility of Natural Hiſtory.

30 To the grazier.

The grazier knows the advantage of attending to the habits and diſtinctive marks of our domeſtic animals. It is natural hiſtory, though not often ſtudied ſcientifically, that teaches him what variety of ſheep to prefer; by what means to obtain a variety of cows, remarkable for their quantity of milk; how to chooſe the ſtock that is beſt adapted to his land, and what is the beſt food for them during winter.

Much benefit is likely to accrue from the attention lately paid to the cultivation of what are termed the artificial graſſes. Inſtead of ſowing his hay ſeeds indiſcriminately, the grazier may ſelect only ſuch graſſes as are, by obſervation, found to be moſt ſuited to his ſoil and cattle.

31 To the farmer.

The farmer's knowledge of the proper ſucceſſion of crops, the beſt times for ſowing them, when to weed, and with what to manure, as well as how to deſtroy both weeds and inſects, is the knowledge of a naturaliſt; and ſurely he who is ſcientifically acquainted with the growth of plants, knowing what part the ſoil acts in vegetation, and what is the aliment moſt required by them, will have great advantage over the mere empirical farmer, who has no better reaſon for what he does, than that his father did the ſame before him.

By ſtudying the natural hiſtory of inſects, we learn the habits of ſuch as are noxious and injurious, and thence derive the means of deſtroying them.

32 To the landed proprietor.

The mineralogiſt has often enriched individual proprietors of land, and benefited his country, by the diſcovery of mines; he is enabled to direct the planners of canals by warning them of obſtacles; and his knowledge has aided the phyſician in aſcertaining the virtues of minerals, and of mineral waters.

33 In the arts.

In the arts, a knowledge of natural hiſtory prevents that confuſion, and thoſe innumerable errors that muſt be committed, when the natural productions which are employed cannot be accurately diſcriminated from others.

It is to the naturaliſt that we are many times indebted for the introduction of foreign animals and foreign plants into our own country. Wheat, oats, barley, and other vegetables, which are now become neceſſary to our exiſtence, were not originally of Britiſh growth. The potato, now ſo general and ſo uſeful, was firſt introduced into this country by Gerard, a noted botaniſt, and was for ſome time cultivated in his garden as a rarity. The ſugar-cane, the bread-fruit tree, the farinaceous palms, the flax and hemp, have all been tranſported by naturaliſts of the preſent day, to regions where they never grew before.

Beſides the above, and many ſimilar inſtances of advantage to be derived from ſtudying the different branches of natural hiſtory, theſe two incalculable benefits neceſſarily ariſe to the ſtudent himſelf, from attending to the whole, or any part of the ſcience; namely, a power of abſtracting the mind, and reaſoning methodically; and a habit of contemplating the Creator in his works*.

Our limits do not permit us to enter further into the fertile topic of the utility and advantages of natural hiſtory. Its utility, in a moral and religious point of view, has been ably illuſtrated by Mr Ray, in his "Wiſdom of God;" by Mr Bingley, in the introduction

---

* Skrimſhire's *Eſſays*.

tion to his "Animal Biography;" and, in particular, by Dr Paley, in his "Natural Theology;" and to theſe works we muſt refer our readers.

34 Art of preſerving ſpecimens.

III. We have ſtated it to be one of the principal objects of natural hiſtory, to teach the mode of preſerving ſpecimens. This art, called by the French *Taxidermie*, is exceedingly curious, and would well deſerve a much fuller conſideration than we can here allot to it. We ſhall confine our attention on this ſubject entirely to the animal kingdom, and even here we muſt be very brief.

The art of preparing and mounting the ſkins of animals appears to be pretty old; but it made no great progreſs before the 17th century, when Reaumur made ſome attempts to preſerve the ſpecimens from the attacks of inſects. In the *Journal de Phyſique* for 1773, there is a memoir addreſſed to the Royal Society of London, by M. Kuckhan, on the methods of preparing birds, which is very curious, but is liable to many objections. In the ſame volume is a memoir by Mauduit, principally reſpecting the means of preſerving animal ſpecimens from the attacks of inſects. His preſervatives are of a poiſonous nature; and, of courſe, their uſe is dangerous, while they do not appear to have been attended with the expected ſucceſs. The arſenical ſoap of Becœur, much celebrated about the ſame time, is liable to ſimilar objections.

The lateſt, and probably the beſt work on this ſubject, is that publiſhed a few years ago by M. Nicolas; and from this the following obſervations are derived.

35 Inſtruments employed.

The inſtruments employed in the preparation of ſpecimens are much the ſame as thoſe uſed by anatomiſts in their ordinary diſſections, conſiſting of ſmall knives or ſcalpels, forceps or pincers of various forms, probes, needles, and pins or wires.

36 Preſervatives againſt inſects.

The preſervatives employed by M. Nicolas to protect the ſpecimens from inſects, are principally of two kinds: 1. Sulphur, which he applies to the ſkins by means of fumigation, thus impregnating them with ſulphurous acid; 2. A liquor for macerating the ſkins, another liquor for rubbing over the hair, and a pomatum for anointing the inſide of the ſkin. The *firſt liquor* is prepared by ſteeping a pound and a half of powdered oak bark, and four ounces of powdered alum, in twenty Engliſh pints of cold water, for two days, taking care to ſhake the mixture from time to time. The *pomatum* is prepared of a pound of white ſoap, half a pound of cauſtic potaſh, four ounces of powdered alum, two Engliſh pints of water, four ounces of oil of petroleum, and the ſame of camphire. The ſoap, cut into ſmall pieces, is put into an earthen pipkin, over a moderate fire; the water poured over it; and when the whole is formed into a ſort of ſoft paſte, the alum and then the oil are added; the whole well ſtirred together, removed from the fire, and when it is nearly cold the camphire is added; being before hand rubbed down in a mortar with a little ſpirit of wine. The pomatum, thus prepared, muſt be kept in glaſs veſſels, well ſtopt; and, when uſed, is to be lowered with water to the conſiſtence of thin cream, and laid on the ſkins by means of a pencil bruſh.

The liquor employed for preſerving the fur is prepared by infuſing an ounce of white ſoap ſhred very ſmall, two ounces of camphire broken into very ſmall pieces, the ſame of *colocynth* or bitter-apple groſsly powdered, in two Engliſh pints of ſpirit of wine, for four or five days, ſhaking the veſſel from time to time, after which the liquor is to be filtered through blotting-paper.

M. Nicolas has given directions for preparing and preſerving ſpecimens of all the various claſſes of animals. We ſhall, as far as our limits permit, briefly follow him through each.

37 Directions for ſtuffing quadrupeds.

In ſkinning quadrupeds, he propoſes to make an inciſion along the middle of the back, from the haunches to the ſhoulders, except in thoſe animals whoſe ſkin is very thick and hard, or is ſet with ſpines, in which the opening muſt be made at the belly in the uſual manner. In detaching the ſkin from the fleſh, we muſt occaſionally employ the knife, and as we proceed, muſt inſert tow between the ſkin and fleſh, to prevent ſoiling the fur. When the whole body is detached, and the ſkin drawn down as far as the ankles, the noſe, and the tip of the tail, the whole body is to be cut away except the head and extremities, which are left to give a better form and ſupport to the ſpecimen. All the fleſhy and fatty parts, the brain, and the eyes, however, muſt be cut away, and nothing left but the bones, the ſpaces between which and the ſkin muſt be ſtuffed with tow cut fine, and a little ſoft clay muſt be put within the orbits, in order to fix the artificial eyes.

Before ſtuffing, the ſkin is to be ſteeped for ſeveral days, from five to fifteen, according to the ſize of the animal, in the liquor firſt deſcribed, and after ſteeping, the inſide is to be well anointed with the pomatum.

When the legs and head are ſtuffed, the cavity of the ſkull filled with very dry moſs, and the eyes fixed, wires are to be paſſed through the inſide of the body, the extremities, and the head and tail, in the following manner. Three iron wires of a moderate ſize, well annealed, at leaſt twice as long as the animal, are to be twiſted together for nearly half the length, and while one wire is left ſtraight, the other two are to be bent at each end, ſo as to form a croſs. When the ſkin is turned, ready for ſtuffing, theſe wires are to be placed within it in ſuch a manner as that the ſtraight wire ſhall paſs through the head and tail, and the croſſing wires through the extremities, coming out at the ball of each foot; and in this way after the cavity is filled up with tow, and the open part neatly ſtitched, the ſpecimen may be fixed on a board in its natural poſition. Nothing remains now but to impregnate the fur with the bitter liquor laſt deſcribed, which is done by means of a ſponge, with which the whole outſide is to be well waſhed, then covered with folds of linen, and dried in the ſhade.

38 Directions for ſtuffing birds.

The art of preſerving birds is perhaps the moſt curious part of the preſent ſubject, and is that to which the moſt attention has been given. M. Nicolas has explained at ſome length the mode recommended by M. Kuckhan in the *Journal de Phyſique*; that by Dr Lettſom, in the *Naturaliſt's and Traveller's Companion*; that of Mauduit, inſerted in the fifth number of the *Encyclopédie Methodique*; and that of Dufreſne, adopted by M. Daudin, and inſerted in his *Traité d'Ornithologie*; after which he details his own.

He deſcribes three methods of preparing birds, according as we can procure freſh-killed ſpecimens, whole dried ſkins brought from abroad, or detached parts of ſeveral

Mode of preſerving ſpecimens.

ſeveral individuals of the ſame ſpecies. We ſhall here confine ourſelves to the firſt of theſe, as being beſt adapted to the generality of our readers.

When a freſh-killed bird is procured, it is to be placed upon a table, upon its back, with the tail turned towards the operator, who, after having ſeparated with his fingers the feathers which cover the belly towards the right and left, is to make with a ſcalpel, a longitudinal inciſion through the ſkin, from the point of the breaſt-bone to about the middle of the belly. The edges of the ſkin are now to be raiſed with a pair of flat pincers, on each ſide, carefully ſeparating the fleſh as occaſion may require, by the knife, and inſerting a little cotton from time to time, to prevent ſoiling the feathers. In this way the ſkin is to be detached from the ſhoulders and neck, and as much as poſſible of the body laid bare, after which a pretty ſtrong thread is to be paſſed through the noſtrils, and tied under the lower mandible, leaving the ends of the thread when tied together, at leaſt twice as long as the neck. Now, holding the bird by the thread, with the back turned towards him, the operator is to hold together the feathers on the two edges of the inciſion as well as thoſe that cover the breaſt, and puſhing the head of the bird inwards with his thumb ſo as to form the neck into an arch, is to cut this off near the body, detach from it the gullet and wind pipe, and all the fleſhy parts, both of the neck and head, by drawing the ſkin as far back as poſſible towards the beak, and cutting off the neck-bones cloſe to the head; he is to empty the ſkull with a little iron inſtrument in the form of an ear-picker, and clean it properly with cotton. He is now to wrap cotton or tow about the head and neck, and to ſeparate the reſt of the ſkin, leaving the pinions and bones of the wings, and legs, and the tail, as directed for quadrupeds. After this has been done, the ſkin is to be turned out like a glove, with all its feathers turned inwards, all the natural openings of the bird, as well as any ſhot-holes, &c. made in killing the bird, are to be ſtitched up with a needle and fine thread; then the whole ſkin as well as the bones, are to be waſhed with a ſtrong infuſion of tan with a little alum, by means of a pencil-bruſh, and the ſkin incloſed in a covered veſſel that it may not dry too haſtily.

In ten or twelve hours time we may waſh the ſkin and bones again with the aſtringent liquor. Twice waſhing in this manner will be ſufficient for very ſmall birds, but thoſe of a middling ſize will require maceration in the firſt liquor employed for quadrupeds during two days, and four or five days for thoſe of larger ſize.

The ſkins being well impregnated with the aſtringent liquor, are to be ſmeared with the ſoapy pomatum, have artificial eyes fixed in the orbits by means of wax, and ſtuffed and mounted much in the ſame manner as quadrupeds, except that the wires employed for this purpoſe are rather differently bended.

Great nicety is required in fixing the different parts of a bird in its natural poſition, and in arranging the feathers ſmoothly and evenly. M. Nicolas directs thin plates of lead, to be placed ſo as to ſecure the wings in the proper poſition till the whole is completely arranged.

To preſerve the feet and legs of birds, he anoints them with linſeed oil mixed with camphire, and applied a little warm.

Mode of preſerving ſpecimens.

The laſt operation conſiſts in enveloping the bird with bandages of muſlin or fine linen, pinned round the neck, breaſt, body, and rump, as well as to ſecure the feathers in their places during drying, as to allow of their being drenched with the bitter liquor to preſerve them from the attacks of inſects.

39 Inſects.

The different orders of inſects require different modes of preparation. The following is a ſummary of our author's mode of preſerving each kind.

For the coleoptera and hemiptera.—One of theſe inſects, as ſoon as caught, is to be carefully wrapt in very fine paper, with the ends of the paper curled round to prevent the animal from moving; and this roll of paper including the inſect, is to be put into a little box of paſteboard till the inſect-hunter returns home. Each inſect is then to be held between the thumb and forefinger of the left hand, the wings to be raiſed by means of a pin, and held open with the middle finger, while the abdomen of the animal is ſlit open from the back, and the entrails abſtracted by means of an iron wire, and the cavity as well as the edges of the wound are to be waſhed with the bitter ſpirituous liquor deſcribed in N° 36. by means of a very fine pencil. Then a ſmall cotton plug impregnated with oil of petroleum is to be ſtuffed into the cavity, with the point of a wire, till the cavity is ſufficiently full, when the wings are to be ſuffered to return to their natural ſituation, and the inſect is ready for mounting. For mounting theſe inſects, M. Nicolas employs little ſquares of card, through the middle and acroſs which he paſſes a ſmall iron wire well annealed, and about the ſize of a harpſicord ſtring. A very fine needle is now to be paſſed through the animal, as near as poſſible to the corſelet; and after having covered the upright iron wire with a light coating of gum-water, he paſſes it through the hole made by the needle, and fixes the animal in ſuch a manner that its feet may reſt upon the card.

For the lepidoptera.—He recommends them to be put, when caught, into a triangular piece of paper, and afterwards into a paſteboard box of the ſame form, opening with a hinge. For mounting theſe inſects it is ſufficient to perforate their bodies with a fine needle, armed with a double thread impregnated with the bitter ſpirituous liquor, making the needle enter by the head and come out at the end of the belly, and then cutting the thread with ſciſſars. The inſect thus prepared is mounted by means of a card, as directed for the *coleoptera*, and a piece of wood about an inch long, ſeven or eight lines broad, and a proper thickneſs, is placed below the wings on each ſide very near the body, and the wings are kept down by means of plates of lead.

40 Fiſhes.

In the preparation of ſpecimen of fiſhes, M. Nicolas prefers the method of Mauduit to that given by Dr Lettſom in the *Naturaliſt's and Traveller's Companion*; but as Mauduit's method requires much ſkill and addreſs, he recommends the following, eſpecially for the flat kinds of fiſh.

He makes a longitudinal inciſion with ſciſſars along the belly of the fiſh from the anus to the lower mandible, and then gradually and carefully ſeparates the ſkin from the fleſh with the aſſiſtance of the blade and flat handle of a ſcalpel, till he has laid bare one ſide of the animal. He then paſſes to the other ſide, proceeding in the ſame manner to detach the ſkin from that part, after which he ſeparates the head from the body with a pair

pair of ſciſſars, and clears away the fleſhy parts attached to the head. He now detaches the ſkin from the back as far as the anus, and then laying the fiſh on the table, he paſſes the flat handle of the ſcalpel below the ſkin that covers the tail and neighbouring parts, in order to ſeparate it completely. This done, he puſhes the tail inwards, and with the aſſiſtance of the ſcalpel and drawing the ſkin very gently, he detaches this as near as poſſible to the end of the tail, which he then ſeparates with ſciſſars, thus leaving the ſkin with nothing attached to it but the head and extremity of the tail. In only remains now to clear away the ears and eyes, and properly clean the head.

The ſkin is now ſteeped for ſome days in the tanning liquor, then laid on a table, and when the head is properly arranged, a model of the body of the fiſh made of ſoft clay, mixed with fine ſand, is placed within the ſkin, which is made to fit neatly over it, is then bound with little bandages of linen, and ſuffered to dry. When the clay is quite dry and hard, and the ſkin has acquired ſo much firmneſs as to retain it proper form, it is to be gently beaten all over to break the clay, ſo that it may be withdrawn through the opening. When this is done, the whole inſide of the ſkin and head is to be ſmeared by means of a pencil bruſh with the ſoap pomatum. After which it is to be entirely filled with cut tow, and the opening ſtitched up as neatly as poſſible. Then artificial eyes are to be placed in the orbits by means of ſoft wax, and the whole body is to be covered with a coat of white varniſh prepared by digeſting four ounces of clear turpentine, three ounces of ſandarac, and one ounce of maſtich in tears, with eight ounces of oil of turpentine, and four ounces of ſpirit of wine, in a bottle placed in a water bath.

41 Reptiles.

In preparing ſpecimens of reptiles,—after what has been ſaid above, little direction will be required. The ſkin is to be ſtript backwards as far as the head, which is to be cut off and cleaned as in other ſpecimens; after which the ſkin is to be macerated, anointed within with pomatum, ſtuffed and varniſhed as before.

42 Cruſtacea.

The *cruſtacea*, including crabs, lobſters, ſtar-fiſh, and ſea-urchins, require but little preparation. In crabs the ſhell, and in lobſters the tail, is to be ſeparated from the reſt of the body; as much as poſſible of the meat is to be picked out from the body and large claws; the whole interior is to be ſmeared with the ſoap pomatum, and after having united the parts, the whole is to be ſuffered to dry.

The ſtar-fiſh and urchins, if taken alive, ſhould be killed by plunging them in ſpirit of wine, and afterwards drying them in the ſun or in an oven moderately heated.

43 Worms.

As to *worms* the only mode of preſerving the *molluſca*, or thoſe with naked bodies, is to keep them in ſpirits; and of the *teſtacea* or ſhell-fiſh, the only part thought worth preſerving is the ſhell; for the preparation of which, ſee CONCHOLOGY.

The above is but an imperfect abſtract of M. Nicolas's "*Methode de preparer et conſerver les Animaux de toutes les claſſes*," which is illuſtrated by plates, and is well deſerving the attention of collectors of ſpecimens.

There is alſo an excellent eſſay on this ſubject by Dufreſne, under *Taxidermie*, in the *Nouveau Dictionaire d'Hiſtoire Naturelle*.

44 Hiſtory of natural hiſtory.

It will be expected that in this introductory article on natural hiſtory, we ſhould ſay ſomething of its riſe and progreſs. Much of our obſervations on this ſubject have been anticipated in preceding articles on the particular branches of natural hiſtory, ſo that little remains for us to do in this place than to give a general ſketch of the early hiſtory of this branch of phyſics.

45 Jewiſh writers.

We have reaſon to believe that the works of nature have formed the favourite ſtudy among the ingenious and inquiſitive from the earlieſt ages of the world. From the continual alluſions to the Creator's works, and the beautiful metaphors drawn from them, which abound in the inſpired writings of the Jewiſh prophets and poets, eſpecially thoſe of Job, Iſaiah, Daniel and David, we know that theſe ſages were well acquainted with natural hiſtory, as far at leaſt as obſervation extended. Solomon, as we are told, was acquainted with all vegetables, "from the cedar of Lebanon to the hyſſop that ſpringeth out of the wall;" and probably ſo wiſe a man was well acquainted with the other kingdoms of nature. Some writers have gone ſo far as to aſſert that Ariſtotle and Theophraſtus learned natural hiſtory from the writings of Solomon, though on what data they ground this aſſertion, we are at a loſs to determine.

46 Ariſtotle.

The principal writers on natural hiſtory among the ancients, whoſe writings have come down to us, are Ariſtotle, Theophraſtus, and Pliny the elder. Of the firſt we may remark with Haller, that his writings on this ſubject exhibit a continued chain of phyſical and anatomical facts, which for the moſt part appear to have been the reſult of accurate obſervation. He relied leſs than any of the ancient naturaliſts on uncertain and fabulous report; he induſtriouſly collected and examined natural bodies, and appears to have himſelf diſſected many animals, eſpecially fiſhes, or at leaſt to have been preſent at their diſſection. There are even to be found in his writings, references by letters to figures which he employed to illuſtrate his obſervations.

47 Theophraſtus.

Theophraſtus wrote chiefly on the natural hiſtory of plants and foſſils, on winds, and on fire. His works have been edited by Heinſius, but, except in plants, they do not contain much that is worthy of our obſervation more than what is to be found in the writings of Ariſtotle.

48 Pliny.

The natural hiſtory of Pliny is a valuable repoſitory of ancient knowledge, which, notwithſtanding all its errors and extravagances, we may venture to call after the panegyric of his nephew, a comprehenſive and learned work, little leſs various than nature herſelf. The author, in the dedication of his work to Veſpaſian, ſenſible of the defects with which it abounds, apologiſes for them, from the conſideration that the path which he took had been in a great meaſure untrodden, and held forth to the traveller few enticements; while ſome parts of his ſubject had been ſo often handled, that readers were become cloyed with them: that it was an arduous taſk to give what is old an appearance of novelty; to add weight and authority to what is new; to caſt a luſtre upon ſubjects that have been obſcured by time; to render acceptable what is become trite and diſguſting; to obtain credit to doubtful relations; and, in a word, to repreſent every thing according to nature, and with all its natural properties. His deſign muſt be acknowledged to be grand and noble, and when we conſider that the work was compoſed in the midſt of important engagements,

engagements, and chiefly at broken periods ſtolen from ſleep, we ſhall not wonder that it was imperfectly executed.

49 Ancients deficient in method.

The ancients had no idea of methodical or ſyſtematic diſtinctions. As they were acquainted with but few bodies in compariſon with the moderns, and attended only to thoſe which were uſeful to man; they diſtinguiſhed them only by their uſual properties, their native country, their habitations, and the uſeful purpoſes to which they might be applied. From the few productions which they deſcribed, they were not led to perceive the neceſſity of ſearching among them for diſtinctive marks or relations, which may prevent their being confounded with each other. They doubtleſs believed that their deſcriptions were ſufficient, and that the names which they impoſed would deſcend with their cuſtoms to poſterity, without being affected by the diſorders and alterations that have changed the face of countries and the ſeat of empires. But the revolutions that have deſolated the faireſt regions of the globe, by inſulating or diſplacing their inhabitants, or by confounding them with one another, and altering their language, have frequently almoſt extinguiſhed the lamp of ſcience. After many ages of ignorance and barbarity, we find in the few works of the ancient naturaliſts, which have eſcaped the ravages of war and the devaſtations of civil diſcord, little more than uncertainty and obſcurity, with reſpect to thoſe ſpecies which they have deſcribed. Notwithſtanding the labours of numerous commentators, we do not certainly know what ſpecies of plant is the *cicuta* employed by the Greeks for the execution of criminals, and which terminated the life of Socrates. We cannot be ſure that the animals, which we find beſt characterized in the ancient writings, bore the names which we attribute to them; nor are we more certain with reſpect to the ancient nomenclature of minerals.

50 Riſe of methods.

As long as ſtudious men cultivated the ſciences only through the medium of the writings of the ancients, and attempted nothing beyond the interpretation of theſe, *natural hiſtory*, like every other branch of phyſics, remained obſcure and confuſed, and fiction or imagination took the place of facts; but when they perceived the advantage of ſtudying nature herſelf, and interrogating her by obſervation, methods were erected, and diſtinctive characters for the ſpecies introduced. This fortunate revolution took place in the 16th century. Cæſalpinus firſt attempted to reduce vegetables to claſſes, and diſtinguiſh them into tribes according to their form.—Geſner, beſides the fine hints that he firſt gave of the conſtant relation between the ſtructure of the ſeed and that of the other parts of plants, was the firſt who attempted any ſyſtematic and methodical arrangement of animals. In the 17th century, Moriſon, Ray, and Rivinus, improved on the hints of Cæſalpinus reſpecting the claſſification of vegetables; and Aldrovandus, Rhedi, and Swammerdam upon thoſe of Geſner reſpecting animals; and in a ſhort time this firſt impulſe given to the art of arranging and diſtinguiſhing natural bodies by conſtant characters, was communicated to all thoſe who were employed in the ſtudy of nature. Tournefort, profiting by all the attempts towards method and ſyſtem in the claſſification of vegetables that had been made before him, advanced a conſiderable ſtep in botany, by his beautiful method of diſtinguiſhing plants according to the form of their flowers and fruits, which he publiſhed towards the end of the 17th century.

51 Linné and Buffon.

The ſame year of the 18th century (1707) gave birth to two men who have advanced the ſcience of natural hiſtory far beyond any of their predeceſſors. We need ſcarcely mention the names of Linné and Buffon. The Swediſh naturaliſt extended his enlarged views through every branch of natural hiſtory; he arranged in his *Syſtema Naturæ* and *Syſtema Vegetabilium* all the productions of nature, and diſtinguiſhed them by characters that were preciſe and ſimple; he created a new language for expreſſing with brevity all theſe characters, and thus preſented to the view, as in a compendious picture, all the properties of bodies. Buffon, proceeding in a different road, treated more copiouſly the moſt important parts of natural hiſtory, and of the animals that are moſt nearly allied to man, in a work which the fire of his genius and the brilliancy of his ſtyle have rendered a univerſal favourite. The rival of Ariſtotle and Pliny, whoſe genius he ſeems to have combined in the greatneſs of his views and extent of his plan, and altogether one of the firſt writers of his age, he inſpired a paſſion for the ſtudy of nature in numbers, who without his works would never have engaged in ſuch a ſtudy, and communicated to his countrymen that taſte which has ever ſince ſurvived him.

After what has been given in the particular treatiſes on natural hiſtory in this Encyclopædia, both as to the progreſs of the ſcience, and the principal works on each department of it, ſince the time of Linné and Buffon; it is unneceſſary for us to trace its progreſs beyond that period. The advances made within theſe few years are immenſe, our ſtock of information is prodigiouſly increaſed, and the modes of ſtudy greatly improved and facilitated. The labours of Cuvier, Geoffroy, Lacépède, Dumont, Dumeril, Lamarck, Duvernois, Sonnini, Bloch, Spallanzani, Eſper, Juſſieu, Wildenow, Werner, Patrin, St Fond, Brochant, Brongniart, Klaproth, Fourcroy, Vauquelin, Shaw, Latham, Bancroft, Cateſby, Ellis, Smith, Withering, Woodville, Kirwan, Playfair, Thomſon, Jameſon, &c. with the aſſiſtance to be derived from the *Annales de Muſeum National*, the *Naturaliſt's Miſcellany*, the *Linnæan Tranſactions*, and the ſplendid plates of Merian, Schreber, Curtis, Sowerby, Sotheby, &c. afford ample proofs of the induſtry and ſucceſs with which this delightful field has been cultivated, and of the rich harveſt that has been derived from the united efforts of ſo many men of genius and talents.

NATURAL *Philoſophy*, is commonly defined to be that branch of knowledge which conſiders the powers and properties of natural bodies, and their mutual actions on one another. The province of moral philoſophy is the mind of man; its inquiries and reſearches are into the intellectual world. Natural philoſophy, on the other hand, is only concerned with the material part of the creation. The Moraliſt's buſineſs is to inquire into the nature of virtue, the cauſes and effects of vice; to propoſe remedies for it, and to point out the mode of attaining happineſs, which only can be the reſult of virtuous conduct. The Naturaliſt, on the contrary, has nothing to do with ſpirit; his buſineſs is ſolely about body or matter; and he ought to have a ſolid and accurate knowledge of all material ſubſtances, together with their affections and properties; and if poſſible, he is to inveſtigate the reaſons of ſuch and ſuch appearances.—Indeed, the firſt and principal part of this ſcience is, to collect all the manifeſt and ſenſible appearances of things, and reduce them into a body of natural hiſtory. Philoſophy has often been ſaid, and is even now very generally thought, to mean an inquiry into all the cauſes of things; but experience informs us, that though we are acquainted with a good number of effects, we can trace but few of their cauſes; ſo that philoſophy itſelf will really be found to be in general but a collection of facts. Still, however, it differs from natural hiſtory in its appropriated ſenſe; the buſineſs of which is only to obſerve the appearances of natural bodies ſeparately, and from theſe appearances to claſs them with other bodies: natural philoſophy goes farther, and recites the action of two or more bodies of the ſame or different kinds upon one another; and though it can neither inveſtigate nor point out the cauſes of thoſe effects, whatever they are, yet, from mathematical reaſoning combined with experience, it can be demonſtrated, that in ſuch circumſtances ſuch effects muſt always take place. There are evidently two ways of making obſervations on the material world: the firſt is, when we view things nearly as they happen to occur, without any deſign or intervention of our own; in which way, indeed, no great improvements can be expected in the art, becauſe chance having the direction, only exhibits occaſional or extemporary properties. The other method is, when, after a thorough acquaintance with bodies, we apply them to other bodies equally known, diligently attending to the reſult, and obſerving whether any thing new ariſes. Such ſeems to be in general the nature of our article; nor is it our intention to be much more particular at preſent. We muſt therefore refer our readers reſpectively to thoſe parts of the ſubject, reſpecting which they wiſh for more ſatisfaction and minuter details. The ancient and modern definitions of the word *philoſophy*, together with its origin, as well as the manner of philoſophizing in former times as well as at preſent, with the gradual improvement of ſcience, particularly natural, we ſhall introduce, we think, more properly, under the words PHILOSOPHY and PHYSICS. We need only add, under the preſent article, what however is well known, that natural philoſophy was till lately divided only into four parts, commonly called the *four branches*, viz. 1. Mechanics; 2. Hydroſtatics; 3. Optics; and, 4. Aſtronomy; and theſe again are ſubdivided into various parts. Modern diſcoveries have added, however, two more parts to the number, viz. Magnetiſm and Electricity. It is remarkable, that in the Engliſh univerſities theſe two latter branches are never taken notice of in lecturing on natural philoſophy, the old diviſion being ſtill retained, without any mention of theſe two important articles. The reaſon may be, that they are only ſubject to experiment, and not yet reduced to mathematical reaſoning; which is the method of teaching philoſophy in one of thoſe celebrated ſeminaries. Of theſe branches of this extenſive ſcience, it is not our intention to take even a general view in this place. We muſt therefore refer our readers to each particular article, where they will find them treated at conſiderable length.

NATURALISATION, in *Law*, the act of naturalizing an alien, or putting him into the condition of a natural-born ſubject, and entitling him to the rights and privileges thereof. But none can be naturalized unleſs they have received the ſacrament within one month before the bringing in of the bill, and taken the oaths of allegiance and ſupremacy in the preſence of the parliament. A perſon who is naturalized may have lands by deſcent, as heir at law, as well as obtain them by purchaſe; but he is diſabled from being a member of the privy council or parliament; or from holding offices, 7 Jac. I. cap. 2. 12 Will. III. cap. 2. All children born out of the king's dominions, whoſe fathers were or are ſubjects of this kingdom at the time of their birth, are adjudged to be natural born ſubjects of this realm, except children of parents attainted of treaſon, or that are in the actual ſervice of a foreign prince at enmity with us, 4 Geo. II. cap. 21. Every foreign ſeaman, who in time of war ſerves two years on board an Engliſh ſhip, is *ipſo facto* naturalized, 13 Geo. II. cap. 3. And all foreign Proteſtants and Jews, upon their reſiding ſeven years in any of the Britiſh colonies, without being abſent above two months at a time, or ſerving two years in a military capacity there, are upon taking the oaths naturalized to all intents and purpoſes, as if they had been born in this kingdom; and therefore are admiſſible to all ſuch privileges, and no other, as Proteſtants or Jews born in this kingdom are entitled to. See ALIEN and DENIZEN.

In France before the Revolution, naturalization was the king's prerogative; in England it is only done by act of parliament. In the former of thoſe places, before their government was overturned, Swiſs, Savoyards, and Scots, did not require naturalization, being reputed regnicoles, or natives.

NATURALS, among phyſicians, whatever naturally belongs to an animal, in oppoſition to non-naturals. See NON-NATURALS.

NATURE, according to Mr Boyle, has eight different ſignifications; it being uſed, 1. For the author of nature, whom the ſchoolmen call *Natura Naturans*, being the ſame with God. 2. By the nature of a thing, we ſometimes mean its eſſence; that is, the attributes which make it what it is, whether the thing be corporeal or not; as when we attempt to define the nature of a fluid, of a triangle, &c. 3. Sometimes we confound that which a man has by nature with what accrues to him by birth; as when we ſay, that ſuch a man is noble by nature. 4. Sometimes we take nature for an internal principle of motion; as when we ſay, that a ſtone by nature falls to the earth. 5. Sometimes we underſtand by nature, the eſtabliſhed courſe of things. 6. Sometimes we take nature for an aggregate of powers belonging to a body, eſpecially a living one; in which ſenſe phyſicians ſay, that nature is ſtrong, weak, or ſpent; or that, in ſuch or ſuch diſeaſes, nature left to herſelf will perform the cure. 7. Sometimes we uſe the term nature for the univerſe, or whole ſyſtem of the corporeal works of God; as when it is ſaid of a phœnix, or chimera, that there is no ſuch thing in nature. 8. Sometimes too, and that moſt commonly, we expreſs by the word *nature*, a kind of ſemi-deity, or other ſtrange kind of being.

If, ſays the ſame philoſopher, I were to propoſe a notion of nature, leſs ambiguous than theſe already mentioned, and with regard to which many axioms relating to that word may be conveniently underſtood, I ſhould firſt diſtinguiſh between the univerſal and the particular nature of things. Univerſal nature I would define to be the aggregate of the bodies that make up the world in its preſent ſtate, conſidered as a principle, by virtue whereof they act and ſuffer, according to the laws of motion preſcribed by the Author of all things. And this makes way for the other ſubordinate notion; ſince the particular nature of an individual conſiſts in the general nature applied to a diſtinct portion of the univerſe; or, which is the ſame thing, it is a particular aſſemblage of the mechanical properties of matter, as figure, motion, &c.

Kingdoms of NATURE. See KINGDOMS.

Conduct or Operations of NATURE. See *NATURAL Hiſtory.*

NAVA, in *Ancient Geography*, (Tacitus); a river of Belgica, which runs north-eaſt into the left or weſt ſide of the Rhine. Now the *Nahe*, riſing at the village Naheweiler, on the borders of the biſhopric of Triers, running through the Lower Palatinate, the duchy of Simmeren, by the ſmall town of Bing, into the Rhine.

NAVAL, ſomething relating to a ſhip; whence,

NAVAL Architecture. See *SHIP-Building.*

NAVAL Camp, in antiquity, a fortification, conſiſting of a ditch and parapet on the land ſide, or a wall built in the form of a ſemicircle, and extended from one point of the ſea to another. This was ſometimes defended with towers, and beautified with gates, through which they iſſued forth to attack their enemies. Homer hath left us a remarkable deſcription of the Grecian fortifications of this ſort, in the Trojan war, beginning at ver. 436. Iliad η.

> Then, to ſecure the naval camp and powers,
> They rais'd embattled walls with lofty towers:
> From ſpace to ſpace were ample gates around,
> For paſſing chariots; and a trench profound,
> Of large extent; and deep in earth below
> Strong piles infix'd ſtood adverſe to the foe.
> POPE's *Tranſl.*

Towards the ſea, or within it, they fixed great pales of wood, like thoſe in their artificial harbours: before theſe the veſſels of burden were placed in ſuch order as that they might be inſtead of a wall, and give protection to thoſe within; in which manner Nicias is reported by Thucydides to have encamped himſelf: but this ſeems only to have been practiſed when the enemy was thought ſuperior in ſtrength, and raiſed great apprehenſions of danger in them. When their fortifications were thought ſtrong enough to defend them from the aſſaults of enemies, it was frequent to drag their ſhips to ſhore, which the Greeks called ανωλκειν, the Romans *ſubducere*. Around the ſhips the ſoldiers diſpoſed their tents, as appears everywhere in Homer: but this ſeems only to have been practiſed in winter, when their enemy's fleet was laid up and could not aſſault them; or in long ſieges, and when they lay in no danger from their enemies by ſea; as in the Trojan war, where the defenders of Troy never once attempted to encounter the Grecians in a ſea-fight.

The adjacent places were uſually filled with inns and ſtews, well ſtocked with females, that proſtituted themſelves to the mariners, merchants, and artificers of all ſorts, who flocked thither in great numbers; this, however, appears to have happened only in times of peace.

NAVAL Crown, among the ancient Romans, a crown adorned with figures of prows of ſhips, conferred on perſons who in ſea engagements firſt boarded the enemy's veſſel. See CROWN.

NAVAL Engagement. See TACTICS, *Naval.*

NAVAL Stores, comprehend all thoſe particulars made uſe of, not only in the royal navy, but in every other kind of navigation; as timber and iron for ſhipping, pitch, tar, hemp, cordage, ſail cloth, gunpowder, ordnance, and fire arms of every ſort, ſhip chandlery wares, &c.

NAVAL Tactics, the military operations of fleets. See TACTICS, *Naval.*

NAVAN, a borough town of Ireland, in the county of Meath and province of Leinſter; ſituated about 23 miles north-weſt of Dublin, on the river Boyne. It conſiſts of two chief ſtreets, which interſect each other at right angles.—The tholſel, or town houſe, is a handſome ſtone building. This place was formerly in great repute, and walled in by Hugh de Lacy. An abbey for regular canons, dedicated to the Virgin Mary, was erected here; but whether antecedent to the end of the 12th century is not certain: about that period, however, it was either founded or re-edified by Joceline de Angulo or Nangle. In the burial ground are the remains of many ancient tombs. A barrack for horſe is now built on the ſite of the abbey.

NAVARRE, a province of Spain, part of the ancient kingdom of Navarre, erected ſoon after the invaſion of the Moors; and is otherwiſe called *Upper Navarre*, to diſtinguiſh it from Lower Navarre belonging to the French. It is bounded on the ſouth and eaſt by Arragon, on the north by the Pyrenees, and on the weſt by Old Caſtile and Biſcay; extending from ſouth to north about 80 miles, and from eaſt to weſt about 75. It abounds in ſheep and cattle; game of all kinds, as boars, ſtags, and roebucks; and in wild fowl, horſes, and honey; yielding alſo ſome grain, wine, oil, and a variety of minerals, medicinal waters, and hot baths. Some of the ancient chiefs of this country were called *Sobrarbores*, from the cuſtom, as it is ſuppoſed, which prevailed among ſome of thoſe free nations, of chooſing and ſwearing their

their princes under ſome particular tree. The name of the province is ſuppoſed to be a contraction of *Nava Errea*, ſignifying, in the language of the Vaſcones, its ancient inhabitants, "a land of valleys."—For the particulars of its hiſtory, ſee the article Spain.

Navarre, *Peter*, an officer of eminence in the 16th century, and particularly celebrated for his dexterity in the directing and ſpringing of mines. He was a native of Biſcay, and of low extraction. According to Paul Jove, who affirms that he had an account of the matter from his own mouth, he was firſt a ſailor; but being diſguſted with that employment, he ſought his fortune in Italy, when poverty compelled him to become footman to the cardinal of Arragon. He afterwards inliſted himſelf a ſoldier in the Houſtine army; and having ſerved there for ſome time, went to ſea again, and diſtinguiſhed himſelf by his courage. The reputation of his valour having reached the ears of Gonſalvo de Cordova, this general employed him in the war againſt Naples, and raiſed him to the rank of a captain. Having contributed greatly to the taking of that city by very opportunely ſpringing a mine, the emperor rewarded him for this ſignal ſervice with the earldom of Alveto, ſituated in that kingdom, and gave him the title of *Count of Navarre*. Having the command of a naval expedition againſt the Moors in Africa, he was at firſt very ſucceſsful, and took poſſeſſion of Oran, Tripoli, and ſome other places; but being afterwards ſhipwrecked on the iſland of Gerbes, the great heats and the Mooriſh cavalry deſtroyed a part of his army. Our hero was equally unfortunate in Italy: He was made priſoner at the famous battle of Ravenna in 1512, and languiſhed in France for the ſpace of two years. When finding that the king of Spain, who had been prejudiced againſt him by his courtiers, would do nothing towards his ranſom, he went into the ſervice of Francis I. who gave him the command of 20 companies of infantry, conſiſting of Gaſcons, Biſcayans, and the inhabitants of the Pyrenean mountains. He diſtinguiſhed himſelf in ſeveral ſucceſsful expeditions, until the year 1522, when having been ſent to the relief of the Genoeſe, he was taken by the Imperialiſts. They conducted him to Naples, where he remained a priſoner for three years in the Caſtel del Ovo. From this confinement he was releaſed by the treaty of Madrid, and afterwards fought at the ſiege of Naples under Laulric in 1528: but being again made priſoner at the unfortunate retreat from Averſa, he was conducted a ſecond time to the Caſtel del Ovo. Here the prince of Orange, having by order of the emperor, cauſed ſeveral perſons of the *Angevine* faction to be beheaded, our hero would undoubtedly have ſuffered the ſame fate, if the governor, ſeeing his diſtreſſed ſituation, and feeling for the misfortunes of ſo great a man, had not ſaved him the ſhame of this laſt puniſhment by allowing him to die a natural death. Others pretend that he was ſtrangled in his bed, having arrived at a very advanced age. Paul Jove and Philip Thomaſini have written his life. This laſt informs us, that he was of a tall ſize, had a ſwarthy countenance, black eyes, beard, and hair. A duke of Seſſa, in the laſt century, being deſirous to honour his memory and that of the marſhal de Lautree, cauſed a monument to be erected to each of them in the church of Saint-Marie-le-Neuve at Naples, where they had been interred without any funeral honours.

Navarre, *Martin*, ſurnamed *Azpilcucta*, becauſe he was born in the kingdom which bears that name, ſucceſſively profeſſor of juriſprudence at Toulouſe, Salamanca, and Coimbra, was conſulted from all quarters as the oracle of law. For a part of his knowledge he was indebted to the ſchools of Cahors and Toulouſe, in which he had ſtudied. His friend Barthelemi Carewza, a Dominican, and archbiſhop of Toledo, having been charged with hereſy by the court of inquiſition at Rome, Navarre ſet out at the age of 80 years to defend him. Pius V. appointed him aſſeſſor to Cardinal Francis Alciat, vice-penitentiary. Gregory XIII. never paſſed his gate without ſending for him, and ſometimes would converſe with him for an hour together on the ſtreet: he even deigned to viſit him, accompanied by ſeveral cardinals. Theſe honours did not render him more haughty. His character became ſo eminent, that even in his own time the greateſt encomium that could be paid to a man of learning was to ſay that he was a *Navarre:* this name thus included the idea of erudition, as that of Roſcius formerly marked an accompliſhed comedian. Azpilcucta was the oracle of the city of Rome, and of the whole Chriſtian world. For the influence which he had acquired, he was indebted not only to his knowledge, but alſo to his probity and virtue. Faithful to the duties which the church preſcribed, his temperance and frugality preſerved to him a vigorous conſtitution; and at a very advanced age his genius was equal to the ſevereſt ſtudy. His ſavings enabled him to give liberal aſſiſtance to the poor. His charities, indeed, were ſo great, that his mule, it is ſaid, would ſtop as ſoon as ſhe perceived a beggar. He died at Rome in 1586, at the age of 92. His works were collected and printed in 6 vols. folio at Lyons in 1597, and at Venice in 1602. They diſplayed more learning than judgement, and are now very ſeldom conſulted. Navarre was uncle by the mother's ſide to St Francis of Sales. See Sales.

NAUCRARI, among the Athenians, was the name given to the chief magiſtrates of the Δημοι, "boroughs or townſhips," called Ναυκραριαι; becauſe each was obliged, beſides two horſemen, to furniſh out one ſhip for the public ſervice.

NAUCRATES, a Greek poet, who was employed by Artemiſia to write a panegyric upon Mauſolus.—An orator who endeavoured to alienate the cities of Lycia from the intereſt of Brutus.

NAUCRATIS, a city of Egypt on the left ſide of the Canopic mouth of the Nile. It was celebrated for its commerce, and no ſhip was permitted to land at any other place, but was obliged to ſail directly to the city, there to depoſite its cargo. It gave birth to Athenæus.

NAUCRATITES Nomos, in *Ancient Geography*, (Pliny); a diviſion of the Delta, ſo called from that town *Naucratis;* though Ptolemy compriſes it under the Nomos Saites.

NAUCYDES, a ſtatuary who lived about four centuries before the Chriſtian era.

NAVE, in *Architecture*, the body of a church, where the people are diſpoſed, reaching from the baluſter, or rail of the door, to the chief choir. Some derive the word from the Greek ναος, "a temple;" and others from ναυς, "a ſhip," by reaſon the vault or roof of a church bears ſome reſemblance to a ſhip.

NAVEL, in *Anatomy*, the centre of the lower part of the abdomen; being that part where the umbilical veſſels paſſed out of the placenta of the mother. See ANATOMY *Index*.

NAVEL-Wort. See COTYLEDON, BOTANY *Index*.

NAVEW. See BRASSICA, BOTANY *Index*.

NAVIGATION

IS the art of conducting or carrying a ſhip from one port to another.

HISTORY.

THE poets refer the invention of the art of navigation to Neptune, ſome to Bacchus, others to Hercules, others to Jaſon, and others to Janus, who is ſaid to have made the firſt ſhip. Hiſtorians aſcribe it to the Æginetes, the Phœnicians, Tyrians, and the ancient inhabitants of Britain. Some ſuppoſe, that the firſt hint was taken from the flight of the kite; others, as Oppian (*De Piſcibus*, lib. i.), from the fiſh called *nautilus:* others aſcribe it to accident.—Scripture refers the origin of ſo uſeful an invention to God himſelf, who gave the firſt ſpecimen thereof in the ark built by Noah under his direction. For the raillery which the good man underwent on account of his enterpriſe ſhows evidently enough that the world was then ignorant of any thing like navigation, and that they even thought it impoſſible.

However, profane hiſtory repreſents the Phœnicians, eſpecially thoſe of their capital Tyre, as the firſt navigators; being urged to ſeek a foreign commerce by the narrowneſs and poverty of a ſlip of ground they poſſeſſed along the coaſts; as well as by the conveniency of two or three good ports, and by their natural genius for traffic. Accordingly, Lebanon, and the other neighbouring mountains, furniſhing them with excellent wood for ſhip-building, in a ſhort time they were maſters of a numerous fleet; and conſtantly hazarding new navigations, and ſettling new trades, they ſoon arrived at an incredible pitch of opulence and populouſneſs: inſomuch as to be in a condition to ſend out colonies, the principal of which was that of Carthage; which, keeping up their Phœnician ſpirit of commerce, in time not only equalled Tyre itſelf, but vaſtly ſurpaſſed it; ſending its merchant fleets through Hercules's Pillars, now the ſtraits of Gibraltar, along the weſtern coaſts of Africa and Europe; and even, if we believe ſome authors, to America itſelf.

Tyre, whoſe immenſe riches and power are repreſented in ſuch lofty terms both by ſacred and profane authors, being deſtroyed by Alexander the Great, its navigation and commerce were transferred by the conqueror to Alexandria, a new city, admirably ſituated for thoſe purpoſes; propoſed for the capital of the empire of Aſia, which Alexander then meditated. And thus aroſe the navigation of the Egyptians; which was afterwards ſo much cultivated by the Ptolemies, that Tyre and Carthage were quite forgotten.

Egypt being reduced into a Roman province after the battle of Actium, its trade and navigation fell into the hands of Auguſtus; in whoſe time Alexandria was only inferior to Rome; and the magazines of the capital of the world were wholly ſupplied with merchandiſes from the capital of Egypt.

At length, Alexandria itſelf underwent the fate of Tyre and Carthage; being ſurpriſed by the Saracens, who, in ſpite of the emperor Heraclius, overſpread the northern coaſts of Africa, &c. whence the merchants being driven, Alexandria has ever ſince been in a languiſhing ſtate, though it ſtill has a conſiderable part of the commerce of the Chriſtian merchants trading to the Levant.

The fall of Rome and its empire drew along with it not only that of learning and the polite arts, but that of navigation; the barbarians, into whoſe hands it fell, contenting themſelves with the ſpoils of the induſtry of their predeceſſors.

But no ſooner were the more brave among thoſe nations well ſettled in their new provinces, ſome in Gaul, as the Franks; others in Spain, as the Goths; and others in Italy, as the Lombards; but they began to learn the advantages of navigation and commerce, and the methods of managing them, from the people they ſubdued; and this with ſo much ſucceſs, that in a little time ſome of them became able to give new leſſons, and ſet on foot new inſtitutions for its advantage. Thus it is to the Lombards we uſually aſcribe the invention and uſe of banks, book-keeping, exchanges, rechanges, &c.

It does not appear which of the European people, after the ſettlement of their new maſters, firſt betook themſelves to navigation and commerce. Some think it began with the French; though the Italians ſeem to have the juſteſt title to it; and are accordingly regarded as the reſtorers thereof, as well as of the polite arts which had been baniſhed together from the time the empire was torn aſunder. It is the people of Italy then, and particularly thoſe of Venice and Genoa, who have the glory of this reſtoration; and it is to their advantageous ſituation for navigation they in great meaſure owe their glory. In the bottom of the Adriatic were a great number of marſhy iſlands, only ſeparated by narrow channels, but thoſe well ſcreened, and almoſt inacceſſible, the reſidence of ſome fiſhermen, who here ſupported themſelves by a little trade in fiſh and ſalt, which they found in ſome of theſe iſlands. Thither the Veneti, a people inhabiting that part of Italy along the coaſts of the gulf, retired, when Alaric king of the Goths, and afterwards Attila king of the Huns, ravaged Italy.

Theſe new iſlanders, little imagining that this was to be their fixed reſidence, did not think of compoſing any body politic; but each of the 72 iſlands of this little archipelago continued a long time under its ſeveral maſters, and each made a diſtinct commonwealth. When their commerce was become conſiderable enough to give jealouſy to their neighbours, they began to think of uniting into a body. And it was this union, firſt begun in the ſixth century, but not completed till the eighth, that laid the ſure foundation of the future grandeur of the ſtate of Venice. From the time of this union, their fleets of merchantmen were ſent to all the ports of the Mediterranean; and at laſt to thoſe of Egypt, particularly Cairo, a new city built by the Saracen princes on the eaſtern banks of the Nile, where they traded for the ſpices and other products of the Indies. Thus they flouriſhed, increaſed their commerce, their navigation, and their conqueſts on the terra firma, till the league of Cambray in 1508, when a number of jealous princes conſpired to their ruin; which was the more eaſily effected by the diminution of their Eaſt India commerce, of which the Portugueſe had got one part and the French another. Genoa, which had applied itſelf to navigation at the ſame time with Venice, and that with equal ſucceſs, was a long time its dangerous rival, diſputed with it the empire of the ſea, and ſhared with it the trade of Egypt and other parts both of the eaſt and weſt.

Jealouſy ſoon began to break out; and the two republics coming to blows, there was almoſt continual war for three centuries before the ſuperiority was aſcertained; when, towards the end of the 14th century, the battle of Chioza ended the ſtrife; the Genoeſe, who till then had uſually the advantage, having now loſt all; and the Venetians, almoſt become deſperate, at one happy blow, beyond all expectation, ſecured to themſelves the empire of the ſea, and ſuperiority in commerce.

About the ſame time that navigation was retrieved in the ſouthern parts of Europe, a new ſociety of merchants was formed in the north, which not only carried commerce to the greateſt perfection it was capable of till the diſcovery of the Eaſt and Weſt Indies, but alſo formed a new ſcheme of laws for the regulation therefore, which ſtill obtain under the names of *Uſes and Cuſtoms of the Sea*. This ſociety is that famous league of the Hanſe towns, commonly ſuppoſed to have begun about the year 1164. See *HANSE Towns*.

For the modern ſtate of navigation in England, Holland, France, Spain, Portugal, &c. ſee COMMERCE, COMPANY, &c.

We ſhall only add, that in examining the cauſes of commerce paſſing ſucceſſively from the Venetians, Genoeſe, and Hanſe towns, to the Portugueſe and Spaniards, and from theſe again to the Engliſh and Dutch, it may be eſtabliſhed as a maxim, that the relation between commerce and navigation, or if we may be allowed to ſay it, their union, is ſo intimate, that the fall of the one inevitably draws after it that of the other; and that they will always either flouriſh or dwindle together. Hence ſo many laws, ordinances, ſtatutes, &c. for its regulation; and hence particularly that celebrated act of navigation, which an eminent foreign author calls the *palladium* or *tutelar deity of the commerce of England;* which is the ſtanding rule, not only of the Britiſh among themſelves, but alſo of other nations with whom they traffic.

The art of navigation has been exceedingly improved in modern times, both with regard to the form of the veſſels themſelves, and with regard to the methods of working them. The uſe of rowers is now entirely ſuperſeded by the improvements made in the formation of the ſails, rigging, &c. by which means ſhips can not only ſail much faſter than formerly, but can tack in any direction with the greateſt facility. It is alſo very probable that the ancients were neither ſo well ſkilled in finding the latitudes, nor in ſteering their veſſels in places of difficult navigation, as the moderns. But the greateſt advantage which the moderns have over the ancients is from the mariner's compaſs, by which they are enabled to find their way with as great facility in the midſt of an immeaſurable ocean, as the ancients could have done by creeping along the coaſt, and never going out of ſight of land. Some people indeed contend, that this is no new invention, but that the ancients were acquainted with it. They ſay, that it was impoſſible for Solomon to have ſent ſhips to Ophir, Tarſhiſh, and Parvaim, which laſt they will have to be *Peru*, without this uſeful inſtrument. They inſiſt, that it was impoſſible for the ancients to be acquainted with the attractive virtue of the magnet, and to be ignorant of its polarity. Nay, they affirm, that this property of the magnet is plainly mentioned in the book of Job, where the loadſtone is mentioned by the name of *topaz*, or *the ſtone that turns itſelf*. But it is certain, that the Romans, who conquered Judea, were ignorant of this inſtrument; and it is very improbable, that ſuch an uſeful invention, if once it had been commonly known to any nation, would have been forgot, or perfectly concealed from ſuch a prudent people as the Romans, who were ſo much intereſted in the diſcovery of it.

Among thoſe who admit that the mariner's compaſs is a modern invention, it has been much diſputed who was the inventor. Some give the honour of it to Flavio Gioia of Amalfi in Campania *, who lived about the beginning of the 14th century; while others ſay that it came from the eaſt, and was earlier known in Europe. But, at whatever time it was invented, it is certain, that the mariner's compaſs was not commonly uſed in navigation before the year 1420. In that year the ſcience was conſiderably improved under the auſpices of Henry duke of Viſco, brother to the king of Portugal. In the year 1485, Roderick and Joſeph, phyſicians to John II. king of Portugal, together with one Martin de Bohemia, a Portugueſe, native of the iſland of Fayal, and ſcholar to Regiomontanus, calculated tables of the ſun's declination for the uſe of ſailors, and recommended the aſtrolabe for taking obſervations at ſea. Of the inſtructions of Martin, the celebrated Chriſtopher Columbus is ſaid to have availed himſelf, and to have improved the Spaniards in the knowledge of the art; for the farther progreſs of which a lecture was afterwards founded at Seville by the emperor Charles V.

The diſcovery of the variation is claimed by Columbus, and by Sebaſtian Cabot. The former certainly did obſerve this variation without having heard of it from any other perſon, on the 14th of September 1492, and it is very probable that Cabot might do the ſame. At that time it was found that there was no variation at the Azores, where ſome geographers have thought proper to place the firſt meridian; though it hath ſince been obſerved that the variation alters in time.—The uſe of the croſs ſtaff now began to be introduced among ſailors. This ancient inſtrument is deſcribed by John Werner of Nuremberg, in his

* See *Mariner's Compaſs*.

his annotations on the firſt book of Ptolemy's Geography, printed in 1514. He recommends it for obſerving the diſtance between the moon and ſome ſtar, in order thence to determine the longitude.

At this time the art of navigation was very imperfect, on account of the inaccuracies of the plane chart, which was the only one then known, and which, by its groſs errors, muſt have greatly miſled the mariner, eſpecially in voyages far diſtant from the equator. Its precepts were probably at firſt only ſet down on the ſea charts, as is the cuſtom at this day: but at length there were two Spaniſh treatiſes publiſhed in 1545; one by Pedro de Medina; the other by Martin Cortes, which contained a complete ſyſtem of the art, as far as it was then known. Theſe ſeem to have been the oldeſt writers who fully handled the art; for Medina, in his dedication to Philip prince of Spain, laments that multitudes of ſhips daily periſhed at ſea, becauſe there were neither teachers of the art, nor books by which it might be learned; and Cortes, in his dedication, boaſts to the emperor that he was the firſt who had reduced navigation into a compendium, valuing himſelf much on what he had performed. Medina defended the plane chart; but he was oppoſed by Cortes, who ſhowed its errors, and endeavoured to account for the variation of the compaſs, by ſuppoſing the needle to be influenced by a magnetic pole (which he called the *point attractive*), different from that of the world; which notion hath been farther proſecuted by others. Medina's book was ſoon tranſlated into Italian, French, and Flemiſh, and ſerved for a long time as a guide to foreign navigators. However, Cortes was the favourite author of the Engliſh nation, and was tranſlated in 1561; while Medina's work was entirely neglected, though tranſlated alſo within a ſhort time of the other. At that time the ſyſtem of navigation conſiſted of the following particulars, and others ſimilar: An account of the Ptolemaic hypotheſis, and the circles of the ſphere; of the roundneſs of the earth, the longitudes, latitudes, climates, &c. and eclipſes of the luminaries; a kalendar; the method of finding the prime, epact, moon's age, and tides; a deſcription of the compaſs, an account of its variation, for the diſcovering of which Cortes ſaid an inſtrument might eaſily be contrived; tables of the ſun's declination for four years, in order to find the latitude from his meridian altitude; directions to find the ſame by certain ſtars; of the courſe of the ſun and moon; the length of the days; of time and its diviſions; the method of finding the hour of the day and night; and laſtly, a deſcription of the ſea chart, on which to diſcover where the ſhip is, they made uſe of a ſmall table, that ſhowed, upon an alteration of one degree of the latitude, how many leagues were run in each rhumb, together with the departure from the meridian. Beſides, ſome inſtruments were deſcribed, eſpecially by Cortes; ſuch as one to find the place and declination of the ſun, with the days, and place of the moon; certain dials, the aſtrolabe, and croſs ſtaff; with a complex machine to diſcover the hour and latitude at once.

About the ſame time were made propoſals for finding the longitude by obſervations of the moon.—In 1530, Gemma Friſius adviſed the keeping of the time by means of ſmall clocks or watches, then, as he ſays, newly invented. He alſo contrived a new ſort of croſs ſtaff, and an inſtrument called the *nautical quadrant*; which laſt was much praiſed by William Cunningham, in his *Aſtronomical Glaſs*, printed in the year 1559.

In 1537 Pedro Nunez, or Nonius, publiſhed a book in the Portugueſe language, to explain a difficulty in navigation propoſed to him by the commander Don Martin Alphonſo de Suſa. In this he expoſes the errors of the plane chart, and likewiſe gives the ſolution of ſeveral curious aſtronomical problems; amongſt which is that of determining the latitude from two obſervations of the ſun's altitude and intermediate azimuth being given. He obſerved, that though the rhumbs are ſpiral lines, yet the direct courſe of a ſhip will always be in the arch of a great circle, whereby the angle with the meridians will continually change: all that the ſteerſman can here do for the preſerving of the original rhumb, is to correct theſe deviations as ſoon as they appear ſenſible. But thus the ſhip will in reality deſcribe a courſe without the rhumb line intended; and therefore his calculations for aſſigning the latitude, where any rhumb line croſſes the ſeveral meridians, will be in ſome meaſure erroneous. He invented a method of dividing a quadrant by means of concentric circles, which, after being much improved by Dr Halley, is uſed at preſent, and is called a *nonius*.

In 1577, Mr William Bourne publiſhed a treatiſe, in which, by conſidering the irregularities in the moon's motion, he ſhows the errors of the ſailors in finding her age by the epact, and alſo in determining the hour from obſerving on what point of the compaſs the ſun and moon appeared. He adviſes, in ſailing towards the high latitudes, to keep the reckoning by the globe, as there the plane chart is moſt erroneous. He deſpairs of our ever being able to find the longitude, unleſs the variation of the compaſs ſhould be occaſioned by ſome ſuch attractive point as Cortes had imagined; of which, however, he doubts: but as he had ſhown how to find the variation at all times, he adviſes to keep an account of the obſervations, as uſeful for finding the place of the ſhip; which advice was proſecuted at large by Simon Stevin, in a treatiſe publiſhed at Leyden in 1599; the ſubſtance of which was the ſame year printed at London in Engliſh by Mr Edward Wright, entitled the Haven-finding Art. In this ancient tract alſo is deſcribed the way by which our ſailors eſtimate the rate of a ſhip in her courſe, by an inſtrument called the *log*. This was ſo named from the piece of wood or log that floats in the water while the time is reckoned during which the line that is faſtened to it is veering out. The author of this contrivance is not known; neither was it taken notice of till 1607, in an Eaſt India voyage publiſhed by Purchas: but from this time it became famous, and was much taken notice of by almoſt all writers on navigation in every country; and it ſtill continues to be uſed as at firſt, though many attempts have been made to improve it, and contrivances propoſed to ſupply its place; many of which have ſucceeded in quiet water, but proved uſeleſs in a ſtormy ſea.

In 1581 Michael Coignet, a native of Antwerp, publiſhed a treatiſe, in which he animadverted on Medina. In this he ſhowed, that as the rhumbs are ſpirals,

rals, making endleſs revolutions about the poles, numerous errors muſt ariſe from their being repreſented by ſtraight lines on the ſea charts; but though he hoped to find a remedy for theſe errors, he was of opinion that the propoſals of Nonius were ſcarcely practicable, and therefore in a great meaſure uſeleſs. In treating of the ſun's declination, he took notice of the gradual decreaſe in the obliquity of the ecliptic; he alſo deſcribed the croſs ſtaff with three tranſverſe pieces, as it is at preſent made, and which he owned to have been then in common uſe among the ſailors. He likewiſe gave ſome inſtruments of his own invention; but all of them are now laid aſide, excepting perhaps his nocturnal. He conſtructed a ſea table to be uſed by ſuch as ſailed beyond the 60th degree of latitude; and at the end of the book is delivered a method of ſailing on a parallel of latitude by means of a ring dial and a 24 hour glaſs. The ſame year the diſcovery of the dipping needle was made by Mr Robert Norman * In his publication on that art he maintains, in oppoſition to Cortes, that the variation of the compaſs was cauſed by ſome point on the ſurface of the earth, and not in the heavens: he alſo made conſiderable improvements in the conſtruction of compaſſes themſelves; ſhowing eſpecially the danger of not fixing, on account of the variation, the wire directly under the *fleur de luce;* as compaſſes made in different countries have it placed differently. To this performance of Norman's is always prefixed a diſcourſe on the variation of the magnetical needle, by Mr William Burrough, in which he ſhows how to determine the variation in many different ways. He alſo points out many errors in the practice of navigation at that time, and ſpeaks in very ſevere terms concerning thoſe who had publiſhed upon it.

* See *Dipping Needle.*

All this time the Spaniards continued to publiſh treatiſes on the art. In 1585 an excellent compendium was publiſhed by Roderico Zamorano; which contributed greatly towards the improvement of the art, particularly in the ſea charts. Globes of an improved kind, and of a much larger ſize than thoſe formerly uſed, were now conſtructed, and many improvements were made in other inſtruments; however, the plane chart continued ſtill to be followed, though its errors were frequently complained of. Methods of removing theſe errors had indeed been ſought after; and Gerard Mercator ſeems to have been the firſt who found the true method of doing this, ſo as to anſwer the purpoſes of ſeamen. His method was to repreſent the parallels both of latitude and longitude by parallel ſtraight lines, but gradually to augment the former as they approached the pole. Thus the rhumbs, which otherwiſe ought to have been curves, were now alſo extended into ſtraight lines; and thus a ſtraight line drawn between any two places marked upon the chart would make an angle with the meridians, expreſſing the rhumb leading from the one to the other. But though, in 1569, Mercator publiſhed an univerſal map conſtructed in this manner, it doth not appear that he was acquainted with the principles on which this proceeded; and it is now generally believed, that the true principles on which the conſtruction of what is called *Mercator's chart* depends, were firſt diſcovered by an Engliſhman, Mr Edward Wright.

Mr Wright ſuppoſes, but, according to the general opinion, without ſufficient grounds, that this enlargement of the degrees of latitude was known and mentioned by Ptolemy, and that the ſame thing had alſo been ſpoken of by Cortes. The expreſſions of Ptolemy alluded to, relate indeed to the proportion between the diſtances of the parallels and meridians; but inſtead of propoſing any gradual enlargement of the parallels of latitude in a general chart, he ſpeaks only of particular maps; and adviſes not to confine a ſyſtem of ſuch maps to one and the ſame ſcale, but to plan them out by a different meaſure, as occaſion might require: only with this precaution, that the degrees of longitude in each ſhould bear ſome proportion to thoſe of latitude; and this proportion is to be deduced from that which the magnitude of the reſpective parallels bears to a great circle of the ſphere. He adds, that in particular maps, if this proportion be obſerved with regard to the middle parallel, the inconvenience will not be great though the meridians ſhould be ſtraight lines parallel to each other. Here he is ſaid only to mean, that the maps ſhould in ſome meaſure repreſent the figures of the countries for which they are drawn. In this ſenſe Mercator, who drew maps for Ptolemy's tables, underſtood him; thinking it, however, an improvement not to regulate the meridians by one parallel, but by two; one diſtant from the northern, the other from the ſouthern extremity of the map by a fourth part of the whole depth; by which means, in his maps, though the meridians are ſtraight lines, yet they are generally drawn inclining to each other towards the poles. With regard to Cortes, he ſpeaks only of the number of degrees of latitude, and not of the extent of them; nay, he gives expreſs directions that they ſhould all be laid down by equal meaſurement on a ſcale of leagues adapted to the map.

For ſome time after the appearance of Mercator's map, it was not rightly underſtood, and it was even thought to be entirely uſeleſs, if not detrimental.—However, about the year 1592, its utility began to be perceived; and ſeven years after, Mr Wright printed his famous treatiſe entitled, The Correction of certain Errors in Navigation, where he fully explained the reaſon of extending the length of the parallels of latitude, and the uſes of it to navigators. In 1610, a ſecond edition of Mr Wright's book was publiſhed with improvements. An excellent method was propoſed of determining the magnitude of the earth; at the ſame time it was judiciouſly propoſed to make our common meaſures in ſome proportion to a degree on its ſurface, that they might not depend on the uncertain length of a barley corn. Some of his other improvements were, "The table of latitudes for dividing the meridian computed to minutes;" whereas it had been only divided to every tenth minute. He alſo publiſhed a deſcription of an inſtrument which he calls the *ſea rings;* and by which the variation of the compaſs, altitude of the ſun, and time of the day, may be determined readily at once in any place, provided the latitude is known. He ſhowed alſo how to correct the errors ariſing from the eccentricity of the eye in obſerving by the croſsſtaff. He made a total amendment in the tables of the declinations and places of the ſun and ſtars from his own obſervations made with a ſix foot quadrant in the years 1594, 95, 96, and 97. A ſea quadrant to take altitudes by a forward or backward obſervation; and likewiſe with a contrivance for the ready finding the latitude

latitude by the height of the pole ſtar, when not upon the meridian. To this edition was ſubjoined a tranſlation of Zamorano's Compendium above mentioned, in which he corrected ſome miſtakes in the original; adding a large table of the variation of the compaſs obſerved in very different parts of the world, to ſhow that it was not occaſioned by any magnetical pole.

Theſe improvements ſoon became known abroad.—In 1608, a treatiſe entitled, *Hypomnemata Mathematica*, was publiſhed by Simon Stevin, for the uſe of Prince Maurice. In that part relating to navigation, the author having treated of ſailing on a great circle, and ſhown how to draw the rhumbs on a globe mechanically, ſets down Wright's two tables of latitudes and of rhumbs, in order to deſcribe theſe lines more accurately, pretending even to have diſcovered an error in Wright's table. But all Stevin's objections were fully anſwered by the author himſelf, who ſhowed that they aroſe from the groſs way of calculating made uſe of by the former.

In 1624, the learned Wellebrordus Snellius, profeſſor of mathematics at Leyden, publiſhed a treatiſe of navigation on Wright's plan, but ſomewhat obſcurely: and as he did not particularly mention all the diſcoveries of Wright, the latter was thought by ſome to have taken the hint of all his diſcoveries from Snellius. But this ſuppoſition is long ago refuted: and Wright enjoys the honour of thoſe diſcoveries which is juſtly his due.

Mr Wright having ſhown how to find the place of the ſhip on his chart, obſerved that the ſame might be performed more accurately by calculation: but conſidering, as he ſays, that the latitudes, and eſpecially the courſes at ſea, could not be determined ſo preciſely, he forbore ſetting down particular examples; as the mariner may be allowed to ſave himſelf this trouble, and only mark out upon his chart the ſhip's way, after the manner then uſually practiſed. However, in 1614, Mr Raphe Handſon, among his nautical queſtions ſubjoined to a tranſlation of Pitiſcus's trigonometry, ſolved very diſtinctly every caſe of navigation, by applying arithmetical calculations to Wright's table of latitudes, or of meridional parts, as it hath ſince been called. Though the method diſcovered by Wright for finding the change of longitude by a ſhip ſailing on a rhumb is the proper way of performing it, Handſon alſo propoſes two ways of approximation to it without the aſſiſtance of Wright's diviſion of the meridian line. The firſt was computed by the arithmetical mean between the coſines of both latitudes; the other by the ſame mean between the ſecants as an alternative, when Wright's book was not at hand; though this latter is wider from the truth than the firſt. By the ſame calculations alſo he ſhowed how much each of theſe compendiums deviates from the truth, and alſo how widely the computations on the erroneous principles of the plane chart differ from them all. The method, however, commonly uſed by our ſailors is commonly called the *middle latitude;* which, though it errs more than that by the arithmetical mean between the two coſines, is preferred on account of its being leſs operoſe: yet in high latitudes it is more eligible to uſe that of the arithmetical mean between the logarithmic coſines, equivalent to the geometrical mean between the coſines themſelves; a method ſince propoſed by Mr John Baſſat. The computation by the middle latitude will always fall ſhort of the true change of longitude; that by the geometrical mean will always exceed; but that by the arithmetical mean falls ſhort in latitudes above 45 degrees, and exceeds in leſſer latitudes. However, none of theſe methods will differ much from the truth when the change of latitude is ſufficiently ſmall.

About this time logarithms were invented by John Napier, baron of Merchiſton in Scotland, and proved of the utmoſt ſervice to the art of navigation. From which Mr Edmund Gunter conſtructed a table of logarithmic ſines and tangents to every minute of the quadrant, which he publiſhed in 1620. In this work he applied to navigation, and other branches of mathematics, his admirable ruler known by the name of Gunter's ſcale *; on which are deſcribed lines of logarithms, of logarithmic ſines and tangents, of meridional parts, &c. He greatly improved the ſector for the ſame purpoſes. He ſhowed alſo how to take a back obſervation by the croſs ſtaff, whereby the error ariſing from the eccentricity of the eye is avoided. He deſcribed likewiſe another inſtrument, of his own invention, called the *croſs bow*, for taking altitudes of the ſun or ſtars, with ſome contrivances for the more ready collecting the latitude from the obſervation. The diſcoveries concerning logarithms were carried to France in 1624 by Mr Edmund Wingate, who publiſhed two ſmall tracts in that year at Paris. In one of theſe he taught the uſe of Gunter's ſcale; and in the other, of the tables of artificial ſines and tangents, as modelled according to Napier's laſt form, erroneouſly attributed by Wingate to Briggs.

* See *Gunter's Scale.*

Gunter's rule was projected into a circular arch by the Reverend Mr William Oughtred in 1633, and its uſes fully ſhown in a pamphlet entitled, *The Circles of Proportion*, where, in an appendix, are well treated ſeveral important points in navigation. It has alſo been made in the form of a ſliding ruler.

The logarithmic tables were firſt applied to the different caſes of ſailing by Mr Thomas Addiſon, in his treatiſe entitled, *Arithmetical Navigation*, printed in 1625. He alſo gives two traverſe tables, with their uſes; the one to quarter points of the compaſs, the other to degrees. Mr Henry Gellibrand publiſhed his diſcovery of the changes of the variation of the compaſs, in a ſmall quarto pamphlet, entitled, *A diſcourſe mathematical on the variation of the magnetical needle*, printed in 1635. This extraordinary phenomenon he found out by comparing the obſervations made at different times near the ſame place by Mr Burrough, Mr Gunter, and himſelf, all perſons of great ſkill and experience in theſe matters. This diſcovery was likewiſe ſoon known abroad; for Father Athanaſius Kircher, in his treatiſe entitled, *Magnes*, firſt printed at Rome in 1641, informs us, that he had been told it by Mr John Greaves; and then gives a letter of the famous Marinus Merſennus, containing a very diſtinct account of the ſame.

As altitudes of the ſun are taken on ſhipboard by obſerving his elevation above the viſible horizon; to obtain from thence the ſun's true altitude with correctneſs, Wright obſerves it to be neceſſary that the dip of the viſible horizon below the horizontal plane paſſing through the obſerver's eye ſhould be brought into the account,

account, which cannot be calculated without knowing the magnitude of the earth. Hence he was induced to propoſe different methods for finding this; but complains that the moſt effectual was out of his power to execute; and therefore contented himſelf with a rude attempt, in ſome meaſure ſufficient for his purpoſe: and the dimenſions of the earth deduced by him correſponded very well with the uſual diviſions of the log line; however, as he wrote not an expreſs treatiſe on navigation, but only for the correcting ſuch errors as prevailed in general practice, the log line did not fall under his notice. Mr Richard Norwood, however, put in execution the method recommended by Mr Wright as the moſt perfect for meaſuring the dimenſions of the earth, with the true length of the degrees of a great circle upon it; and, in 1635, he actually meaſured the diſtance between London and York; from whence, and the ſummer ſolſtitial altitudes of the ſun obſerved on the meridian at both places, he found a degree on a great circle of the earth to contain 367,196 Engliſh feet, equal to 57,300 French fathoms or toiſes: which is very exact, as appears from many meaſures that have been made ſince that time. Of all this Mr Norwood gave a full account in his treatiſe called *The Seaman's Practice*, publiſhed in 1637. He there ſhows the reaſon why Snellius had failed in his attempt: he points out alſo various uſes of his diſcovery, particularly for correcting the groſs errors hitherto committed in the diviſions of the log line. But neceſſary amendments have been little attended to by ſailors, whoſe obſtinacy in adhering to eſtabliſhed errors has been complained of by the beſt writers on navigation. This improvement has at length, however, made its way into practice, and few navigators of reputation now make uſe of the old meaſure of 42 feet to a knot. In that treatiſe alſo Mr Norwood deſcribes his own excellent method of ſetting down and perfecting a ſea reckoning, by uſing a traverſe table; which method he had followed and taught for many years. He ſhows alſo how to rectify the courſe by the variation of the compaſs being conſidered; as alſo how to diſcover currents, and to make proper allowance on their account. This treatiſe, and another on trigonometry, were continually reprinted, as the principal books for learning ſcientifically the art of navigation. What he had delivered, eſpecially in the latter of them, concerning this ſubject, was contracted as a manual for ſailors, in a very ſmall piece called his *Epitome;* which uſeful performance has gone through a great number of editions. No alterations were ever made in the Seaman's Practice till the 12th edition in 1676, when the following paragraph was inſerted in a ſmaller character: "About the year 1672, Monſieur Picart has publiſhed an account in French, concerning the meaſure of the earth, a breviate whereof may be ſeen in the Philoſophical Tranſactions, N° 112, wherein he concludes one degree to contain 365,184 Engliſh feet, nearly agreeing with Mr Norwood's experiment;" and this advertiſement is continued through the ſubſequent editions as late as the year 1732.

About the year 1645, Mr Bond publiſhed in Norwood's Epitome a very great improvement in Wright's method, by a property in his meridian line, whereby its diviſions are more ſcientifically aſſigned than the author himſelf was able to effect; which was from this theorem, that theſe diviſions are analogous to the exceſſes of the logarithmic tangents of half the reſpective latitudes augmented by 45 degrees above the logarithm of the radius. This he afterwards explained more fully in the third edition of Gunter's works, printed in 1653; where, after obſerving that the logarithmic tangents from 45° upwards increaſe in the ſame manner that the ſecants added together do, if every half degree be accounted as a whole degree of Mercator's meridional line. His rule for computing the meridional parts belonging to any two latitudes, ſuppoſed on the ſame ſide of the equator, is to the following effect: "Take the logarithmic tangent, rejecting the radius, of half each latitude, augmented by 45 degrees; divide the difference of thoſe numbers by the logarithmic tangent of 45° 30′, the radius being likewiſe rejected; and the quotient will be the meridional parts required, expreſſed in degrees." This rule is the immediate conſequence from the general theorem, That the degrees of latitude bear to one degree (or 60 minutes, which in Wright's table ſtands for the meridional parts of one degree), the ſame proportion as the logarithmic tangent of half any latitude augmented by 45 degrees, and the radius neglected, to the like tangent of half a degree augmented by 45 degrees, with the radius likewiſe rejected. But here was farther wanting the demonſtration of this general theorem, which was at length ſupplied by Mr James Gregory of Aberdeen in his *Exercitationes Geometricæ*, printed at London in 1668; and afterwards more conciſely demonſtrated, together with a ſcientific determination of the diviſor, by Dr Halley in the Philoſophical Tranſactions for 1695, N° 219. from the conſideration of the ſpirals into which the rhumbs are transformed in the ſtereographic projection of the ſphere upon the plane of the equinoctial; and which is rendered ſtill more ſimple by Mr Roger Cotes, in his Logometria, firſt publiſhed in the Philoſophical Tranſactions for 1714, N° 388. It is moreover added in Gunter's book, that if $\frac{1}{20}$th of this diviſion, which does not ſenſibly differ from the logarithmic tangent of 45° 1′ 30″ (with the radius ſubtracted from it), be uſed, the quotient will exhibit the meridional parts expreſſed in leagues, and this is the diviſor ſet down in Norwood's Epitome. After the ſame manner the meridional parts will be found in minutes, if the like logarithmic tangent of 45° 1′ 30″, diminiſhed by the radius, be taken; that is, the number uſed by others being 12633, when the logarithmic tables conſiſt of eight places of figures beſides the index.

In an edition of the Seaman's Kalender, Mr Bond declared, that he had diſcovered the longitude by having found out the true theory of the magnetic variation; and to gain credit to his aſſertion, he foretold, that at London in 1657 there would be no variation of the compaſs, and from that time it would gradually increaſe the other way; which happened accordingly. Again, In the Philoſophical Tranſactions for 1668, N° 40. he publiſhed a table of the variation for 49 years to come. Thus he acquired ſuch reputation, that his treatiſe, entitled, *The Longitude Found*, was in 1676 publiſhed by the ſpecial command of Charles II. and approved by many celebrated mathematicians. It was not long, however, before it met with oppoſition; and in 1678 another treatiſe, entitled, *The Longitude not Found*, made its appearance; and as Mr Bond's hypotheſis did not in any manner anſwer its author's ſanguine expectations, the affair was undertaken by Dr Halley. The reſult of his ſpeculation was, that the magnetic needle is influenced by four poles; but this wonderful phenomenon ſeems hitherto to have eluded all our reſearches. In 1700, however, Dr Halley publiſhed a general map, with curve lines expreſſing the paths where the magnetic needle had the ſame variation; which was received with univerſal applauſe. But as the poſitions of theſe curves vary from time to time, they ſhould frequently be corrected by ſkilful perſons; as was done in 1644 and 1756, by Mr Willam Mountaine, and Mr James Dodſon, F. R. S. In the Philoſophical Tranſactions for 1690, Dr Halley alſo gave a diſſertation on the monſoons; containing many very uſeful obſervations for ſuch as ſail to places ſubject to theſe winds.

After the true principles of the art were ſettled by Wright, Bond, and Norwood, the authors on navigation became ſo numerous, that it would be impoſſible to enumerate them. New improvements were daily made, and every thing relative to it was ſettled with an accuracy not only unknown to former ages, but which would have been reckoned utterly impoſſible. The earth being found to be a ſpheroid, and not a perfect ſphere, with the ſhorteſt diameter paſſing through the poles, a tract was publiſhed in 1741, by the Rev. Doctor Patrick Murdoch, wherein he accommodated Wright's ſailing to ſuch a figure; and Mr Colin Maclaurin, the ſame year, in the Philoſophical Tranſactions, N° 461. gave a rule for determining the meridional parts of a ſpheroid; which ſpeculation is farther treated of in his book of Fluxions, printed at Edinburgh in 1742.

Among the latter diſcoveries in navigation, that of finding the longitude both by lunar obſervations and by time-keepers is the principal. It is owing chiefly to the rewards offered by the Britiſh parliament that this has attained the preſent degree of perfection. We are indebted to Dr Maſkelyne for putting the firſt of theſe methods in practice, and for other important improvements in navigation. The time-keepers, conſtructed by Harriſon for this expreſs purpoſe, were found to anſwer ſo well, that he obtained the parliamentary reward.

The only works that have appeared of late in navigation are thoſe on the longitude and navigation by Dr Mackay, of which the following account is tranſcribed from the Anti-Jacobin Review for September 1804.

“ This publication, (Dr Mackay's Treatiſe on Navigation) and that on the longitude by the ſame author, form the moſt correct and practical ſyſtem of navigation and nautical ſcience hitherto publiſhed in this country; they may be conſidered not only of individual utility, but of national importance.”

THEORY OF NAVIGATION.

THE motion of a ſhip in the water is well known to depend on the action of the wind upon its ſails, regulated by the direction of the helm. As the water is a reſiſting medium and the bulk of the ſhip very conſiderable, it thence follows that there is always a great reſiſtance on her fore-part; and when this reſiſtance becomes ſufficient to balance the moving force of the wind upon the ſails, the ſhip attains her utmoſt degree of velocity, and her motion is no longer accelerated. This velocity is different according to the different ſtrength of the wind; but the ſtronger the wind, the greater reſiſtance is made to the ſhip's paſſage through the water: and hence, though the wind ſhould blow ever ſo ſtrong, there is alſo a limit to the velocity of the ſhip: for the ſails and ropes can bear but a certain force of air; and when the reſiſtance on the fore-part becomes more than equivalent to their ſtrength, the velocity can be no longer increaſed, and the rigging gives way.

The direction of a ſhip's motion depends on the poſition of her ſails with regard to the wind, combined with the action of the rudder. The moſt natural direction of the ſhip is, when ſhe runs directly before the wind, the ſails are then diſpoſed, ſo as to be at right angles thereto. But this is not always the caſe, both on account of the variable nature of the winds, and the ſituation of the intended port, or of intermediate headlands or iſlands. When the wind therefore happens not to be favourable, the ſails are placed ſo as to make an oblique angle both with the direction of the ſhip and with the wind; and the ſails, together with the rudder, muſt be managed in ſuch a manner, that the direction of the ſhip may make an acute angle with that of the wind; and the ſhip, making boards on different tacks, will by this means arrive at the intended port.

The reaſon of the ſhip's motion in this caſe is, that the water reſiſts the ſide more than the fore-part, and that in the ſame proportion as her length exceeds her breadth. This proportion is ſo conſiderable, that the ſhip continually flies off where the reſiſtance is leaſt, and that ſometimes with great ſwiftneſs. In this way of ſailing, however, there is a great limitation: for if the angle made by the keel with the direction of the wind be too acute, the ſhip cannot be kept in that poſition; neither is it poſſible for a large ſhip to make a more acute angle with the wind than about 6 points; though ſmall ſloops, it is ſaid, may make an angle of about 5 points with it. In all theſe caſes, however, the velocity of the ſhip is greatly retarded; and that not only on account of the obliquity of her motion, but by reaſon of what is called her *lee-way*. This is occaſioned by the yielding of the water on the lee-ſide of the ſhip, by which means the veſſel acquires a compound motion, partly in the direction of the wind, and partly in that which is neceſſary for attaining the deſired port.

It is perhaps impoſſible to lay down any mathematical principles on which the lee-way of a ſhip could be properly calculated; only we may ſee in general that it depends on the ſtrength of the wind, the roughneſs of the ſea, and the velocity of the ſhip. When the wind is not very ſtrong, the reſiſtance of the water on the lee-ſide bears a very great proportion to that of the current of air; and therefore it will yield but very little: however, ſuppoſing the ſhip to remain in the ſame place, it is evident, that the water having once begun to yield, will continue to do ſo for ſome time, even though no additional force was applied to it; but as the wind continually applies the ſame force as at firſt, the lee-way of the ſhip muſt go on conſtantly increaſing till the reſiſtance of the water on the lee-ſide balances the force applied on the other, when it will become uniform, as doth the motion of a ſhip ſailing before the wind. If the ſhip changes her place with any degree of velocity, then every time ſhe moves her own length, a new quantity of water is to be put in motion, which hath not yet received any momentum, and which of conſequence will make a greater reſiſtance than it can do when the ſhip remains in the ſame place. In proportion to the ſwiftneſs of the ſhip, then, the lee-way will be the leſs: but if the wind is very ſtrong, the velocity of the ſhip bears but a ſmall proportion to that of the current of air; and the ſame effects muſt follow as though the ſhip moved ſlowly, and the wind was gentle; that is, the ſhip muſt make a great deal of lee-way.—The ſame thing happens when the ſea riſes high, whether the wind is ſtrong or not; for then the whole water of the ocean, as far as the ſwell reaches, has acquired a motion in a certain direction, and that to a very conſiderable depth. The mountainous waves will not fail to carry the ſhip very much out of her courſe; and this deviation will certainly be according to their velocity and magnitude. In all caſes of a rough ſea, therefore, a great deal of lee-way is made.—Another circumſtance alſo makes a variation in the quantity of the lee-way; namely, the lightneſs or heavineſs of the ſhip; it being evident, that when the ſhip ſinks deep in the water, a much greater quantity of that element is to be put in motion before ſhe can make any lee-way, than when ſhe ſwims on the ſurface. As therefore it is impoſſible to calculate all theſe things with mathematical exactneſs, it is plain that the real courſe of a ſhip is exceedingly difficult to be found, and frequent errors muſt be made, which can only be corrected by celeſtial obſervations.

In many places of the ocean there are *currents*, or places where the water, inſtead of remaining at reſt, runs with a very conſiderable velocity for a great way in ſome particular direction, and which will certainly carry the ſhip greatly out of her courſe. This occaſions an error of the ſame nature with the lee-way: and therefore, whenever a current is perceived, its direction and velocity ought to be determined, and the proper allowances made.

Another ſource of error in reckoning the courſe of a ſhip proceeds from the variation of the compaſs.

There are few parts of the world where the needle points exactly north; and in thoſe where the variation is known, it is ſubject to very conſiderable alterations. By theſe means the courſe of the ſhip is miſtaken; for as the ſailors have no other ſtandard to direct them than the compaſs, if the needle, inſtead of pointing due north, ſhould point north-eaſt, a prodigious error would be occaſioned during the courſe of the voyage. and the ſhip would not come near the port to which ſhe was bound. To avoid errors of this kind, the only method is, to obſerve the ſun's amplitude and azimuth as frequently as poſſible, by which the variation of the compaſs will be perceived, and the proper allowances can then be made for errors in the courſe which this may have occaſioned.

Errors will ariſe in the reckoning of a ſhip, eſpecially when ſhe ſails in high latitudes, from the ſpheroidal figure of the earth; for as the polar diameter of our globe is found to be conſiderably ſhorter than the equatorial one, it thence follows, that the farther we remove from the equator, the longer are the degrees of latitude. Of conſequence, if a navigator aſſigns any certain number of miles for the length of a degree of latitude near the equator, he muſt vary that meaſure as he approaches towards the poles, otherwiſe he will imagine that he hath not ſailed ſo far as he actually hath done. It would therefore be neceſſary to have a table containing the length of a degree of latitude in every different parallel from the equator to either pole; as without this a troubleſome calculation muſt be made at every time the navigator makes a reckoning of his courſe. Such a table, however, hath not yet appeared; neither indeed does it ſeem to be an eaſy matter to make it, on account of the difficulty of meaſuring the length even of one or two degrees of latitude in different parts of the world. Sir Iſaac Newton firſt diſcovered this ſpheroidal figure of the earth; and ſhowed, from experiments on pendulums, that the polar diameter was to the equatorial one as 229 to 230. This proportion, however, hath not been admitted by ſucceeding calculators. The French mathematicians, who meaſured a degree on the meridian in Lapland, made the proportion between the equatorial and polar diameters to be as 1 to 0.9891. Thoſe who meaſured a degree at Quito in Peru, made the proportion 1 to 0.99624, or 266 to 265. M. Bouguer makes the proportion to be as 179 to 178; and M. Buffon, in one part of his theory of the earth, makes the equatorial diameter exceed the polar one by $\frac{1}{183}$ of the whole. According to M. du Sejour, this proportion is as 321 to 320; and M. de la Place, in his Memoir upon the Figure of Spheroids, has deduced the ſame proportion. From theſe variations it appears that the point is not exactly determined, and conſequently that any corrections which can be made with regard to the ſpheroidal figure of the earth muſt be very uncertain.

It is of conſequence to navigators in a long voyage to take the neareſt way to their port; but this is ſcarcely poſſible to be done. The ſhorteſt diſtance between any two points on the ſurface of a ſphere is meaſured by an arch of a great circle intercepted between them; and therefore it is adviſeable to direct the ſhip along a great circle of the earth's ſurface. But this is a matter of conſiderable difficulty, becauſe there are no fixed marks by which it can be readily known whether the ſhip ſails in the direction of a great circle or not. For this reaſon the ſailors commonly chooſe to direct their courſe by the rhumbs, or the bearing of the place by the compaſs. Theſe bearings do not point out the ſhorteſt diſtance between places; becauſe, on a globe, the rhumbs are ſpirals, and not arches of great circles. However, when the places lie directly under the equator, or exactly under the ſame meridian, the rhumb then coincides with the arch of a great circle, and of conſequence ſhows the neareſt way. The ſailing on the arch of a great circle is called *great circle ſailing*; and the caſes of it depend all on the ſolution of problems in ſpherical trigonometry.

PRACTICE OF NAVIGATION.

BOOK I.

Containing the various Methods of Sailing.

INTRODUCTION.

THE art of navigation depends upon aſtronomical and mathematical principles. The places of the ſun and fixed ſtars are deduced from obſervation and calculation, and arranged in tables, the uſe of which is abſolutely neceſſary in reducing obſervations taken at ſea, for the purpoſe of aſcertaining the latitude and longitude of the ſhip, and the variation of the compaſs. The problems in the various ſailings are reſolved either by trigonometrical calculation, or by tables or rules formed by the aſſiſtance of trigonometry. By mathematics, the neceſſary tables are conſtructed, and rules inveſtigated for performing the more difficult parts of navigation. For theſe ſeveral branches of ſcience, and for logarithmic tables, the reader is referred to the reſpective articles in this work. A few tables are given at the end of this article; but as the other tables neceſſary for the practice of navigation are to be found in almoſt every treatiſe on that ſubject, it therefore ſeems unneceſſary to inſert them in this place.

CHAP. I. *Preliminary Principles.*

SECT. I. *Of the Latitude and Longitude of a Place.*

THE ſituation of a place on the ſurface of the earth is eſtimated by its diſtance from two imaginary lines interſecting each other at right angles: The one of theſe is called the *equator*, and the other the *firſt meridian*. The ſituation of the equator is fixed, but that of the firſt meridian is arbitrary, and therefore different nations aſſume different firſt meridians. In Britain, we eſteem that to be the firſt meridian which paſſes through the royal obſervatory at Greenwich.

The equator divides the earth into two equal parts, called the *northern* and *ſouthern hemiſpheres*; and the latitude of a place is its diſtance from the equator, reckoned on a meridian in degrees and parts of a degree; and is either north nor ſouth, according as it is in the northern or ſouthern hemiſphere.

The firſt meridian being continued round the globe, divides it into two equal parts, called the *eaſtern* and *weſtern hemiſpheres*; and the longitude of a place is that portion of the equator contained between the firſt meridian and the meridian of the given place, and is either eaſt or weſt; according as it is in the eaſtern or weſtern hemiſphere, reſpectively to the firſt meridian.

PROB. I. The latitudes of two places being given, to find the difference of latitude.

RULE. Subtract the leſs latititude from the greater, if the latitudes be of the ſame name, but add them if of contrary; and the remainder or ſum will be the difference of latitude.

Example 1. Required the difference of latitude between the Lizard, in latitude 49° 57′ N. and Cape St Vincent, in latitude 37° 2′ N?

Latitude of the Lizard	49°	57′ N.
Latitude of Cape St Vincent	37	2 N.
Difference of latitude	12	55 = 775 miles.

Ex. 2. What is the difference of latitude between Funchal, in latitude 32° 38′ N, and the Cape of Good Hope, in latitude 34° 29′ S?

Latitude of Funchal	32°	38′ N.
Lat. of Cape of Good Hope	34	29 S.
Difference of latitude	67	7 = 4027 miles.

PROB. II. Given the latitude of one place, and the difference of latitude between it and another place, to find the latitude of that place.

RULE. If the given latitude and the difference of latitude be of the ſame name, add them; but if of different names, ſubtract them, and the ſum or remainder will be the latitude required of the ſame name with the greater.

Ex. 1. A ſhip from latitude 39° 22′ N. ſailed due north 560 miles—Required the latitude come to?

Latitude ſailed from - - -	39°	22′ N.
Difference of latitude 560′ - - =	9	20 N.
Latitude come to - - - - -	48	42 N.

Ex. 2. A ſhip from latitude 7° 19′ N. ſailed 854 miles ſouth—Required the latitude come to?

Latitude ſailed from - - -	7°	19′ N.
Difference of latitude 854′ - =	14	14 S.
Latitude come to - - -	6	55 S.

PROB. III. The longitudes of two places being given, to find their difference of longitude.

RULE. If the longitudes of the given places are of the ſame name, ſubtract the leſs from the greater, and the remainder is the difference of longitude: but if the longitudes are of contrary names, their ſum is the difference of longitude. If this exceeds 180°, ſubtract it from 360°, and the remainder is the difference of longitude.

Ex. 1. Required the difference of longitude between Edinburgh and New York, their longitudes being 3° 14′ W. and 74° 10′ W. reſpectively?

Longitude of New York - -	74°	10′ W.
Longitude of Edinburgh - -	3	14 W.
Difference of longitude - -	70	56

Ex. 2. What is the difference of longitude between Maſkelyne's Iſles in longitude 167° 59′ E. and Olinde, in longitude 35° 5′ W?

Latitude and Longitude.

Longitude of Maſkelyne's Iſles	167°	59′ E.
Longitude of Olinde	35	5 W.
Sum	203	4
Subtract from	360	0
Difference of longitude	156	56

Prob. IV. Given the longitude of a place, and the difference of longitude between it and another place, to find the longitude of that place.

Rule. If the given longitude and the difference of longitude be of a contrary name, ſubtract the leſs from the greater, and the remainder is the longitude required of the ſame name with the greater quantity; but if they are of the ſame name, add them, and the ſum is the longitude ſought, of the ſame name with that given. If this ſum exceeds 180°, ſubtract it from 360°, the remainder is the required longitude of a contrary name to that given.

Ex. 1. A ſhip from longitude 9° 54′ E. ſailed weſterly till the difference of longitude was 23° 18′—Required the longitude come to?

Longitude ſailed from	9°	54′ E.
Difference of longitude	23	18 W.
Longitude come to	13	24 W.

Ex. 2. The longitude ſailed from is 25° 9′ W. and difference of longitude 18° 46′ W.—Required the longitude come to?

Longitude left	25°	9′ W.
Difference of longitude	18	46 W.
Longitude in	43	55 W.

Sect. II. *Of the Tides.*

The theory of the tides has been explained under the article Astronomy, and will again be farther illuſtrated under that of Tides. In this place, therefore, it remains only to explain the method of calculating the time of high water at a given place.

As the tides depend upon the joint actions of the ſun and moon, and therefore upon the diſtance of theſe objects from the earth and from each other; and as, in the method generally employed to find the time of high water, whether by the mean time of new moon, or by the epacts, or tables deduced therefrom, the moon is ſuppoſed to be the ſole agent, and to have an uniform motion in the periphery of a circle, whoſe centre is that of the earth; it is hence obvious that method cannot be accurate, and by obſervation the error is ſometimes found to exceed two hours. That method is therefore rejected, and another given, in which the error will ſeldom exceed a few minutes, unleſs the tides are greatly influenced by the winds.

Prob. I. To reduce the times of the moon's phaſes as given in the Nautical Almanac to the meridian of a known place.

Rule. To the time of the propoſed phaſe, as given in the Nautical Almanac, apply the longitude of the place in time, by addition or ſubtraction, according as it is eaſt or weſt, and it will give the time of the phaſe at the given place.

Ex. 1. Required the time of new moon at Salonique in May 1793?

Tides.

Time of new moon per Naut. Alm.	9^d	15^h	31′
Longitude of Salonique in time	0	1	33 E.
Time of new moon required, in May	9	17	4

Ex. 2. What is the time of the laſt quarter of the moon at Reſolution bay in October 1793?

Time of laſt quarter per Naut. Alm.	26^d	5^h	47′
Longitude in time	0	9	17 W.
Time at Reſolution bay of laſt quarter, October	25	20	30, or

26th day at 8^h 30′ A. M.

Prob. II. To find the time of high water at a known place.

Rule. In the Nautical Almanac ſeek in the given month, or in that immediately preceding or following it, for the time of that phaſe which happens neareſt to the given day: reduce the time of this phaſe to the meridian of the given place by Prob. I. and take the difference between the reduced time and the noon of the given day.

Find the equation anſwering to this difference in Table VII. which applied to the time of high water on the day of new or full moon at the given place, according as the table directs, will give the approximate time of high water in the afternoon.

Now, take the interval between the reduced time of the phaſe and the approximate time of high water; find the correſponding equation, which applied as before to the ſyzigy time of high water, will give the time of the afternoon high water.

If the time of the morning high water is required, increaſe the laſt interval by 12 hours, if the given day falls before the phaſe, or diminiſh it by 12 hours when after that phaſe; and the equation to this time, applied to the ſyzigy time, gives the morning time of high water.

Ex. 1. Required the morning and afternoon times of high water at Leith, 11th December 1793?

Neareſt phaſe to 11th Dec. is 1ſt quart.	9^d	20^h	29′
Longitude of Leith in time	—0	0	13
Time at Leith of 1ſt quarter	9	20	16
Given day	11	0	0
Difference	1	3	44
Time of H. W. at Leith-pier on ſyz.	0	2	20
Equat. from Tab. to 1^d 3^h 44′	+0	6	32
Approximate time of high water	11	8	52
Reduced time of 1ſt quarter	9	20	16
Interval	1	12	36
Time of high water at Leith on ſyz.		2	20
Equat. from the Tab. to 1^d 12^h 36′		7	0
Time of high water at Leith		9	20P.M.
Time of H. W. at Leith at full & change		2	20
Equat. to 1d 12h 36′—12h=1d 0h 36′		6	22
High water at Leith, Dec. 11th, at		8	42A.M.

The time of high water found by the common method is about an hour and a half ſooner.

Ex. 2. Required the time of high water at Funchal, 15th November 1793?

Tides.

The neareſt phaſe to 15th November is that of full moon, - - - - -	17d	8h	46′
Longitude of Funchal in time, -	0	1	8 W.
Time of full moon at Funchal, -	17	7	38
Given day, November - -	15	0	0
Difference, - - - -	2	7	38
Time of high water at Funchal at full and change, - - - .	0	12	4
Equation from the Table to 2d 7h 38′ before full moon, - -	—0	1	35
Approx. time of high water, Nov.	15	10	29
Reduced time of full moon, -	17	7	38
Interval, - - - - -	1	11	9
Time of high water at full and change,		12	4
Equation to 1d 11h before full moon,		0	56
Time of high water, - - - -		11	8P.M.

Equation to 1d 11h + 12h=1d 23h is 1h 15′, and 12h 4′—1h 15′=10h 49′=time of high water in the forenoon.

Ex. 3. Required the time of high water at Duſkey Bay, 24th October 1793?

The neareſt phaſe to the 24th October is the laſt quarter - - - - -	26d	5h	47′
Longitude of Duſkey Bay in time,	+0	11	5 E.
Reduced time of firſt quarter of moon	26	16	52
Given day - - - - -	24	0	0
Difference, - - - - -	2	16	52
Time of high water at full and change,		10	57
Equation to 2d 16h 52′ before laſt quarter, - - - - -	+	2	52
Approximate time of high water,		1	49
Change of equation to app. time 1h 49′			3
Time of high water in the afternoon, .		1	52
Change of equation to 12 hours, -			20
Time of high water in the morning,		1	32

SECT. III. *Of meaſuring a Ship's Run in a given Time.*

The method commonly uſed at ſea to find the diſtance ſailed in a given time, is by means of a log-line and half-minute-glaſs. A deſcription of theſe is given under the articles LOG and LOG-LINE; which ſee.

It has been already obſerved, that the interval between each knot on the line ought to be 50 feet, in order to adapt it to a glaſs that runs 30 ſeconds. But although the line and glaſs be at any time perfectly adjuſted to each other, yet as the line ſhrinks after being wet, and as the weather has a conſiderable effect upon the glaſs, it will therefore be neceſſary to examine them from time to time; and the diſtance given by them muſt be corrected accordingly. The diſtance ſailed may, therefore, be affected by an error in the glaſs, or in the line, or in both. The true diſtance may, however, be found as follows.

PROB. I. The diſtance ſailed by the log, and the ſeconds run by the glaſs, being given, to find the true diſtance, the line being ſuppoſed right.

Ship's Run.

RULE.—Multiply the diſtance given by the log by 30, and divide the product by the ſeconds run by the glaſs, the quotient will be the true diſtance.

Ex. 1. The hourly rate of ſailing by the log is nine knots, and the glaſs is found to run out in 35 ſeconds. Required the true rate of ſailing?

9
30

35)270(7.7=true rate of ſailing.

Ex. 2. The diſtance ſailed by the log is 73 miles, and the glaſs runs out in 26 ſeconds. Sought the true diſtance?

73
30

26)2190(84.2 the true diſtance.

PROB. II. Given the diſtance ſailed by the log, and the meaſured interval between two adjacent knots on the line; to find the true diſtance, the glaſs running exactly 30 ſeconds.

RULE. Multiply twice the diſtance, ſailed by the meaſured length of a knot, point off two figures to the right, and the remainder will be the true diſtance.

Ex. 1. The hourly rate of ſailing by the log is five knots, and the interval between knot and knot meaſures 53 feet. Required the true rate of ſailing?

Meaſured interval	=	53
Twice hourly rate	=	10
True rate of ſailing	=	5.30

Ex. 2. The diſtance ſailed is 64 miles, by a log-line which meaſures 42 feet to a knot. Required the true diſtance?

Twice given diſtance,	=	128
Meaſured interval,		42
		256
		512
True diſtance,		53.76

PROB. III. Given the length of a knot, the number of ſeconds run by the glaſs in half a minute, and the diſtance ſailed by the log; to find the true diſtance.

RULE. Multiply the diſtance ſailed by the log by ſix times the meaſured length of a knot, and divide the product by the ſeconds run by the glaſs; the quotient, pointing off one figure to the right, will be the true diſtance.

Example. The diſtance ſailed by the log is 159 miles, the meaſured length of a knot is 42 feet, and the glaſs runs 33 ſeconds in half a minute. Required the true diſtance?

Diſtance by the log, 159
Six times length of a knot=42×6=252

318
795
318

Seconds run by the glaſs = 33)40068(121.4= true diſtance.

CHAP. II. *Plane Sailing.*

PLANE ſailing is the art of navigating a ſhip upon principles deduced from the notion of the earth's being an extended plane. On this ſuppoſition the meridians are eſteemed as parallel right lines. The parallels of latitude are at right angles to the meridians; the lengths of the degrees on the meridians, equator, and parallels of latitude, are everywhere equal; and the degrees of longitude are reckoned on the parallels of latitude as well as on the equator.—In this ſailing four things are principally concerned, namely, the *courſe*, *diſtance*, *difference of latitude*, and *departure*.

The courſe is the angle contained between the meridian and the line deſcribed by the ſhip, and is uſually expreſſed in points of the compaſs.

The diſtance is the number of miles a ſhip has ſailed on a direct courſe in a given time.

The difference of latitude is the portion of a meridian contained between the parallels of latitude ſailed from and come to; and is reckoned either north or ſouth, according as the courſe is in the northern or ſouthern hemiſphere.

The departure is the diſtance of the ſhip from the meridian of the place ſhe left, reckoned on a parallel of latitude. In this ſailing, the departure and difference of longitude are eſteemed equal.

Plate CCCLXIII.

In order to illuſtrate the above, let A (fig. 1.) repreſent the poſition of any given place, and AB the meridian paſſing through that place; alſo let AC repreſent the line deſcribed by a ſhip, and C the point arrived at. From C draw CB perpendicular to AB. Now in the triangle ABC, the angle BAC repreſents the courſe, the ſide AC the diſtance, AB the difference of latitude, and BC the departure.

In conſtructing a figure relating to a ſhip's courſe, let the upper part of what the figure is to be drawn on repreſent the *north*, then the lower part will be *ſouth*, the right-hand ſide *eaſt*, and the left-hand ſide *weſt*.

A north and ſouth line is to be drawn to repreſent the meridian of the place from which the ſhip ſailed; and the upper or lower part of this line, according as the courſe is ſoutherly or northerly, is to be marked as the poſition of that place. From this point as a centre, with the chord of 60°, an arch is to be deſcribed from the meridian towards the right or left, according as the courſe is eaſterly or weſterly; and the courſe, taken from the line of chords if given in degrees, but from the line of rhumbs if expreſſed in points of the compaſs, is to be laid upon this arch, beginning at the meridian. A line drawn through this point and that ſailed from, will repreſent the diſtance, which if given muſt be laid thereon, beginning at the point ſailed from. A line is to be drawn from the extremity of the diſtance perpendicular to the meridian; and hence the difference of latitude and departure will be obtained.

If the difference of latitude is given, it is to be laid upon the meridian, beginning at the point repreſenting the place the ſhip left; and a line drawn from the extremity of the difference of latitude perpendicular to the meridian, till it meets the diſtance produced, will limit the figure.

If the departure is given, it is to be laid off on a parallel, and a line drawn through its extremity will limit the diſtance. When either the diſtance and difference of latitude, diſtance and departure, or difference of latitude and departure, are given, the meaſure of each is to be taken from a ſcale of equal parts, and laid off on its reſpective line, and the extremities connected. Hence the figure will be formed.

PROB. I. Given the courſe and diſtance, to find the difference of latitude and departure.

Example. A ſhip from St Helena, in latitude 15° 55′ S. ſailed S. W. by S. 158 miles. Required the latitude come to, and departure.

By Conſtruction.

Draw the meridian AB (fig. 2.), and with the chord of 60° deſcribe the arch *m n*, and make it equal to the rhumb of 3 points, and through *n* draw AC equal to 158 miles; from C, draw CB perpendicular to AB; then AB applied to the ſcale from which AC was taken, will be found to meaſure 131.4 and BC 87.8.

By Calculation.

To find the difference of latitude.

As radius	-	-	10.00000
is to the coſine of the courſe	3 points		9.91985
ſo is the diſtance	158	-	2.19866
to the difference of latitude	131.4	-	2.11851

To find the departure.

As radius	-	-	10.00000
is to the ſine of the courſe	3 points	-	9.74474
ſo is the diſtance	158	-	2.19866
to the departure	87.8	-	1.94340

By Inſpection.

In the traverſe table, the difference of latitude anſwering to the courſe 3 points, and diſtance 158 miles, in a diſtance column is 131.4, and departure 87.8.

By Gunter's Scale.

The extent from 8 points to 5 points, the complement of the courſe on the line of ſine rhumbs (marked SR.) will reach from the diſtance 158 to 131.4, the difference of latitude on the line of numbers; and the extent from 8 points to 3 points on ſine rhumbs, will reach from 158 to 87.8, the departure on numbers (A).

Latitude St Helena	=	15° 55′ S.
Difference of latitude	-	2 11 S.
Latitude come to	-	18 6 S.

PROB. II. Given the courſe and difference of latitude, to find the diſtance and departure.

Example.

(A) For the method of reſolving the various problems in navigation, by the ſliding gunter, the reader is referred to Dr Mackay's Treatiſe on the Deſcription and Uſe of that Inſtrument.

Example. A ſhip from St George's, in latitude 38° 45′ north, ſailed SE½S: and the latitude by obſervation was 35° 7′ N. Required the diſtance run, and departure?

Latitude St George's	-	38° 45′ N
Latitude come to	-	35 7 N
Difference of latitude	-	3 38=218 miles.

By Conſtruction.

Draw the portion of the meridian AB (fig. 3.) equal to 218 m.: from the centre A with the chord of 60° deſcribe the arch *mn*, which make equal to the rhumb of 3½ points: through A*n* draw the line AC, and from B draw BC perpendicular to AB, and let it be produced till it meets AC in C. Then the diſtance AC being applied to the ſcale, will meaſure 282 m. and the departure BC 179 miles.

By Calculation.

To find the diſtance.

As radius - - - - - -		10.00000
is to the ſecant of the courſe	3½ points	10.11181
ſo is the difference of latitude -	218 m.	2.33846
to the diſtance - -	282 -	2.45027

To find the departure.

As radius - - - - - -		10.00000
is to the tangent of the courſe	3½ points -	9.91417
ſo is the difference of latitude	218 -	2.33846
to the departure - -	178.9 -	2.25253

By Inſpection.

Find the given difference of latitude 218 m. in a latitude column, under the courſe of 3½ points; oppoſite to which, in a diſtance column, is 282 miles; a departure column is 178.9 m. the diſtance and departure required.

By Gunter's Scale.

Extend the compaſs from 4½ points, the complement of the courſe, to 8 points on ſine rhumbs, that extent will reach from the difference of latitude 218 miles, to the diſtance 282 miles in numbers; and the extent from 4 points to the courſe 3½ points on the line of tangent rhumbs (marked T. R.) will reach from 218 miles to 178.9, the departure on numbers.

Prob. III. Given courſe and departure, to find the diſtance and difference of latitude?

Example. A ſhip from Palma, in latitude 28° 37′ N. ſailed NW. by W. and made 192 miles of departure: Required the diſtance run, and latitude come to?

By Conſtruction.

Make the departure BC (fig. 4.) equal to 192 miles, draw BA perpendicular to BC, and from the centre C, with the chord of 60°, deſcribe the arch *mn*, which make equal to the rhumb of 3 points, the complement of the courſe; draw a line through C*n*, which produce till it meets BA in A: then the diſtance AC being meaſured, will be equal to 231 m. and the difference of latitude AB will be 128.3 miles.

By Calculation.

To find the diſtance.

As the ſine of the courſe	5 points	9.91985
is to radius - - - - - -		10.00000
ſo is the departure -	192	2.28330
to the diſtance - -	230.9 -	2.36345

To find the difference of latitude.

As the tangent of the courſe	5 points	10.17511
is to radius - - - - - -		10.00000
ſo is the departure - -	192	2.28330
to the difference of latitude	128.3	2.10819

By Inſpection.

Find the departure 192 m. in its proper column above the given courſe 5 points; and oppoſite thereto is the diſtance 231 miles, and difference of latitude 138.3, in their reſpective columns.

By Gunter's Scale.

The extent from 5 points to 8 points on the line of ſine rhumbs, being laid from the departure 192 on numbers, will reach to the diſtance 231 on the ſame line; and the extent from 5 points to 4 points on the line of tangent rhumbs, will reach from the departure 192, to the difference of latitude 128.3 on numbers.

Latitude of Palma - - -		28° 37′ N
Difference of latitude - - -		2 8 N
Latitude come to - - -		30 45 N

Prob. IV. Given the diſtance and difference of latitude, to find the courſe and departure.

Example. A ſhip from a place in latitude 43° 13′ N, ſails between the north and eaſt 285 miles; and is then by obſervation found to be in latitude 46° 31′ N: Required the courſe and departure?

Latitude ſailed from	- -	43° 13′ N
Latitude by obſervation	- -	46 31 N
Difference of latitude	-	3 18=198 miles.

By Conſtruction.

Draw the portion of the meridian AB (fig. 5.) equal to 198 miles; from B draw BC perpendicular to AB: then take the diſtance 285 miles from the ſcale, and with one foot of the compaſs in A deſcribe an arch interſecting BC in C, and join AC. With the chord of 60° deſcribe the arch *mn*, the portion of which, contained between the diſtance and difference of latitude, applied to the line of chords, will meaſure 46°, the courſe; and the departure BC being meaſured on the line of equal parts, will be found equal to 205 miles.

By Calculation.

To find the courſe.

As the diſtance - -	285 -	2.45484
is to the difference of latitude	198 -	2.29660
ſo is the radius - - - -		10.00000
to the coſine of the courſe -	46° 0′ -	9.84176

To

To find the departure.

As radius	- - -		10.00000
is to the ſine of the courſe	46° 0′	-	9.85693
ſo is the diſtance	- 285	-	2.45484
to the departure	- 205	-	2.31177

By Inſpection.

Find the given diſtance in the table in its proper column; and if the difference of latitude anſwering thereto is the ſame as that given, namely, 198, then the departure will be found in its proper column, and the courſe at the top or bottom of the page, according as the difference of latitude is found in a column marked *lat.* at top or bottom. If the difference of latitude thus found does not agree with that given, turn over till the neareſt thereto is found to anſwer to the given diſtance. This is in the page marked 46 degrees at the bottom, which is the courſe, and the correſponding departure is 205 miles.

By Gunter's Scale.

The extent from the diſtance 285 to the difference of latitude 198 on numbers, will reach from 90° to 44°, the complement of the courſe on ſines; and the extent from 90° to the courſe 46° on the line of ſines being laid from the diſtance 285, will reach to the departure 205 on the line of numbers.

Prob. V. Given the diſtance and departure, to find the courſe and difference of latitude.

Example. A ſhip from Fort-Royal in the iſland of Grenada, in latitude 12° 9′ N, ſailed 260 miles between the ſouth and weſt, and made 190 miles of departure: Required the courſe and latitude come to?

By Conſtruction.

Fig. 6.

Draw BC (fig. 6.) perpendicular to AB, and equal to the given departure 190 miles; then from the centre C, with the diſtance 260 miles, ſweep an arch interſecting AB in A, and join AC. Now deſcribe an arch from the centre A with the chord of 60°, and the portion *mn* of this arch, contained between the diſtance and difference of latitude, meaſured on the line of chords, will be 47° the courſe; and the difference of latitude AB applied to the ſcale of equal parts, meaſures 177½ miles.

By Calculation.

To find the courſe.

As the diſtance	- 260	-	2.41497
is to the departure	- 190	-	2.27875
ſo is radius	- - -		10.00000
to the ſine of the courſe	46° 57′		9.86378

To find the difference of latitude.

As radius	- - -		10.00000
is to the coſine of the courſe	46° 57′		9.83419
ſo is the diſtance	- 260	-	2.41497
to the difference of latitude	177.5	-	2.24916

By Inſpection.

Seek in the traverſe table until the neareſt to the given departure is found in the ſame line with the given diſtance 260. This is found to be in the page marked 47° at the bottom, which is the courſe; and the correſponding difference of latitude is 177.3.

By Gunter's Scale.

The extent of the compaſs, from the diſtance 260 to the departure 190 on the line of numbers, will reach from 90° to 47°, the courſe on the line of ſines: and the extent from 90° to 43°, the complement of the courſe on ſines, will reach from the diſtance 260 to the difference of latitude 177½ on the line of numbers.

Latitude Fort-Royal	- -		12° 9′ N
Difference of latitude	- 177	-	=2 57 S
Latitude in	- - -		9 12 N

Prob. VI. Given difference of latitude and departure, ſought courſe and diſtance.

Example. A ſhip from a port in latitude 7° 56′ S, ſailed between the ſouth and eaſt, till her departure is 132 miles; and is then by obſervation found to be in latitude 12° 3′ S. Required the courſe and diſtance?

Latitude ſailed from	-	7° 56′ S.
Latitude in by obſervation		12 3 S.
Difference of latitude	-	4 7=247.

By Conſtruction.

Fig. 7.

Draw the portion of the meridian AB (fig. 7.) equal to the difference of latitude 247 miles; from B draw BC perpendicular to AB, and equal to the given departure 132 miles, and join AC: then with the chord of 60° deſcribe an arch from the centre A; and the portion *mn* of this arch being applied to the line of chords, will meaſure about 28°; and the diſtance AC, meaſured on the line of equal parts, will be 280 miles.

By Calculation.

To find the courſe.

As the difference of latitude -	247	2.39270
is to the departure - -	132	2.12057
ſo is radius - - -		10.00000
to the tangent of the courſe	28° 7′	9.72787

To find the diſtance.

As radius - - -		10.00000
is to the ſecant of the courſe	28° 7′	10.05454
ſo is the difference of latitude	247 -	2.39270
to the diſtance -	280 -	2.44724

By Inſpection.

Seek in the table till the given difference of latitude and departure, or the neareſt thereto, are found together in their reſpective columns, which will be under 28°, the required courſe; and the diſtance anſwering thereto is 280 miles.

By Gunter's Scale.

The extent from the given difference of latitude 247 to the departure 132 on the line of numbers, will reach from 45° to 28°, the courſe on the line of tangents; and the extent from 62°, the complement of the courſe, to 90° on ſines, will reach from the difference of latitude 247, to the diſtance 280 on numbers.

Chap. III. *Of Traverſe Sailing.*

If a ſhip ſail upon two or more courſes in a given time, the irregular track ſhe deſcribes is called a *traverſe*; and to reſolve a traverſe, is the method of reducing theſe ſeveral courſes, and the diſtances run, into a ſingle courſe and diſtance. The method chiefly uſed for this purpoſe at ſea is by inſpection, which ſhall therefore be principally adhered to; and is as follows.

Make a table of a breadth and depth ſufficient to contain the ſeveral courſes, &c. This table is to be divided into ſix columns: the courſes are to be put in the firſt, and the correſponding diſtances in the ſecond column; the third and fourth columns are to contain the differences of latitude, and the two laſt the departures.

Now, the ſeveral courſes and their correſponding diſtances being properly arranged in the table, find the difference of latitude and departure anſwering to each in the traverſe table; remembering that the difference of latitude is to be put in a north or ſouth column, according as the courſe is in the northern or ſouthern hemiſphere; and that the departure is to be put in an eaſt column if the courſe is eaſterly, but in a weſt column if the courſe is weſterly: Obſerving alſo, that the departure is leſs than the difference of latitude when the courſe is leſs than 4 points or 45°; otherwiſe greater.

Add up the columns of northing, ſouthing, eaſting, and weſting, and ſet down the ſum of each at its bottom; then the difference between the ſums of the north and ſouth columns will be the difference of latitude made good, of the ſame name with the greater; and the difference between the ſums of the eaſt and weſt columns, is the departure made good, of the ſame name with the greater ſum.

Now, ſeek in the traverſe table, till a difference of latitude and departure are found to agree as nearly as poſſible with thoſe above; then the diſtance will be found on the ſame line, and the courſe at the top or bottom of the page, according as the difference of latitude is greater or leſs than the departure.

In order to reſolve a traverſe by conſtruction, deſcribe a circle with the chord of 60°, in which draw two diameters at right angles to each other, at whoſe extremities are to be marked the initials of the cardinal points, north being uppermoſt.

Lay off each courſe on the circumference, reckoned from its proper meridian; and from the centre to each point draw lines, which are to be marked with the proper number of the courſe.

On the firſt radius lay off the firſt diſtance from the centre; and through its extremity, and parallel to the ſecond radius, draw the ſecond diſtance of its proper length; through the extremity of the ſecond diſtance, and parallel to the third radius, draw the third diſtance of its proper length; and thus proceed until all the diſtances are drawn.

A line drawn from the extremity of the laſt diſtance to the centre of the circle will repreſent the diſtance made good: and a line drawn from the ſame point perpendicular to the meridian, produced, if neceſſary, will repreſent the departure; and the portion of the meridian intercepted between the centre and departure, will be the difference of latitude made good.

EXAMPLES.

I. A ſhip from Fyal, in lat. 38° 32′ N, ſailed as follows: ESE 163 miles SW $\frac{1}{2}$ W 110 miles, SE $\frac{3}{4}$ S 180 miles, and N by E 68 miles. Required the latitude come to, the courſe, and diſtance made good?

By Inſpection.

Courſe.	Diſt.	Diff. of Latitude.		Departure.	
		N	S	E	W
ESE	163	—	62.4	150.6	—
SW$\frac{1}{2}$W	110	—	69.8	—	85.0
SE$\frac{3}{4}$S	180	—	144.5	107.2	—
N*b*E	68	66.7	—	13.3	—
		66.7	276.7 66.7	271.1 85.0	85.0
S41$\frac{1}{2}$E	281		210.0	186.1	
Latitude left - -				38° 32′ N.	
Difference of latitude -				3 21 S.	
Latitude come to -				35 11 N.	

By Conſtruction.

With the chord of 60° deſcribe the circle NE, SW (fig. 8.), the centre of which repreſents the place the ſhip ſailed from: draw two diameters NS, EW at right angles to each other; the one repreſenting the meridian, and the other the parallel of latitude of the place ſailed from. Take each courſe from the line of rhumbs, lay it off on the circumference from its proper meridian, and number it in order 1, 2, 3, 4. Upon the firſt rhumb C1, lay off the firſt diſtance 163 miles from C to A; through it draw the ſecond diſtance AB parallel to C2, and equal to 110 miles; through B draw BD equal to 180 miles, and parallel to C3; and draw DE parallel to C4, and equal to 68 miles. Now CE being joined, will repreſent the diſtance made good; which applied to the ſcale will meaſure 281 miles. The arch S *n*, which repreſents the courſe, being meaſured on the line of chords, will be found equal to 41$\frac{1}{2}$°. From E draw EF perpendicular to CS produced; then CF will be the difference of latitude, and FE the departure made good; which applied to the ſcale will be found to meaſure 210 and 186 miles reſpectively. Fig. 8.

As the method by conſtruction is ſcarcely ever practiſed at ſea, it, therefore, ſeems unneceſſary to apply it to the ſolution of the following examples.

II. A ſhip from latitude 1° 38′ S. ſailed as under. Required her preſent latitude, courſe, and diſtance made good?

Courſe.	Diſt.	Diff. of Latitude.		Departure.	
		N	S	E	W
NW*b*N	43	35.8	—	—	23.9
WNW	78	29.9	—	—	72.1
SE*b*E	56	—	31.1	46.6	—
WSW$\frac{1}{2}$W	62	—	18.0	—	59.3
N$\frac{3}{4}$E	85	84.1	—	12.5	—
		149.8 49.1	49.1	59.1	155.3 59.1
N 44° W	139	100.7=1° 41′			96.2
Latitude left -		1 38 S.			
Latitude come to		0 3 N.			

III.

III. Yeſterday at noon we were in latitude 13° 12′ N, and ſince then have run as follows: SSE 36 miles, S 12 miles, NW $\frac{1}{2}$ W 28 miles, W 30 miles, SW 42 miles, W*b*N 39 miles, and N 20 miles. Required our preſent latitude, departure, and direct courſe and diſtance?

Courſes.	Diſt.	Diff. of Latitude.		Departure.	
		N	S	E	W
SSE	36	—	33.3	3.8	—
S	12	—	12.0	—	—
NW$\frac{1}{2}$W	28	17.8	—	—	21.6
W	30	—	—	—	30.0
SW	42	—	29.7	—	29.7
W*b*N	39	7.6	—	—	38.2
N	20	20.0	—	—	—
		45.4	75.0	13.8	119.5
			45.4		13.8
S 74° W	110		29.6=0°30′		105.7

Yeſterday's latitude - 13 12 N

Preſent latitude - 12 42 N

IV. The courſe per compaſs from Greigſneſs (B) to the May is SW $\frac{1}{4}$ S, diſtance 58 miles; from the May to the Staples S*b*E $\frac{3}{4}$ E, 44 miles; and from the Staples to Flamborough Head S*b*E, 110 miles. Required the courſe per compaſs, and diſtance from Greigſneſs to Flamborough Head?

Courſes.	Diſt.	Diff. of Latitude.		Departure.	
		N	S	E	W
SW $\frac{1}{4}$ S	58	—	43.0	—	38.9
S*b*E $\frac{3}{4}$ E	44	—	41.4	14.8	—
S*b*E	110	—	107.9	21.5	—
			192.3	36.3	38.9
					36.3
					2.6

Hence the courſe per compaſs is nearly S 1° W, and diſtance 192$\frac{1}{3}$ miles.

CHAP. IV. *Of Parallel Sailing.*

THE figure of the earth is ſpherical, and the meridians gradually approach each other, and meet at the poles. The difference of longitude between any two places is the angle at the pole contained between the meridians of thoſe places; or it is the arch of the equator intercepted between the meridians of the given places; and the meridian diſtance between two places in the ſame parallel, is the arch thereof contained between their meridians. It hence follows, that the meridian diſtance, anſwering to the ſame difference of longitude, will be variable with the latitude of the parallel upon which it is reckoned; and the ſame difference of longitude will not anſwer to a given meridian diſtance when reckoned upon different parallels.

Parallel ſailing is, therefore, the method of finding the diſtance between two places lying in the ſame parallel whoſe longitudes are known; or, to find the difference of longitude anſwering to a given diſtance, run in an eaſt or weſt direction. This ſailing is particularly uſeful in making low or ſmall iſlands.

In order to illuſtrate the principles of parallel ſailing, let CABP (fig. 9.) repreſent a ſection of one fourth part of the earth, the arch ABP being part of a meridian; CA the equatorial, and CP the polar ſemi-axis. Alſo let B be the ſituation of any given place on the earth; and join BC, which will be equal to CA or CP (C). The arch AB, or angle ACB, is the meaſure of the latitude of the place B; and the arch BP, or angle BCP, is that of its complement. If BD be drawn from B perpendicular to CP, it will repreſent the coſine of latitude to the radius BC or CA. Fig. 9.

Now ſince circles and ſimilar portions of circles are in the direct ratio of their radii; therefore,

As radius
Is to the coſine of latitude;
So is any given portion of the equator
To a ſimilar portion of the given parallel.

But the difference of longitude is an arch of the equator; and the diſtance between any two places under the ſame parallel, is a ſimilar portion of that parallel.

Hence R : coſine latitude :: Diff. longitude : Diſtance.
And by inverſion,
Coſine latitude : R :: Diſtance : Diff. of longitude.
Alſo,
Diff. of longitude : Diſtance :: R : coſ. latitude.

PROB. I. Given the latitude of a parallel, and the number of miles contained in a portion of the equator, to find the miles contained in a ſimilar portion of that parallel.

Ex. 1. Required the number of miles contained in a degree of longitude in latitude 55° 58′?

By Conſtruction.

Draw the indefinite right line AB (fig. 10.); make the angle BAC equal to the given latitude 55° 58′, and AC equal to the number of miles contained in a degree of longitude at the equator, namely 60: from C draw CB perpendicular to AB; and AB being meaſured on the line of equal parts, will be found equal to 33.5, the miles required. Fig. 10.

(B) Greigſneſs is about 2$\frac{1}{2}$ miles diſtant from Aberdeen, in nearly a SE*b*E$\frac{1}{2}$E direction.

(C) This is not ſtrictly true, as the figure of the earth is that of an oblate ſpheroid; and therefore the radius of curvature is variable with the latitude. The difference between CA and CP, according to Sir Iſaac Newton's hypotheſis, is about 17 miles.

By Calculation.

As radius - - -		10.00000
is to the coſine of latitude, -	55° 58′	9.74794
ſo is miles in a deg. of long. at eq.	60	1.77815
to the miles in a deg. in the given par.	33.58	1.52609

By Inſpection.

To 56°, the neareſt degree to the given latitude, and diſtance 60 miles, the correſponding difference of latitude is 33.6, which is the miles required.

By Gunter's Scale.

The extent from 90° to 34°, the complement of the given latitude on the line of ſines, will reach from 60 to 33.6 on the line of numbers.

There are two lines on the other ſide of the ſcale, with reſpect to Gunter's line, adapted to this particular purpoſe; one of which is entitled *chords*, and contains the ſeveral degrees of latitude: The other, marked M. L. ſignifying *miles of longitude*, is the *line of longitudes*, and ſhows the number of miles in a degree of longitude in each parallel. The uſe of theſe lines is therefore obvious.

Ex. 2. Required the diſtance between Treguier in France, in longitude 3° 14′ W, and Gaſpey Bay, in longitude 64° 27′ W, the common latitude being 48° 47′ N?

Longitude Treguier -	3° 14′ W		
Longitude Gaſpey Bay	64 27 W		
Difference of longitude	61 13=3673′		
As radius -	-	-	10.00000
is to the coſine of latitude,	48° 47′	-	9.81882
ſo is the difference of longitude	3673	-	3.56502
to the diſtance -	2420	-	3.38384

Prob. II. Given the number of miles contained in a portion of a known parallel, to find the number of miles in a ſimilar portion of the equator.

Example. A ſhip from Cape Finiſterre, in latitude 42° 52′ N, and longitude 9° 17′ W, ſailed due weſt 342 miles. Required the longitude come to?

By Conſtruction.

Fig. 11. Draw the ſtraight line AB (fig. 11.) equal to the given diſtance 342 miles, and make the angle BAC equal to 42° 52′, the given latitude: from B draw BC perpendicular to AB, meeting AC in C; then AC applied to the ſcale will meaſure $466\frac{1}{2}$, the difference of longitude required.

By Calculation.

As radius - - -		10.00000
is to the ſecant of latitude,	42° 52′	10.13493
ſo is the diſtance -	342	2.53403
to the difference of longitude	466.6	2.66896

By Inſpection.

The neareſt degree to the given latitude is 43°; under which, and oppoſite to 171, half the given diſtance in a latitude column, is 234, in a diſtance column, which doubled gives 468, the difference of longitude.

If the proportional part anſwering to the difference between the given latitude and that uſed, be applied to the above, the ſame reſult with that found by calculation will be obtained.

By Gunter's Scale.

The extent from 47″ 8′, the complement of latitude to 90° on the line of ſines, being laid the ſame way from the diſtance 342, will reach to the difference of longitude $466\frac{1}{2}$ on the line of numbers.

Londgitude Cape Finiſterre	-	9° 17′ W
Difference of longitude	-	7 47 W
Longitude come to	- -	17 4 W

Prob. III. Given the number of miles contained in any portion of the equator, and the miles in a ſimilar portion of a parallel; to find the latitude of that parallel.

Example. A ſhip ſailed due eaſt 358 miles, and was found by obſervation to have differed her longitude 8° 42′. Required the latitude of the parallel?

By Conſtruction.

Make the line AB (fig. 12.) equal to the given diſtance; to which let BC be drawn perpendicular, with an extent equal to 522′, then difference of longitude; deſcribe an arch from the centre A, cutting BC in C; then the angle BAC being meaſured by means of the line of chords, will be found equal to $46°\frac{2}{3}$, the required latitude. Fig. 12.

By Calculation.

As the diſtance	-	358	2.55388
is to the difference of longitude,		522	2.71767
ſo is radius - -	-		10.00000
to the ſecant of the latitude,		46° 42′	10.16379

By Inſpection.

As the difference of longitude and diſtance exceed the limits of the table, let therefore the half of each be taken; theſe are 261 and 179 reſpectively. Now, by entering the table with theſe quantities, the latitude will be found to be between 46 and 47 degrees. Therefore, to latitude 46°, and diſtance 261 miles, the correſponding difference of latitude is 181′.3, which exceeds the half of the given diſtance by 2′.3. Again, to latitude 47°, and diſtance 261, the difference of latitude is 170.0, being 1′.0 leſs than the half of that given: therefore the change of diſtance anſwering to a change of 1° of latitude is 3′.3.

Now, as 3′.3 : 2′.3 :: 1° : 42′.
Hence the latitude required is 46° 42′.

By Gunter's Scale.

The extent from 522 to 358 on the line of numbers, will reach from 90° to about $43°\frac{1}{3}$, the complement of which $46\frac{2}{3}$ is the latitude required.

Prob. IV. Given the number of miles contained in the portion of a known parallel, to find the length of a ſimilar portion of another known parallel.

Example. From two ports in latitude 33° 58′ N, diſtance 348 miles, two ſhips ſail directly north till they are in latitude 48° 23′ N. Required their diſtance?

By Conſtruction.

Draw the line CB, CE (fig. 13.), making angles with Fig. 13.

with CP equal to the complements of the given latitudes, namely, 56° 2′ and 41° 37′ reſpectively: make BD equal to the given diſtance 348 miles, and perpendicular to CP; now from the centre C, with the radius CB, deſcribe an arch interſecting CE in E; then EF drawn from the point E, perpendicular to CP, will repreſent the diſtance required; which being applied to the ſcale, will meaſure $278\frac{1}{2}$ miles.

By Calculation.

As the coſine of the latitude left	33° 58′	9.91874
is to the coſine of the lat. come to	48 23	9.82226
ſo is the given diſtance ·	348	2.54158
to the diſtance required -	278.6	2.44510

By Inſpection.

Under 34°, and oppoſite to 174, half the given diſtance in a latitude column is 210 in a diſtance column; being half the difference of longitude anſwering thereto. Now, find the difference of latitude to diſtance 210 miles over 48° of latitude, which is 140′.5; from which 1′.1 (the proportional part anſwering to 23 minutes of latitude) being ſubtracted, gives 139′.4 which doubled is 278′.8, the diſtance required.

By Gunter's Scale.

The extent from 56° 2′, the complement of the latitude left, to 41° 37′, the complement of that come to, on the line of ſines, being laid the ſame way from 348, will reach to $278\frac{1}{2}$, the diſtance ſought on the line of numbers.

Prob. V. Given a certain portion of a known parallel, together with a ſimilar portion of an unknown parallel; to find the latitude of that parallel.

Example. Two ſhips, in latitude 56° 0′ N, diſtant 180 miles, ſail due ſouth; and having come to the ſame parallel, are now 232 miles diſtant. The latitude of that parallel is required?

By Conſtruction.

Fig. 14. Make DB (fig. 14.) equal to the firſt diſtance 180 miles, DM equal to the ſecond 232, and the angle DBC equal to the given latitude 56°; from the centre C, with the radius CB, deſcribe the arch BE; and through M draw ME parallel to CD, interſecting the arch BE in E; join EC and draw EF perpendicular to CD: then the angle FEC will be the latitude required; which being meaſured, will be found equal to 43° 53′.

By Calculation.

As the diſtance on the known parallel	180	2.25527
is to the diſtance on that required	232	2.36549
ſo is the coſine of the latitude left	56° 0′	9.74756
to the coſine of the latitude come to	43 53	9.85778

By Inſpection.

To latitude 56°, and half the firſt diſtance 90 in a latitude column, the correſponding diſtance is 161, which is half the difference of longitude. Now 161, and 116, half the ſecond diſtance, are found to agree between 43 and 44 degrees; therefore, to latitude 43° and diſtance 161, the correſponding difference of latitude is 117′.7; the exceſs of which above 116′ is 1′.7: and to latitude 44°, and diſtance 161, the difference of latitude is 115′.8: hence 117.7—115.8=1′.9, the change anſwering to a difference of 1° of latitude.

Therefore, 1′.9 : 1′.7 :: 1° : 53′

Hence, the latitude is 43° 53′.

By Gunter's Scale.

The extent from 180 to 232 on the line of numbers, being laid in the ſame direction on the line of ſines, from 34°, the complement of the latitude ſailed from, will reach to 46° 7′, the complement of the latitude come to.

Chap. V. *Of Middle Latitude Sailing.*

The earth is a ſphere, and the meridians meet at the poles; and ſince a rhumb-line makes equal angles with every meridian, the line a ſhip deſcribes is, therefore, that kind of a curve called a *ſpiral*.

Let AB (fig. 15.) be any given diſtance ſailed upon an oblique rhumb, PBN, PAM the extreme meridians, MN a portion of the equator, and PCK, PEL two meridians interſecting the diſtance AB in the points CE infinitely near each other. If the arches BS, CD, and AR, be deſcribed parallel to the equator, it is hence evident, that AS is the difference of latitude, and the arch MN of the equator, the difference of longitude, anſwering to the given diſtance AB and courſe PAB. Fig. 15.

Now, ſince CE repreſents a very ſmall portion of the diſtance AB, DE will be the correſpondent portion of a meridian: hence the triangle EDC may be conſidered as rectilineal. If the diſtance be ſuppoſed to be divided into an infinite number of parts, each equal to CE, and upon theſe, triangles be conſtructed whoſe ſides are portions of a meridian and parallel, it is evident theſe triangles will be equal and ſimilar; for, beſides the right angle, and hypothenuſe which is the ſame in each, the courſe or angle CED is alſo the ſame. Hence, by the 12th of V. Euc. the ſum of all the hypothenuſes CE, or the diſtance AB, is to the ſum of all the ſides DE, or the difference of latitude AS, as one of the hypothenuſes CE is to the correſponding ſide DE. Now, let the triangle GIH (fig. 16.) be conſtructed ſimilar to the triangle CDE, having the angle G equal to the courſe: then as GH : GI :: CE : DC :: AB : AS. Fig. 16.

Hence, if GH be made equal to the given diſtance AB, then GI will be the correſponding difference of latitude.

In like manner, the ſum of all the hypothenuſes CE, or the diſtance AB, is to the ſum of all the ſides CD, as CE is to CD, or as GH to HI, becauſe of the ſimilar triangles.

The ſeveral parts of the ſame rectilineal triangle will, therefore, repreſent the courſe, diſtance, difference of latitude, and departure.

Although the parts HG, GI, and angle G of the rectilineal triangle GIH, are equal to the correſponding parts AB, AS, and angle A, of the triangle ASB upon the ſurface of the ſphere; yet HI is not equal to BS, for HI is the ſum of all the arcs CD; but CD is greater than OQ, and leſs than ZX: therefore HI is greater than BS, and leſs than AR. Hence the difference of longitude MN cannot be inferred from the departure reckoned either upon the parallel ſailed from, or on that come to, but on ſome intermediate parallel TV,

Middle Latitude Sailing.

TV, ſuch that the arch TV is exactly equal to the departure: and in this caſe, the difference of longitude would be eaſily obtained. For TV is to MN as the ſine PT to the ſine PM; that is, as the coſine of latitude is to the radius.

The latitude of the parallel TV is not, however, eaſily determined with accuracy; various methods have, therefore, been taken in order to obtain it nearly, with as little trouble as poſſible: firſt, by taking the arithmetical mean of the two latitudes for that of the mean parallel: ſecondly, by uſing the arithmetical mean of the coſines of the latitudes: thirdly, by uſing the geometrical mean of the coſines of the latitudes: and laſtly, by employing the parallel deduced from the mean of the meridional parts of the two latitudes. The firſt of theſe methods is that which is generally uſed.

Fig. 17. In order to illuſtrate the computations in middle latitude ſailing, let the triangle ABC (fig. 17.) repreſent a figure in plane ſailing, wherein AB is the difference of latitude, AC the diſtance, BC the departure, and the angle BAC the courſe. Alſo, let the triangle DBC be a figure in parallel ſailing, in which DC is the difference of longitude, BC the meridian diſtance, and the angle DCB the middle latitude. In theſe triangles there is, therefore, one ſide BC common to both; and that triangle is to be firſt reſolved in which two parts are given, and then the unknown parts of the other triangle will be eaſily obtained.

Prob. I. Given the latitudes and longitudes of two places, to find the courſe and diſtance between them.

Example. Required the courſe and diſtance from the iſland of May, in latitude 56° 12′ N, and longitude 2° 37′ W, to the Naze of Norway, in latitude 57° 50′ N, and longitude 7° 27′ E?

Latitude iſle of May	56° 12′ N	-	56° 12′
Latitude Naze of Norway	57 50 N	-	57 50
Difference of latitude	1 38=98′	-	114 2
Middle latitude	-	-	57 1
Longitude iſle of May	2 37W		
Longitude Naze of Norway	7 27E		
Difference of longitude	10 4=604′		

By Conſtruction.

Fig. 18. Draw the right line AD (fig. 18.) to repreſent the meridian of the May; with the chord of 60° deſcribe the arch *mn*, upon which lay off the chord of 32° 59, the complement of the middle latitude from *m* to *n*: from D through *n* draw the line DC equal to 604′, the difference of longitude, and from C draw CB perpendicular to AD: make BA equal to 98′, the difference of latitude, and join AC; which applied to the ſcale will meaſure 343 miles, the diſtance ſought: and the angle A being meaſured by means of the line of chords, will be found equal to 73° 24′, the required courſe.

Middle Latitude Sailing.

By Calculation.

To find the courſe (D).

As the difference of latitude	98′	-	1.99123
is to the difference of longitude	604	-	2.78104
ſo is the coſine of middle latitude	57° 1′	-	9.73591
to the tangent of the coſine	73 24	-	10.52572

To find the diſtance.

As radius	-	-	10.00000
is to the ſecant of the courſe	73° 24′	-	10.54411
ſo is the difference of latitude	98′	-	1.99123
to the diſtance	343	-	2.53534

By Inſpection.

To middle latitude 57°, and 151 one-fourth of the difference of longitude in a diſtance column, the correſponding difference of latitude is 82.2.

Now 24.5, one-fourth of the difference of latitude, and 82.2, taken in a departure column, are found to agree neareſt in table marked $6\frac{1}{2}$ points at the bottom, which is the courſe; and the correſponding diſtance $85\frac{3}{4}$ multiplied by 4 gives 343 miles, the diſtance required.

By Gunter's Scale.

The extent from 98 the difference of latitude, to 604 the difference of longitude on numbers, being laid the ſame way from 33°, the complement of the middle latitude on ſines, will reach to a certain point beyond the termination of the line on the ſcale. Now the extent between this point and 90° on ſines, will reach from 45° to 73° 24′, the courſe on the line of tangents. And the extent from 73° 24′ the courſe, to 33° the complement of the middle latitude on the line of ſines, being laid the ſame way from 604 the difference of longitude, will reach to 343 the diſtance on the line of numbers.

The true courſe, therefore, from the iſland of May to the Naze of Norway is N 73° 24′ E, ENE$\frac{3}{4}$E nearly; but as the variation at the May is $2\frac{1}{2}$ points weſt, therefore, the courſe per compaſs from the May is E*b*S.

Prob. II. Given one latitude, courſe, and diſtance ſailed, to find the other latitude and difference of longitude.

Example. A ſhip from Breſt, in latitude 48° 23′ N, and longitude 4° 30′ W, ſailed SW$\frac{3}{4}$W 238 miles. Required the latitude and longitude come to?

By Conſtruction.

With the courſe and diſtance conſtruct the triangle ABC (fig. 17.), and the difference of latitude AB being meaſured, will be found equal to 142 miles: hence the latitude come to is 46° 1′ N, and the middle latitude 47° 12′. Now make the angle DCB equal to Fig. 17.

(D) For R. : coſine mid. lat. :: Diff. of long. : Departure;
And diff. of lat. : Dep. :: R. : Tangent courſe.
Hence diff. of lat. : coſine mid. lat. :: diff. of long. : tang. courſe;
Or diff. of lat. : diff. of long. :: coſine mid. lat. : tang. courſe.

Middle Latitude Sailing.

to 47° 12′; and DC being meaſured, will be 281, the difference of longitude: hence the longitude come to is 9° 11′ W.

By Calculation.

To find the difference of latitude.

As radius			10.00000
is to the coſine of the courſe,	4¾		9.77503
ſo is the diſtance,	238		2.37658
to the difference of latitude	141.8		2.15161
Latitude of Breſt,	48° 23′ N		48° 23′ N
Difference of lat.	2 22 S	half	1 11 S
Lat. come to	46° 1′ N.	Mid. lat.	47 12

To find the difference of longitude (E).

As the coſine of Mid. Lat.	47° 12′	9.83215
is to the ſine of the courſe	4¾ points	9.90483
ſo is the diſtance	238	2.37658
to the difference of longitude	281.3	2.44926
Longitude of Breſt		4° 30′ W
Difference of longitude		4 41 W
Longitude come to		9 11 W.

By Inſpection.

To the courſe 4¾ points, and diſtance 238 miles, the difference of latitude is 141.8, and the departure 191.1. Hence the latitude come to is 46° 1′ N, and middle latitude 47° 12′. Then to middle latitude 47° 12′, and departure 191.1 in a latitude column, the correſponding diſtance is 281′, which is the difference of longitude.

By Gunter's Scale.

The extent from 8 points to 3¼ points, the complement of the courſe on ſine rhumbs, being laid the ſame way from the diſtance 238, will reach to the difference of latitude 142 on the line of numbers; and the extent from 42° 48′ the complement of the middle latitude, to 53° 26′, the courſe on the line of ſines, will reach from the diſtance 238 to the difference of longitude 281 on numbers.

Prob. III. Given both latitudes and courſe, required the diſtance and difference of longitude?

Example. A ſhip from St Antonio, in latitude 17° 0′ N, and longitude 24° 25′ W, ſailed NW, ¾ N, till by obſervation her latitude is found to be 28° 34′N. Required the diſtance ſailed, and longitude come to?

Latitude St Antonio	17° 0 N		17° 0 N
Latitude by obſervation	28 34 N		28 34 N
Difference of lat.	11 34=694m.		45 34
		Middle lat.	22 47

By Conſtruction.

Fig. 19.

Conſtruct the triangle ABC (fig. 19.), with the given courſe and difference of latitude, and make the angle BCD equal to the middle latitude. Now the diſtance AC and difference of longitude DC being meaſured, will be found equal to 864 and 558 reſpectively.

By Calculation.

To find the diſtance.

As radius,		10.00000
is to the ſecant of the courſe	3¼ points	10.09517
ſo is the difference of lat.	694	2.84136
To the diſtanee	864	2.93653

To find the difference of longitude.

As the coſine of middle latitude	22° 47′	9.96472
is to the tangent of the courſe	3¾ points	9.87020
ſo is the difference of latitude	694	2.84136
To the difference of longitude	558.3	2.74684
Longitude of St Antonio		24° 25′ W
Difference of longitude		9 18 W
Longitude come to		33 43 W

By Inſpection.

To courſe 3¼ points, and difference of latitude 231.3 one third of that given, the departure is 171.6 and diſtance 288, which multiplied by 3 is 864 miles.

Again to the middle latitude 22° 47′, or 23°, and departure 171.6 in a latitude column, the diſtance is 186, which multiplied by 3 is 558, the difference of longitude.

By Gunter's Scale.

The extent from 4¾ points, the complement of the courſe, to 8 points on the line of ſine rhumbs, will reach from the difference of latitude 694 to the diſtance 864 on numbers; and the extent from the courſe 36° 34′ to 67° 13′, the complement of middle latitude on ſines, will reach from the diſtance 864 to the difference of longitude 558 on numbers.

Prob. IV. Given one latitude, courſe, and departure, to find the other latitude, diſtance, and difference of longitude.

Example. A ſhip from latitude 26° 30′ N, and longitude 45° 30′ W, ſailed NE½N till her departure is 216 miles. Required the diſtance run, and latitude and longitude come to?

By Conſtruction.

Fig. 20.

With the courſe and departure conſtruct the triangle ABC (fig. 20.), and the diſtance and difference of latitude being meaſured, will be found equal to 340 and 263 reſpectively. Hence the latitude come to is 30° 53′, and middle latitude 28° 42′. Now make the angle BCD equal to the middle latitude, and the difference of longitude DC applied to the ſcale will meaſure 246′.

By Calculation.

To find the diſtance.

As the ſine of the courſe	3½ points	9.80236
is to radius		10.00000
ſo is the departure	216	2.33445
To the diſtance	340.5	2.53209

To

(E) This proportion is obvious, by conſidering the whole figure as an oblique-angled plane triangle.

Middle Latitude Sailing.

To find the difference of latitude.

As the tangent of the courſe	3½ points		9.91417
is to radius	- -	-	10.00000
ſo is the departure	216	-	2.33445
to the difference of lat.	263.2	-	2.42028
Latitude ſailed from	26° 30′N		26° 30′N
Difference of latitude	4 23 N	half	2 12 N
Latitude come to	30 53 N.	Mid. lat.	28 42

To find the difference of longitude.

As radius	- - -	10.00000
is to the ſecant of the mid. lat.	28° 42′	10.05693
ſo is the departure	216	2.33445
to the difference of longitude	246.2	2.39138
Longitude left	- - -	45° 30′W
Difference of longitude	- -	4 6 E
Longitude come to	- -	41 24 W

By Inſpection.

Under the courſe 3½ points, and oppoſite to 108, half the departure, the diſtance is 170, and difference of latitude 131½; which doubled, give 340 and 263 for the diſtance and difference of latitude reſpectively.

Again, to middle latitude 28° 42′, and departure 108, the diſtance is 123; which doubled is 246 the difference of longitude.

By Gunter's Scale.

The extent from the courſe 3½ points, on ſine rhumbs, to the departure 216 on numbers, will reach from 8 points on ſine rhumbs to about 340, the diſtance on numbers; and the ſame extent will reach from 4½ points, the complement of the courſe, to 263, the difference of latitude on numbers; and the extent from 61° 18′ the complement of the middle latitude, to 90° on ſines, will reach from the departure 216 to the difference of longitude 246 on numbers.

Prob. V. Given both latitudes and diſtance; to find the courſe and difference of longitude.

Example. From Cape Sable, in latitude 43° 24′ N, and longitude 65° 39′ W, a ſhip ſailed 246 miles on a direct courſe between the ſouth and eaſt, and is then by obſervation in latitude 40° 48′ N. Required the courſe and longitude in?

Latitude Cape Sable,	43° 24′N		43° 24′N
Latitude by obſervation,	40 48′N		40 48′N
Difference of latitude,	2 36=156′,	ſum	24 12
		Middle latitude	42 6

By Conſtruction.

Fig. 21.

Make AB (fig. 21.) equal to 156 miles; draw BC perpendicular to AB, and make AC equal to 246 miles. Draw CD, making with CB an angle of 42° 6′ the middle latitude. Now DC will be found to meaſure 256, and the courſe or angle A will meaſure 50° 39′.

By Calculation.

To find the courſe.

As the diſtance	246	2.39093
is to the difference of latitude	156	2.19312
ſo is radius,	- - -	10.00000
to the coſine of the courſe,	50° 39′	9.80219

To find the difference of longitude.

As the coſine of middle latitude	42° 6′	9.87039
is to the ſine of the courſe	50 39	9.88834
ſo is the diſtance	246	2.39093
to the difference of longitude	256.4	2.40888
Longitude Cape Sable,	- - -	65° 39′W
Difference of longitude	- - -	4 16′E
Longitude come to	- - -	61 23 W

By Inſpection.

The diſtance 246, and difference of latitude 156, are found to correſpond above 4½ points, and the departure is 190.1. Now, to the middle latitude 42°, and departure 190.1 in a latitude column, the correſponding diſtance is 256, which is the difference of longitude required.

By Gunter's Scale.

The extent from 246 milcs, the diſtance, to 156, the difference of latitude on numbers, will reach from 90° to about 39°⅓, the complement of the courſe on the line of ſines: and the extent from 48°, the complement of the middle latitude, to 50°⅔, the courſe on ſines, will reach from the diſtance 246m. to the difference of longitude 256m. on numbers.

Prob. VI. Given both latitudes and departure; ſought the courſe, diſtance, and difference of longitude.

Example. A ſhip from Cape St Vincent, in latitude 37° 2′N, longitude 9° 2′W, ſails between the ſouth and weſt; the latitude come to is 18° 16′N, and departure 838 miles. Required the courſe and diſtance run, and longitude come to?

Latitude Cape St Vincent,	37° 2′N		37° 2′
Latitude come to	18 16 N		18 16
Difference of latitude	18 46=1126	ſum	55 18
		Middle latitude	17 39

By Conſtruction.

Fig. 22.

Make AB (fig. 22.) equal to the difference of latitude 1126 miles, and BC equal to the departure 838, and join AC; draw CD ſo as to make an angle with CB equal to the middle latitude 27° 39′. Then the courſe being meaſured on chords is about 36°⅓, and the diſtance and difference of longitude, meaſured on the line of equal parts, will be found to be 1403 and 946 reſpectively.

By Calculation.

To find the courſe.

As the difference of latitude	1126	3.05154
is to the departure	838	2.92324
ſo is radius	- - -	10.00000
to the tangent of the courſe	36° 39′	9.87170

To find the diſtance.

As radius	- - -	10.00000
is to the ſecant of the courſe	36° 39′	10.09566
ſo is the difference of latitude	1126	3.05154
to the diſtance	1403	3.14720

To

Middle Latitude Sailing.

To find the difference of longitude.

As radius		10.00000
is to the ſecant of mid. lat.	27° 39′	10.05266
ſo is the departure	838	2.92324
to the difference of longitude	946	2.97590
Longitude Cape St Vincent		9° 2′W
Difference of longitude		15 46W
Longitude come to		24 48W

By Inſpection.

One tenth of the difference of latitude 112.6 and of the departure 83.8, are found to agree under $3\frac{1}{2}$ points, and the correſponding diſtance is 140, which multiplied by 10 gives 1400 miles. And to middle latitude $27^{\circ}\frac{2}{3}$, and 209.5 one fourth of the departure in a latitude column, the diſtance is 236.5; which multiplied by 4 is 946, the difference of longitude.

By Gunter's Scale.

The extent from the difference of latitude 1126 to the departure 838 on numbers, will reach from 45° to $36^{\circ}\frac{2}{3}$ the courſe on tangents; and the extent from $53^{\circ}\frac{1}{3}$ the complement of the courſe to 90° on ſines, will reach from 1126 to 1403 the diſtance on numbers. Laſtly, the extent from $62^{\circ}\frac{1}{3}$ the complement of the middle latitude, to 90° on ſines, will reach from the departure 838 to the difference of longitude 946 on numbers.

Prob. VII. Given one latitude, diſtance, and departure, to find the other latitude, courſe, and difference of longitude.

Example. A ſhip from Bourdeaux, in latitude 44° 50′ N, and longitude 0° 35′ W, ſailed between the north and weſt 374 miles, and made 210 miles of weſting. Required the courſe, and the latitude and longitude come to?

By Conſtruction.

Fig. 23. With the given diſtance and departure make the triangle ABC (fig. 23.). Now the courſe being meaſured on the line of chords is about $34^{\circ}\frac{1}{6}$, and the difference of latitude on the line of numbers is 309 miles: hence the latitude come to, is 49° 59′ N, and middle latitude 47° 25′. Then make the angle BCD equal to 47° 25′, and DC being meaſured will be 310 miles, the difference of longitude.

By Calculation.

To find the courſe.

As the diſtance	374	2.57287
is to the departure	210	2.32222
ſo is radius		10.00000
to the ſine of the courſe	34° 10′	9.74935

To find the difference of latitude.

As radius		10.00000
is to the coſine of the courſe	34° 10′	9.91772
ſo is the diſtance	374	2.57287
to the difference of latitude	309.4	2.49059
Latitude of Bourdeaux	44° 50′N	44° 50′
Difference of latitude	5 9 N half	2 33
Latitude come to	49 59 N Mid. lat.	47 25

To find the difference of longitude.

As radius		10.00000
is to the ſecant of mid. lat.	47° 25′	10.16963
ſo is the departure	210	2.32222
to the difference of longitude	310.3	2.49185
Longitude of Bourdeaux		0° 35′W
Difference of longitude		5 10 W
Longitude in		5 45 W

Middle Latitude Sailing.

By Inſpection.

The half of the diſtance 187, and of the departure 105, are found to agree neareſt under 34°, and the difference of latitude anſwering thereto is 155; which doubled is 310 miles.

Again, to middle latitude 47° 25′, and departure 105 in a latitude column, the correſponding diſtance is 155 miles, which doubled is 310 miles, the difference of longitude.

By Gunter's Scale.

The extent from the diſtance 374 miles to the departure 210 miles on the line of numbers, will reach from 90° to 34° 10′, the courſe on the line of ſines; and the extent from 90° to 55° 50′, the complement of the courſe on ſines, will reach from the diſtance 374 to the difference of latitude 309 miles on numbers.

Again, the extent from 42° 35′, the complement of the middle latitude, to 90° on ſines, will reach from the departure 210 to the difference of longitude 310 on numbers.

Prob. VIII. Given one latitude, departure, and difference of longitude, to find the other latitude, courſe, and diſtance.

Example. A ſhip from latitude 54° 56′ N, longitude 1° 10′ W, ſailed between the north and eaſt, till by obſervation ſhe is found to be in longitude 5° 26′ E, and has made 220 miles of eaſting. Required the latitude come to, courſe, and diſtance run?

Longitude left	1° 10′W
Longitude come to	5 26 E
Difference of longitude	6 36=396

By Conſtruction.

Make BC (fig. 24.) equal to the departure 220, and CD equal to the difference of longitude 396:—then the middle latitude BCD being meaſured, will be found equal to 59° 15′: hence the latitude come to is 57° 34′, and difference of latitude 158°. Now make AB equal to 158, and join AC, which applied to the ſcale, will meaſure 271 miles. Alſo the courſe BAC being meaſured on chords will be found equal $54^{\circ}\frac{1}{3}$. Fig. 24.

By Calculation.

To find the middle latitude.

As the departure	220	2.34242
is to the diff. of longitude	396	2.59769
ſo is radius		10.00000
To the ſecant of mid. lat.	56° 15′	10.25527
Double, mid. lat.	112 30	
Latitude left	54 56	
Latitude come to	57 34	
Diff. of latitude	2 38=158 miles	

Middle Latitude Sailing.

To find the courſe.

As the difference of latitude	158	2.19866
is to the departure -	220	2.34242
ſo is radius - - - - - -		10.00000
to the tangent of the courſe	54° 19′	10.14376

To find the diſtance.

As radius - - - - - -		10.00000
is to the ſecant of the courſe	54° 19′	10.23410
ſo is the difference of latitude	158	2.19866
to the diſtance - -	270.9	2.43276

By Inſpection.

As the difference of longitude and departure exceed the limits of the tables, let, therefore, their halves be taken; theſe are 198 and 110 reſpectively. Now theſe are found to agree exactly in the page marked 5 points at the bottom. Whence the middle latitude is 56° 15′, and difference of latitude 158 miles.

Again, the difference of latitude 158 and departure 220 will be found to agree nearly above 54° the courſe, and the diſtance on the ſame line is 271 miles.

By Gunter's Scale.

The extent from the difference of longitude 396 to the departure 220 on numbers, will reach from 90° to 33° 45′, the complement of the middle latitude on ſines; and hence the difference of latitude is 158 miles. Now the extent from 158 to 220 on numbers, will reach from 45° to $54^{\circ}\frac{1}{3}$ on tangents; and the extent from the complement of the courſe $35^{\circ}\frac{2}{3}$ to 90° on ſines, will reach from the difference of latitude 158 to the diſtance 271 on numbers.

Prob. IX. Given the courſe and diſtance ſailed, and difference of longitude; to find both latitudes.

Example. A ſhip from a port in north latitude, ſailed SE$\frac{3}{4}$S 438 miles, and differed her longitude 7° 28′. Required the latitude ſailed from, and that come to?

By Conſtruction.

Fig. 25.

With the courſe and diſtance conſtruct the triangle ABC (fig. 25.), and make DC equal to 448 the given difference of longitude. Now the middle latitude BCD will meaſure 48° 58′, and the difference of latitude AB 324 miles: hence the latitude left is 51° 40′, and that come to 46° 16′.

By Calculation.

To find the difference of latitude.

As radius - - - - - -		10.00000
is to the coſine of the courſe	$3\frac{3}{4}$ pts.	9.86979
ſo is the diſtance - -	438	2.64147
to the difference of latitude	324.5	2.51126

To find the middle latitude.

As the difference of longitude	448	2.65128
is to the diſtance - -	438	2.64147
ſo is the ſine of the courſe -	$3\frac{3}{4}$ pts.	9.82708
to the coſine of mid. latitude	48° 58′	9.81727
half difference of latitude	2 42	
Latitude ſailed from -	51 40	
Latitude come to -	46 16	

By Inſpection.

To the courſe $3\frac{3}{4}$ points, and half the diſtance 219 miles, the departure is 147.0, and difference of latitude 162.2; which doubled is 323.4. Again, to half the difference of longitude 224 in a diſtance column, the difference of latitude is 149.9 above 48°, and 146.9 over 49°.

Now, as 30 : 29 :: 60′ : 58′.

Hence the middle latitude is 48° 58′: the latitude ſailed from is therefore 51° 40′, and latitude come to 46° 16′.

By Gunter's Scale.

The extent from 8 points to $4\frac{1}{4}$ points, the complement of the courſe on ſine rhumbs, will reach from the diſtance 438 miles to the difference of latitude 3245 on numbers. And the extent from the difference of longitude 448, to the diſtance 438 on numbers, will reach from the courſe 42° 11′ to the complement of the middle latitude 41° 2′ on ſines. Hence the latitude left is 51° 40′, and that come to 46° 16′.

Prob. X. To determine the difference of longitude made good upon compound courſes, by middle latitude ſailing.

Rule I. With the ſeveral courſes and diſtances find the difference of latitude and departure made good, and the ſhip's preſent latitude, as in traverſe ſailing.

Now enter the traverſe table with the given middle latitude, and the departure in a latitude column, the correſponding diſtance will be the difference of longitude, of the ſame name with the departure.

Example. A ſhip from Cape Clear, in latitude 51° 18′ N, longitude 9° 46′ W, ſailed as follows:—SW*b*S 34 miles, W*b*N 63 miles, NNW 48 miles, and NE$\frac{1}{2}$E 85 miles. Required the latitude and longitude come to?

Courſes.	Diſt.	Diff. of Latitude.		Departure.	
		N	S	E	W
SW*b*S	54	—	44.9	—	30.0
W*b*N	63	12.3	—	—	61.8
NNW	48	44.4	—		18.4
NE$\frac{1}{2}$E	85	53.9	—	6 7	—
		110.6	44.9	65.7	110.2
		44.9	—	—	65.7
N 34° W	79	65.7=	1 6N		44.5

Latitude of Cape Clear	51 18N
Latitude come to	52 24N
Sum - -	103 42
Middle latitude	51 51

Now, to middle latitude 51° 51′ or 52°, and departure 44.5 in a latitude column, the difference of longitude is 72 in a diſtance column.

Longitude of Cape Clear	9 46 W
Difference of longitude	1 12 W
Longitude come to -	10° 58′W

The above method is that always practiſed to find the difference of longitude made good in the courſe of of a day's run; and will, no doubt, give the difference of longitude tolerably exact in any probable run a ſhip may make in that time, eſpecially near the equator. But in a high latitude, when the diſtances are conſiderable, this method is not to be depended on.—To illuſtrate this, let a ſhip be ſuppoſed to ſail from latitude 57° N, as follows: E 240 miles, N 240 miles, W 240 miles, and S 240 miles: then, by the above method, the ſhip will be come to the ſame place ſhe left. It will, however, appear evident from the following conſideration, that this is by no means the caſe; for let two ſhips, from latitude 61° N, and diſtant 240 miles, ſail directly ſouth till they are in latitude 57° N; now their diſtance being computed by Problem IV. of Parallel Sailing, will be 269.6 miles; and, therefore, if the ſhip ſailed as above, ſhe will be 29.6 miles weſt of the place ſailed from; and the error in longitude will be equal to $240 \times \overline{\text{ſecant } 61^\circ - \text{ſecant } 57^\circ} = 29.6 \times \text{ſecant } 57^\circ = 54.4$.

Theorems might be inveſtigated for computing the errors to which the above method is liable. Theſe corrections may, however, be avoided, by uſing the following method.

Rule II. Complete the traverſe table as before, to which annex five columns: the firſt column is to contain the ſeveral latitudes the ſhip is in at the end of each courſe and diſtance; the ſecond, the ſums of each following pair of latitude; the third, half the ſums, or middle latitudes; and the fourth and fifth columns are to contain the differences of longitude.

Now find the difference of longitude anſwering to each middle latitude and its correſponding departure, and put them in the eaſt or weſt difference of longitude columns, according to the name of the departure. Then the difference of the ſums of the eaſt and weſt columns will be the difference of longitude made good, of the ſame name with the greater.

Example. A ſhip from Halliford in Iceland, in lat. 64° 30′ N, long. 27° 15′ W, ſailed as follows: SSW 46 miles, SW 61 miles, S*b*W 59 miles, SE*b*E 86 miles, S*b*E½E 76 miles. Required the lat. and long. come to?

TRAVERSE TABLE.

Courſes.	Diſt.	Diff. of Lat.		Departure.	
		N	S	E	W
SSW	46	—	42.5	—	17.6
SW	61	—	43.1	—	43.1
S*b*W	59	—	57.9	—	11.5
SE*b*E	86	—	47.8	71.5	—
S*b*E½E	76	—	72.7	22.0	—
			264.0	93.5	72.2
				72.2	
				21.3	

By Rule I.

Latitude Halliford - -	64° 30′N
Difference of latitude -	4 24 S
Latitude in - -	60 6 N
Sum - - -	124 36
Middle latitude - -	62 18

Now, to middle lat. 62 18, and departure 21.3, the difference of long. is 46 E.

Long. Halliford - -	27 15 W
Longitude in - - -	16 29

The error of comm. method, in this Ex. is 12′.

LONGITUDE TABLE.

Succeſſive Latitudes.	Sums.	Middle Latitudes.	Diff. of Longitude	
			E	W
64° 30′	—	—	—	—
63 48	128° 18′	64° 9′	—	40.4
63 5	126 53	63 27	—	96.4
62 7	125 12	62 36	—	25.0
61 19	123 26	61 43	150.9	—
60 6	121 25	60 43	45.0	—
			195.9	161.8
			161.8	

Difference of longitude -	34.1
Longitude Halliford -	27.15 W
Longitude in - -	26.41 W

Chap. VI. *Of Mercator's Sailing.*

It was obſerved in Middle Latitude Sailing, that the difference of longitude made upon an oblique rhumb could not be exactly determined by uſing the middle latitude. In Mercator's ſailing, the difference of longitude is very eaſily found, and the ſeveral problems of ſailing reſolved with the utmoſt accuracy, by the aſſiſtance of Mercator's chart or equivalent tables.

In Mercator's chart, the meridians are ſtraight lines parallel to each other; and the degrees of latitude, which at the equator are equal to thoſe of longitude, increaſe with the diſtance of the parallel from the equator. The parts of the meridian thus increaſed are called *meridional parts*. A table of theſe parts was firſt conſtructed by Mr Edward Wright, by the continual addition of the ſecants of each minute of latitude.

For by parallel ſailing,

R : coſ. of lat. :: part of equat. : ſimilar part of parallel.

And

And becauſe the equator and meridian on the globe are equal; therefore,

R : coſ. lat. :: part of meridian : ſimilar part of parallel.

Or ſec. lat. : R :: part of merid. : ſimilar part of parallel.

Hence, $\frac{\text{ſecant latitude}}{\text{part of meridian}}, = \frac{\text{R}}{\text{part of parallel}}$.

But in Mercator's chart the parallels of latitude are equal, and radius is a conſtant quantity. If therefore, the latitude be aſſumed ſucceſſively equal to ' 1′, 2,′ 3′,' &c. and the correſponding parts of the enlarged meridian be repreſented by *a*, *b*, *c*, &c.; then,

$$\frac{\text{ſecant } 1'}{\text{part of mer. } a} = \frac{\text{ſecant } 2'}{\text{part of mer. } b} = \frac{\text{ſecant } 3'}{\text{part of mer. } c}, \text{ \&c.}$$

Hence ſecant 1′ : part of mer. *a* :: ſecant 2′ : part of mer. *b* :: ſecant 3′ : part of mer. *c*, &c.

Therefore by 12th V. Euclid,

Secant 1′ : part of mer. *a* :: ſecant 1′ + ſecant 2′ + ſecant 3′, &c. : parts of $a + b +$ mer. *c*, &c.

That is, the meridional parts of any given latitude are equal to the ſum of the ſecants of the minutes in that latitude (E).

Since CD : LK :: R : ſecant LD, fig. 15.

And in the triangle CED,

ED : CD :: R : tangent CED;

Therefore, ED : LK :: R^2 : ſecant LD × tangent CED

$$\text{Hence LK} = \frac{\text{ED} \times \text{ſec.} \times \text{LD} \times \text{tang. CED}}{\text{R}^2} = \frac{\text{ED} \times \text{ſec. LD}}{\text{R}} \times \frac{\text{tang. CED}}{\text{R}}.$$

But $\frac{\text{ED} \times \text{ſec. LD}}{\text{R}}$ is the enlarged portion of the meridian anſwering to ED. Now the ſum of all the quantities $\frac{\text{ED} \times \text{ſecant LD}}{\text{R}}$ correſponding to the ſum of all the ED's contained in AS, will be the meridional parts anſwering to the difference of latitude AS; and MN is the ſum of all the correſponding portions of the equator LK.

$$\text{Whence MN} = \text{mer. diff. of lat.} \times \text{tangent } \frac{\text{CED}}{\text{R}}.$$

That is, the difference of longitude is equal to the meridional difference of latitude multiplied by the tangent of the courſe, and divided by the radius.

This equation anſwers to a right-angled rectilineal triangle, having an angle equal to the courſe; the adjacent ſide equal to the meridional difference of latitude, and the oppoſite ſide the difference of longitude. This triangle is, therefore, ſimilar to a triangle conſtructed, with the courſe and difference of latitude, according to the principles of plane ſailing, and the homologous ſides will be proportional. Hence, if, in fig. 26. the angle A repreſents the courſe, AB the difference of latitude, and if AD be made equal to the meridional difference of latitude; then DE, drawn perpendicular to AD, meeting the diſtance produced to E, will be the difference of longitude.

Plate CCCLXIV. fig. 26.

It is ſcarcely neceſſary to obſerve, that the meridional difference of latitude is found by the ſame rules as the proper difference of latitude; that is, if the given latitudes be of the ſame name, the difference of the correſponding meridional parts will be the meridional difference of latitude; but if the latitudes are of a contrary denomination, the ſum of theſe parts will be the meridional difference of latitude.

Prob. I. Given the latitudes and longitudes of two places, to find the courſe and diſtance between them.

Ex. Required the courſe and diſtance between Cape Finiſterre, in latitude 42° 52′ N, longitude 9° 17′ W, and Port Praya in the iſland of St Jago, in latitude 14° 54′ N, and longitude 23° 29′ W?

Lat. Cape Finiſterre	42° 52′	Mer. parts	2852
Latitude Port Praya	14 54	Mer. parts	904
Difference of lat. =	27 58	Mer. diff. lat.	1948
	1678		

Longitude Cape Finiſterre		9° 17′ W
Longitude Port Praya	-	23 29 W
Diff. longitude	- -	14 12=852.

By Conſtruction.

Fig. 26.

Draw the ſtraight line AD (fig. 26.) to repreſent the meridian of Cape Finiſterre, upon which lay off AB, AD equal to 1678, and 1948, the proper and meridional differences of latitude; from D draw DE perpendicular to AD, and equal to the difference of longitude 852, join AE, and draw BC parallel to DE; then the difference AC will meaſure 1831 miles, and the courſe BAC 23° 37′.

By Calculation.

To find the courſe.

As the meridian difference of lat.	1948 -	3.28959
is to the difference of longitude -	852 -	2.93044
ſo is radius - - - - -		10.00000
to the tangent of the courſe 23° 37′	-	9.64085

To find the diſtance.

As radius - - - - -		10.00000
is to the ſecant of the courſe,	23° 37′ -	10.03798
ſo is the difference of latitude	1678 - -	3.22479
to the diſtance - -	1831 - -	3.26277

By Inſpection.

As the meridian difference of latitude and difference of longitude are too large to be found in the tables, let the tenth of each be taken; theſe are 194.8 and 85.2 reſpectively. Now theſe are found to agree neareſt under 24°; and to 167.8, one-tenth of the proper difference of latitude, the diſtance is about 183 miles, which multiplied by 10 is 1830 miles.

By Gunter's Scale.

The extent 1948, the meridional difference of latitude, to 852, the difference of longitude on the line of numbers, will reach from 45° to 23° 37′, the courſe on

---

(E) This is not ſtrictly true; for inſtead of taking the ſum of the ſecants of every minute in the diſtance of the given parallel from the equator, the ſum of the ſecants of every point of latitude ſhould be taken.

on the line of tangents. And the extent from 66° 23′, the complement of the courſe to 90° on ſines, will reach from 1678, the proper difference of latitude, to 1831, the diſtance on the line of numbers.

Prob. II. Given the courſe and diſtance, ſailed from a place whoſe ſituation is known, to find the latitude and longitude of the place come to.

Example. A ſhip from Cape Hinlopen in Virginia, in latitude 38° 47′ N, longitude 75° 4′ W, ſailed 267 miles NE*b*N. Required the ſhip's preſent place?

By Conſtruction.

Fig. 27.

With the courſe and diſtance ſailed, conſtruct the triangle ABC (fig. 27.); and the difference of latitude AB being meaſured, is 222 miles: hence the latitude come to is 42° 29′ N, and the meridional difference of latitude 293. Make AD equal to 293; and draw DE perpendicular to AD, and meeting AC produced in E: then, the difference of longitude DE being applied to the ſcale of equal parts will meaſure 196; the longitude come to is therefore 71° 48′ W.

By Calculation.

To find the difference of latitude.

As radius - - -		10.00000
is to the coſine of the courſe, -	3 points -	9.91985
ſo is the diſtance -	267 - -	2.42651
to the difference of latitude -	222 - -	2.34636

Lat. Cape Hinlopen = 38° 47′ N. Mer. parts 2528
Difference of lat. - 3 42 N.

Latitude come to - 42 29 N. Mer. parts 2821

Meridional difference of latitude 293

To find the difference of longitude.

As radius - - - - -		10.00000
is to tangent of the courſe, -	3 points -	9.82489
ſo is the mer. diff. of latitude -	293 - -	2.46687
to the difference of longitude -	195.8 - -	2.29176

Longitude Cape Hinlopen - 75° 4′ W
Difference of longitude - - 3 16 E

Longitude come to - - 71 48 W

By Inſpection.

To the courſe 3 points, and diſtance 267 miles, the difference of latitude is 222 miles: hence the latitude in is 42° 29′, and the meridional difference of latitude 293. Again, to courſe 3 points, and 146.5 half the mer. difference of latitude, the departure is 97.9, which doubled is 195.8, the difference of longitude.

By Gunter's Scale.

The extent from 8 points to the complement of the courſe 5 points, on ſine rhumbs, will reach from the diſtance 267 to the difference of latitude 222 on numbers; and the extent from 4 points to three points on tangent rhumbs, will reach from the meridional difference of latitude 293 to the difference of longitude 196 on numbers.

Prob. III. Given the latitudes and bearing of two places; to find their diſtance and difference of longitude.

Example. A ſhip from Port Canſo in Nova Scotia, in latitude 45° 20′ N, longitude 60° 55′ W, ſailed SE ¼ S, and by obſervation is found to be in latitude 41° 14′ N. Required the diſtance ſailed, and longitude come to?

Lat. Port Canſo - 45° 20′ N - Mer. parts - 3058
Lat. in by obſervation 41 14 N - Mer. parts - 2720

Difference of lat. - 4 6=246 Mer. diff. lat. 338

By Conſtruction.

Fig. 28.

Make AB (fig. 28.) equal to 246, and AD equal to 338; draw AE, making an angle with AD equal to 3¾ points, and draw BC, DE perpendicular to AD. Now AC being applied to the ſcale, will meaſure 332, and DE 306.

By Calculation.

To find the diſtance.

As radius - - - - -		10.00000
is to the ſecant of the courſe, -	3¾ points -	10.13021
ſo is the difference of latitude -	246 - -	2.39093
to the diſtance - -	332 - -	2.52114

To find the difference of longitude.

As radius - - - - -		10.00000
is to the tangent of the courſe, -	3¾ points -	9.95729
ſo is the mer. diff. of latitude -	338 - -	2.52892
to the difference of longitude -	306.3 - -	2.48621

Longitude Port Canſo - - 60° 55′ W
Difference of longitude - - 5 6 E

Longitude in - - 53 49 W

By Inſpection.

Under the courſe 3¾ points, and oppoſite to half the difference of latitude 123 in a latitude column is 166 in a diſtance column, which doubled is 332 the diſtance; and oppoſite to 169, half the meridional difference of latitude in a latitude column, is 153 in a departure column, which doubled is 306, the difference of longitude.

By Gunter's Scale.

The extent from the complement of the courſe 4¼ points to 8 points on ſine rhumbs, will reach from the difference of latitude 246 m. to the diſtance 332 on numbers; and the extent from 4 points, to the courſe 3¾ points on tangent rhumbs, will reach from the meridional difference of latitude 338 to the difference of longitude 306 on numbers.

Prob. IV. Given the latitude and longitude of the place ſailed from, the courſe and departure; to find the diſtance, and the latitude and longitude of the place come to.

Example. A ſhip ſailed from Sallee in latitude 33° 58′ N, longitude 6° 20′ W, the corrected courſe was NW*b*W½W, and departure 420 miles. Required the diſtance run, and the latitude and longitude come to?

By Conſtruction.

Fig. 29.

With the courſe and departure conſtruct the triangle ABC (fig. 29.); now AC and AB being meaſured, will be found to be equal to 476 and 224 reſpectively: hence

hence the latitude come to is 37° 42′ N, and meridional difference of latitude 276. Make AD equal to 276; and draw DE perpendicular thereto, meeting the diſtance produced in E; then DE applied to the ſcale will be found to meaſure 516′. The longitude in is, therefore, 14° 56′ W.

By Calculation.

To find the diſtance.

As radius		10.00000
is to the coſecant of the courſe	5½ pts	10.05457
ſo is the departure	420	2.62325
to the diſtance	476.2	2.67782

To find the difference of latitude.

As radius		10.00000
is to the co-tangent of the courſe,	5½ pts	9.72796
ſo is the departure	420	2.62325
to the difference of latitude	224.5	2.35121

Lat. of Sallee	33° 58′ N	Mer. parts	2169
Diff. of lat.	3 44 N		
Lat. in	37 42 N	Mer. parts	2445
Mer. difference of latitude			276

To find the difference of longitude.

As radius		10.00000
is to the tangent of the courſe	5½ pts	10.27204
ſo is the mer. diff. of latitude	276	2.44091
to the difference of longitude	516.3	2.71295

Longitude of Sallee	6° 20′ W
Difference of longitude	8 36 W
Longitude in	14 56 W

By Inſpection.

Above 5½ points the courſe, and oppoſite to 210 half the departure, are 238 and 112; which doubled, we have 476 and 224, the diſtance and difference of latitude reſpectively. And to the ſame courſe, and oppoſite to 138, half the meridional difference of latitude, in a latitude column, is 258 in a departure column; which being doubled is 516, the difference of longitude.

By Gunter's Scale.

The extent from 5½ points, the courſe on ſine rhumbs, to the departure 420 on numbers, will reach from 8 points on ſine rhumbs to the diſtance 476 on numbers; and from the complement of the courſe 2½ points on ſine rhumbs, to the difference of latitude 224 on numbers.

Again, the extent from difference of latitude 224 to the meridional difference of latitude 276 on numbers, will reach from the departure 420 to the difference of longitude 516 on the ſame line.

Prob. V. Given the latitudes of two places, and their diſtance, to find the courſe and difference of longitude.

Example. A ſhip from St Mary's, in latitude 36° 57′ N, longitude 25° 9′ W, ſailed on a direct courſe between the north and eaſt 1162 miles, and is then by obſervation in latitude 49° 57′ N. Required the courſe ſteered, and longitude come to?

Lat. of St Mary's,	36° 57′ N	Mer. parts	3470
Lat. come to	49 57 N	Mer. parts	2389
Difference of lat.	13 0	Mer. diff. lat.	1081
	780		

By Conſtruction.

Make AB (fig. 30.) equal to 780, and AD equal to 1081; draw BC, DE perpendicular to AD; make AC equal to 1162′, and through AC draw ACE. Then the courſe or angle A being meaſured, will be found equal to 47° 50′, and the difference of longitude DE will be 1194.

Fig. 30.

By Calculation.

To find the courſe.

As the diſtance	1162	3.06521
is to the difference of latitude,	780	2.89209
ſo is radius		10.00000
to the coſine of the courſe	47° 50′	9.82688

To find the difference of longitude.

As radius		10.00000
is to the tangent of the courſe,	47° 50′	10.04302
ſo is the mer. diff. of latitude	1081	3.03383
to the difference of longitude	1194	3.07685

Longitude of St Mary's	25° 9′ W
Difference of longitude	19 54 E
Longitude in	5 15 W

By Inſpection.

Becauſe the diſtance and difference of latitude exceed the limits of the table, take the tenth of each; theſe are 116.2 and 78.0: Now theſe are found to agree neareſt above 4½ points, which is therefore the courſe; and to this courſe, and oppoſite to 108.1, one tenth of the meridional difference of latitude, in a latitude column, is 119.3 in a departure column, which multiplied by 10 is 1193, the difference of longitude.

By Gunter's Scale.

The extent from the diſtance 1162 m. to the difference of latitude 780 m. on numbers, will reach from 90° to 42° 10′ in the line of ſines. And the extent 45°, to the courſe 47° 50′ on the line of tangents, will reach from the meridional difference of latitude 1081 to the difference of longitude 1194 on numbers.

Prob. VI. Given the latitudes of two places, and the departure, to find the courſe, diſtance, and difference of longitude.

Example. From Aberdeen, in latitude 57° 9′ N, longitude 2° 8′ W, a ſhip ſailed between the ſouth and eaſt till her departure is 146 miles, and latitude come to 53° 32′ N. Required the courſe and diſtance run, and longitude come to?

Latitude Aberdeen	57° 9′ N	Mer. parts	4199
Latitude come to	53 32 N	Mer. parts	3817
Difference of latitude	3 37=217′	Mer. diff. lat.	382

By Conſtruction.

With the difference of latitude 217 m. and departure 146 m. conſtruct the triangle ABC (fig. 31.), make AD

Fig. 31.

AD equal to 382, draw DE parallel to BC, and produce AC to E: Then the courſe BAC will meaſure 33° 56′, the diſtance AC 261, and the difference of longitude DE 257.

By Calculation.

To find the courſe.

As the difference of latitude	217	2.33646
is to the departure	146	2.16435
ſo is radius		10.00000
to the tangent of the courſe	33° 56′	9.82789

To find the diſtance.

As radius		10.00000
is to the ſecant of the courſe	33° 56′	10.08109
ſo is the difference of latitude	217	2.33646
to the diſtance	261.5	2.41755

To find the difference of longitude.

As the difference of latitude	217	2.33646
is to the mer. diff. of latitude	382	2.58206
ſo is the departure	146	2.16435
to the difference of longitude	257	2.40995
Longitude of Aberdeen		2° 8′ W
Difference of longitude		4 17 E
Longitude come to		2 9 E

By Inſpection.

The difference of latitude 217, and departure 146, are found to agree neareſt under 34°, and the correſponding diſtance is 262 miles. To the ſame courſe, and oppoſite to 190.7, the neareſt to 191, half the meridional difference of latitude, is 128.6 in a departure column, which doubled is 257, the difference of longitude.

By Gunter's Scale.

The extent from the difference of latitude 217, to the departure 146 on numbers, will reach from 45° to about 34°, the courſe on the line of tangents; and the ſame extent will reach from the meridional difference of latitude 382 to 257, the difference of longitude on numbers.—Again, the extent from the courſe 34° to 90 on ſines, will reach from the departure 146 to the diſtance 261 on numbers.

PROB. VII. Given one latitude, diſtance, and departure; to find the other latitude, courſe, and difference of longitude.

Example. A ſhip from Naples, in latitude 40° 51′ N, longitude 14° 14′ E, ſailed 252 miles on a direct courſe between the ſouth and weſt, and made 173 miles of weſting. Required the courſe made good, and the latitude and longitude come to?

By Conſtruction.

Fig. 32.

With the diſtance and departure make the triangle ABC (fig. 32.) as formerly.—Now the courſe BAC being meaſured by means of a line of chords will be found equal to 43° 21′, and the difference of latitude applied to the ſcale of equal parts will meaſure 183′: hence the latitude come to is 37° 48′ N, and meridional difference of latitude 237.—Make AD equal to 237, and complete the figure, and the difference of longitude DE will meaſure 224′: hence the longitude in is 10° 30′ E.

By Calculation.

To find the courſe.

As the diſtance	252	2.40140
is to the departure	173	2.23805
ſo is radius		10.00000
to the ſine of the courſe	43° 21′	9.83665

To find the difference of latitude.

As radius		10.00000
is to the coſine of the courſe	43° 21′	9.86164
ſo is the diſtance	252	2.40140
to the difference of latitude	183.2	2.26304
Latitude of Naples	40° 51′ N. Mer. parts	2690
Difference of latitude	3 3 S.	
Latitude come to	37 48 N. Mer. parts	2453
Meridional difference of latitude		237

To find the difference of longitude.

As radius		10.00000
is to the tangent of the courſe	43° 21′	9.97497
ſo is the mer. diff. of latitude	237	2.37475
to the difference of longitude	223.7	2.34972
Longitude of Naples		14° 14′ E
Difference of longitude		3 44 W
Longitude in		10 30 E

By Inſpection.

Under 43° and oppoſite to the diſtance 252 m. the departure is 171. 8, and under 44°, and oppoſite to the ſame diſtance, the departure is 175.0.

Then as 3.2 : 1.2 :: 60′ : 22′.

Hence the courſe is 43° 22′.

Again, under 43° and oppoſite to 118.5, half the meridional difference of latitude in a latitude column, is 110.5 in a departure column; alſo under 44° and oppoſite to 118.5 is 114.4.

Then as 3.2 : 1.2 :: 3.9 : 1.5.

And 110.5+1.5=112, which doubled is 224, the difference of longitude.

By Gunter's Scale.

The extent from the diſtance 252 on numbers, to 90° on ſines, will reach from the departure 173 on numbers, to the courſe $43\frac{1}{3}$ on ſines; and the ſame extent that will reach from the complement of the courſe $46^\circ\frac{2}{3}$ on ſines will reach to the difference of latitude 183 on numbers.—Again, the extent from 45° to $43^\circ\frac{1}{3}$ on tangents will reach from the meridional difference of latitude 237, to the difference of longitude 224, on numbers.

PROB. VIII. Given one latitude, courſe, and difference of longitude: to find the other latitude and diſtance.

Example. A ſhip from Tercera, in latitude 38° 45′N, longitude 27° 6′ W, ſailed on a direct courſe, which, when corrected, was N 32° E, and is found by obſervation to be in longitude 18° 24′ W. Required the latitude come to, and diſtance ſailed?

Longitude of Tercera - - - 27° 6′W
Longitude in - - - 18 24 W

Difference of longitude - - 8 42=522

By Conſtruction.

Fig. 33. Make the right-angled triangle ADE (fig. 33.) having the angle A equal to the courſe 32°, and the ſide DE equal to the difference of longitude 522: then AD will meaſure 835, which added to the meridional parts of the latitude left, will give thoſe of the latitude come to 48° 46′; hence, the difference of latitude is 601: make AB equal thereto, to which let BC be drawn perpendicular; then AC applied to the ſcale will meaſure 708 miles.

By Calculation.

To find the meridional difference of latitude.

As radius - - - - 10.00000
is to the co-tangent of the courſe 32° 0′ 10.20421
ſo is the difference of longitude 5 22 2.71767

to the mer. difference of latitude 8352 2.92188
Latitude of Tercera 30° 45′ N Mer. parts 2526
Mer. diff. of lat. 835

Latitude come to - 48 46N Mer. parts 3361

Difference of latitude 10 1=601 miles.

To find the diſtance.

As radius - - - 10.00000
is to the ſecant of the courſe - 32° 0′ - 10.07158
ſo is the difference of latitude - 601 - 2.77887

to the diſtance - - 707.7 - 2.85045

By Inſpection.

To courſe 32°, and oppoſite to 130.5, one fourth of the given difference of longitude in a departure column, the difference of latitude is 208.8, which multiplied by 4 is 835, the meridional difference of latitude; hence the latitude in is 48° 46′ N, and difference of latitude 601.

Again, to the ſame courſe, and oppoſite to 200, one third of the difference of latitude, the diſtance is 236, which multiplied by 3 gives 708 miles.

By Gunter's Scale.

The extent from the courſe 32°, to 45° on tangents, will reach from the difference of longitude 522 to the meridional difference of latitude 835 on numbers.—And the extent from the complement of the courſe 58° to 90° on ſines, will reach from the difference of latitude 601, to the diſtance 708 miles on numbers.

Prob. IX. To find the difference of longitude made good upon compound courſes.

Rule. With the ſeveral courſes and diſtances, complete the Traverſe Table, and find the difference of latitude, departure, and courſe made good, and the latitude come to as in Traverſe Sailing. Find alſo the meridional difference of latitude.

Now to the courſe and meridional difference of latitude, in a latitude column, the correſponding departure will be the difference of longitude, which applied to the longitude left will give the ſhip's preſent longitude.

Example. A ſhip from port St Julian, in latitude 49° 10′ S, longitude 68° 44′ W, ſailed as follows; ESE 53 miles, SE*b*S 74 miles, E by N 68 m. SE*b*E½E 47 miles, and E 84 miles. Required the ſhip's preſent place?

Courſes.	Diſt.	Diff. of Lat.		Departure.	
		N	S	E	W
ESE	53		20.3	49.0	
SE*by*S	74		61.5	41.1	
E*by*N	68	13.3		66.7	
SE*by*E½E	47		22.1	41.5	
E	84			84.0	
		13.3	103.9 13.3	282.3	
S 72° E	197		90.6=1° 31′		

Latitude left, - 49 10 S m. pt. 3397

Latitude come to - 50 41 S m. pt. 3539

Mer. difference of latitude - - 142

Now to courſe 72°, and oppoſite to 71, half the mer. difference of latitude in a latitude column, is 218.7 in a departure column, which doubled is 437, the difference of longitude.

Longitude of Port St Julian - 68° 44′W
Difference of longitude - 7 17 E

Longitude come to - - 61 27 W

Although the above method is that uſually employed at ſea to find the difference of longitude, yet as it has been already obſerved, it is not to be depended on, eſpecially in high latitudes, long diſtances, and a conſiderable variation in the courſes, in which caſe the following method becomes neceſſary.

Rule II. Complete the Traverſe Table as before, to which annex five columns. Now with the latitude left, and the ſeveral differences of latitude, find the ſucceſſive latitudes, which are to be placed in the firſt of the annexed columns; in the ſecond, the meridional parts correſponding to each latitude is to be put; and in the third, the meridional differences of latitude.

Then to each courſe, and correſponding meridional difference of latitude, find the difference of longitude, by Prob. IV. which place in the fourth or fifth columns, according as the coaſt is eaſterly or weſterly; and the difference between the ſums of theſe columns will be the difference of longitude made good upon the whole, of the ſame name with the greater.

Remarks.

1. When the courſe is north or ſouth, there is no difference of longitude.

2. When the courſe is eaſt or weſt, the difference of longitude cannot be found by Mercator's Sailing; in this caſe the following rule is to be uſed.

To the neareſt degree to the given latitude taken as a courſe, find the diſtance anſwering to the departure in a latitude column: this diſtance will be the difference of longitude.

Ex.

Ex. 1. Four days ago we took our departure from Faro-head, in latitude 58° 40′ N, and longitude 4° 50′ W, and ſince have ſailed as follows: NW 32 miles, W 69 miles, WNW 93 miles, W*b*S 77 miles, SW 58 miles, and W¾S 49 miles.—Required our preſent latitude and longitude?

TRAVERSE TABLE.

Courſes.	Diſt.	Diff. of Lat.		Departure.	
		N	S	E	W
NW	32	22.6			22.6
W	69				69.0
WNW	93	35.6			85.9
W*b*S	77		15.0		75.5
SW	58		41.0		41.0
W¾S	49		7.2		48.5
		58.2	63.2 58.2		342.5
W 1° S	343		5.0		

LONGITUDE TABLE.

Succeſſive Latitudes.	Merid. Parts.	Merid. Diff. Lat.	Diff. of Longitude.	
			E	W
58° 40′	4370			
59 3	4415	45		45.0
59 3	4415	0		134.0
59 38	4484	69		166.5
59 23	4454	30		151.0
58 42	4374	80		80.0
58 35	4361	13		88.0
				664.5

Longitude of Faro head	-	4° 50′ W.
Difference of longitude	-	11 4 W.
Longitude in	- -	15 54 W.

Ex. 2. A ſhip from latitude 78° 15′ N, longitude 28° 14′ E, ſailed the following courſes and diſtances. The latitude come to is required, and the longitude, by both methods: the bearing and diſtance of Hacluit's head-land, in latitude 79° 55′ N, longitude 11° 55′ E, is alſo required?

TRAVERSE TABLE.

Courſes.	Diſt	Diff. of Latitude.		Departure.	
		N	S	E	W
WNW	154	58.9	—	—	142.3
SW	96	—	67.9	—	67.9
NW½W	89	56.4	—	—	68.8
N*b*E	110	107.9	—	21.5	—
NW ¼N	56	45.0	—	—	33.4
S*b*E¾E	78	—	73.4	26.3	—
		268.2 141.3	141.3	47.8	312.4 47.8
		126.9			264.6

By Rule I.

Latitude left	78° 15′ N.	Mer. pts. 7817
Diff. of latitude	2 7 N.	
Lat. come to -	80 22 N.	Mer. pts. 8504

Meridional diff. of latitude	-	687
As difference of lat. - 126.9	-	2.10346
is to mer. diff. of lat. - 687	-	2.83696
ſo is the departure - 264.6	-	2.42256
to diff. of longit. - 1432	-	3.15606

	23° 52′ W.
Longitude left -	28 14 E.
Longitude in -	4 22 E.

The error of this method, in the preſent example, is therefore 1° 23′.

LONGITUDE TABLE.

Succeſſive Latitudes.	Merid. Parts.	Merid. Diff. Lat.	Diff. of Longitude.	
			E	W
78° 15′	7817		—	
79 14	8120	303	—	731.7
78 6	7774	346	—	346.0
79 2	8056	282	—	343.6
80 50	8676	620	123.6	—
81 35	8970	294	—	218.0.
80 22	8504	466	166.7	—
			290.3	1639.3 290.3
				1349.0

Longitude left	- -	28° 14′ E.
Difference of longitude	-	22 29 W.
Longitude in	- -	5 45 E.

To find the bearing and diſtance of Hacluit's head-land.

Lat. H. H. = 79° 55′ N. M. P. 8347 Lon. 11° 55′ E.
Lat. ſhip. = 80 22 N. M. P. 8504 Lon. 5 45 E.
Diff. lat. 0 27 M. D. L. 157 D. L. 6 10
370

Now to 78.5 half the meridional difference of latitude, and 185.0 half the difference of longitude, the courſe 67°, and oppoſite to the difference of latitude 27, the diſtance is 69 miles.—Hence Hacluit's head-land bears S 67° E, diſtant 69 miles.

Method of reſolving the Problems of Mercator's Sailing.

Chap. VII. *Containing the Method of reſolving the ſeveral Problems of Mercator's Sailing, by the Aſſiſtance of a Table of Logarithmic Tangents.*

Prob. I. Given one latitude, diſtance, and difference of longitude; to find the courſe, and other latitude.

Rule. To the arithmetical complement of the logarithm of the diſtance, add the logarithm of the difference of longitude in minutes, and the log. coſine of the given latitude; the ſum rejecting radius will be the log. ſine of the approximate courſe.

To the given latitude taken as a courſe in the traverſe table, add half the difference of longitude in a diſtance column; the correſponding departure will be the firſt correction of the courſe, which is ſubtractive if the given latitude is the leaſt of the two; otherwiſe, additive.

In Table A, under the complement of the courſe, and oppoſite to the firſt correction in the ſide column, is the ſecond correction. In the ſame table find the number anſwering to the courſe at the top, and difference of longitude in the ſide column; and ſuch part of this number being taken as is found in table B oppoſite to the given latitude, will be the third correction. Now theſe two corrections, ſubtracted from the courſe corrected by the firſt correction, will give the true courſe.

Now the courſe and diſtance being known, the difference cf latitude is found as formerly.

	Table A.									Table B.	
Arc.	10°	20°	30°	40°	50°	60°	70°	80°	90°	Lat.	
1°	3′	1	1′	1′	0′	0′	0′	0′	0′	0°	$\frac{1}{3}$
2	12	6	4	2	2	1	1	0	0	10	$\frac{1}{3}$
3	27	13	8	6	4	3	2	1	0	20	$\frac{1}{6}+\frac{1}{7}$
4	47	23	14	10	7	5	3	1	0	30	$\frac{1}{6}+\frac{1}{8}$
5	74	36	23	16	11	8	5	2	0	40	$\frac{1}{6}+\frac{1}{10}$
6	107	52	33	22	16	11	7	3	0	50	$\frac{1}{4}$
7	145	70	44	30	21	15	9	4	0	60	$\frac{1}{5}$
8	190	92	58	40	28	19	12	6	0	70	$\frac{1}{6}+\frac{1}{50}$
										80, &c.	$\frac{1}{6}$

Example. From latitude 50° N, a ſhip ſailed 290 miles between the ſouth and weſt, and differed her longitude 5°. Required the courſe, and latitude come to?

Diſtance - -	290. ar. co. log.	7.53760
Diff. of longitude -	300 log.	2.47712
Latitude - -	50° 0′ co. -	9.80807
Approximate courſe -	41 41 ſine -	9.82279
To lat. 50°, and half diff. long. 150 in a diſt. col. the firſt corr. in a dep. col. is 115 -		+1 55
Approximate courſe -	41 41	
Cor. - - -	1 55	
In table A to co. courſe 48° and 1ſt corr. 1° 55′ the ſecond direction is		—0 2
To courſe 41° and diff. long. 5°, the number is 15, of which $\frac{1}{5}$ (Tab. B) being taken, gives		—0 3
True courſe - - - - -		S. 43 31 W

To find the difference of latitude.

As radius - - - - - -		10.00000
is to the coſine of the courſe	43° 33′ -	9.86020
ſo is the diſtance - -	290 -	2.46240
to the difference of latitude -	210.2	2.32260
Latitude left - - - -		50° 0′ N
Difference of latitude - - -		3 30 S
Latitude come to - - - -		46 30 N

This problem was propoſed, and reſolved, by Mr Robert Hues in his *Treatiſe on the Globes*, printed at London in the year 1639, p. 181.

It was afterwards propoſed by Dr Halley, in the ſecond volume of the *Miſcellanea Curioſa*, p. 35. in the following words:

A ſhip ſails from a given latitude, and, having run a certain number of leagues, has altered her longitude by a given angle; it is required to find the courſe ſteered. And he then adds—*The ſolution hereof would be very acceptable, if not to the public, at leaſt to the author of this tract, being likely to open ſome further light into the myſteries of geometry.*

Since that time, this problem has been ſolved in an indirect manner, by ſeveral writers on navigation, and others:—As Monſieur Bouguer, in his *Nouveau Traité de Navigation;* Mr Robertſon, in the ſecond volume of his *Elements of Navigation;* Mr Emerſon, in his *Theory of Navigation*, which accompanies his *Mathematical Principles of Geography;* Mr Iſrael Lyons, in the *Nautical Almanack* for 1772; and Monſieur Bezout, in his *Traité de Navigation;* and lately, Baron Maſeres, with the aſſiſtance of Mr Attwood, has given the firſt direct ſolution of this problem. For a compariſon of the various ſolutions which have hitherto been made of this problem, the reader is referred to that by Dr Mackay, in the fourth and ſixth volumes of Baron Maſeres's *Scriptores Logarithmici*.

It was intended in this place to have given rules, to make allowance for the ſpheroidal figure of the earth: but as the ratio of the polar to the equatorial ſemi-axis is not as yet determined with ſufficient accuracy, neither is it known if both hemiſpheres be ſimilar figures; therefore theſe rules would be grounded on aſſumption only, and might probably err more from the truth

truth than thoſe adapted to the ſpherical hypotheſis. This therefore is ſuppoſed to be a ſufficient apology for not inſerting them.

Chap. VIII. *Of Oblique Sailing.*

Oblique ſailing is the application of oblique-angled plane triangles to the ſolution of problems at ſea. This ſailing will be found particularly uſeful in going along ſhore, and in ſurveying coaſts and harbours, &c.

Ex. 1. At 11h A. M. the Girdle Neſs bore WNW, and at 2h P. M. it bore NW*b*N: the courſe during the interval S*b*W five knots an hour. Required the diſtance of the ſhip from the Neſs at each ſtation?

By Conſtruction.

. 34. Deſcribe the circle NE, SW (fig. 34.), and draw the diameters NS, EW, at right angles to each other: from the centre C, which repreſents the firſt ſtation, draw the WNW line CF; and from the ſame point draw CH, S*b*W, and equal to 15 miles the diſtance ſailed.—From H draw HF in a NW*b*N direction, and the point F will repreſent the Girdle Neſs. Now the diſtances CF, HF will meaſure 19.1 and 26.5 miles reſpectively.

By Calculation.

In the triangle FCH are given the diſtance CH 15 miles, the angle FCH equal to 9 points, the interval between the S*b*W and WNW points, and the angle CHF equal to 4 points, being the ſupplement of the angle contained between the S*b*W and NW*b*N points; hence CFH is 3 points: to find the diſtances CF, HF.

To find the diſtance CF.

As the ſine of CFH	-	3 points	-	9.74474
is to the ſine of CHF	-	4 points	-	9.84948
ſo is the diſtance CH		15 miles	-	1.17609
to the diſtance CF	-	19.07	-	1.28083

To find the diſtance FH.

As the ſine of CFH	-	3 points	-	9.74474
is to the ſine of FCH	-	points	-	9.99157
ſo is the diſtance CH	-	15 miles	-	1.17609
to the diſtance FH	-	26.48		1.42292

Ex. 2. The diſtance between the SE point of the iſland of Jerſey and the iſland of Brehaut is 13 leagues: and the correct bearing and diſtance of Cape Frehel from the iſland of Brehaut is SE*b*E 26 miles. It is alſo known that the SE point of Jerſey bears NNE from Cape Frehel: from whence the diſtance of theſe two is required, together with the bearing of the ſame point from the iſland of Brehaut ?.

By Conſtruction.

g. 35. Deſcribe a circle, (fig. 35.) and draw two diameters at right angles, the extremities of which will repreſent the cardinal points, north being uppermoſt.—Let the centre B repreſent Brehaut, from which draw the SE*b*E line BF equal to 26 miles, and the point F will repreſent Cape Frehel, from which draw the NNE line FI; make BI equal to 39 miles: Then FI applied to the ſcale will meaſure 34½ miles, and the inclination of BI to the meridian will be found equal to 63°⅓.

By Calculation.

In the triangle BIF are given BI and BF equal to 39 miles, and 26 miles reſpectively; and the angle BFI equal to 7 points: To find the ſide FI, and angle FBI.

To find the angle BIF.

As the diſtance BI	-	39	-	1.59106
is to the diſtanee BF	-	26	-	1.41497
ſo is the ſine of BFI	-	78° 45′	-	9.99157
to the ſine of BIF	-	40 50	-	9.81548
Sum	- - - -	119 35		
Angle FBI	- - -	60 25		
———EBF	- - -	33 45		
Difference, or EBI	-	26 40		

Bearing of Jerſey from Brehaut N 63 20 E.

To find the diſtance FI.

As the ſine of BFI	-	78° 45′	-	9.99157
is to the ſine of FBI	-	60 25	-	9.93934
ſo is the diſtance BI	-	39 miles		1.59106
to the diſtance FI	- -	34.58	-	1.53883

Ex. 3. At noon Dungeneſs bore per compaſs N*b*W, diſtance 5 leagues; and having run NW*b*W 7 knots an hour, at 5 P. M. we were up with Beachyhead. Required the bearing and diſtance of Beachyhead from Dungeneſs?

By Conſtruction.

Deſcribe a circle (fig. 36.) to repreſent the horizon; from the centre C draw the N*b*W line CD equal to 15 miles; and the NW*b*W line CB equal to 35 miles; join DB, which applied to the ſcale will meaſure about 26½ miles; and the inclination of DB to the meridian will be found equal to N 79°¾W. Fig. 36.

By Calculation.

In the triangle DCB are given the diſtances CD, CB equal to 15 and 35 miles reſpectively; and the angle BCD equal to 4 points; to find the angles B and D, and the diſtance BD.

To find the angles.

Diſtance CB=35, ſum of the ang. 16 points
CD=15, angle C - 4

Sum	- 50, angles B and D	12		
Difference	20, half ſum -	6 pts.		= 67° 30′
As the ſum of the diſtances	-	50	-	1.69897
is to their difference	-	20	-	1.30103
ſo is the tangent of half ſum angles		67 30	-	10.38378
to the tangent of half their diff.		44 0	-	9.98484
Angle CDB	- - -	111 30		
Supplement	- - -	68 30		
Angle, NCD	- -	11 15		

Magnetic bearing - N 79 45 W. Or by allowing 2¼ points of weſterly variation, the true bearing of Beachyhead from Dungeneſs will be W¼S nearly.

To

Oblique Sailing.

To find the diſtance.

As the ſine of CDB	-	111° 30′		9.96868
is to the ſine of BCD	-	45.0		9.84948
ſo is the diſtance BC	-	35	-	1.54407
to the diſtance BD	-	26.6		1.42487

Ex. 4. Running up Channel E*b*S per compaſs at the rate of 5 knots an hour. At 11^h A. M. the Eddiſtone lighthouſe bore N*b*E$\frac{1}{4}$E, and the Start point NE*b*E$\frac{1}{4}$E; and at 4 P. M. the Eddiſtone bore NW*b*N, and the Start N$\frac{3}{4}$E. Required the diſtance and bearing of the Start from the Eddiſtone, the variation being 2$\frac{1}{4}$ points W?

By Conſtruction.

Fig. 37.

Let the point C (fig. 37.) repreſent the firſt ſtation, from which draw the N*b*E$\frac{1}{4}$E line CA, the NE*b*E$\frac{1}{4}$E line CB, and the E*b*S line CD, which make equal to 25 miles the diſtance run in the elapſed time; then from D draw the NE*b*N line DA interſecting CA in A, which repreſents the Eddiſtone; and from the ſame point draw the N$\frac{3}{4}$E line DB cutting CB in B, which therefore repreſents the Start. Now the diſtance AB applied to the ſcale will meaſure 22.9, and the bearing per compaſs BAF will meaſure 73$^{\circ}\frac{1}{3}$.

By Calculation.

In the triangle CAD are given CD equal to 25 miles, the angle CAD equal to 4$\frac{1}{4}$ points, the diſtance between N*b*E$\frac{1}{4}$E and NW*b*N; and the angle ADC equal to 4 points, the diſtance between the NW*b*N and W*b*N points; to find the diſtance CA.

As the ſine of CAD	4$\frac{1}{4}$ points	-	9.86979
is to the ſine of CDA	4 points	-	9.84948
ſo is the diſtance CD	25 miles	-	1.39794
to the diſtance CA	23.86	-	1.37763

In the triangle BCD, are given the diſtance CD 25 miles, the angle CBD 4$\frac{1}{2}$ points the interval between NE*b*E$\frac{1}{4}$ and N$\frac{3}{4}$E, and CDB 7$\frac{3}{4}$ points, the diſtance between W*b*N and N$\frac{3}{4}$E; to find the diſtance CD.

As the ſine of CBD	-	4$\frac{1}{2}$ points		9.88819
is to the ſine CDB	-	7$\frac{3}{4}$ points		9.99947
ſo is the diſtance CD	-	25 miles		1.39794
to the diſtance CB	-	32.3	-	1.50922

In the triangle CAB, the diſtances CA, CB, are given, together with the included angle ACB, equal to 4 points, the diſtance between N*b*E$\frac{1}{4}$E and NE*b*E$\frac{1}{4}$E; to find the angle CAB and diſtance AB.

Diſtance CB	32.3	Angle ACB	-	=45° 0′
Diſtance CA	23.86	Sum of CAB and ABC		135 0
Sum	56.16	Half	- -	67 30
Difference	8.44			

As the ſum of the diſtances	56.16	-	1.74943
is to their difference -	8.44	-	0.92634
ſo is the tangent of half ſum angles -	67 30	-	10.38278
to the tangent of half diff. angles -	19 56	-	9.55969
Angle CAB - -	87 26		
Angle CAF - -	14 4		
Bearing per compaſs	S 73 22 E or ESE$\frac{1}{2}$E; and		

the variation 2$\frac{1}{4}$ points being allowed to the left of ESE$\frac{1}{2}$E, gives E$\frac{3}{4}$N, the true bearing of the Start from the Eddiſtone.

Oblique Sailing.

To find the diſtance.

As the ſine of CAB	87° 26′	-	9.99956
is to the ſine of ACB	45 0′	-	9.84948
ſo is the diſtance CB	- 32.3		1.50922
to the diſtance AB	- 22.86		1.35914

Ex. 5. A ſhip from a port in latitude 57° 9′ N, longitude 2° 9′ W, ſailed 82 miles on a direct courſe, and ſpoke a ſhip that had run 100 miles from a port in latitude 56° 21′ N, longitude 2° 50′ W.—Required the courſe of each ſhip, and the latitude and longitude come to?

Lat.	57° 9′ N	Mer. parts	4199	Lon.	2° 9′ W
——	56 21 N	————	4112	—	2 50 W
Diff. of lat.	48	Mer. diff. lat.	87	Diff. lon.	41

By Conſtruction.

With the meridional difference of latitude, the difference of longitude, and difference of latitude, conſtruct the triangles ADE, ABC (fig. 38.) as in Mercator's Sailing; then A will repreſent the northernmoſt, and C the ſouthernmoſt port. The diſtance AC applied to the ſcale will meaſure 53 miles, and the bearing BCA will be 25$^{\circ}\frac{1}{4}$. From the points A and C, with diſtances equal to 82 and 100 miles reſpectively, deſcribe arches interſecting each other in M, which will therefore be the place of meeting.—Now the angle ABM, the ſhip's courſe from the ſouthernmoſt port, will meaſure N 80$^{\circ}\frac{4}{5}$E; and the other ſhip's courſe, or angle BAM, will be 67$^{\circ}\frac{4}{5}$, or ESE. From M draw the parallel MNP, and AN will be the difference of latitude made by the one ſhip, and CP that by the other ſhip: hence either of theſe being meaſured and applied to its correſpondent latitude, will give 56° 38′, the latitude in. Make AF equal to 57, the meridional difference of latitude between the northernmoſt port and latitude in: from F draw FG perpendicular to AF, and produce AM to G, then FG will be the difference of longitude, which applied to the ſcale will meaſure 139: hence the longitude in, is 0° 10′ E.

Fig. 38.

By Calculation.

In the triangle ADE, ABC, are given AD equal to 87, DE equal to 41, and AB equal to 48; to find the angle BAC and diſtance AC.

To find the bearing of the ports.

As the meridional diff. of lat.	87	-	1.93952
is to the diff. of long. -	41	-	1.61278
ſo is radius - -		-	10.00000
to the tangent of the bearing	25° 14′		9.67326

To find the diſtance of the ports.

As radius - -		-	10.00000
is to the ſecant of the bearing -	25° 14′	-	10.04355
ſo is the diff. of latitude	48	-	1.68124
to the diſtance -	53.06	-	1.72479

In the triangle AMC, the three ſides are given to find the angles.

Oblique Sailing.

To find the angle ACM.

AM	82		
MC	100	ar. co. log.	8.00000
AC	53.06	ar. co. log.	8.27523
Sum	235.06	log.	2.07015
Half	117.53	log.	1.55059
Difference	53.53		
			19.89597
	27 29	coſine	9.94798
Angle ACM	54 58		
Angle BAC	25 14		

Southernmoſt ſhip's courſe } N. 80 12 E

To find the angle MAC.

As AM	82	1.91381
is to MC	100	2.00000
ſo is the ſine of ACM	54 58	9.91319
to the ſine of MAC	93 3	9.99938
Angle BAC	25 14	

Northernmoſt ſhip's courſe } S 67 49 E, or ESE.

In the right-angled triangle AMN, given AM, and the angle MAN, to find the differences of latitude AN.

As radius			10.00000
is to the coſine of the courſe	67° 49′		9.57700
ſo is the diſtance	82		1.91381
to the diff. of lat.	30.96		1.49081
Latitude of northernmoſt port	57 9	Mer. parts	4199
Latitude in	56 38	Mer. parts	4142
Meridional difference of latitude			57

To find the difference of longitude FG.

As radius		10.00000
is to the tangent of the courſe	67° 49′	10.38960
ſo is the mer. diff. of lat.	57	1.75587
to the diff. of long.	139.8	2.14547
Longitude left	2° 9′ W	
Difference of longitude	2 20 E	
Longitude in	0 11	

CHAP. IX. *Of Windward Sailing.*

WINDWARD ſailing is, when a ſhip by reaſon of a contrary wind is obliged to ſail on different tacks in order to gain her intended port; and the object of this ſailing is to find the proper courſe and diſtance to be run on each tack.

Ex. 1. A ſhip is bound to a port 48 miles directly to the windward, the wind being SSW, which it is intended to reach on two boards; and the ſhip can lie within ſix points of the wind. Required the courſe and diſtance on each tack?

Windward Sailing.

By Conſtruction.

Draw the SSW line CB (fig. 39.) equal to 48 miles. Make the angles ACB, ABC, each equal to 6 points. Hence the firſt courſe will be W, and the ſecond SE: alſo the diſtance CA, or AB, applied to the ſcale, will meaſure 62¾ miles, the diſtance to be ſailed on each board. Fig. 39.

By Calculation.

From A draw AD perpendicular to BC; then in the triangle ADC are given CD equal to 24 miles; and the angle ACD, equal to 6 points, to find the diſtance AC.

As radius		10.00000
is to the ſecant of C	6 points	10.41716
ſo is CD	24 miles	1.38021
to CA	62.7	1.79737

Ex. 2. The wind at NW, a ſhip bound to a port 64 miles to the windward, propoſes to reach it on three boards; two on the ſtarboard, and one on the larboard tack, and each within 5 points of the wind. Required the courſe and diſtance on each tack?

By Conſtruction.

Draw the NW line CA (fig. 40.) equal to 64 miles; from C draw CB W*b*S, and from A draw AD parallel thereto, and in an oppoſite direction; biſect AC in E, and draw BED parallel to the N*b*E rhumb, meeting CB, AD in the points B and D: then CB=AD applied to the ſcale will meaſure 36¼ miles, and BD=2CB=72½ miles. Fig. 40.

By Calculation.

From B draw BF perpendicular to AC; then, in the triangle BFC are given the angle BCF equal to 5 points, and CF equal to one-fourth of CA=16 m. to find CB.

As radius		10.00000
is to the ſecant of BCF	5 points	10.25526
ſo is CF	16 m.	1.20412
to CB	36.25	1.55938

Ex. 3. A ſhip which can lie within 5½ points of the wind, is bound to a port 36 miles to the windward, the wind being NE*b*N, which it is intended to reach on four boards, the firſt being on the larboard tack. Required the courſe and diſtance on each?

By Conſtruction.

Draw the NE*b*N line CA (fig. 41.) equal to 36 miles, and biſect it in B; from C and B draw lines parallel to the E½S rhumb; and from A and B draw lines parallel to the SSE½E point, meeting the former in the points D and E. Now the diſtances AD, BD, BE, and CE, are equal; and any one of them applied to the ſcale will meaſure 19.1 miles. Fig. 41.

By Calculation.

From E draw EF perpendicular to AC; and in the triangle CFE are given CF=9 m. and the angle FCE =5½ points, to find CE.

As

As radius		10.00000
is to the ſecant of FCE	5½ points	10.32661
ſo is CF	9 miles	0.95424
to the diſtance CE	19.1 miles	1.28085

Ex. 4. A ſhip bound to a port bearing N*b*W diſtant 40 miles, with the wind at N*b*E½E, intends to reach it on two boards. Required the courſe and diſtance on each tack, the ſhip lying within 5½ points of the wind?

By Conſtruction.

Fig. 42.

Draw the N*b*W line CA (fig. 42.) equal to 40 miles; and becauſe the wind is N*b*E½E, and the ſhip can lie within 5½ points of the wind, the courſe on the larboard tack will be E*b*N, and on the ſtarboard NW. Therefore, from the centre C draw the E*b*N line CB, and from it draw the NW line AB, meeting CB in B; then CB and AB applied to the ſcale will meaſure 26.7 and 48.1 m. reſpectively.

By Calculation.

In the triangle ACB, given AC=40 miles, and the angles A, B, and C, equal to 3, 5, and 8 points reſpectively, to find AB and BC.

To find the diſtance CB.

As the ſine of B	5 points	9.91985
is to the ſine of A	3 points	9.74474
ſo is the diſtance CA	40 miles	1.60206
to the diſtance CB	26.73	1.42695

To find the diſtance AB.

As the ſine of B	5 points	9.91985
is to the ſine of C	8 points	10.00000
ſo is the diſtance CA	40 miles	1.60206
to the diſtance AB	48.11	1.68221

Ex. 5. A ſhip cloſe hauled within 5 points of the wind, and making one point of leeway, is bound to a port bearing SSW, diſtant 54 miles, the wind being S*b*E: It is intended to make the port at three boards, the firſt of which muſt be on the larboard tack in order to avoid a reef of rocks. Required the courſe and diſtance on each tack?

By Conſtruction.

Fig. 43.

Draw the SSW line CA (fig. 43.) equal to 54 m. and as the wind is S*b*E, and the ſhip makes her courſe good within 6 points of the wind, therefore the courſe on the larboard tack will be SW*b*W, and on the ſtarboard E*b*S: hence from C draw the SW*b*W line CB, and from A draw AD parallel thereto; biſect CA in E, and draw BED parallel to the E*b*S line; then will CB and AD be the diſtances on the larboard tack, which applied to the ſcale, each will be found to meaſure 37.4; and the diſtance on the ſtarboard tack BD will meaſure 42.4 miles.

By Calculation.

The triangles CBE, EAD are equal and ſimilar: hence in the firſt of theſe are given CE, equal to 27 miles, half the diſtance between the ſhip and port; the angles C, B, and E, equal to 3, 4, and 9 points reſpectively, to find CB and BE.

To find CB, the diſtance on the larboard tack.

As the ſine of B	4 points	9.84948
is to the ſine of E	9 points	9.99157
ſo is the diſtance CE	27 miles	1.43136
to the diſtance BC	37.45	1.57345

To find BE half the diſtance on the ſtarboard tack.

As the ſine of B	4 points	9.84948
is to the ſine of C	3 points	9.74474
ſo is the diſtance CE	27 miles	1.43136
to the diſtance BE	21.21	1.32662
Whole diſtance AC	42.42	

Ex. 6. A ſhip plying to the windward, with the wind at NNE, after ſailing 51 miles on each of two tacks, is found by obſervation to have made 36 miles of difference of latitude. How near the wind did ſhe make her way good?

By Conſtruction.

Make CA (fig. 44.) equal to 36 miles; draw AB perpendicular to CA, and draw the NNE line CB, meeting AB in B; make CD, BD each equal to 51 miles, and theſe being meaſured, will be found equal to 6 points. Fig. 44.

By Calculation.

In the triangles CAB, BCD, are given AB equal to 36 m. CD=BD=51, and the angle ACB equal to 2 points; to find the angle BCD.

As the diſtance CD	51	1.70757
is to the diff. of latitude CA	18	1.25527
ſo is the ſecant of ACB	2 points	10.03438
to the coſine of BCD	67° 32′	9.58208

Chap. X. *Of Current Sailing.*

The computations in the preceding chapters have been performed upon the aſſumption that the water has no motion. This may no doubt anſwer tolerably well in thoſe places where the ebbings and flowings are regular, as then the effect of the tide will be nearly counterbalanced. But in places where there is a conſtant current or ſetting of the ſea towards the ſame point, an allowance for the change of the ſhip's place ariſing therefrom muſt be made: And the method of reſolving theſe problems, in which the effect of a current, or heave of the ſea, is taken into conſideration, is called *current ſailing*.

In a calm, it is evident a ſhip will be carried in the direction and with the velocity of the current. Hence, if a ſhip ſails in the direction of the current, her rate will be augmented by the rate of the current; but if ſailing directly againſt it, the diſtance made good will be equal to the difference between the ſhip's rate as given by the log and that of the current. And the abſolute motion of the ſhip will be a-head, if her rate exceeds that of the current; but if leſs, the ſhip will make ſternway. If the ſhip's courſe be oblique to the current, the diſtance made good in a given time will be repreſented by the third ſide of a triangle, whereof the diſtance given by the log, and the drift of the current in the ſame time, are the other ſides; and the true courſe will be the angle contained between the meridian and the line actually deſcribed by the ſhip.

Ex,

Ex. 1. A ſhip ſailed NNE at the rate of 8 knots an hour, during 18 hours, in a current ſetting NW*b*W $2\frac{1}{2}$ miles an hour. Required the courſe and diſtance made good?

By Conſtruction.

Plate CCCLXV. Fig. 45

Draw the NNE line CA (fig. 45.) equal to $18\times8=144$ miles; and from A draw AB parallel to the NW*b*W rhumb, and equal to $18\times2\frac{1}{2}=45$ miles: now BC being joined will be the diſtance, and NCB the courſe. The firſt of theſe will meaſure 159 miles, and the ſecond 6° 23′.

By Calculation.

In the triangle ACB, are given AC=144 miles, AB=45 miles, and the angle CAB=9 points, to find BAC and BC.

To find the courſe made good.

Diſt. AC	144	Ang. BAC=9 pts=	101° 15′
Diſt. AB	45		
		B+C	78 45
Sum	189		
Diff.	99	$\frac{B+C}{2}$	39 $22\frac{1}{2}$

As the ſum of the ſides	189	2.27646
is to the difference of the ſides	99	1.99563
ſo is the tan. of half ſum angles	39 $22\frac{1}{2}$	9.91417
to the tan. of half diff. angles	23 $15\frac{1}{2}$	9.63334
Angle ACB	16 7	
Angle ACN	22 30	
Courſe made good	N 6 23	

To find the diſtance.

As the ſine of ACB	16° 7′	9.44341
is to the ſine of CAB	101 15	9.99157
ſo is the diſtance AB	45	1.65321
to the diſtance CB	159	2.20137

Ex. 2. A ſhip from a port in latitude 42° 52′ N, ſailed S*b*W$\frac{1}{2}$W 17 miles in 7 hours, in a current ſetting between the north and weſt; and then the ſame port bore ENE, and the ſhip's latitude by obſervation was 42° 42′ N. Required the ſetting and drift of the current?

By Conſtruction.

Fig. 46.

Draw the S*b*W$\frac{1}{2}$W line CA (fig. 46.) equal to 17 miles, and make CB equal to 10 miles, the difference of latitude: through B draw the parallel of latitude BD, and draw the WSW line CD, interſecting BD in D: AD being joined, will repreſent the drift of the current, which applied to the ſcale will meaſure 20.2, and the angle DAE will be its ſetting, and will be found equal to 72°.

By Calculation.

In the triangle CBD, given CB=10 miles, and the angle BCD=6 points; to find the diſtance CD.

As radius		10.00000
is to the ſecant of BCD	6 points	10.41710
ſo is the diff. of lat. CB	10 miles	1.00000
to the diſtance CD	26.13	1.41710

Again, In the triangle ACD are given the diſtance AC=17 miles, CD=26.13, and the angle ACD $4\frac{1}{2}$ points; to find the remaining parts.

To find the ſetting of the current.

Diſtance DC=26.13 Angle ACD=$4\frac{1}{2}$ points.
Diſtance AC=17. 0 CAD+CDA $11\frac{1}{2}$

Sum - 43.13 $\frac{\text{CAD}+\text{CDA}}{2}=5\frac{3}{4}=64\ 41'$

Difference - 9.13

As the ſum of the ſides	43.13	1.63478
is to the differ. of the ſides	9.13	0.96047
ſo is tang. half ſum angles	64°41′	10.32509
to tang. half diff. angles	24 6	9.65078
Angle CAD	88 47	
Angle CAE=ACB=$1\frac{1}{2}$ pt. =	16 52	
Setting of the current EAD =	71 55	

To find the drift of the current.

As the ſine of CAD	88° 47′	9.99990
is to the ſine of ACD	$4\frac{1}{2}$ points	9.88819
ſo is the diſtance CD	26.13	1.41710
to the drift of current AD	20.2	1.30539

Hence the hourly rate of the current is $\frac{20.2}{7}=2.9$ knots.

Ex. 3. A ſhip, from latitude 38° 20′ N, ſailed 24 hours in a current ſetting NW*b*N, and by account is in latitude 38° 42′ N, having made 44 miles of eaſting; but the latitude by obſervation is 38° 58′ N. Required the courſe and diſtance made good, and the drift of the current.

By Conſtruction.

Fig. 47.

Make CE (fig. 47.) equal to 22 miles, the difference of latitude by D, R, and EA=54 miles, the departure, and join CA; make CD=38 miles, the difference of latitude by obſervation; draw the parallel of latitude DB; and from A draw the NW*b*N line AB, interſecting DB in B, and AB will be the drift of the current in 24 hours: CB being joined, will be the diſtance made good, and the angle DCB the true courſe. Now, AB and CB applied to the ſcale, will meaſure 19.2 and 50.5 reſpectively: and the angle DCB will be $41^\circ\frac{1}{4}$.

By Calculation.

From B draw BF perpendicular to AE, then in the triangle AFB are given BF=16 miles, and the angle ABF=3 points; to find AB and AF.

To find the drift of the current AB.

As radius		10.00000
is to the ſecant of ABF	3 points	10.08015
ſo is BF	16 miles	1.20412
to the drift of the current AB	19.24	1.28427

Hence the hourly rate$=\frac{19.24}{24}=0.8$.

To find AF.

As radius		10.00000
is to the tangent of ABF	3 points	9.82489
ſo is BF	16 miles	1.20412
to AF	10.69	1.02901
Departure by account EA	44.	

True departure EF=DB=33.31

Now,

Now, in the triangle CDB are given the difference of latitude and departure; to find the courſe and diſtance.

To find the courſe.

As the difference of latitude CD	38.	1.57978
is to the departure DB	33.31	1.52257
ſo is radius		10.00000
to the tangent of the courſe	41° 14′	9.94279

To find the diſtance.

As radius		10.00000
is to the ſecant of the courſe	41° 14′	10.12376
ſo is the difference of latitude	38	1.57978
to the diſtance	50.53	1.70354

Ex. 4. In the Straits of Sunda, at 2 P. M. ſteering SE*b*S at the rate of 5 knots an hour, I paſſed cloſe by the ſmall iſlands off Hog point. At 6, not having changed our courſe, came to anchor on the Java ſhore. Upon ſetting the ſaid iſland from this anchoring place, I find it bears due north, its diſtance by the chart being 22 miles. It follows from hence, that our courſe has been affected by a current. Required its velocity and direction?

By Conſtruction.

Fig. 48. From A (fig. 48.) draw the SE*b*S line AB=20, which will repreſent the ſhip's apparent track through the water; draw AC equal to 22 miles ſouth, and C will be the ſhip's real place; and BC being joined will be the current's drift in four hours; which applied to the ſcale will meaſure 12.3; from A draw AD parallel to BC, and the angle CAD will be the direction of the current, and will be found to meaſure $64°\frac{1}{5}$.

By Calculation.

In the triangle ABC, given AB=20m. AC=22m. and the included angle A=3 points; to find the remaining parts.

To find the ſetting of the current.

Diſtance AC=22 m. Included angle =3 points.

AB=20 B+C=13

Sum 42

Difference 2 $\frac{B+C}{2}=6\frac{1}{2}p=73.7\frac{1}{2}$

As the ſum of the ſides	42	1.62325
is to the diff. of the ſides	2	0.30103
ſo is the tang. of half ſum angles	73° 7′$\frac{1}{2}$	10.51806
to tang. of half diff. angles	8.55$\frac{1}{4}$	9.19584

Setting of the current S 64 12W, or SW*b*W$\frac{1}{4}$W.

To find the drift of the current.

As the ſine of ACB	64° 12′	9.95440
is to the ſine of BAC	33 45	9.74474
ſo is the diſtance AB	20	1.30103
to the velocity of cur. BC	12 34	1.09137

and $\frac{12.34}{4}=3.1$, its hourly rate.

Example 5. A ſhip bound from Dover to Calais, lying 21 miles to the SE*b*E$\frac{1}{2}$E, and the flood tide ſetting NE$\frac{1}{2}$E $2\frac{1}{2}$ miles an hour. Required the courſe ſhe muſt ſteer, and the diſtance run by the log at 6 knots an hour to reach her port?

By Conſtruction.

In the poſition of the SE*b*E$\frac{1}{2}$E rhumb, draw DC =21 miles (fig. 49.); draw DE NE$\frac{1}{2}$E=$2\frac{1}{2}$ miles; from E with 6 miles cut DC in F; draw DB parallel to EF, meeting CB drawn parallel to DE: then the diſtance DB applied to the ſcale will meaſure 19.4, and the courſe SDB will be SE$\frac{1}{2}$S. Fig. 49.

By Calculation.

In the triangle DBF, given DE=$2\frac{1}{2}$ miles, EF =6 miles and the angle EDF=6 points; to find the angle DFE=CBD.

As the hourly rate of ſailing	6m.	0.77815
is to the hourly rate of current	$2\frac{1}{2}$m.	0.39794
ſo is the ſine of EDF=6 points	67° 30′	9.96562
to the ſine of DFE	22 38	9.58541
Angle SDC=$5\frac{1}{2}$ points =	61 52	
Courſe SDB	39 14=SE$\frac{1}{2}$S.	

In the triangle DBC, given DC=21 miles, the angle BDC=DFE=22° 38′, and the angle DCB= DEF=6 points; to find the diſtance DB.

As the ſine of DBC	89° 52′	9.99999
is to the ſine of DCB	67 30	9.96562
ſo is the true diſtance DC	21 m.	1.32222
to the diſtance by the log DB.	21 m.	1.28785

CHAP. XI. *Inſtruments propoſed to ſolve the various Problems in Sailing, independent of Calculation.*

VARIOUS methods, beſides thoſe already given, have been propoſed to ſave the trouble of calculation.—One of theſe methods is by means of an inſtrument compoſed of rulers, ſo diſpoſed as to form a right-angled triangle, having numbers in a regular progreſſion marked on their ſides. Theſe inſtruments are made of different materials, ſuch as paper, wood, braſs, &c. and are differently conſtructed, according to the fancy of the inventor. Among inſtruments of this kind, that by John Cooke, Eſq. ſeems to be the beſt. A number of other inſtruments, very differently conſtructed, have been propoſed for the ſame purpoſe; of theſe, however, we ſhall only take notice of the rectangular inſtrument, by A. Mackay, LL.D. F.R.S.E. &c.

I. *Of* COOKE's *Triangular Inſtrument.*

Fig. 50. *Deſcription.* The ſtock *a b c d* (fig. 50.) is a parallelopiped: The length from *a* to *b* is two feet, the breadth from *a* to *d* two inches, and the depth is one inch and a half. The ſtock is perforated longitudinally, ſo as to be capable of containing within it *e f*, a cylindrical piece of wood one inch diameter; *g h* is an aperture on the ſurface of the ſtock about a quarter of an inch wide, which diſcloſes one-twelfth part of the ſurface of the cylinder contained; the edge *d c* is divided into twelve parts, each of theſe is ſubdivided into ſix parts, and each of theſe again into ten parts. The ſurface of the cylinder is divided longitudinally into twelve parts, and on each of them is engraved a portion

Inſtruments to ſolve Problems in Sailing, without Calculation.

portion of a line of meridional parts 22 feet long, which contains the meridional parts for every minute from the equator as far towards the pole as navigation is practicable; and the ſmalleſt diviſion on it is not leſs than $\frac{1}{20}$th of an inch. By rolling and ſliding this cylinder, any part of any line on it may be brought into any poſition which may be required; the box *i* is engrooved into the edge of the ſtock *a b*, ſo that it may move freely from *a* to *b*; a limb from this box extends to *k*, which ſerves to mark that degree of the perpendicular *i l* which is parallel to the centre of the ſemicircle *m*; *i l* is two feet long, and graduated on both edges as the ſtock; it is perpendicular to the ſtock, and is fixed in the box *i*, by which it may be moved from *a* to *b*; *o p n* is a ſemicircle of ſix inches radius, engraved, as appears in the plate, which ſlides freely from *c* to *d* in a groove in the edge of the ſtock *c d*; *m q* is the index moving on the centre *m*, the edge of which marks the courſe on the ſemicircle; it is two feet long, and divided into 72 parts; and theſe are ſubdivided in the ſame manner as thoſe on the ſtock and perpendicular, to which they are equal; *r* is a vernier attached to the index to ſhow minutes; *S* is a vernier compoſed of concentric ſemicircles, which ſlides along the edge *q m*, to the interſection of the perpendicular and index, where it ſerves as a vernier to both; below *x* is a ſmall piece of ivory, with a mark on it to point out the degree of the line *d c*, which is perpendicularly under the centre of the ſemicircle. Fig. 51. is a view of the back part of the inſtrument.

Fig. 51.

Uſe. The method of working every caſe which occurs in navigation, is to make the inſtrument ſimilar to that ideal triangle which is compoſed of the difference of latitude, departure, and diſtance; or, to that compoſed of the meridional difference of latitude, difference of longitude, and enlarged diſtance; or, to that compoſed of the difference of longitude, departure, and ſine of the middle latitude; which is done by means of the data procured from the compaſs, log-line, and quadrant: whence it follows, from the nature of ſimilar triangles, or from the relation which exiſts between the ſides of triangles and the ſines of their oppoſite angles, that the parts of the inſtrument become proportional to thoſe which they repreſent; and will aſcertain the length of the lines, or the extent of the angles ſought, by its graduations.

In the practice of this inſtrument, a ſmall ſquare is neceſſary in order to bring the centre of the ſemicircle perpendicularly over the meridional degree correſponding to the latitude.

Plane Sailing.

PROB. I. The courſe and diſtance ſailed being given, to find the difference of latitude and departure.

Example. A ſhip from latitude 24° 18′ N, ſailed NW*b*N 168 miles. Required the latitude come to, and departure?

Set the centre of the ſemicircle perpendicularly over the given latitude 24° 18′, and the index to the courſe 3 points; move the perpendicular until it cut the index at the given diſtance 168; then at the point of interſection on the perpendicular is 93.3 miles, the departure, and on the baſe, by the edge of the box, is 26° 38′, the latitude come to.

PROB. II. Both latitudes and courſe given, to find the diſtance and departure.

Example. Let the latitude ſailed from be 43° 50′ N, that come to 47° 8′ N, and the courſe NNE. Required the diſtance and departure?

Move the centre of the ſemicircle to the latitude left 43° 50′, and the edge of the box to the latitude come to 47° 8′; fix the index at the given courſe 2 points: then at the point of interſection of the index and perpendicular is the diſtance 214 miles on the index, and the departure 82 miles on the perpendicular.

PROB. III. Given the courſe and departure, to find the diſtance and difference of latitude.

Example. Let the latitude ſailed from be 32° 38′ N, the courſe SW*b*S, and the departure 200 miles. Required the diſtance and latitude come to?

Move the centre of the ſemicircle to the latitude left 32° 38′, ſet the index to the given courſe 3 points, and move the perpendicular till the given departure 200 cuts the index; at this point on the index is 360 miles, and the edge of the box will cut the latitude come to 27° 39′ N.

PROB. IV. Given the difference of latitude and diſtance, to find the courſe and departure.

Example. Let the latitude left be 17° 10′ N, the latitude come to 21° 40′ N, and the diſtance ſailed on a direct courſe between the north and weſt 300 miles. Required the courſe and departure?

Move the ſemicircle and box to the given latitudes, and the index until the diſtance found thereon meets the perpendicular; then at the point of contact on the perpendicular is 130.8, the departure, and on the ſemicircle by the index is 25° 50′, the courſe.

PROB. V. The diſtance and departure given, to find the courſe and difference of latitude.

Example. The diſtance ſailed is 246 miles between the ſouth and eaſt, the departure is 138 miles, and the latitude left 51° 10′ N. Required the courſe and latitude come to?

Set the centre of the ſemicircle to 51° 10′, the latitude ſailed from; find the diſtance 246 on the index, and the departure 138 on the perpendicular; then move both till theſe points meet, and the courſe 34° 10′ will be found on the ſemicircle by the index, and the latitude in 47° 47′ N, by the edge of the box.

PROB. VI. Both latitudes and departure given, to find the courſe and diſtance.

Example. A ſhip from latitude 43° 10′ N, ſailed between the north and weſt till ſhe was in latitude 47° 14′ N, and has made 170 miles of departure. Required the courſe and diſtance?

Move the centre of the ſemicircle over 43° 10′, and the edge of the box to 47° 14′; find the departure on the perpendicular, and bring the edge of the index thereto; now at the point of interſection is the diſtance 297.4 miles on the index, and the courſe 34° 52′ on the ſemicircle.

Traverſe Sailing.

Example. A ſhip from latitude 46° 48′ N, ſailed SSW$\frac{1}{2}$W 24 miles, S*b*W 36 miles, and S$\frac{1}{2}$E 40

Inſtruments to ſolve Problems in Sailing, without Calculation.

miles. Required the latitude in, together with the direct courſe and diſtance?

Set the ſemicircle to the latitude ſailed from 46° 48′, and the index to the courſe SSW½W; mark the diſtance 24 on the index, and bring the perpendicular to meet it; then the index will cut the departure 11.3 on the perpendicular, and the perpendicular will cut the latitude 46° 27′ N on the baſe. For the next courſe and diſtance, bring the ſemicircle to the latitude marked by the perpendicular, and lay down the courſe S*b*W: if it be towards the firſt meridian, move the laſt marked departure until it meets the index, and the limb of the box will mark the preſent departure; but if the courſe be from the firſt meridian, bring the laſt departure 11.3 to the limb of the box, the index will mark the departure made good 18.3 on the perpendicular, and the latitude arrived at 40° 52′ will be marked on the baſe by the perpendicular: proceed in the ſame manner with all the courſes of which the traverſe conſiſts, then the difference of latitude 1° 36′ will be intercepted between the latitude ſailed from 46° 48′, and the latitude come to 45° 12′ laſt marked by the perpendicular; and alſo the departure made good will be intercepted between that point on the perpendicular where the firſt departure commenced, and that where the laſt terminated. Now, with the difference of latitude 1° 36′ and the departure, the courſe will be S 8° 30′ W, and diſtance 97 miles, by laſt problem in Plane Sailing.

Parallel Sailing.

Prob. I. The difference of longitude between two places in one parallel of latitude given, to find the diſtance between them.

Example. Let the common latitude be 49° 30′ N, and the difference of longitude 3° 30′. Required the diſtance?

Set the index to 40° 30′, the complement of the latitude on the ſemicircle; mark the difference of longitude in miles on the index; then move the perpendicular until it meets the termination of the difference of longitude on the index, and the part of the perpendicular intercepted between the limb of the box and the point of interſection will be the diſtance 136.4 miles.

Prob. II. The diſtance between two places in one parallel of latitude given, to find the difference of longitude between them.

Example. Let the latitude of the given parallel be 49° 30′ N, the diſtance ſailed 136.4 E. Required the difference of longitude?

Set the index to the complement of the latitude 40° 30′, and mark the diſtance ſailed on the perpendicular; then move it until it meets the index, and the point of interſection will ſhow the difference of longitude 210′ or 3° 30′ on the index.

Prob. III. Given the diſtance ſailed on a parallel, and the difference of longitude, to find the latitude of that parallel.

Example. The diſtance ſailed due eaſt is 136.4, and the difference of longitude 3° 30′. Required the latitude of the parallel?

Find the difference of longitude 210 on the index, and the diſtance 136.4 on the perpendicular, and move both until theſe numbers meet, and the complement of the latitude 4° 30′ will be ſhown by the index on the ſemicircle.

Inſtruments to ſolve Problems in Sailing, without Calculation.

Mercator's and Middle Latitude Sailing.

Prob. I. The latitudes and longitudes of two places given, to find the direct courſe and diſtance between them.

Example. Required the courſe and diſtance between two places whoſe latitudes and longitudes are 50° 30′ N, 19° 0′ W, and 54° 30′ N, 15° 30′ W, reſpectively?

By Mercator's Sailing.

To find the courſe.

Move the centre of the ſemicircle perpendicularly over the meridional degree anſwering to latitude 50° 50′ N, then move the box until the edge of the perpendicular cuts the meridional parts of the other latitude 54° 30′ N, and move the index until it cuts the difference of longitude 3° 30′ on the perpendicular, and the index will mark the courſe 30° 10′, or NNE¾E nearly on the ſemicircle.

To find the diſtance.

Screw the index to this courſe, and move the centre of the ſemicircle to the latitude 50° 50′ N, and the edge of the perpendicular to the latitude 54° 30′ N, then the perpendicular will cut the diſtance 254.7 on the index.

By Middle Latitude Sailing.

To find the departure.

Move the centre of the ſemicircle to the latitude 50° 50′, and the edge of the index to the complement of the middle latitude 37° 20′ on the ſemicircle; then move the box until the edge of the perpendicular interſects the termination of the difference of longitude 210 miles on the index, which point of interſection will mark the departure 128 on the perpendicular.

To find the courſe and diſtance.

Move the edge of the perpendicular to the other latitude 54° 30′, and the index until it cuts the departure 128 on the perpendicular; then will the perpendicular mark the diſtance on the index 254.7 miles, and the index will mark the courſe on the ſemicircle 30° 10′, or NNE¾E nearly.

Prob. II. Both latitudes and courſe given, to find the diſtance and difference of longitude.

Example. A ſhip from latitude 50° 50′ N, longitude 19° 0′ W, ſailed N 30° 10′ E, until ſhe is in latitude 54° 30′ N. Required the diſtance and difference of longitude?

By Mercator's Sailing.

To find the difference of longitude.

Move the box and ſemicircle as in the former problem to the meridional parts of the given latitudes, then ſet the index to the courſe, and it will mark the difference of longitude 3° 30′ on the perpendicular: Hence the longitude in is 15° 30′ W.

To find the diſtance.

Move the perpendicular and ſemicircle to the given latitudes, and put the index to the given courſe; then the perpendicular will cut the diſtance 254.7 miles on the index.

By

Inſtruments to ſolve Problems in Sailing, without Calculation.

By Middle Latitude Sailing.

To find the diſtance and departure.

Move the ſemicircle and perpendicular to the given latitudes, and the index to the courſe; then the perpendicular will ſhow the departure 128 miles, and the index the diſtance 254.7 miles at the point of interſection.

To find the difference of longitude.

Set the index to the complement of the middle latitude on the ſemicircle, and move the box until the termination of the departure on the perpendicular meets the index, which will mark the difference of longitude thereon 210 m. or 3° 30′.

Prob. III. Both latitudes and diſtance given, to find the courſe and difference of longitude.

Example. From latitude 50° 50′ N, longitude 19° 0′ W, a ſhip ſailed 254.7 miles between the north and eaſt, and by obſervation is in latitude 54° 30′ N. Required the courſe and difference of longitude?

By Mercator's Sailing.

To find the courſe.

Move the perpendicular and ſemicircle to the given latitudes, and the index until the diſtance ſailed marked on it meets the perpendicular; then the index will mark the courſe N 30° 10′ E on the ſemicircle.

To find the difference of longitude.

Screw the index to the courſe, move the perpendicular and ſemicircle to the meridional parts of the given latitudes, and the ſpace intercepted between the limb of the box and the index will be the difference of longitude 3° 30′.

By Middle Latitude Sailing.

To find the departure and courſe.

Move the ſemicircle and perpendicular to the given latitudes, and the index until the diſtance ſailed on it cuts the perpendicular; then the perpendicular will ſhow the departure 128 miles, and the ſemicircle the courſe N 30° 10′ E.

To find the difference of longitude.

Set the index to 37° 20′, the complement of the middle latitude on the ſemicircle, and move the perpendicular until the termination of the departure on it cuts the index: then the point of interſection will mark the difference of longitude 210 miles on the index.

Prob. IV. Both latitudes and departure given, to find the courſe, diſtance, and difference of longitude.

Example. Let the latitude and longitude ſailed from be 56° 40′ S and 28° 55′ E reſpectively, the latitude come to 61° 20′ S, and departure 172 miles. Required the courſe, diſtance, and difference of longitude?

By Mercator's Sailing.

To find the courſe and diſtance.

Move the perpendicular and ſemicircle to the given latitude (H); then move the index till it meets the extremity of the departure on the perpendicular; the diſtance will be marked on the index 329, and the courſe S 31° 35′ E, or SSE$\frac{3}{4}$E nearly, on the ſemicircle.

Inſtruments to ſolve Problems in Sailing, without Calculation.

To find the difference of longitude.

Move the perpendicular and ſemicircle to the meridional parts of the given latitudes, and the index will cut the difference of longitude on the perpendicular 5° 35′.

By Middle Latitude Sailing.

The courſe and diſtance are found as before.

To find the difference of longitude.

Set the index to 31°, the complement of the middle latitude on the ſemicircle, and move the perpendicular until the departure marked on it cuts the index, and this point of interſection will mark the difference of longitude on the index 335 m. or 5° 35′.

Prob. V. One latitude, courſe, and diſtance given, to find the difference of latitude and difference of longitude.

Example. Let the latitude left be 56° 40′ S, longitude 28° 55′ E, the courſe S 31° 35′ E, and diſtance 329 m. Required the latitude and longitude come to?

By Mercator's Sailing.

To find the latitude come to.

Set the ſemicircle to the latitude ſailed from, and the index to the courſe, and bring the perpendicular to the diſtance, which at the ſame time will mark the latitude come to 61° 20′ S.

To find the difference of longitude.

Screw the index to the courſe, and move the ſemicircle and perpendicular to the meridional parts of both latitudes; then the index will cut the difference of longitude on the perpendicular 5° 35′.

By Middle Latitude Sailing.

The latitude arrived at is found as above.

To find the departure.

The ſemicircle and perpendicular being ſet to both latitudes, and the index to the courſe, it will ſhow the departure 172.7 on the perpendicular.

To find the difference of longitude.

Set the index to 31°, the complement of the middle latitude on the ſemicircle, and move the perpendicular until the departure marked on it cuts the index, and the diviſion on the index at the point of interſection will be the difference of longitude 335.

Prob. VI. One latitude, courſe, and departure given, to find the diſtance, difference of latitude, and difference of longitude.

Example. Let the latitude ſailed from be 56° 40′ N, longitude 28° 35′ W, the courſe N 31° 35′ W, and departure 172.7. Required the diſtance, and the latitude and longitude come to?

By Mercator's Sailing.

To find the diſtance and latitude come to.

Move the ſemicircle to the latitude left, and the index to the courſe; mark the departure on the perpendicular,

---

(H) In ſouthern latitudes, the end of the cylinder where the numbers begin muſt be turned towards the north pointed out by the ſemicircle; and in northern latitudes, it muſt be reverſed.

Inſtruments to ſolve Problems in Sailing, without Calculation.

dicular, and move it until the termination thereof meets the index, then the point of interſection will ſhow the diſtance 329 miles on the index, and the perpendicular will ſhow the latitude arrived at 61° 20′ N on the baſe.

To find the difference of longitude.

Screw the index, and move the perpendicular and ſemicircle to the meridional parts of both latitudes, then the index will cut the difference of longitude 5° 35′ on the perpendicular.

By Middle Latitude Sailing.

Find the diſtance ſailed and latitude in as above, and the difference of longitude as in Problem IV. by middle latitude ſailing.

Prob. VII. One latitude, the diſtance ſailed, and departure given, to find the courſe, difference of latitude, and difference of longitude.

Example. The latitude ſailed from is 48° 30′ N, and longitude 14° 40′ W; the diſtance run is 345 miles between the ſouth and eaſt, and the departure 200 miles. Required the courſe, and the latitude and longitude come to?

By Mercator's Sailing.

To find the courſe and latitude come to.

Move the ſemicircle to the latitude left, mark the diſtance on the index, and the departure on the perpendicular, move both until theſe points meet; then will the index ſhow the courſe S 35° 26′ E on the ſemicircle, and the latitude come to 43° 49′ on the baſe.

The difference of longitude is found as in the preceding problem.

By Middle Latitude Sailing.

The courſe and latitude come to are found as above, and the difference of longitude as in Problem IV. by middle latitude ſailing.

II. *Of* Dr Mackay's *Rectangular Inſtrument.*

Plate CCCLXVI. Fig. 52.

Deſcription. Fig. 52. is a repreſentation of this inſtrument, of about one-third of the original ſize.— The length CA is divided into 100 equal parts, and the breadth CB into 70; but in this plate every ſecond diviſion only is marked, in order to avoid confuſion; through theſe diviſions parallels are drawn, terminating at the oppoſite ſides of the inſtrument. Upon the upper and right hand ſides are two ſcales; the firſt contains the degrees of the quadrant, and the other the points and quarters of the compaſs. M is an index moveable about the centre C, and divided in the ſame manner as the ſides (1). Fig. 53. is a portion of the enlarged meridian, ſo conſtructed that the firſt degree is equal to three diviſions on the inſtrument; and therefore, in the uſe of this line, each diviſion on the inſtrument is to be accounted 20 minutes. The ſize of the plate would not admit of the continuation of the line.

Uſe. From a bare inſpection of this inſtrument, it is evident that any triangle whatever may be formed on it. In applying it to nautical problems, the courſe is to be found at top, or right-hand ſide, in the column of degrees or points, according as it is expreſſed; the diſtance is to be found on the index, the difference of latitude at either ſide column, and the departure at the head or foot of the inſtrument. The numbers in theſe columns may repreſent miles, leagues, &c.; but when uſed in conjunction with the enlarged meridional line, then 10 is to be accounted 100 miles, 20 is to be eſteemed 200 miles, and ſo on, each number being increaſed in a tenfold ratio; and the intermediate numbers are to be reckoned accordingly.

Inſtruments to ſolve Problems in Sailing, without Calculation.

Plane Sailing.

Prob. I. The courſe and diſtance ſailed given, to find the difference of latitude and departure.

Example. Let the courſe be NE$\frac{1}{2}$N, diſtance 44 miles. Required the difference of latitude and departure?

Move the index until the graduated edge be over 3$\frac{1}{2}$ points, and find the given diſtance 44 miles on the index: this diſtance will be found to cut the parallel of 34 miles, the difference of latitude in the ſide column, and that of 28 miles, the departure at the top.

Prob. II. Given the courſe and difference of latitude, to find the diſtance and departure.

Example. Required the diſtance and departure anſwering to the courſe 28°, and difference of latitude 60 miles?

Lay the index over the given courſe 28°: find the difference of latitude 60 miles in the ſide column; its parallel will cut the index at 68 miles, the diſtance and the correſponding departure at the top is 32 miles.

Prob. III. The courſe and departure given, to find the diſtance and difference of latitude.

Example. Let the courſe be SSW and the departure 36 miles. Required the diſtance and difference of latitude?

Lay the index over two points; find the departure at the top, and its parallel will cut the index at 94 miles the diſtance, and the difference of latitude on the ſide column is 87 miles.

Prob. IV. Given the diſtance and difference of latitude, to find the courſe and departure.

Example. The diſtance is 35 leagues, and the difference of latitude 30 leagues. Required the courſe and departure?

Bring 35 leagues on the index to the parallel of 30 leagues in the ſide; then the departure at the top is 18 leagues, and the courſe by the edge of the index on the line of rhumbs is 2$\frac{1}{4}$ points.

Prob. V. Given the diſtance and departure, to find the courſe and difference of latitude.

Example. Let the diſtance be 58 miles, and the departure

---

(1) In the original inſtrument are two ſlips, divided like the ſide and end of the inſtrument. One of theſe ſlips is moveable in a direction parallel to the ſide of the inſtrument, and the other parallel to the end.

Inſtruments to ſolve Problems in Sailing, without Calculation.

parture 15 miles. Required the courſe and difference of latitude ?

Move the index until 58 found thereon cuts the parallel of 15 from the top: this will be found to interſect the parallel of 56 miles, the difference of latitude; and the courſe by the edge of the ruler is 15°.

Prob. VI. The difference of latitude and departure being given, to find the courſe and diſtance.

Example. Let the difference of latitude be 30 miles, the departure 28 miles. Required the courſe and diſtance ?

Bring the index to the interſection of the parallels of 30 and 28; then the diſtance on the index is 41 miles, and the courſe by its edge is 43°.

Traverſe Sailing.

Find the difference of latitude and departure anſwering to each courſe and diſtance by Problem I. of Plane Sailing, and from thence find the difference of latitude and departure made good; with which find the courſe and diſtance by the laſt problem.

An example is unneceſſary.

Parallel Sailing.

Prob. I. Given the difference of longitude between two places on the ſame parallel, to find the diſtance between them.

Example. Let the latitude of a parallel be 48°, and the difference of longitude between two places on it 3° 40′. Required their diſtance ?

Put the index to 48°, the given latitude, and find the difference of longitude 220 on the index, and the correſponding parallel from the ſide will be 147, the diſtance required.

Prob. II. The latitude of a parallel, and the diſtance between two places on that parallel, being given, to find the difference of longitude between them.

Example. The latitude of a parallel is 56°, and the diſtance between two places on it 200 miles. Required their difference of longitude ?

Put the index to the given latitude, and find the diſtance in the ſide column, and the interſection of its parallel with the index will give 358, the difference of longitude ſought.

Prob. III. Given the diſtance and difference of longitude between two places on the ſame parallel, to find the latitude of that parallel.

Example. The number of miles in a degree of longitude is 46.5. Required the latitude of the parallel ?

Bring 60 on the index to cut the parallel of 46.5 from the ſide, then the edge of the index will give 39° 11′, the latitude required.

Middle Latitude and Mercator's Sailing.

Prob. I. The latitudes and longitudes of two places being given, to find the courſe and diſtance between them.

Example. Required the courſe and diſtance between Genoa, in latitude 44° 25′ N, longitude 8° 36′ E, and Palermo, in latitude 38° 10′ N, longitude 13° 38′ E ?

By Mercator's Sailing.

Take the interval between 38° 10′ and 44° 25′ on the enlarged meridian, which laid off from C upwards will reach to 500; now find the difference of longitude 302 at the top, and bring the divided edge of the index to the interſection of the correſponding parallels, and the index will ſhow the courſe 31° 8′ on the line of degrees; then find the difference of the latitude 375 on the ſide column, and its parallel will interſect the index at 438, the diſtance.

Inſtruments to ſolve Problems in Sailing, without Calculation.

By Middle Latitude Sailing.

Put the index to 41° 18′, the complement of the middle latitude on degrees, and the difference of longitude 302 on the index will interſect the parallel of 227, the departure, in the ſide column. Now move the index to the interſection of the parallels of 375 and 227, the firſt being found in the ſide column, and the other at top or bottom; then the diſtance anſwering thereto on the index will be 438, and the courſe on the ſcale of degrees is 41° 10′.

Prob. II. Given one latitude, courſe, and diſtance, to find the other latitude and difference of longitude.

Example. Let the latitude and longitude ſailed from be 39° 22′ N, and 12° 8′ W reſpectively, the courſe NNW$\frac{1}{2}$W, and diſtance 500 miles. Required the latitude and longitude come to ?

By Mercator's Sailing.

Put the index to the courſe 2$\frac{1}{2}$ points, and find the diſtance 500 miles thereon; then the correſponding difference of latitude will be 441 miles, and the departure 235$\frac{1}{2}$ miles, hence the latitude in is 46° 43′ N. Now take the interval between the latitudes of 39° 22′, and 46° 43′ on the enlarged meridian, which laid off from C will reach to about 605, the parallel of which will interſect the vertical parallel of the difference of longitude 323 at the edge of the index: hence the longitude in is 17° 31′ W.

By Middle Latitude Sailing.

Find the difference of latitude and departure as before, and hence the latitude in is 46° 43′ N, and the middle latitude 43° 3′. Now put the index to 43° 3′, and the horizontal parallel of the departure 235$\frac{1}{2}$ will interſect the index at 322, the difference of longitude.

Prob. III. Both latitudes and courſe given, to find the diſtance and difference of longitude.

Example. The latitude ſailed from is 22° 54′ S, and longitude 42° 40′ W, the courſe is SE by E, and latitude come to 26° 8′ S. Required the diſtance ſailed, and longitude in ?

By Mercator's Sailing.

Bring the index to 5 points, the given courſe, and the parallel of 194, the difference of latitude found in the ſide column will interſect the index at 349, the diſtance; and it will cut the vertical parallel of 290, the departure.

Take the interval between the given latitudes 22° 54′ and 26° 8′ on the enlarged meridian; lay off that extent from the centre on the ſide column, and it will reach to 213: the parallel of this number will interſect the vertical parallel of 319, the difference of longitude. Hence the longitude in is 37° 21′ W.

Inſtruments to ſolve Problems in Sailing, without Calculation.

By Middle Latitude Sailing.

With the given courſe and difference of latitude find the diſtance and departure as before; then bring the index to the middle latitude 24° 31′; find the departure 290 in the ſide column, and its parallel will interſect the index at 319, the difference of longitude.

PROB. IV. One latitude, courſe, and departure, given, to find the other latitude, diſtance, and difference of longitude.

Example. The latitude and longitude left are 20° 30′ N, and 49° 17′ W, reſpectively; the courſe is NE$\frac{3}{4}$N, and departure 212 miles. Required the latitude and longitude come to, and diſtance ſailed?

By Mercator's Sailing.

Put the index to the given courſe 3$\frac{3}{4}$ points, and the vertical parallel of 212 will cut the index at 356, the diſtance, and the horizontal parallel of 286, the difference of latitude; the latitude come to is therefore 25° 16′ N.

Now take the interval between the latitudes 20° 30′, and 25° 16′ on the enlarged meridian, which laid off from the centre C will reach to 311; and this parallel will interſect the vertical parallel of the difference of longitude 230, at the edge of the index. Hence the longitude in is 45° 27′ W.

By Middle Latitude Sailing.

Find the diſtance and difference of latitude as directed above; then bring the index to 22° 53′, the middle latitude, and the horizontal parallel of 212, the departure, will interſect the index at 230, the difference of longitude.

PROB. V. Both latitudes and diſtance given, to find the courſe and difference of longitude.

Example. The diſtance ſailed is 500 miles between the north and weſt; the latitude and longitude left are 40° 10′ N, and 9° 20′ W reſpectively, and the latitude in is 46° 40′ N. Required the courſe and longitude in?

By Mercator's Sailing.

Bring the diſtance 500 on the index to interſect the horizontal parallel of the difference of latitude 390; then the courſe 38° 44′ is found on the line of degrees by the edge of the index, and the vertical parallel of the above point of interſection is that anſwering to 313, the departure.

Take the interval between the latitudes 40° 10′, and 46° 40′, which lay off from the centre C, and its horizontal parallel will interſect the vertical parallel of 431, the difference of longitude, by the edge of the index, it being in the ſame poſition as before. Hence the longitude in is 16° 31′ W.

By Middle Latitude Sailing.

The courſe and departure are found as formerly, and the middle latitude is 43° 25′, to which bring the edge of the index, and the horizontal parallel of 313, the departure, will interſect the index at 431, the difference of longitude.

PROB. VI. Both latitudes and departure given, to find the courſe, diſtance, and difference of longitude.

Example. Let the latitude ſailed from be 42° 52′ N, long. 9° 17′ W, the departure 250 miles W, and the latitude come to 36° 18′ N. Required the courſe and diſtance ſailed, and the longitude come to?

By Mercator's Sailing.

Find the point of interſection of the horizontal parallel of 394, the difference of latitude, and the vertical parallel of 250, the departure; to this point bring the index, and the correſponding diviſion thereon will be 467 miles, and the courſe on the ſcale of degrees by the edge of the index will be 32° 24′.

Take the interval between the latitudes on the enlarged meridian; which being laid off from the centre will reach to 512: now the horizontal parallel of 512 will cut the vertical parallel of 325, the difference of longitude, at the edge of the index. The longitude come to is therefore 14° 42′ W.

By Middle Latitude Sailing.

The courſe and diſtance are to be found in the ſame manner as above. Then bring the index to 39° 35′, the middle latitude, and the horizontal parallel of 250 will interſect the edge of the index at 324½, the difference of longitude.

PROB. VII. Given one latitude, diſtance, and departure, to find the other latitude, courſe, and difference of longitude.

Example. A ſhip from latitude 32° 38′ N, longitude 17° 6′ W, ſailed 586 miles between the ſouth and weſt, and made 336 miles of departure:—Required the courſe, and the latitude and longitude come to?

By Mercator's Sailing.

Move the index till the diſtance 586 interſects the vertical parallel of the departure 336; then the correſponding horizontal parallel will be 480, the difference of latitude, and the courſe 35°. Hence the latitude in is 24° 38′ N.

Now take the interval between the latitudes on the enlarged meridian, which laid off from the centre will reach to 547, the horizontal parallel of which will cut the vertical parallel of 383, the difference of longitude. The longitude in is therefore 23° 29′ W.

By Middle Latitude Sailing.

Find the courſe and difference of latitude as before, and hence the middle latitude is 28° 38′, to which bring the index, and the horizontal parallel of 336, the departure, will interſect the index at 383, the difference of longitude.

It ſeems unneceſſary to enlarge any further on the uſe of this inſtrument, as the above will make it ſufficiently underſtood.

CHAP. XII. *Of Sea-Charts.*

Sea-Charts.

THE charts uſually employed in the practice of navigation, are of two kinds, namely, *Plane* and *Mercator's Charts.* The firſt of theſe is adapted to repreſent a portion of the earth's ſurface near the equator; and the laſt for all portions of the earth's ſurface. For a particular deſcription of theſe, reference has already been made from the article CHART, to thoſe of PLANE and MERCATOR: and as theſe charts are particularly deſcribed under the above articles, it is therefore ſufficient in this place to deſcribe their uſe.

Uſe

Sea-Charts.

Uſe of the Plane Chart.

Prob. I. To find the latitude of a place on the chart.

Rule. Take the leaſt diſtance between the given place and the neareſt parallel of latitude; now this diſtance applied the ſame way on the graduated meridian, from the extremity of the parallel, will give the latitude of the propoſed place.

Thus the diſtance between Bonaviſta and the parallel of 15 degrees, being laid from that parallel upon the graduated meridian, will reach to $16^{\circ}\ 5'$, the latitude required.

Prob. II. To find the courſe and diſtance between two given places on the chart.

Rule. Lay a ruler over the given places, and take the neareſt diſtance between the centre of any of the compaſſes on the chart and the edge of the ruler; move this extent along, ſo as one point of the compaſs may touch the edge of the rule, and the ſtraight line joining their points may be perpendicular thereto; then will the other point ſhow the courſe: The interval between the places, being applied to the ſcale, will give the required diſtance.

Thus the courſe from Palma to St Vincent will be found to be about SSW $\frac{1}{4}$ W, and the diſtance $13^{\circ}\frac{1}{4}$ or 795 m.

Prob. III. The courſe and diſtance ſailed from a known place being given, to find the ſhip's place on the chart.

Rule. Lay a ruler over the place ſailed from, parallel to the rhumb, expreſſing the given courſe; take the diſtance from the ſcale, and lay it off from the given place by the edge of the ruler; and it will give the point repreſenting the ſhip's preſent place.

Thus, ſuppoſe a ſhip had ſailed SW*b*W 160 miles from Cape Palmas; then by proceeding as above, it will be found that ſhe is in latitude $2^{\circ}\ 57'$ N.

The various other problems that may be reſolved by means of this chart require no further explanation, being only the conſtruction of the remaining problems in Plane Sailing on the chart.

Uſe of Mercator's Chart.

The method of finding the latitude and longitude of a place, and the courſe or bearing between two given places by this chart, is performed exactly in the manner as in the Plane Chart, which ſee.

Prob. I. To find the diſtance between two given places on the chart.

Case I. When the given places are under the ſame meridian.

Rule. The difference or ſum of their latitudes, according as they are on the ſame or on oppoſite ſides of the equator, will be the diſtance required.

Case II. When the given places are under the ſame parallel.

Rule. If that parallel be the equator, the difference or ſum of their longitudes is the diſtance; otherwiſe, take half the interval between the places, lay it off upwards and downwards on the meridian from the given parallel, and the intercepted degrees will be the diſtance between the places.

Or, take an equal extent of a few degrees from the meridian on each ſide of the parallel, and the number of extents, and parts of an extent, contained between the places, being multiplied by the length of an extent, will give the required diſtance.

Method of finding the Latitude and Longitude at Sea.

Case III. When the given places differ both in latitude and longitude.

Rule. Find the difference of latitude between the given places, and take it from the equator or graduated parallel; then lay a ruler over the two places, and move one point of the compaſs along the edge of the ruler until the other point juſt touches a parallel; then the diſtance between the place where the point of the compaſs reſted by the edge of the ruler, and the point of interſection of the ruler and parallel, being applied to the equator, will give the diſtance between the places in degrees and parts of a degree, which multiplied by 60 will reduce it to miles.

Prob. II. Given the latitude and longitude in, to find the ſhip's place on the chart.

Rule. Lay a ruler over the given latitude, and lay off the given longitude from the firſt meridian by the edge of the ruler, and the ſhip's preſent place will be obtained.

Prob. III. Given the courſe ſailed from a known place, and the latitude in, to find the ſhip's preſent place on the chart.

Rule. Lay a ruler over the place ſailed from, in the direction of the given courſe, and its interſection with the parallel of latitude arrived at will be the ſhip's preſent place.

Prob. IV. Given the latitude of the place left and the courſe and diſtance ſailed, to find the ſhip's preſent place on the chart.

Rule. The ruler being laid over the place ſailed from, and in the direction of the given courſe, take the diſtance ſailed from the equator, put one point of the compaſs at the interſection of any parallel with the ruler, and the other point of the compaſs will reach to a certain place by the edge of the ruler. Now this point remaining in the ſame poſition, draw in the other point of the compaſs until it juſt touch the above parallel when ſweeped round: apply this extent to the equator, and it will give the difference of latitude. Hence the latitude in will be known, and the interſection of the correſponding parallel with the edge of the ruler will be the ſhip's preſent place.

The other problems of Mercator's Sailing may be very eaſily reſolved by this chart; but as they are of leſs uſe than thoſe given, they are, therefore, omitted, and may ſerve as an exerciſe to the ſtudent.

BOOK II.

Containing the method of finding the Latitude and Longitude of a Ship at Sea, and the Variation of the Compaſs.

Chap. I. *Of Hadley's Quadrant.*

Hadley's quadrant is the chief inſtrument in uſe at preſent for obſerving altitudes at ſea. The form of this inſtrument, according to the preſent mode of conſtruction,

Method of finding the Latitude and Longitude at Sea.

Plate CCCLXVII Fig. 54.

conſtruction, is an octagonal ſector of a circle, and therefore contains 45 degrees; but becauſe of the double reflection, the limb is divided into 90 degrees. See ASTRONOMY and QUADRANT. Fig. 54. repreſents a quadrant of the common conſtruction, of which the following are the principal parts.

1. ABC, the frame of the quadrant.
2. BC, the arch or limb.
3. D, the index; *a b*, the ſubdividing ſcale.
4. E, the index-glaſs.
5. F, the fore horizon-glaſs.
6. G, the back horizon-glaſs.
7. K, the coloured or dark glaſſes.
8. HI, the vanes or ſights.

Of the Frame of the Quadrant.

The frame of the quadrant conſiſts of an arch BC, firmly attached to the two radii AB, AC, which are bound together by the braces LM, in order to ſtrengthen it, and prevent it from warping.

Of the Index D.

The index is a flat bar of braſs, and turns on the centre of the octant: at the lower end of the index there is an oblong opening; to one ſide of this opening the vernier ſcale is fixed, to ſubdivide the diviſions of the arch; at the end of the index there is a piece of braſs, which bends under the arch, carrying a ſpring to make the ſubdividing ſcale lie cloſe to the diviſions. It is alſo furniſhed with a ſcrew to fix the index in any deſired poſition. The beſt inſtruments have an adjuſting ſcrew fitted to the index, that it may be moved more ſlowly, and with greater regularity and accuracy, than by the hand. It is proper, however, to obſerve, that the index muſt be previouſly fixed near its right poſition by the above-mentioned ſcrew.

Of the Index Glaſs E.

Upon the index, and near its axis of motion, is fixed a plane ſpeculum, or mirror of glaſs quickſilvered. It is ſet in a braſs frame, and is placed ſo that its face is perpendicular to the plane of the inſtrument. This mirror being fixed to the index moves along with it, and has its direction changed by the motion thereof; and the intention of this glaſs is to receive the image of the ſun, or any other object, and reflect it upon either of the two horizon-glaſſes, according to the nature of the obſervation.

The braſs frame with the glaſs is fixed to the index by the ſcrew *c*; the other ſcrew ſerves to re-place it in a perpendicular poſition, if by any accident it has been deranged.

Of the Horizon Glaſſes F, G.

On the radius AB of the octant are two ſmall ſpeculums: the ſurface of the upper one is parallel to the index glaſs, and that of the lower one perpendicular thereto, when *o* on the index coincides with *o* on the limb. Theſe mirrors receive the reflected rays, and tranſmit them to the obſerver.

The horizon-glaſſes are not entirely quickſilvered; the upper one F is only ſilvered on its lower half, or that next the plane of the quadrant, the other half being left tranſparent, and the back part of the frame cut away, that nothing may impede the ſight through the unſilvered part of the glaſs. The edge of the foil of this glaſs is nearly parallel to the plane of the inſtrument, and ought to be very ſharp, and without a flaw. The other horizon glaſs is ſilvered at both ends. In the middle there is a tranſparent ſlit through which the horizon may be ſeen.

Method of finding the Latitude and Longitude at Sea.

Each of theſe glaſſes is ſet in a braſs frame, to which there is an axis paſſing through the wood work, and is fitted to a lever on the under ſide of the quadrant, by which the glaſs may be turned a few degrees on its axis, in order to ſet it parallel to the index-glaſs. The lever has a contrivance to turn it ſlowly, and a button to fix it. To ſet the glaſſes perpendicular to the plane of the inſtrument, there are two ſunk ſcrews, one before and one behind each glaſs: theſe ſcrews paſs through the plate on which the frame is fixed into another plate; ſo that by looſening one and tightening the other of theſe ſcrews, the direction of the frame with its mirror may be altered, and ſet perpendicular to the plane of the inſtrument.

Of the Coloured Glaſſes K.

There are uſually three coloured glaſſes, two of which are tinged red and the other green. They are uſed to prevent the ſolar rays from hurting the eye at the time of obſervation. Theſe glaſſes are ſet in a frame, which turns on a centre, ſo that they may be uſed ſeparately or together as the brightneſs of the ſun may require. The green glaſs is particularly uſeful in obſervations of the moon; it may be alſo uſed in obſervations of the ſun, if that object be very faint. In the fore-obſervation, theſe glaſſes are fixed as in fig. 54.; but when the back obſervation is uſed, they are removed to N.

Of the two Sight Vanes, H, I.

Each of theſe vanes is a perforated piece of braſs, deſigned to direct the ſight parallel to the plane of the quadrant. That which is fixed at I is uſed for the fore, and the other for the back, obſervation. The vane I has two holes, one exactly at the height of the ſilvered part of the horizon-glaſs, the other a little higher, to direct the ſight to the middle of the tranſparent part of the mirrror.

Of the diviſions on the Limb of the Quadrant.

The limb of the quadrant is divided from right to left into 90 primary diviſions, which are to be conſidered as degrees, and each degree is ſubdivided into three equal parts, which are therefore of 20 minutes each: the intermediate minutes are obtained by means of the ſcale of diviſions at the end of the index.

Of the Vernier, or Subdividing Scale.

The dividing ſcale contains a ſpace equal to 21 diviſions of the limb, and is divided into 20 equal parts. Hence the difference between a diviſion on the dividing ſcale and a diviſion on the limb is one-twentieth of a diviſion on the limb, or one minute. The degree and minute pointed out by the dividing ſcale may be eaſily found thus.

Obſerve what minute on the dividing ſcale coincides with a diviſion on the limb; this diviſion being added to the degree and part of a degree on the limb, imme-

diately

diately preceding the firſt diviſion on the dividing ſcale, will be the degree and minute required.

Thus ſuppoſe the fourteenth minute on the dividing ſcale coincided with a diviſion on the limb, and that the preceding diviſion on the limb to *o* on the vernier was 56° 40′; hence the diviſion ſhown by the vernier is 56° 54′. A magnifying glaſs will aſſiſt the obſerver to read off the coinciding diviſions with more accuracy.

Adjuſtments of Hadley's Quadrant.

The adjuſtments of the quadrant conſiſt in placing the mirrors perpendicular to the plane of the inſtrument. The fore horizon-glaſs muſt be ſet parallel to the ſpeculum, and the planes of the ſpeculum and back horizon-glaſs produced muſt be perpendicular to each other when the index is at *o*.

ADJUSTMENT I. To ſet the index-glaſs perpendicular to the plane of the quadrant.

Fig. 55. and 56. *Method* 1. Set the index towards the middle of the limb, and hold the quadrant ſo that its plane may be nearly parallel to the horizon: then look into the index-glaſs; and if the portion of the limb ſeen by reflection appears in the ſame plane with that ſeen directly, the ſpeculum is perpendicular to the plane of the inſtrument. If they do not appear in the ſame plane, the error is to be rectified by altering the poſition of the ſcrews behind the frame of the glaſs.

Method 2. This is performed by means of the two adjuſting tools, fig. 55, 56, which are two wooden frames, having two lines on each, exactly at the ſame diſtance from the bottom.

Place the quadrant in a horizontal poſition on a table; put the index about the middle of the arch; turn back the dark glaſſes; place one of the above-mentioned tools near one end of the arch, and the other at the oppoſite end, the ſide with the lines being towards the index-glaſs; then look into the index-glaſs, directing the ſight parallel to the plane of the inſtrument, and one of the tools will be ſeen by direct viſion, and the other by reflection. By moving the index a little, they may be brought exactly together. If the lines coincide, the poſition of the mirror is right; if not, they muſt be made to coincide by altering the ſcrews behind the frame, as before.

ADJUSTMENT II. To ſet the fore horizon-glaſs perpendicular to the plane of the inſtrument.

Set the index to *o;* hold the plane of the quadrant parallel to the horizon; direct the ſight to the horizon, and if the horizons ſeen directly and by reflection are apparently in the ſame ſtraight line, the fore horizon-glaſs is perpendicular to the plane of the inſtrument; if not, one of the horizons will appear higher than the other. Now if the horizon ſeen by reflection is higher than that ſeen directly, releaſe the neareſt ſcrew in the pedeſtal of the glaſs, and ſcrew up that on the farther ſide, till the direct and reflected horizons appear to make one continued ſtraight line. But if the reflected horizon is lower than that ſeen directly, unſcrew the fartheſt, and ſcrew up the neareſt ſcrew till the coincidence of the horizons is perfect, obſerving to leave both ſcrews equally tight, and the fore horizon-glaſs will be perpendicular to the plane of the quadrant.

ADJUSTMENT III. To ſet the fore horizon-glaſs parallel to the index-glaſs, the index being at *o*.

Set *o* on the index exactly to *o* on the limb, and fix it in that poſition by the ſcrew at the under ſide; hold the plane of the quadrant in a vertical poſition, and direct the ſight to a well-defined part of the horizon; then if the horizon ſeen in the ſilvered part coincides with that ſeen through the tranſparent part, the horizon-glaſs is adjuſted; but if the horizons do not coincide, unſcrew the milled ſcrew in the middle of the lever on the other ſide of the quadrant, and turn the nut at the end of the lever until both horizons coincide, and fix the lever in this poſition by tightening the milled ſcrew.

As the poſition of the glaſs is liable to be altered by fixing the lever, it will therefore be neceſſary to re-examine it, and if the horizons do not coincide, it will be neceſſary either to repeat the adjuſtment, or rather to find the error of adjuſtment, or, as it is uſually called, the *index-error;* which may be done thus:

Direct the ſight to the horizon, and move the index until the reflected horizon coincides with that ſeen directly; then the difference between *o* on the limb and *o* on the vernier is the index error; which is additive when the beginning of the vernier is to the right of *o* on the limb, otherwiſe ſubtractive.

ADJUSTMENT IV. To ſet the back horizon-glaſs perpendicular to the plane of the inſtrument.

Put the index to *o;* hold the plane of the quadrant parallel to the horizon, and direct the ſight to the horizon through the back ſight vane. Now if the reflected horizon is in the ſame ſtraight line with that ſeen through the tranſparent part, the glaſs is perpendicular to the plane of the inſtrument. If the horizons do not unite, turn the ſunk ſcrews in the pedeſtal of the glaſs until they are apparently in the ſame ſtraight line.

ADJUSTMENT V. To ſet the back horizon-glaſs perpendicular to the plane of the index-glaſs produced, the index being at *o*.

Let the index be put as much to the right of *o* as twice the dip of the horizon amounts to; hold the quadrant in a vertical poſition, and apply the eye to the back vane; then if the reflected horizon coincides with that ſeen directly, the glaſs is adjuſted; if they do not coincide, the ſcrew in the middle of the lever on the other ſide of the quadrant muſt be releaſed, and the nut at its extremity turned till both horizons coincide. It may be obſerved, that the reflected horizon will be inverted; that is, the ſea will be apparently uppermoſt and the ſky lowermoſt.

As this method of adjuſtment is eſteemed troubleſome, and is often found to be very difficult to perform at ſea, various contrivances have therefore been propoſed to render this adjuſtment more ſimple. Some of theſe are the following.

1. Mr Dollond's method of adjuſting the back horizon-glaſs.

In this method an index is applied to the back horizon-glaſs, by which it may be moved ſo as to be parallel to the index-glaſs, when *o* on the vernier coincides with *o* on the limb. When this is effected, the index of the back horizon-glaſs is to be moved exactly 90° from its former poſition, which is known by means of a divided arch for that purpoſe; and then the plane of the back horizon-glaſs will be perpendicular to the plane of the index-glaſs produced.

2. Mr Blair's method of adjuſting the back horizon-glaſs.

All that is required in this method is to poliſh the lower edge of the index-glaſs, and expoſe it to view. The back horizon-glaſs is adjuſted by means of a reflection from this poliſhed edge, in the very ſame method as the fore horizon-glaſs is adjuſted by the common method.

Fig. 57. In order to illuſtrate this, let RIHE (fig. 57.) repreſent a pencil of rays emitted from the object R, incident on the index-glaſs I, from which it is reflected to the fore horizon-glaſs H, and thence to the eye at E. By this double reflection, an image of the object is formed at *r*. RHE repreſents another pencil from the ſame object R, coming directly through the fore horizon-glaſs to the eye at E; ſo that the doubly reflected image *r* appears coincident with the object R itſelf, ſeen directly.

When this coincidence is perfect, and the object R ſo very diſtant as to make the angle IRH inſenſible, the poſition of the ſpeculums I and H will differ inſenſibly from parallеliſm; that is, the quadrant will be adjuſted for the fore obſervation. Now it is from the eaſe and accuracy with which this adjuſtment can at any time be made, that the fore-obſervation derives its ſuperiority over the back obſervation. But by grinding the edge of the index-glaſs perpendicular to its reflecting ſurface, and poliſhing it, the obſervation is rendered capable of an adjuſtment equally eaſy and accurate as the fore horizon-glaſs: for by a pencil of rays emitted from the object S, incident on the reflecting edge of the index-glaſs D, thence reflected to the back horizon-glaſs B, and from that to the eye at *e*, an image will be formed at *s*; which image being made to coincide with the object S itſelf, ſeen directly, aſcertains the poſition of the back horizon-glaſs relative to the index-glaſs, with the ſame preciſion, and in a manner equally direct, as the former operation does that of the fore horizon-glaſs.

Directions for adjuſting the Back Horizon-Glaſs.

The method of adjuſting the quadrant for the back-obſervation is this. If it is to be done without making uſe of the teleſcope, place the index at *o*, and, applying the eye to the hole in the ſight vane (K), or tube for directing the ſight, direct it through the back horizon-glaſs to the horizon, if that is the object to be uſed for adjuſting. The two horizons are then to be made to coincide, holding the quadrant firſt in a vertical and then in a horizontal poſition; by which means both adjuſtments will be effected as in the fore-obſervation.

There will be no difficulty in finding the reflected horizon, if the obſerver firſt directs his eye to that part of the horizon-glaſs where he obſerves the image of the poliſhed edge of the index-glaſs, which will appear double. When the direct horizon is made to appear in this caſe, the reflected one will be ſeen cloſe by it, unleſs the inſtrument wants a great adjuſtment. In this caſe, a little motion of the back horizon-glaſs backwards and forwards will preſently bring it in view.

When the horizon, or any obſcure terreſtrial object, is to be made uſe of for adjuſting by means of the reflecting edge, there is a precaution to be taken, without which the obſerver will ſometimes meet with what will appear an unaccountable difficulty; for if the ſky, or other object behind him, ſhould happen to be pretty bright, he will not be able to diſcern the horizon at all. This ariſes from the image of the object behind him, which is reflected from the ſilvered ſurface of the index glaſs, appearing to coincide with the horizon; in which caſe, the bright picture of the former, which is formed in the bottom of the eye, prevents the fainter impreſſion of the latter from being perceived. This will be avoided, either by applying a black ſcreen over the ſilvered ſurface of the index-glaſs, or, without being at this trouble, by ſtanding at a door or window, ſo that only the dark objects within can be reflected from the index-glaſs: but if the obſervation is to be made in the open air, a hat, or any ſuch dark obſtacle, held before the ſilvered ſurface of the index-glaſs, will very effectually remove this inconvenience.

It may be remarked, that ſome obſervers, inſtead of making the principal adjuſtment, place the ſpeculums parallel, by moving the index without altering the poſition of the horizon-glaſs: and the difference between *o* on the vernier and *o* on the limb is the index error, which muſt be ſubtracted from all angles meaſured by the back-obſervation, when *o* on the index, is to the right of *o* on the limb; and added when to the left.

3. Mr Wright's method of adjuſting the back horizon-glaſs of his improved patent quadrant.

Fig. 58. Is a repreſentation of the quadrant complete in all its parts for uſe. A, is the reflecting ſurface of the index-glaſs, which is made of the uſual length, and $\frac{9}{10}$ of an inch broad. The bottom part is covered in front by the braſs frame, and the reflecting ſurface is $\frac{7}{10}$ on the back. B, the fore horizon-glaſs, placed as uſual: O, the back horizon-glaſs, now placed under the fore ſight-vane on the firſt radius of the quadrant I: C, the ſight-vane of the fore horizon-glaſs: D, the ſight-vane of the back horizon-glaſs: E, the coloured glaſſes in a braſs frame, in the proper place for the fore obſervation: F, a hole in the frame to receive the coloured glaſſes when an obſervation is to be taken with the back horizon-glaſs in the common way, by turning the back to the ſun: G, a hole in the frame of the fartheſt radius K, to receive the coloured glaſſes when an obſervation is to be taken by the new method; which is by looking through the lower hole in the ſight-vane of the back horizon-glaſs, directly at

Fig. 58.

(K) Beſides the hole in the ſight-vane, commonly made, there muſt be another nearer to the horizon-glaſs, and ſo placed that an eye directed through it to the centre of the horizon glaſs ſhall there perceive the image of the poliſhed edge of the index-glaſs. This hole muſt not be made ſmall like the other, but equal to the ordinary ſize of the pupil of the eye, there being on ſome occaſions no light to ſpare.

Method of finding the Latitude and Longitude at Sea.

at the ſun in the line of ſight DN; the horizon from behind will then be reflected from the back of the index-glaſs to the horizon-glaſs, and from thence to the eye. (See fig. 62.). H, a braſs clamp on the upper end of the index, having a milled ſcrew underneath, which faſtens the round plate to the index when required. (See fig. 59.). IK, the graduated arch of the quadrant divided into 90 degrees: L, the braſs index which moves over the graduated arch: M, the vernier to ſubdivide the diviſions on the arch into ſingle minutes of a degree.

Fig. 59. Fig. 59. ſhows the upper part of the index L on a larger ſcale, with part of the braſs frame that faſtens the index-glaſs, and the three adjuſting ſcrews D to adjuſt its axis vertical to the plane of the quadrant: B, the centre on which the milled plate O moves over the index: The dotted line BF is the diſtance it is required to move: K, the adjuſting ſcrew to ſtop it in its proper place for adjuſting the back obſervation-glaſs: G, a piece of braſs faſtened to the index oppoſite to the clamp H, to keep the plate O always cloſe to the index L.

Fig. 60. Fig. 60. repreſents the parallel poſition of the index and horizon glaſſes after adjuſtment by the ſun: BC, a ray from the ſun incident on the index-glaſs C, and from thence reflected to the fore horizon-glaſs D, and again to the eye at E, in the line DE, where the eye ſees the ſun at A by direct viſion, and the image by reflection, in one; the parallel lines AE and BC being ſo near to each other, that no apparent angle can be obſerved in the planes of the index and horizon-glaſs, when adjuſted by a diſtant object.

Fig. 61. In fig. 61. the index-glaſs is removed 45 degrees from the plane of the fore horizon-glaſs, and fixed in its proper place for adjuſting the back horizon-glaſs parallel to its plane, in the ſame manner as the fore horizon-glaſs is adjuſted.

Fig. 62. In fig. 62. the index-glaſs (after the adjuſtment of the fore and back horizon-glaſſes) is carried forward by the index on the arch 90 degrees, and makes an angle of 45° with the plane of the fore horizon-glaſs, and is at right angles to the plane of the back horizon-glaſs. The eye at E now ſees the ſun in the horizon at H, reflected by the index and horizon glaſſes from the zenith at Z, the image and object being 90 degrees diſtant. The back horizon K is now reflected from the back ſurface of the index-glaſs C to the horizon-glaſs M, and from thence to the eye at D, in a right line with the fore horizon F. In order to make an exact contact of the fore and back horizons at F, the index muſt be advanced beyond the 90th degree on the arch, by a quantity equal to twice the dip of the horizon.

The quadrant is adjuſted for the fore-obſervation as uſual, having previouſly fixed the index-glaſs in its proper place by the milled ſcrew at H, as repreſented in fig. 59.

To adjuſt the Quadrant for the Back-obſervation.

Faſten the index to 90° on the limb; looſen the ſcrew H (fig. 59.), and turn the plate O by the milled edge until the end of the adjuſting ſcrew K touch the edge of the clamp M; and by means of a diſtant object obſerve if the glaſſes are then parallel, as at fig. 60.: if they are, faſten the ſcrew H; if not, with a ſcrew-driver turn the ſcrew K gently to the right or left to make them perfect, and then faſten the ſcrew. Now remove the index back to O on the limb, and the index-glaſs will be parallel to the back horizon glaſs E, fig. 61.; If not, make them ſo by turning the adjuſting ſcrew of the glaſs E, the eye being at the upper hole in the ſight-vane D, and the ſight directed to the horizon, or any diſtant object in the direction DN (fig. 58.). Now the index remaining in this poſition, the index-glaſs is to be returned, to ſtop at the pin E, and it will be parallel to the fore horizon-glaſs as at firſt: then the quadrant will be adjuſted for both methods of obſervation.

Method of finding the Latitude and Longitude at Sea.

To obſerve the Sun's Altitude by the Back-obſervation.

Remove the coloured glaſſes to G (fig. 58.), and look through the lower hole in the ſight-vane D, in the line of direction DN, directly to the ſun, and move the index forward on the arch exactly in the ſame manner as in the fore-obſervation: make the contact of the ſun's limb and the back horizon exact, and the degrees and minutes ſhown by the index on the limb is the ſun's zenith diſtance. It may be obſerved, that the horizon will be inverted. If the ſun's lower limb be obſerved, the ſemidiameter is to be ſubtracted from the zenith diſtance; but if the upper limb is obſerved, the ſemidiameter is to be added.

The obſervation may be made in the uſual manner, by turning the back to the ſun. In this caſe the coloured glaſſes are to be ſhifted to F, and proceed according to the directions formerly given.

Uſe of Hadley's Quadrant.

The altitude of any object is determined by the poſition of the index on the limb, when by reflection that object appears to be in contact with the horizon.

If the object whoſe altitude is to be obſerved be the ſun, and if ſo bright that its image may be ſeen in the tranſparent part of the fore horizon-glaſs, the eye is to be applied to the upper hole in the ſight vane; otherwiſe, to the lower hole: and in this caſe, the quadrant is to be held ſo that the ſun may be biſected by the line of ſeparation of the ſilvered and tranſparent parts of the glaſs. The moon is to be kept as nearly as poſſible in the ſame poſition; and the image of the ſtar is to be obſerved in the ſilvered part of the glaſs adjacent to the line of ſeparation of the two parts.

There are two different methods of taking obſervations with the quadrant. In the firſt of theſe the face of the obſerver is directed towards that part of the horizon immediately under the ſun, and is therefore called the *fore obſervation*. In the other method, the obſerver's back is to the ſun, and it is hence called the *back-obſervation*. This laſt method of obſervation is to be uſed only when the horizon under the ſun is obſcured, or rendered indiſtinct by fog or any other impediment.

In taking the ſun's altitude, whether by the fore or back obſervation, the obſerver muſt turn the quadrant about upon the axis of viſion, and at the ſame time turn himſelf about upon his heel, ſo as to keep the ſun always in that part of the horizon-glaſs which is at the ſame diſtance as the eye from the plane of the quadrant. In this way the reflected ſun will deſcribe an arch of a parallel circle round the true ſun, whoſe convex ſide will be downwards in the fore-obſervation and upwards in the back; and conſequently, when by moving the index, the loweſt point of the arch in the fore-obſervation, or higheſt in the back, is made to touch the horizon, the quadrant will ſtand in a vertical plane, and the altitude above the viſible horizon will be properly obſerved. The reaſon of theſe operations may be thus explained: The image of the ſun being always kept in the axis of viſion, the index will always ſhow on the quadrant the diſtance between the ſun and any object ſeen directly which its image appears to touch; therefore, as long as the index remains unmoved, the image of the ſun will deſcribe an arch everywhere equidiſtant from the ſun in the heavens, and conſequently a parallel circle about the ſun, as a pole. Such a tranſlation of the ſun's image can only be produced by the quadrant's being turned about upon a line drawn from the eye to the ſun, as an axis. A motion of rotation upon this line may be reſolved into two, one upon the axis of viſion, and the other upon a line on the quadrant perpendicular to the axis of viſion; and conſequently a proper combination of theſe two motions will keep the image of the ſun conſtantly in the axis of viſion, and cauſe both jointly to run over a parallel circle about the ſun in the heavens: but when the quadrant is vertical, a line thereon perpendicular to the axis of viſion, becomes a vertical axis; and as a ſmall motion of the quadrant is all that is wanted, it will never differ much in practice from a vertical axis. The obſerver is directed to perform two motions rather than the ſingle one equivalent to them on a line drawn from the eye to the ſun: becauſe we are not capable, while looking towards the horizon, of judging how to turn the quadrant about upon the elevated line going to the ſun as an axis, by any other means than by combining the two motions above mentioned, ſo as to keep the ſun's image always in the proper part of the horizon-glaſs. When the ſun is near the horizon, the line going from the eye to the ſun will not be far removed from the axis of viſion; and conſequently the principal motion of the quadrant will be performed on the axis of viſion, and the part of motion made on the vertical axis will be but ſmall. On the contrary, when the ſun is near the zenith, the line going to the ſun is not far removed from a vertical line, and conſequently the principal motion of the quadrant will be performed on a vertical axis, by the obſerver's turning himſelf about, and the part of the motion made on the axis of viſion will be but ſmall. In intermediate altitudes of the ſun, the motions of the quadrant on the axis of viſion, and on the vertical axis, will be more equally divided.

Obſervations taken with the quadrant are liable to errors, ariſing from the bending and elaſticity of the index, and the reſiſtance it meets with in turning round its centre: whence the extremity of the index, on being puſhed along the arch, will ſenſibly advance before the index-glaſs begins to move, and may be ſeen to recoil when the force acting on it is removed. Mr Hadley ſeems to have been apprehenſive that his inſtrument would be liable to errors from this cauſe; and in order to avoid them, gives particular directions that the index be made broad at the end next the centre, and that the centre, or axis itſelf, have as eaſy a motion as is conſiſtent with ſteadineſs; that is, an entire freedom from looſeneſs, or *ſhake*, as the workmen term it. By ſtrictly complying with theſe directions the error in queſtion may indeed be greatly diminiſhed; ſo far, perhaps, as to render it nearly inſenſible, where the index is made ſtrong, and the proper medium between the two extremes of a ſhake at the centre on one hand, and too much ſtiffneſs there on the other, is nicely hit; but it cannot be entirely corrected. For to more or leſs of bending the index will always be ſubject; and ſome degree of reſiſtance will remain at the centre, unleſs the friction there could be totally removed, which is impoſſible.

Of the reality of the error to which he is liable from this cauſe, the obſerver, if he is provided with a quadrant furniſhed with a ſcrew for moving the index gradually, may thus ſatiſfy himſelf. After finiſhing the obſervation, lay the quadrant on a table, and note the angle; then cautiouſly looſen the ſcrew which faſtens the index, and it will immediately, if the quadrant is not remarkably well conſtructed, be ſeen to ſtart from its former ſituation, more or leſs according to the perfection of the joint and the ſtrength of the index. This ſtarting, which is owing to the index recoiling after being releaſed from the confined ſtate it was in during the obſervation, will ſometimes amount to ſeveral minutes; and its direction will be oppoſite to that in which the index was moved by the ſcrew at the time of finiſhing the obſervation. But how far is affects the truth of the obſervation, depends on the manner in which the index was moved in ſetting it to *o*, for adjuſting the inſtrument; or in finiſhing the obſervations neceſſary for finding the index error.

The eaſieſt and beſt rule to avoid theſe errors ſeems to be this: In all obſervations made by Hadley's quadrant, let the obſerver take notice conſtantly to finiſh his obſervations, by moving the index in the ſame direction which was uſed in ſetting it to *o* for adjuſting; or in the obſervations neceſſary for finding the index error. If this rule is obſerved, the error ariſing from the ſpring of the index will be obviated. For as the index was bent the ſame way, and in the ſame degree in adjuſting as in obſerving, the truth of the obſervations will not be affected by this bending.

To take Altitudes by the Fore-obſervation.

I. *Of the Sun.*

Turn down either of the coloured glaſſes before the horizon-glaſs, according to the brightneſs of the ſun; direct the ſight to that part of the horizon which is under the ſun, and move the index until the coloured image of the ſun appear in the horizon-glaſs; then give the quadrant a ſlow vibratory motion about the axis of viſion; move the index until the lower or upper limb of the ſun is in contact with the horizon, at the loweſt part of the arch deſcribed by this motion; and the degrees and minutes ſhown by the index on the limb will be the altitude of the ſun.

II. *Of the Moon.*

Put the index to *o*, turn down the green glaſs, place the eye at the lower hole in the ſight-vane, and obſerve the moon in the ſilvered part of the horizon-glaſs; move the index gradually, and follow the moon's reflected image until the enlightened limb is in contact

Method of finding the Latitude and Longitude at Sea.

with the horizon, at the lower part of the arch deſcribed by the vibratory motion as before, and the index will ſhow the altitude of the obſerved limb of the moon. If the obſervation is made in the day-time, the coloured glaſs is unneceſſary.

III. *Of a Star or Planet.*

The index being put to *o*, direct the ſight to the ſtar through the lower hole in the ſight-vane and tranſparent part of the horizon-glaſs; move the plane of the quadrant a very little to the left, and the image of the ſtar will be ſeen in the ſilvered part of the glaſs. Now move the index, and the image of the ſtar will appear to deſcend: continue moving the index gradually until the ſtar is in contact with the horizon at the loweſt part of the arch deſcribed; and the degrees and minutes ſhown by the index on the limb will be the altitude of the ſtar.

To take Altitudes by the Back-obſervation.

I. *Of the Sun.*

Put the ſtem of the coloured glaſſes into the perforation between the horizon-glaſſes, turn down either according to the brightneſs of the ſun, and hold the quadrant vertically; then direct the ſight through the hole in the back ſight-vane, and the tranſparent ſlit in the horizon-glaſs to that part of the horizon which is oppoſite to the ſun; now move the index till the ſun is in the ſilvered part of the glaſs, and by giving the quadrant a vibratory motion, the axis of which is that of viſion, the image of the ſun will deſcribe an arch whoſe convex ſide is upwards; bring the limb of the ſun, when in the upper part of this arch, in contact with the horizon; and the index will ſhow the altitude of the other limb of the ſun.

II. *Of the Moon.*

The altitude of the moon is obſerved in the ſame manner as that of the ſun, with this difference only, that the uſe of the coloured glaſs is unneceſſary unleſs the moon is very bright; and that the enlightened limb, whether it be the upper or lower, is to be brought in contact with the horizon.

III. *Of a Star or Planet.*

Look directly to the ſtar through the vane and tranſparent ſlit in the horizon-glaſs; move the index until the oppoſite horizon, with reſpect to the ſtar, is ſeen in the ſilvered part of the glaſs; and make the contact perfect as formerly. If the altitude of the ſtar is known nearly, the index may be ſet to that altitude, the ſight directed to the oppoſite horizon, and the obſervation made as before.

SECT. II. *Of finding the Latitude of a Place.*

The obſervation neceſſary for aſcertaining the latitude of a place, is that of the meridional altitude of a known celeſtial object; or two altitudes when the object is out of the meridian. The latitude is deduced with more certainty and with leſs trouble from the firſt of theſe methods, than from the ſecond; and the ſun, for various reaſons, is the object moſt proper for this purpoſe at ſea. It, however, frequently happens, that by the interpoſition of clouds, the ſun is obſcured at noon; and by this means the meridian altitude is loſt. In this caſe, therefore, the method by double altitudes becomes neceſſary. The latitude may be deduced from three altitudes of an unknown object, or from double altitudes, the apparent times of obſervation being given.

Method of finding the Latitude and Longitude at Sea.

The altitude of the limb of an object obſerved at ſea, requires four ſeparate corrections in order to obtain the true altitude of its centre: theſe are for *ſemidiameter*, *dip*, *refraction*, and *parallax*. (See Astronomy, and the reſpective articles). The firſt and laſt of theſe corrections vaniſh when the obſerved object is a fixed ſtar.

When the altitude of the lower limb of any object is obſerved, its ſemidiameter is to be added thereto in order to obtain the central altitude; but if the upper limb be obſerved, the ſemidiameter is to be ſubtracted. If the altitude be taken by the back-obſervation, the contrary rule is to be applied. The dip is to be ſubtracted from, or added to, the obſerved altitude, according as the fore or back-obſervation is uſed. The refraction is always to be ſubtracted from, and the parallax added to, the obſerved altitude.

Prob. I. To reduce the ſun's declination to any given meridian.

Rule. Find the number in Table IX. anſwering to the longitude in the table neareſt to that given, and to the neareſt day of the month. Now, if the longitude is weſt, and the declination increaſing, that is, from the 20th of March to the 22d of June, and from the 22d of September to the 22d of December, the above number is to be added to the declination: during the other part of the year, or while the declination is decreaſing, this number is to be ſubtracted. In eaſt longitude, the contrary rule is to be applied.

Ex. 1. Required the ſun's declination at noon 16th April 1810, in longitude 84° W?

Sun's declination at noon at Greenwich		9° 59.2′ N.
Number from Table IX.	- -	+ 5.0
Reduced declination	- - -	10 4.2

Ex. 2. Required the ſun's declination at noon 22d March 1793, in longitude 151° E?

Sun's declination at noon at Greenwich		0° 53′N
Equation from Table X.	- -	— 10
Reduced declination	- -	0 43 N

Prob. II. Given the ſun's meridian altitude, to find the latitude of the place of obſervation.

Rule. The ſun's ſemidiameter is to be added to, or ſubtracted from, the obſerved altitude, according as the lower or upper limb is obſerved; the dip anſwering to the height from Table V. is to be ſubtracted if the fore-obſervation is uſed; otherwiſe, it is to be added; and the refraction anſwering to the altitude from Table IV. is to be ſubtracted: hence the true altitude of the ſun's centre will be obtained. Call the altitude ſouth or north, according as the ſun is ſouth or north at the time of obſervation; which ſubtracted from 90°, will give the zenith diſtance of a contrary denomination.

Reduce the ſun's declination to the meridian of the place of obſervation, by Prob. I.; then the ſum or difference

Method of finding the Latitude and Longitude at Sea.

ference of the zenith diſtance and declination, according as they are of the ſame or of a contrary denomination, will be the latitude of the place of obſervation, of the ſame name with the greater quantity.

Ex. 1. October 19. 1810, in longitude 32° E, the meridian altitude of the ſun's lower limb was 48° 53′ S, height of the eye 18 feet. Required the latitude?

Obs. alt ſun's lower limb	48°53′S	Sun's dec. 19. Oct. noon.	9°51′S
Semidiameter	+0 16	Equation Table IX.	— 2
Dip and refraction	—0 5	Reduced declin.	9 49 S
True alt. ſun's centre	49 4 S	Zenith diſtance -	40 56 N
		Latitude	31 7 N

Ex. 2. November 16. 1812, in longitude 158° W, the meridian altitude of the ſun's lower limb was 87° 37′ N, height of the eye 10 feet. Required the latitude?

Obs. alt. ſun's low. limb	87°37′N.	Sun's dec. noon.	18°48′S
Semidiameter	+0 16	Equation tab.	+0 8
Dip and refract.	—0 3	Reduced dec.	19 5 S
True alt. ſun's centre	87 50 N.	Zenith diſtance	2 10 S
		Latitude	21 6 S

Ex. 3. December 19. 1811, being nearly under the meridian of Greenwich, the altitude of the ſun's upper limb at noon was 4° 30′ S, height of the eye 20 feet. Required the latitude?

Obſerved altitude of the ſun's upper limb	4° 30′ S
Sun's ſemidiameter - -	0 16
Dip and refraction - -	0 15
True altitude of the ſun's centre -	3 59 S
Zenith diſtance - - -	86 1 N
Declination - - -	23 25 S
Latitude - - -	62 36 N

Ex. 4. Auguſt 23. 1812, in longitude 107° E, the meridian altitude of the ſun's lower limb by the back obſervation was 61° 8′ N, and the height of the eye 14 feet. Required the latitude?

Obſerved altitude ſun's upper limb -	61° 8′ N
Sun's ſemidiameter - -	—0 16
Dip - - -	+0 3½
Refraction - - -	—0 ½
True altitude of ſun's centre -	60 55 N
Zenith diſtance - - -	29 5 S
Reduced declination - -	11 26 N
Latitude - - -	17 39 S

The dip in Table V. anſwers to an entirely open and unobſtructed horizon. It, however, frequently happens, that the ſun is over the land at the time of obſervation, and the ſhip nearer to the land than the viſible horizon would be if unconfined. In this caſe, the dip will be different from what it would otherwiſe have been, and is to be taken from Table VI. in which the height is expreſſed at the top, and the diſtance from the land in the ſide column in nautical miles.—Seamen, in general, can eſtimate the diſtance of any object from the ſhip with ſufficient exactneſs for this purpoſe, eſpecially when that diſtance is not greater than ſix miles; which is the greateſt diſtance of the viſible horizon from an obſerver on the deck of any ſhip.

Method of finding the Latitude and Longitude at Sea.

Prob. III. Given the meridian altitude of a fixed ſtar, to find the latitude of the place of obſervation.

Rule. Correct the altitude of the ſtar by dip and refraction, and find the zenith diſtance of the ſtar as formerly; take the declination of the ſtar from Table XI. and reduce it to the time of obſervation. Now, the ſum or difference of the zenith diſtance and declination of the ſtar, according as they are of the ſame or of a contrary name, will be the latitude of the place of obſervation.

Ex. 1. December 1. 1810, the meridian altitude of Sirius was 59° 50′ S, height of the eye 14 feet. Required the latitude?

Obſerved altitude of Sirius -	59° 50′ S
Dip and refraction - -	—0 4
True altitude - - -	59 46 S
Zenith diſtance - - -	30 14 N
Declination - - -	16 28 S
Latitude - - -	13 46 N

Ex. 2. February 17. 1797, the meridian altitude of Procyon was 71° 15′ N, the height of the eye 10 feet. Required the latitude?

Obſerved altitude of Procyon -	71° 15′ N
Dip and refraction - -	—0 3
True altitude - - -	71 12 N
Zenith diſtance - - -	18 48 S
Declination - - -	5 43 N
Latitude - - -	13 5 S

Prob. IV. Given the meridian altitude of a planet, to find the latitude of the place of obſervation.

Rule. Compute the true altitude of the planet as directed in laſt problem (which is ſufficiently accurate for altitudes taken at ſea); take its declination from the Nautical Almanac, p. iv. of the month, and reduce it to the time and meridian of the place of obſervation; then the ſum or difference of the zenith diſtance and declination of the planet will be the latitude as before.

Ex. 1. Auguſt 7. 1812, the meridian altitude of Saturn was 68° 42′ N, and height of the eye 15 feet. Required the latitude?

Obſerved altitude of Saturn -	68° 42′ N
Dip and refraction - -	—0 4
True altitude - -	68 38 N
Zenith diſtance - - -	21 22 S
Declination - -	22 42 S
Latitude - -	44 6 S

Ex. 2. October 15. 1812, the meridian altitude of Jupiter was 81° 5′ S, height of the eye 18 feet. Required the latitude?

Method of finding the Latitude and Longitude at Sea.

Obſerved altitude of Jupiter	81° 5′ S
Dip	—0 3
True altitude	81 2 S
Zenith diſtance	8 58 N
Declination	19 4 S
Latitude	10 6 S

Prob. V. Given the meridian altitude of the moon, to find the latitude of the place of obſervation.

Rule. Take the number † anſwering to the ſhip's longitude, and daily variation of the moon's paſſing the meridian; which being applied to the time of paſſage given in the Nautical Almanac, will give the time of the moon's paſſage over the meridian of the ſhip.

† *Dr Mackay's Treatiſe on the Longitude*, Tab. XX.

Reduce this time to the meridian of Greenwich; and by means of the Nautical Almanac find the moon's declination, horizontal parallax, and ſemidiameter at the reduced time.

Apply the ſemidiameter and dip to the obſerved altitude of the limb, and the apparent altitude of the moon's centre will be obtained; to which add the correction anſwering to the apparent altitude and horizontal parallax ‡, and the ſum will be the true altitude of the moon's centre; which ſubtracted from 90°, the remainder is the zenith diſtance, and the ſum or difference of the zenith diſtance and declination, according as they are of the ſame or of a contrary name, will be the latitude of the place of obſervation.

‡ Ditto, Tab. XX.

Ex. 1. December 24. 1792, in longitude 30° W, the meridian altitude of the moon's lower limb was 81° 15′ N, height of the eye 12 feet. Required the latitude?

Time of paſſ. over the mer. of Greenwich	=9h 19′
Equation Table XX.	+0 4
Time of paſſ. over mer. ſhip	9 23
Longitude in time	2 0
Reduced time	11 23
Moon's dec. at midnight, Table IX.	=14° 53′N
Eq. to time from midnight	—0 4
Reduced declination	14 49 N
Moon's hor. par.	55′ 25″
Moon's ſemidiameter	15 6
Augmentation	+0 14
Aug. ſemidiameter	15 20

Method of finding the Latitude and Longitude at Sea.

Obſerved altitude of the moon's lower limb	81° 15′N
Semidiameter	+0 15
Dip	—0 3
Apparent altitude of the moon's centre	81 27 N
Correction	+0 8
True altitude of moon's centre	81 35 N
Zenith diſtance	8 25 S
Declination	14 49 N
Latitude	6 42 N

Remark. If the object be on the meridian below the pole at the time of obſervation, then the ſum of the true altitude and the complement of the declination is the latitude, of the ſame name as the declination or altitude.

Ex. 1. July 2. 1812, in longitude 15° W, the altitude of the ſun's lower limb at midnight was 8° 58′ height of the eye 18 feet. Required the latitude?

Obſerved altitude ſun's lower limb	8° 58′
Semidiameter	+0 16
Dip and refraction	—0 10
True altitude of ſun's centre	9 4 N
Compl. declin. reduced to time and place	66 57 N
Latitude	76 1 N

Prob. VI. Given the latitude by account, the declination and two obſerved altitudes of the ſun, and the interval of time between them, to find the true latitude.

Rule. To the log. ſecant of the latitude by account, add the log. ſecant of the ſun's declination; the ſum, rejecting 20 from the index, is the *logarithm ratio*. To this add the log. of difference of the natural ſines of the two altitudes, and the log. of the half elapſed time from its proper column.

Find this ſum in column of middle time, and take out the time anſwering thereto; the difference between which and the half elapſed time will be the time from noon when the greater altitude was obſerved.

Take the log. anſwering to this time from column of riſing, from which ſubtract the log. ratio, the remainder is the logarithm of a natural number; which being added to the natural ſine of the greater altitude, the ſum is the natural coſine of the meridian zenith diſtance; from which and the ſun's declination the latitude is obtained as formerly.

If the latitude thus found differs conſiderably from that by account, the operation is to be repeated, uſing the computed latitude in place of that by account (1).

Example 1.

---

(1) This method is only an approximation, and ought to be uſed under certain reſtrictions; namely,

The obſervations muſt be taken between nine o'clock in the forenoon and three in the afternoon. If both obſervations be in the forenoon, or both in the afternoon, the interval muſt not be leſs than the diſtance of the time of obſervation of the greateſt altitude from noon. If one obſervation be in the forenoon and the other in the afternoon, the interval muſt not exceed four hours and a half; and in all caſes, the nearer the greater altitude is to noon the better.

If the ſun's meridian zenith diſtance be leſs than the latitude, the limitations are ſtill more contracted. If the latitude be double the meridian zenith diſtance, the obſervations muſt be taken between half paſt nine in the morning and half paſt two in the afternoon, and the interval muſt not exceed three hours and a half. The obſervations muſt be taken ſtill nearer to noon, if the latitude exceed the zenith diſtance in a greater proportion. See Maſkelyne's Britiſh Mariner's Guide, Dr Mackay's Treatiſes on the Longitude and Navigation, &c. and Requiſite Tables, 2d edit.

Method of finding the Latitude and Longitude at Sea.

Example 1. July 9. 1811, in latitude by account 27° N, at 10h 29′ A. M. per watch, the corrected altitude of the ſun was 65° 24′, and at 12h 31′, the altitude was 74° 8′. Required the true latitude ?

Times *per* wat Alt. N. Sines. Lat. by acc. 37° 0′ Secant 0.09765
10h 29′ 65° 24′ 90924 Declination 22 28 Secant 0.03428
12 31 74 8 96190 Logarithm ratio - 0.13193
2 2 Differ. 5266 Logarithm - 3 72148
1 1 Half elapſed time - - 0.57999
31 10″ Middle time - - 4.43340
29 50 Riſing - - - 2.92740
Log. ratio 0.13193
Natural number - - 624 - 2.79547
Greateſt altitude 74° 8′ N ſine 96190
Mer. zenith diſt. 14 30 N coſine 96814
Declination 22 28
Latitude - 36 58 N.

Ex. 2. October 17. 1812, in latitude 43° 24′ N. by account, at 0h 38′ P. M. the correct altitude of the ſun's centre was 36° 5′, and at 2h 46′ P. M. the altitude was 24° 49′. Required the latitude ?

Times *per* wat. Alt. N. Sines Lat by acc 43° 24′ Secant 0.13872
0h 38′ 36° 5′ 58896 Declination 9 18 Secant 0.00575
2 46 24 49 41972 Logarithm ratio - 0.14447
2 8 Differ. 16924 Log. - - 4 22850
1 4 - Half elapſed time - - 0.55966
1 41 20″ - Middle time - - - 4.93263
37 20 Riſing - - - 3.12184
Log. ratio 0.14447
Natural Number 649 2.97737
Greateſt altitude - 36° 5′ N. ſine 58896
Mer. zen. diſtance 53 15 N coſine 59845
Declination - 9 18
Latitude - - 43 57 N.

Ex. 3. In latitude 49° 48′ N. by account, the ſun's declination being 9° 37′ S. at 0h 32′ P. M. per watch, the altitude of the ſun's lower limb was 28° 32′, and at 2h 41′ it was 19° 25′; the height of the eye 12 feet. Required the true latitude ?

First obſerved altit. 28° 32′ Second altitude 19° 25′
Semidiameter +0 16 Semidiameter +0 16
Dip and refraction —0 5 Dip and refr. —0 6
True altitude 28 43 True altitude 19 35

Time *per* wat. Alt. N. Sines. Lat. by acc. 49° 48′ Secant. 0.19013
0h 32′ 28° 43′ 48048 Declination 9 37 Secant. 0.00615
2 41 19 35 33518 Log. ratio - - 0.09628
2 9 Difference 14530 Log. - - 4.16227
1 4 30″ - Half elapſed time - 0.55637
1 37 0 - Middle time - - 4.91492
32 30 - Riſing - - 3.00164
Natural number - 639 - 2.80536
Mer. zen. diſt. 60° 52′ N. coſine 48687
Declination 9 37 S.
Latitude 51 15 N.

Method of finding the Latitude and Longitude at Sea.

As the latitude by computation differs 1° 27′ from that by account, the operation muſt be repeated.

Computed latitude 51° 15′ Secant 0.20348
Declination 9 37 Secant 0.00615
Logarithm ratio - - 0.20963
Difference of nat. ſines 14530 Log. 4.16227
Half elapſed time 1h 4′ 30″ Log. 0.55637
Middle time 1 40 20 Log. 4.92827
Riſing - 0 35 50 Log. 3.08630
Natural number - - 753 2.87667
Gr. altitude 28° 43′ N. ſine 48048
Mer. zen. diſt. 60 47 N. coſine 48801
Declination 9 37
Latitude 51 10 N.

As this latitude differs only 5′ from that uſed in the computation, it may therefore be depended on as the true latitude.

Prob. VII. Given the latitude by account, the ſun's declination, two obſerved altitudes, the elapſed time, and the courſe and diſtance run between the obſervations; to find the ſhip's latitude at the time of obſervation of the greater altitude.

Rule. Find the angle contained between the ſhip's courſe and the ſun's bearing at the time of obſervation of the leaſt altitude, with which enter the Traverſe Table as a courſe, and the difference of latitude anſwering to the diſtance made good will be the reduction of altitude.

Now, if the leaſt altitude be obſerved in the forenoon, the reduction of altitude is to be applied thereto by addition or ſubtraction, according as the angle between the ſhip's courſe and the ſun's bearing is leſs or more than eight points. If the leaſt altitude be obſerved in the afternoon, the contrary rule is to be uſed.

The difference of longitude in time between the obſervations is to be applied to the elapſed time by addition or ſubtraction, according as it is eaſt or weſt. This is, however, in many caſes ſo inconſiderable as to be neglected.

With the corrected altitudes and interval, the latitude by account and ſun's declination at the time of obſervation of the greateſt altitude, the computation is to be performed by the laſt problem.

Ex. 1. July 6. 1793, in latitude 58° 14′ N by account, and longitude 16° E, at 10h 54′ A. M. per watch, the altitude of the ſun's lower limb was 53° 17′, and at 1h 17′ P. M. the altitude was 52° 51′, and bearing per compaſs SW*b*W; the ſhip's courſe during the elapſed time was S*b*W½W, and the hourly rate of ſailing 8 knots, the height of the eye 16 feet. Required the true latitude at the time of obſervation of the greater altitude ?

Sun's bear. at 2d. ob. SW*b*W. Interval bet. obſerv. 2h 23′
Ship's courſe S*b*W½W Diſt. run=2h 23×8=19m.
Contained angle 3½ points.

Now

Now to courſe 3½ points, and diſtance 19 miles, the difference of latitude is 14.7 or 15 miles.

Firſt obſerved alt.	53° 17′	Second obſerved alt.	52° 51′
Semidiameter	+0 16	Semidiameter	+0 16
Dip and refract.	—0 4	Dip and refraction	—0 4
True altitude	53 29	Reduction -	—0 15
		Reduced altitude	52 48
Time of ob. of gr. alt.	10h 54′ A.M.	Sun's dec.	22° 39′ N.
Longitude in time	1 4	Eq. to r. t.	+ 1
Reduced time	9 50 A.M.	Red. decl.	22 40 N.

Time *per* wat.	Alt.	N. Sines.	Lat. by acc.	58° 14′ Secant	0.27863
10h 54′	53° 29′	80368	Declination	22 40 Secant	0.03491
1 17	52 48	79653	Logarithm ratio	-	0.31354
2 23	Differ.	715	Logarithm	-	2.85431
1 11 30″	-	-	Half elapſed time		0.51294
5 30	-	-	Middle time	-	3.68079
1 6 0		-	Riſing	- -	3.61469
			Log. ratio		0.31354

Natural number - -		2001 -	3.30115
Greateſt altitude	53° 29′ N.	ſine 80368	
Mer. zenith diſt.	34 33 N.	coſ. 82369	
Declination	22 40 N.		
Latitude -	57 13 N.		

Since the computed latitude differs ſo much from that by account, it will be neceſſary to repeat the operation.

Computed latitude	57° 13′	Secant	0.26643
Declination	22 40	Secant	0.03491
Logarithm ratio - - -			0.30134
Difference of natural ſines	715	Log.	2.85431
Half elapſed time	1h 11′ 30″	Log.	0.51294
Middle time	5 20	Log.	3.66859
Riſing -	1 6 10	Log.	3.61686
Logarithm ratio - - -			0.30134
Natural number - -	2068		3.31552
Greateſt altitude	53° 29′ N.	ſine 80368	
Mer. zen. diſt.	34 29 N.	coſ. 82436	
Declination	22 40 N.		
Latitude	57 9 N.		

As this latitude differs only 4 miles from that uſed in the computation, it may therefore be depended on as the true latitude.

Remark. If the ſun come very near the zenith, the ſines of the altitude will vary ſo little as to make it uncertain which ought to be taken as that belonging to the natural ſine of the meridian altitude. In this caſe, the following method will be found preferable.

To the log. riſing of the time from noon found as before, add the log. ſecant of half the ſum of the eſtimate meridian altitude, and greateſt obſerved altitude; from which ſubtract the log. ratio, its index being increaſed by 10, and the remainder will be the log. ſine of an arch; which added to the greateſt altitude will give the ſun's meridian altitude.

Ex. 2. December 21ſt 1793, in latitude 22° 40′ S, by account at 11h 57′ the correct altitude of the ſun's centre was 89° 10′, and at 12h 4′ 40″, the altitude was 88° 50′. Required the true latitude?

Times *per* wat.	Alt.	N. Sines.	Lat. by acc.	22° 40′ Secant	0.03491
11h 57′ 0″	89° 10′	99989	Declination	23 28 Secant	0.03749
12 4 40	88 50	99979	Logarithm ratio	-	0.07240
0 7 10	Differ.	10	Log.	- -	1.00000
0 3 50			Half elapſed time	- -	1.77663
0 0 50			Middle time	- -	2.84903
0 3 0			Riſing	- - -	9.93284

Comp. of lat. by acc.	67° 20′		
Declination -	23 28		
Sum - -	90 48		
Eſtimate mer. altitude	89 12	89° 11′ ſec.	11.84609
Greateſt altitude	89 10		
			12.77893
Logarithm ratio +5 - -			5.07240
Arch - -	0 17	ſine	7.70653
Greateſt altitude -	89 10		
Meridian altitude	89 27	zen. diſt.	0° 33′ N
		declinat.	23 28 S
		latitude	22 55 S

This differing from the aſſumed latitude, the work muſt be repeated.

Latitude -	22° 55′	- ſecant	0.03571
Declination	23 28	- ſecant	0.03749
Logarithm ratio - -			0.07320
Difference of natural ſines	1°	log.	1.00000
Half elapſed time	3′ 50″		1.77663
Middle time -	0 50		2.84983
Riſing - -	3 0		0.93284
Comp. of lat.	67° 5′		
Declination -	23 28		
Sum -	90 33		
Mer. alt. -	89 27	89° 18′½ ſec.	11.91827
Greateſt alt.	89 10		
			12.85111
Log. ratio +5 - - -			5.07320
Arch -	0 21	- -	7.77791
Greateſt altitude	89 10		
Merid. altitude	89 31	zen. diſt.	0° 29′
		Declination	23 28
		Latitude	22 59 S

If the work be repeated with this laſt latitude, the latter part only may be altered.

Method of finding the Latitude and Longitude at Sea

Latitude	22° 59′	ſecant	0.03592
Declination	23 28	ſecant	0.03749
Eſt. mer. alt.	89 31	log. ratio	0.07341
Greateſt altitude	89 10	ar. com.—5	4.92659
Sum	178 41		
Half	89 20½	ſecant	1.93972
Riſing	0h 3′ 0″	-	0.93284
Arch	0 22	ſine	7.79915
Greateſt altitude	89 10		
Meridian altitude	89 32		
Zenith diſtance	0 28		
Declination	23 28		
Latitude	23 0 S.		

Prob. VIII. Given the altitudes of two known ſtars, obſerved at the ſame or at different times; and if at different times, the interval between the obſervations; to find the latitude.

Rule. If both altitudes be obſerved at the ſame time, call the difference between their right aſcenſions the reduced interval.

But if the altitudes be taken at different times, reduce the interval between the obſervations to ſidereal time, by adding thereto the proportional part anſwering to the interval, and 3′ 56″, the daily acceleration of the fixed ſtars. Now to the right aſcenſion of the firſt obſerved ſtar, add the interval in ſidereal time, and the difference between this ſum and the right aſcenſion of the other ſtar will be the reduced interval.

To the logarithm riſing of the reduced interval, add the logarithmic coſines of the ſtars declinations; ſubtract the natural number anſwering to the ſum of theſe logarithms from the natural coſine of the difference or ſum of the ſtars declinations, according as they are of the ſame or of a contrary name, and the remainder will be the natural ſine of arch firſt.

To the logarithmic coſine of arch firſt add the logarithmic ſecant of declination of the ſtar having the leaſt polar diſtance, and the logarithm half elapſed time of the reduced interval, the ſum will be the logarithm half elapſed time of arch ſecond.

From the natural coſine of the difference between arch firſt and the altitude of the ſtar having the greateſt polar diſtance, ſubtract the natural ſine of the altitude of the other ſtar, and find the logarithm of the remainder; to which add the logarithm ſecant of arch firſt, and the logarithmic ſecant of the altitude of the ſtar having the greateſt polar diſtance, the ſum will be the logarithm riſing of arch third. The difference between arches ſecond and third is arch fourth.

To the logarithm riſing of arch fourth add the logarithmic coſines of the declination and altitude of the ſtar having the greateſt polar diſtance; ſubtract the correſponding natural number from the natural coſine of the difference between the altitude and declination, the polar diſtance being leſs than 90°; otherwiſe, from their ſum, and the remainder will be the natural ſine of the latitude.

Ex. January 1ſt 1793, the true altitude of Capella was 69° 23′, and at the ſame inſtant the true altitude of Sirius was 16° 19′. Required the latitude?

Method of finding the Latitude and Longitude at Sea.

Right aſcenſion of Capella	5h 1′ 25″
Right aſcenſion of Sirius	6 36 1
Interval	1 34 36

Interval	1h 34′ 36″			riſing	3.92270
Capella's declin.	45° 46′ N			coſine	9.84360
Sirius's declin.	16 27 S			coſine	9.98185
Sum	62 13 N	coſine	46613		
			5599		3.74815
Arch firſt	24 13 N	ſine	41014	coſ.	9.96000
Capella's declin.	45 46			ſecant	0.15640
Interval	1h 34′ 36″			H. E. time	0.39670
Arch ſecond	1 11 28			H. E. time	0.51310
Arch firſt	24 13			ſecant	0.04000
Sirius's altitude	16 19			ſecant	0.01785
Difference	7 54N.	coſine	99051		
Capella's altitude	69 23N.	ſine	93596		
			5455		3.73679
Arch third	1h 21′ 20″			riſing	3.79464
Arch ſecond	1 11 28				
Arch fourth	9 52			riſing	1.96708
Sirius's declin.	16 27			coſine	9.98185
altitude	16 19			coſine	9.98215
Sum	32 46 N	coſ.	84088		
			85		1.93008
Latitude	57 9 N	ſine	84003		

Chap. II. *Containing the Method of finding the Longitude at Sea by Lunar Obſervations.*

Sect. I. *Introduction.*

The obſervations neceſſary to determine the longitude by this method are, the diſtance between the ſun and moon, or the moon and a fixed ſtar near the ecliptic, together with the altitude of each. The ſtars uſed in the Nautical Almanack for this purpoſe are the following: namely, *α Arietis*, *Aldebaran*, *Pollux*, *Regulus*, *Spica Virginis*, *Antares*, *α Aquilæ*, *Fomalhaut*, and *α Pegaſi*; and the diſtances of the moon's centre from the ſun, and from one or more of theſe ſtars, are contained in the viii. ix. x. and xi. pages of the month, at the beginning of every third hour apparent time, by the meridian of Greenwich. The diſtance between the moon and the ſun, or one of theſe ſtars, is obſerved with a ſextant; and the altitudes of the objects are taken as uſual with a Hadley's quadrant.

In the practice of this method, it will be found convenient to be provided with three aſſiſtants; two of theſe are to take the altitudes of the ſun and moon, or moon and ſtar, at the ſame time the principal obſerver is taking the diſtance between the objects; and the third aſſiſtant is to obſerve the time, and write down

Of finding the Longitude at Sea by Lunar Obſervations.

down the obſervations. In order to obtain accuracy, it will be neceſſary to obſerve ſeveral diſtances, and the correſponding altitudes; the intervals of time between them being as ſhort as poſſible; and the ſum of each divided by the number will give the mean diſtance and mean altitudes; from which the time of obſervation at Greenwich is to be computed by the rules to be explained.

If the ſun or ſtar from which the moon's diſtance is obſerved be at a proper diſtance from the meridian, the time at the ſhip may be inferred from the altitude obſerved at the ſame time with the diſtance: in this caſe, the watch is not neceſſary; but if that object be near the meridian, the watch is abſolutely neceſſary, in order to connect the obſervations for aſcertaining the apparent time at the ſhip and at Greenwich with each other.

An obſerver without any aſſiſtants may very eaſily take all the obſervations, by firſt taking the altitudes of the objects, then the diſtance, and again their altitudes, and reduce the altitudes to the time of obſervation of the diſtance; or, by a ſingle obſervation of the diſtance, the apparent time being known, the longitude may be determined.

A ſet of obſervations of the diſtance between the moon and a ſtar, and their altitudes, may be taken with accuracy during the time of the evening or morning twilight; and the obſerver, though not much acquainted with the ſtars, will not find it difficult to diſtinguiſh the ſtar from which the moon's diſtance is to be obſerved. For the time of obſervation nearly, and the ſhip's longitude by account being known, the eſtimate time at Greenwich may be found; and by entering the Nautical Almanac with the reduced time, the diſtance between the moon and given ſtar will be found nearly. Now ſet the index of the ſextant to this diſtanec, and hold the plane of the inſtrument ſo as to be nearly at right angles to the line joining the moon's cuſps, direct the ſight to the moon, and by giving the ſextant a ſlow vibratory motion, the axis of which being that of viſion, the ſtar, which is uſually one of the brighteſt in that part of the heavens, will be ſeen in the tranſparent part of the horizon glaſs.

Sect. II. *Of the Sextant.*

This inſtrument is conſtructed for the expreſs purpoſe of meaſuring with accuracy the angular diſtance between the ſun and moon, or between the moon and a fixed ſtar, in order to aſcertain the longitude of a place by lunar obſervations. It is, therefore, made with more care than the quadrant, and has ſome additional appendages that are wanting in that inſtrument.

Plate CCLXVIII.

Fig. 63. repreſents the ſextant, ſo framed as not to be liable to bend. The arch AA is divided into 120 degrees; each degree is divided into three parts; each of theſe parts, therefore, contains 20 minutes, which are again ſubdivided by the vernier into every half minute or 30 ſeconds. The vernier is numbered at every fifth of the longer diviſions, from the right towards the left, with 5, 10, 15, and 20; the firſt diviſion to the right being the beginning of the ſcale.

In order to obſerve with accuracy, and make the images come preciſely in contact, an adjuſting ſcrew B is added to the index, which may thereby be moved with greater accuracy than it can be by hand; but this ſcrew does not act until the index is fixed by the finger ſcrew C. Care ſhould be taken not to force the adjuſting ſcrew when it arrives at either extremity of its adjuſtment. When the index is to be moved any conſiderable quantity, the ſcrew C at the back of the ſextant muſt be looſened; but when the index is brought nearly to the diviſion required, this back ſcrew ſhould be tightened, and then the index may be moved gradually by the adjuſting ſcrew.

Of finding the Longitude at Sea by Lunar Obſervations.

There are four tinged glaſſes D, each of which is ſet in a ſeparate frame that turns on a centre. They are uſed to defend the eye from the brightneſs of the ſolar image and the glare of the moon, and may be uſed ſeparately or together as occaſion requires.

There are three more ſuch glaſſes placed behind the horizon glaſs at E, to weaken the rays of the ſun or moon when they are viewed directly through the horizon glaſs. The paler glaſs is ſometimes uſed in obſerving altitudes at ſea, to take off the ſtrong glare of the horizon.

The frame of the index glaſs I is firmly fixed by a ſtrong cock to the centre plate of the index. The horizon glaſs F is fixed in a frame that turns on the axes or pivots, which move in an exterior frame; the holes in which the pivots move may be tightened by four ſcrews in the exterior frame. G is a ſcrew by which the horizon glaſs may be ſet perpendicular to the plane of the inſtrument: ſhould this ſcrew become looſe, or move too eaſy, it may be eaſily tightened by turning the capſtan headed ſcrew H, which is on one ſide of the ſocket through which the ſtern of the finger ſcrew paſſes.

Fig. 64.
Fig. 65.
Fig. 66.

The ſextant is furniſhed with a plain tube (fig. 64.) without any glaſſes; and to render the objects ſtill more diſtinct, it has two teleſcopes, one (fig. 65.) repreſenting the objects erect, or in their natural poſition: the longer one (fig. 66.) ſhows them inverted; it has a large field of view, and other advantages, and a little uſe will ſoon accuſtom the obſerver to the inverted poſition, and the inſtrument will be as readily managed by it as by the plain tube alone. By a teleſcope the contact of the images is more perfectly diſtinguiſhed; and by the place of the images in the field of the teleſcope, it is eaſy to perceive whether the ſextant is held in the proper place for obſervation. By ſliding the tube that contains the eye-glaſſes in the inſide of the other tube, the object is ſuited to different eyes, and made to appear perfectly diſtinct and well defined.

Fig. 67.

The teleſcopes are to be ſcrewed into a circular ring at K; this ring reſts on two points againſt an exterior ring, and is held thereto by two ſcrews: by turning one or other of theſe ſcrews, and tightening the other, the axis of the teleſcope may be ſet parallel to the plane of the ſextant. The exterior ring is fixed on a triangular braſs ſtem that ſlides in a ſocket, and by means of a ſcrew at the back of the quadrant may be raiſed or lowered ſo as to move the centre of the teleſcope to point to that part of the horizon glaſs which ſhall be judged the moſt fit for obſervation. Fig. 67. is a circular head, with tinged glaſſes to ſcrew on the eye end of either of the teleſcopes or the plain tube. The glaſſes are contained in a circular plate which has four holes; three of theſe are fitted with tinged glaſſes, the fourth is open. By preſſing the finger againſt the projecting edge of this plate, and turning it round, the open hole, or any of the tinged glaſſes, may be brought between the eye-glaſs of the teleſcope and the eye.

Fig. 68.

Fig. 68. is a magnifying glaſs, to aſſiſt the obſerver to read off the angle with more accuracy: and fig. 69. a ſcrew-driver.

Mr Hoppe of Church-ſtreet, Minories, London, has lately contrived a ſextant, with two arches, which is, therefore, preferable to the common ſextant.

Adjuſtments of the Sextant.

The adjuſtments of a ſextant are, to ſet the mirrors perpendicular to its plane and parallel to each other when the index is at zero, and to ſet the axis of the teleſcope parallel to the plane of the inſtrument. The three firſt of theſe adjuſtments are performed nearly in the ſame manner as directed in the ſection on the quadrant: as however the ſextant is provided with a ſet of coloured glaſſes placed behind the horizon glaſs, the index error may be more accurately determined by meaſuring the ſun's diameter twice, with the index placed alternately before and behind the beginning of the diviſions: half the difference of theſe two meaſures will be the index error, which muſt be added to, or ſubtracted from, all obſervations, according as the diameter meaſured with the index to the left of *o* is leſs or greater than the diameter meaſured with the index to the right of the beginning of the diviſions.

Adjuſtment IV. *To ſet the Axis of the Teleſcope parallel to the Plane of the Inſtrument.*

Turn the eye end of the teleſcope until the two wires are parallel to the plane of the inſtrument; and let two diſtant objects be ſelected, as two ſtars of the firſt magnitude, whoſe diſtance is not leſs than 90° or 100°; make the contact of theſe objects as perfect as poſſible at the wire neareſt the plane of the inſtrument; fix the index in this poſition; move the ſextant till the objects are ſeen at the other wire, and if the ſame points are in contact, the axis of the teleſcope is parallel to the plane of the ſextant; but if the objects are apparently ſeparated, or do partly cover each other, correct half the error by the ſcrews in the circular part of the ſupporter, one of which is above and the other between the teleſcope and ſextant: turn the adjuſting ſcrew at the end of the index till the limbs are in contact; then bring the objects to the wire next the inſtrument; and if the limbs are in contact, the axis of the teleſcope is adjuſted; if not, proceed as at the other wire, and continue till no error remains.

It is ſometimes neceſſary to know the angular diſtance between the wires of the teleſcope; to find which, place the wires perpendicular to the plane of the ſextant, hold the inſtrument vertical, direct the ſight to the horizon, and move the ſextant in its own plane till the horizon and upper wire coincide; keep the ſextant in this poſition, and move the index till the reflected horizon is covered by the lower wire: and the diviſion ſhown by the index of the limb, corrected by the index error, will be the angular diſtance between the wires. Other and better methods will readily occur to the obſerver at land.

Uſe of the Sextant.

When the diſtance between the moon and the ſun or a ſtar is to be obſerved, the ſextant muſt be held ſo that its plane may paſs through the eye of the obſerver and both objects; and the reflected image of the moſt luminous of the two is to be brought in contact with the other ſeen directly. To effect this, therefore, it is evident, that when the brighteſt object is to the right of the other, the face of the ſextant muſt be held upwards; but if to the left, downwards. When the face of the ſextant is held upwards, the inſtrument ſhould be ſupported with the right hand, and the index moved with the left hand. But when the face of the ſextant is from the obſerver, it ſhould be held with the left hand, and the motion of the index regulated by the right hand.

Sometimes a ſitting poſture will be found very convenient for the obſerver, particularly when the reflected object is to the right of the direct one; in this caſe, the inſtrument is ſupported by the right hand, the elbow may reſt on the right knee, the right leg at the ſame time reſting on the left knee.

If the ſextant is provided with a ball and ſocket, and a ſtaff, one of whoſe ends is attached thereto, and the other reſts in a belt faſtened round the body of the obſerver, the greater part of the weight of the inſtrument will by this means be ſupported by his body.

To obſerve the Diſtance between the Moon and any Celeſtial Object.

1. Between the Sun and Moon.

Put the teleſcope in its place, and the wires parallel to the plane of the inſtrument; and if the ſun is very bright, raiſe the plate before the ſilvered part of the ſpeculum; direct the teleſcope to the tranſparent part of the horizon glaſs, or to the line of ſeparation of the ſilvered and tranſparent parts according to the brightneſs of the ſun, and turn down one of the coloured glaſſes; then hold the ſextant ſo that its plane produced may paſs through the ſun and moon, having its face either upwards or downwards according as the ſun is to the right or left of the moon; direct the ſight through the teleſcope to the moon, and move the index till the limb of the ſun is nearly in contact with the enlightened limb of the moon; now faſten the index, and by a gentle motion of the inſtrument make the image of the ſun move alternately paſt the moon; and, when in that poſition where the limbs are neareſt each other, make the coincidence of the limbs perfect by means of the adjuſting ſcrew: this being effected, read off the degrees and parts of a degree ſhown by the index on the limb, uſing the magnifying glaſs; and thus the angular diſtance between the neareſt limbs of the ſun and moon is obtained.

2. Between the Moon and a Star.

Direct the middle of the field of the teleſcope to the line of ſeparation of the ſilvered and tranſparent parts of the horizon glaſs; if the moon is very bright, turn down the lighteſt coloured glaſs; and hold the ſextant ſo that its plane may be parallel to that paſſing through the eye of the obſerver and both objects; its face being upwards if the moon is to the right of the ſtar, but if to the left, the face is to be held from the obſerver; now direct the ſight through the teleſcope to the ſtar, and

Of finding the Longitude at Sea by Lunar Obſervations.

move the index till the moon appears by the reflection to be nearly in contact with the ſtar; faſten the index, and turn the adjuſting ſcrew till the coincidence of the ſtar and enlightened limb of the moon is perfect: and the degrees and parts of a degree ſhown by the index will be the obſerved diſtance between the moon's enlightened limb and the ſtar.

The contact of the limbs muſt always be obſerved in the middle between the parallel wires.

It is ſometimes difficult for thoſe not much accuſtomed to obſervations of this kind, to find the reflected image in the horizon glaſs: it will perhaps in this caſe be found more convenient to look directly to the object, and, by moving the index, to make its image coincide with that ſeen directly.

Sect. III. *Of the Circular Inſtrument of Reflection.*

This inſtrument was propoſed with a view to correct the errors to which the ſextant is liable; particularly the error ariſing from the inaccuracy of the diviſions on the limb. It conſiſts of the following parts; a circular ring or limb, two moveable indices, two mirrors, a teleſcope, coloured glaſſes, &c.

The limb of this inſtrument is a complete circle of metal, and is connected with a perforated central plate by ſix radii: it is divided into 720 degrees; each degree is divided into three equal parts; and the diviſion is carried to minutes by means of the index ſcale as uſual.

The two indices are moveable about the ſame axis, which paſſes exactly through the centre of the inſtrument:—the firſt index carries the central mirror, and the other the teleſcope and horizon glaſs; each index being provided with an adjuſting ſcrew for regulating its motion, and a ſcale for ſhowing the diviſions on the limb.

The central mirror is placed on the firſt index immediately above the centre of the inſtrument, and its plane makes an angle of about 30° with the middle line of the index. The four ſcrews in its pedeſtal for making its plane perpendicular to that of the inſtrument have ſquare heads, and are therefore eaſily turned either way by a key for that purpoſe.

The horizon glaſs is placed on the ſecond index near the limb, ſo that as few as poſſible may be intercepted of the rays proceeding from the reflected object when to the left. The perpendicular poſition of this glaſs is rectified in the ſame manner as that of the horizon glaſs of a ſextant, to which it is ſimilar. It has another motion, whereby its plane may be diſpoſed ſo as to make a proper angle with the axis of the teleſcope, and a line joining its centre, and that of the central mirror.

The teleſcope is attached to the other end of the index. It is an achromatic aſtronomical one, and therefore inverts objects; it has two parallel wires in the common focus of the glaſſes, whoſe angular diſtance is between two and three degrees; and which, at the time of obſervation, muſt be placed parallel to the plane of the inſtrument. This is eaſily done, by making the mark on the eye-piece coincide with that on the tube. The teleſcope is moveable by two ſcrews in a vertical direction with regard to the plane of the inſtrument, but is not capable of receiving a lateral motion.

There are two ſets of coloured glaſſes, each ſet containing four, and differing in ſhade from each other. The glaſſes of the larger ſet, which belongs to the central mirror, ſhould have each about half the degree of ſhade with which the correſpondent glaſs of the ſet belonging to the horizon mirror is tinged. Theſe glaſſes are kept tight in their places by ſmall preſſing ſcrews, and make an angle of about 85° with the plane of the inſtrument; by which means the image from the coloured glaſs is not reflected to the teleſcope. When the angle to be meaſured is between 5° and 34°, one of the glaſſes of the largeſt ſet is to be placed before the horizon glaſs.

Of finding the Longitude at Sea by Lunar Obſervations.

The handle is of wood, and is ſcrewed to the back of the inſtrument, immediately under the centre, with which it is to be held at the time of obſervation.

Fig. 70.

Fig. 70. is a plan of the inſtrument, wherein the limb is repreſented by the divided circular plate; A is the central mirror; *a a*, the places which receive the ſtems *a a* of the glaſs, fig. 73.; EF, the firſt or central index with its ſcale and adjuſting ſcrew; MN, the ſecond or horizon index; GH, the teleſcope; IK, the ſcrews for moving it towards or from the plane of the inſtrument; C, the plane of the coloured glaſs, fig. 72.; and D, its place in certain obſervations.

Fig. 71.

Fig. 71. is a ſection of the inſtrument, wherein the ſeveral parts are referred to by the ſame letters as in fig. 70.: Fig. 72. repreſents one of the horizon coloured glaſſes; and fig. 73. one of the central coloured glaſſes: Fig. 74. is the key for turning the adjuſting ſcrews of the mirrors: Fig. 75. is the handle: Fig. 76. a ſection of one of the radii towards its middle: Fig. 77. is uſed in ſome terreſtrial obſervations for diminiſhing the light of the direct object, whoſe place at the time of obſervation is D: Fig. 78. is the tool for adjuſting the central mirror; and for rectifying the poſition of the teleſcope with regard to the plane of the inſtrument, there is another tool exactly of the ſame ſize. The height of theſe is nearly equal to that of the middle of the central mirror.

Adjuſtments of the Circular Inſtrument.

I. *To ſet the horizon glaſs ſo that none of the rays from the central mirror ſhall be reflected to the teleſcope from the horizon mirror, without paſſing through the coloured glaſs belonging to this laſt mirror.*—Place the coloured glaſs before the horizon mirror; direct the teleſcope to the ſilvered part of that mirror, and make it nearly parallel to the plane of the inſtrument; move the firſt index; and if the rays from the central mirror to the horizon glaſs, and from thence to the teleſcope, have all the ſame degree of ſhade with that of the coloured glaſs uſed, the horizon glaſs is in its proper poſition; otherwiſe the pedeſtal of the glaſs muſt be turned until the uncoloured images diſappear.

II. Place the two adjuſting tools on the limb, about 350° of the inſtrument diſtant, one on each ſide of the diviſion on the left, anſwering to the plane of the central mirror produced: then the eye being placed at the upper edge of the neareſt tool, move the central index till one half only of the reflected image of this tool is ſeen in the central mirror towards the left, and move the other tool till its half to the right is hid by the ſame edge of the mirror; then, if the upper edges of both tools are apparently in the ſame ſtraight line,

Of finding the Longitude at Sea by Lunar Obſervations.

the central mirror is perpendicular to the plane of the inſtrument; if not, bring them into this poſition by the ſcrews in the pedeſtal of the mirror.

III. *To ſet the horizon mirror perpendicular to the plane of the inſtrument.*—The central mirror being previouſly adjuſted, direct the ſight through the teleſcope to any well-defined diſtant object; then if, by moving the central index, the reflected image paſſes exactly over the direct object, the mirror is perpendicular; if not, its poſition muſt be rectified by means of the ſcrews in the pedeſtal of the glaſs.

A planet, or ſtar of the firſt magnitude, will be found a very proper object for this purpoſe.

IV. *To make the line of collimation parallel to the plane of the inſtrument.*—Lay the inſtrument horizontally on a table; place the two adjuſting tools on the limb, towards the extremities of one of the diameters of the inſtrument; and at about 15 or 20 feet diſtant let a well defined mark be placed, ſo as to be in the ſame ſtraight line with the tops of the tools; then raiſe or lower the teleſcope till the plane, paſſing through its axis and the tops of the tools, is parallel to the plane of the inſtrument, and direct it to the fixed object; turn either or both of the ſcrews of the teleſcope till the mark is apparently in the middle between the wires; then is the teleſcope adjuſted; and the difference, if any, between the diviſions pointed out by the indices of the ſcrews will be the error of the indices. Hence this adjuſtment may in future be eaſily made.

In this proceſs the eye tube muſt be ſo placed as to obtain diſtinct viſion.

V. *To find that diviſion to which the ſecond index being placed the mirrors will be parallel, the central index being at zero.*—Having placed the firſt index exactly to *o*, direct the teleſcope to the horizon mirror, ſo that its field may be biſected by the line of ſeparation of the ſilvered and tranſparent parts of that mirror; hold the inſtrument vertically, and move the ſecond index until the direct and reflected horizons agree; and the diviſion ſhown by the index will be that required.

This adjuſtment may be performed by meaſuring the ſun's diameter in contrary directions, or by making the reflected and direct images of a ſtar or planet to coincide.

Uſe of the Circular Inſtrument.

To obſerve the Diſtance between the Sun and Moon.

I. The ſun being to the right of the moon.

Set a proper coloured glaſs before the central mirror, if the diſtance between the objects is leſs than 35°; but if above that quantity, place a coloured glaſs before the horizon mirror: make the mirrors parallel, the firſt index being at *o*, and hold the inſtrument ſo that its plane may be directed to the objects, with its face downwards, or from the obſerver: direct the ſight through the teleſcope to the moon; move the ſecond index, according to the order of the diviſions on the limb, till the neareſt limbs of the ſun and moon are almoſt in contact: faſten that index, and make the coincidence of the limbs perfect by the adjuſting ſcrew belonging thereto: then invert the inſtrument, and move the central index towards the ſecond by a quantity equal to twice the arch paſſed over by that index: direct the plane of the inſtrument to the objects: look directly to the moon, and the ſun will be ſeen in the field of the teleſcope: faſten the central index, and make the contact of the ſame two limbs exact by means of the adjuſting ſcrew: Then half the angle ſhown by the central index will be the diſtance between the neareſt limbs of the ſun and moon.

Of finding the Longitude at Sea by Lunar Obſervations.

II. The ſun being to the left of the moon.

Hold the inſtrument with its face upwards, ſo that its plane may paſs through both objects; direct the teleſcope to the moon, and make its limb coincide with the neareſt limb of the ſun's reflected image, by moving the ſecond index: now put the inſtrument in an oppoſite poſition; direct its plane to the objects, and the ſight to the moon, the central index being previouſly moved towards the ſecond by a quantity equal to twice the meaſured diſtance; and make the ſame two limbs that were before obſerved coincide exactly, by turning the adjuſting ſcrew of the firſt index: then half the angle ſhown by the firſt index will be the angular diſtance between the obſerved limbs of the ſun and moon. This inſtrument has of late been greatly improved by Captain Mendoza.

To obſerve the Angular Diſtance between the Moon and a Fixed Star or Planet.

I. The ſtar being to the right of the moon.

In this caſe the ſtar is to be conſidered as the direct object; and the enlightened limb of the moon's reflected image is to be brought in contact with the ſtar or planet, both by a direct and inverted poſition of the inſtrument, exactly in the ſame manner as deſcribed in the laſt article. If the moon's image is very bright, the lighteſt tinged glaſs is to be uſed.

II. The ſtar being to the left of the moon.

Proceed in the ſame manner as directed for obſerving the diſtance between the ſun and moon, the ſun being to the right of the moon, uſing the lighteſt tinged glaſs, if neceſſary.

SECT. IV. *Of the Method of determining the Longitude from Obſervation.*

PROB. I. To convert degrees or parts of the equator into time.

RULE. Multiply the degrees and parts of a degree by 4, beginning at the loweſt denomination, and the product will be the correſponding time. Obſerving that minutes multiplied by 4 produce ſeconds of time, and degrees multiplied by 4 give minutes.

Ex. 1. Let 26° 45′ be reduced to time.

26° 45′
4
1h 47′ 0″=time required.

Ex. 2. Reduce 83° 37′ to time.

83° 37′
4
Correſponding time = 5 34 28

PROB. II. To convert time into degrees.

RULE. Multiply the given time by 10, to which add the half of the product. The ſum will be the correſponding degrees.

Ex.

NAVIGATION.

Fig. 1.

Fig. 2.

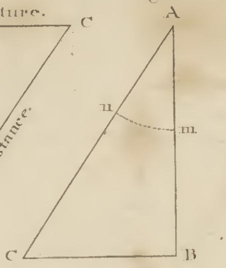


Fig. 3.

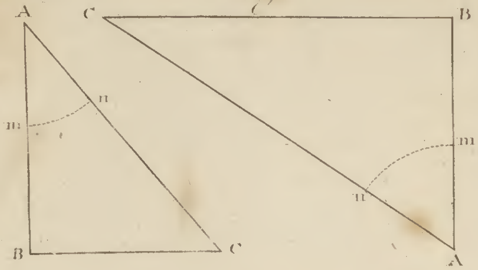


Fig. 4.

Fig. 5.

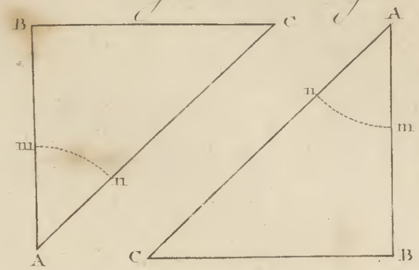


Fig. 6.

Fig. 7.

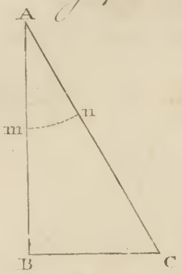


Fig. 8.

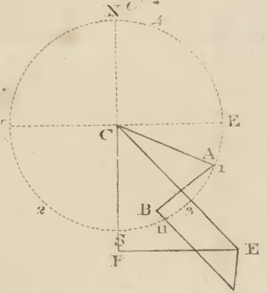


Fig. 9.

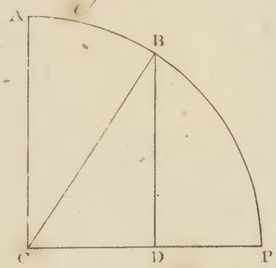


Fig. 10.

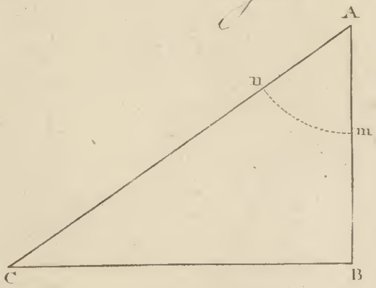


Fig. 11.

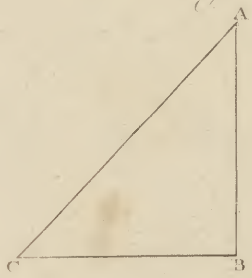


Fig. 12.

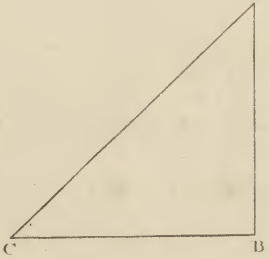


Fig. 13.

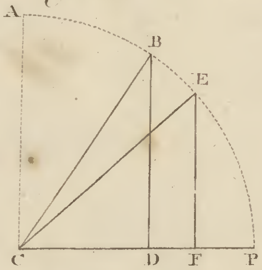


Fig. 14.

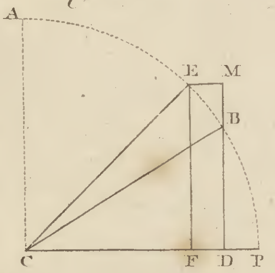


Fig. 15.

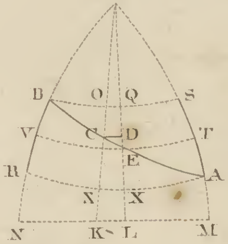


Fig. 16.

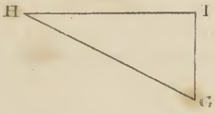


Fig. 17.

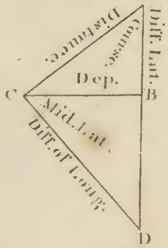


Fig. 18.

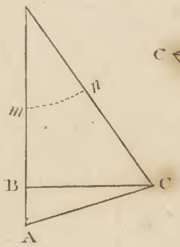


Fig. 19.

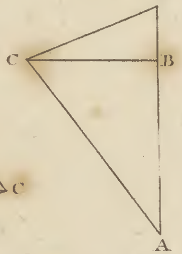


Fig. 20.

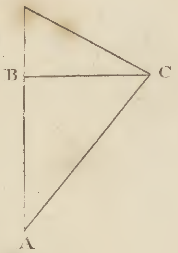


Fig. 21.

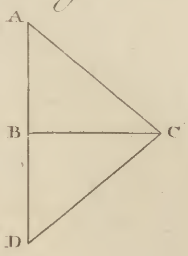


Fig. 22.

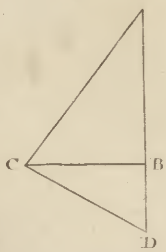


Fig. 23.

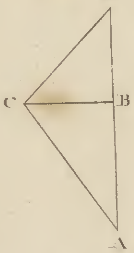


Fig. 24.

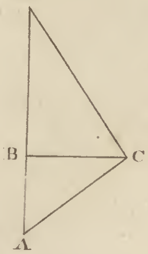
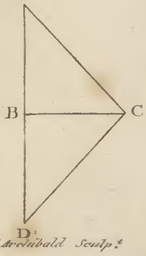


Fig. 25.



W. Archibald Sculp.

NAVIGATION.

PLATE CCCLXIV.

Fig. 26.

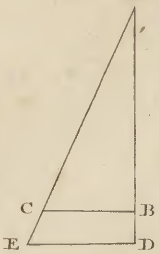


Fig. 27.

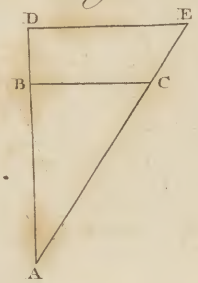


Fig. 28.

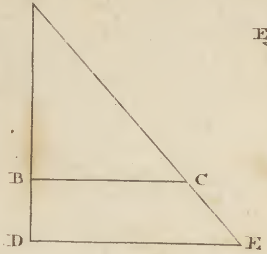


Fig. 29.

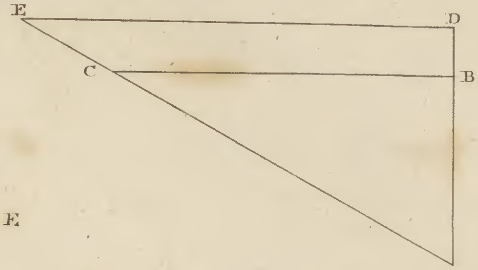


Fig. 30.

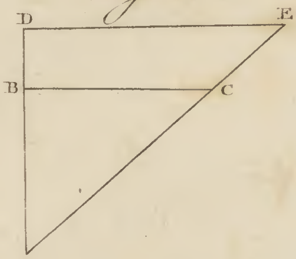


Fig. 31.

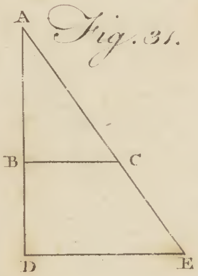


Fig. 32.

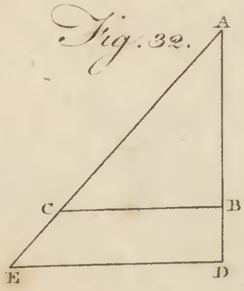


Fig. 33.

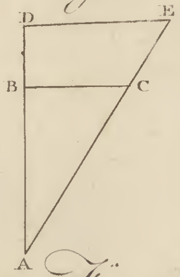


Fig. 34.

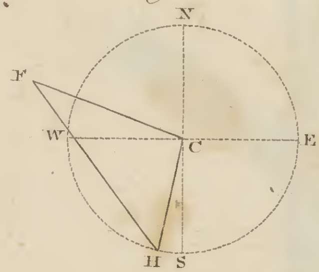


Fig. 35.

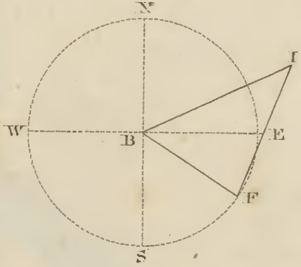


Fig. 36.

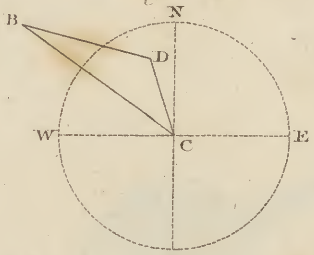


Fig. 37.

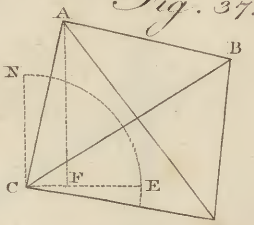


Fig. 38.

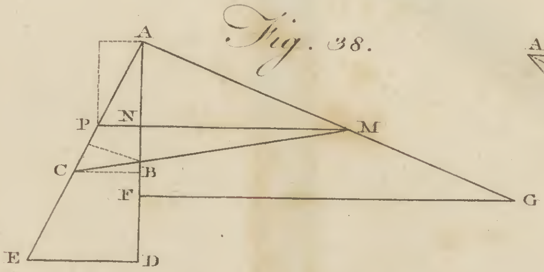


Fig. 39.

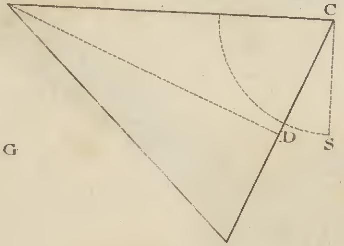


Fig. 40.

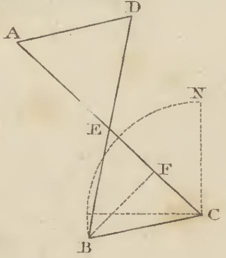


Fig. 41.

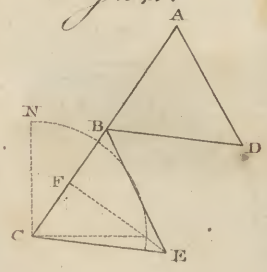


Fig. 42.

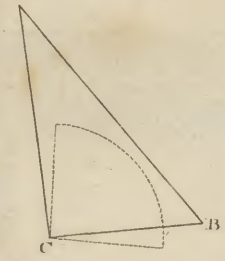


Fig. 43.

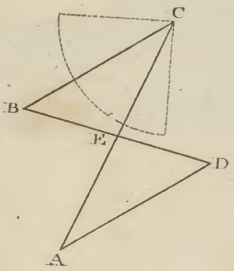
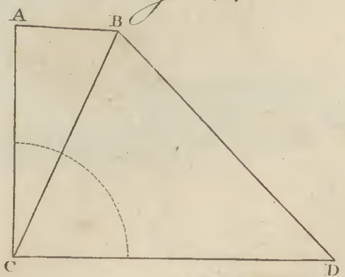


Fig. 44.



W. Archibald Sculp.t

Fig. 45.

Fig. 46.

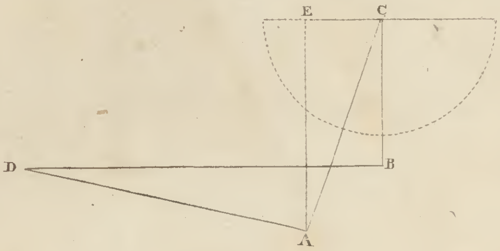


Fig. 47.

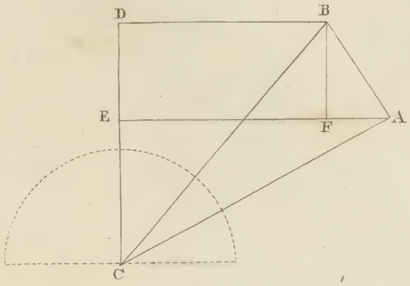


Fig. 48.

Fig. 49.

Fig. 50.

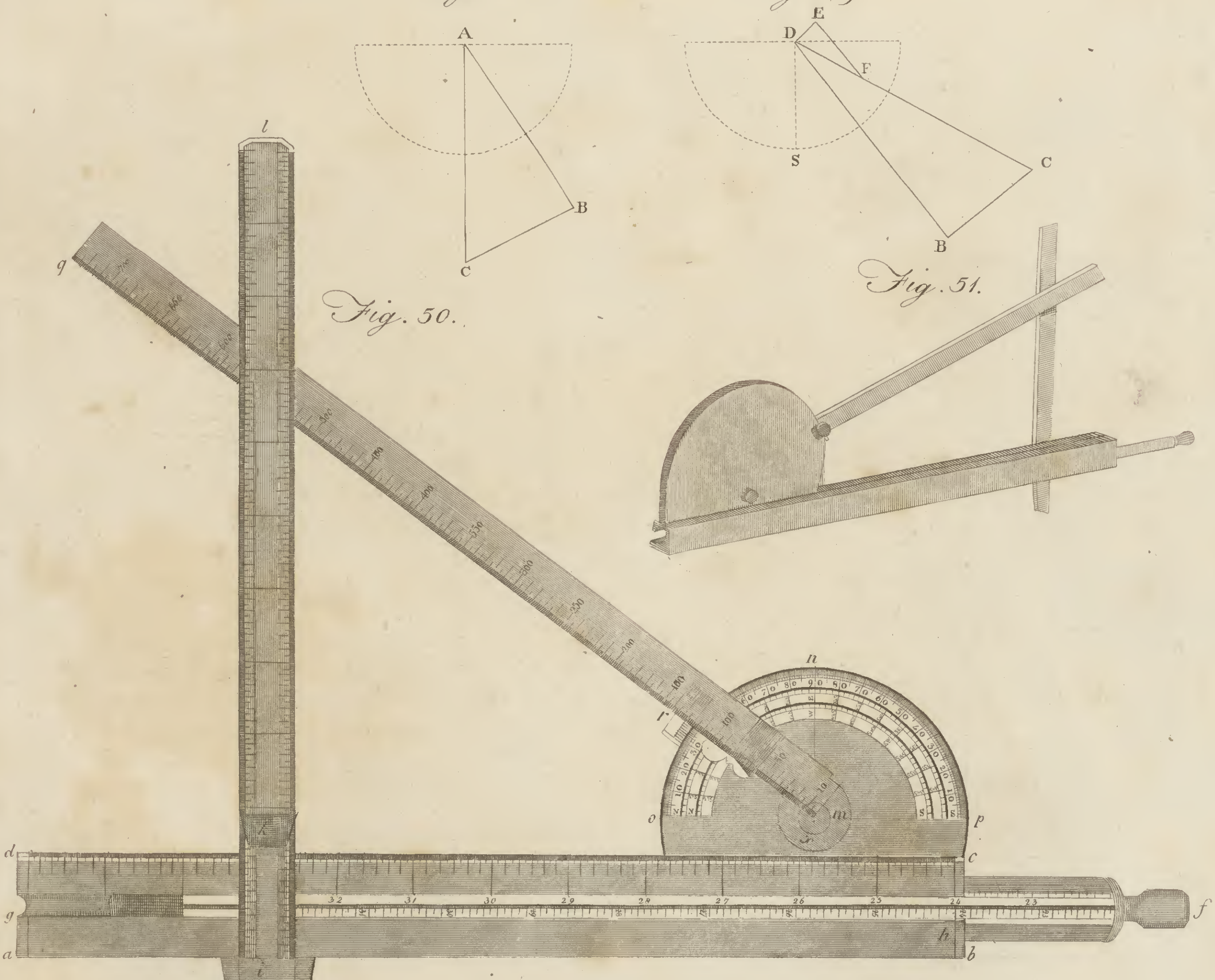


Fig. 51.

W. Archibald Sculp.t

Fig. 53.

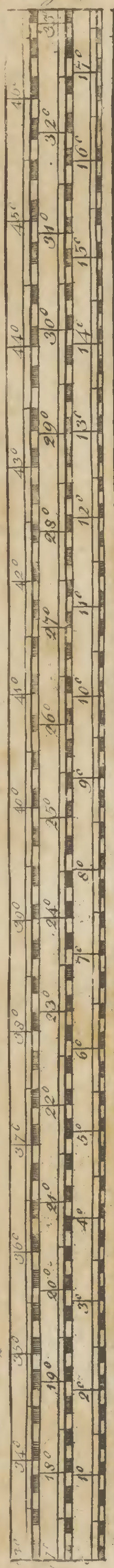
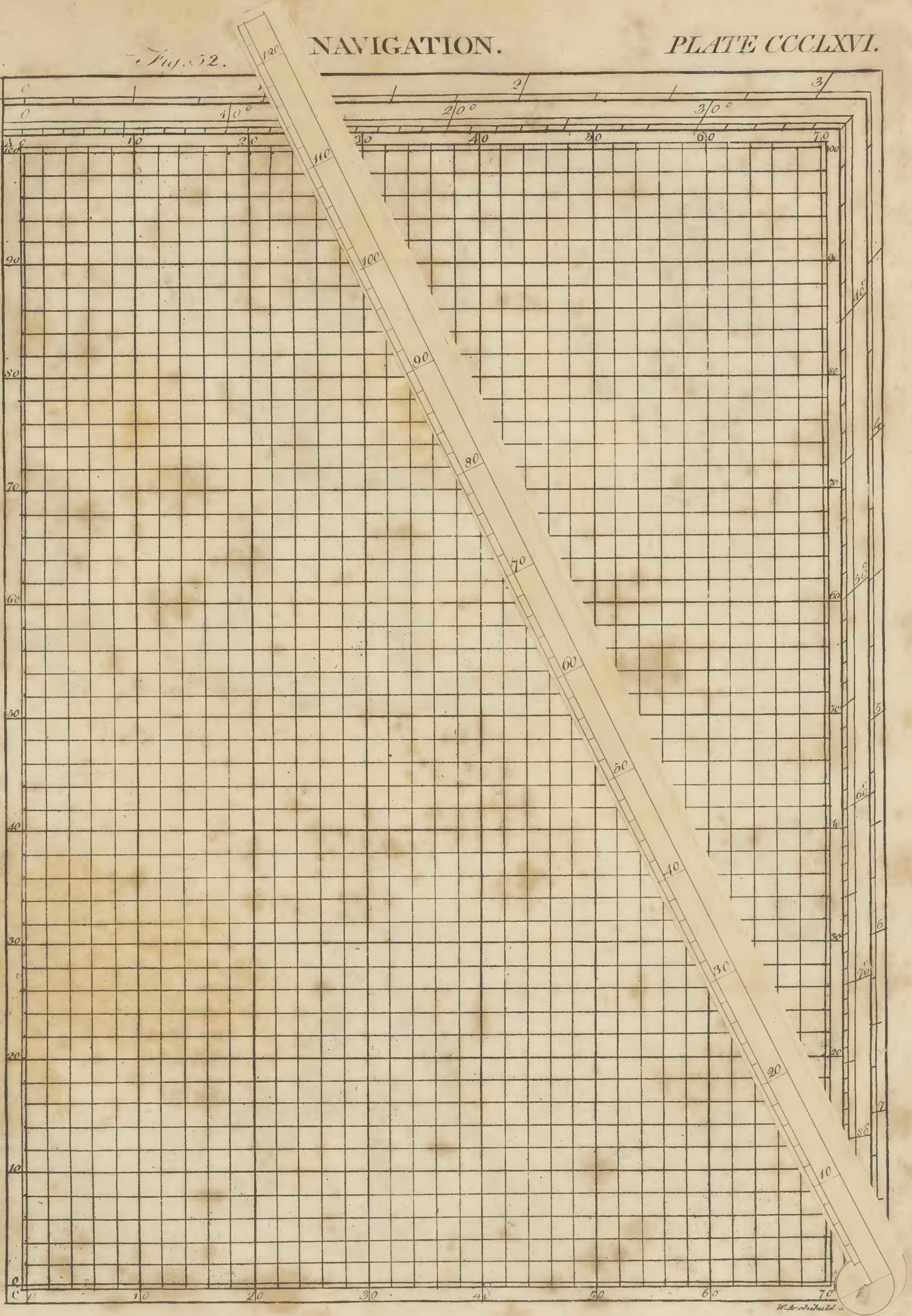


Fig. 52.



W. Archibald sc.

NAVIGATION. *PLATE CCCLXVII.*

Fig. 55

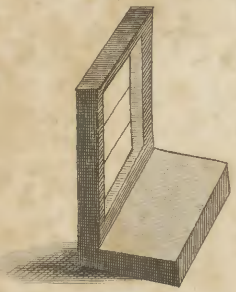


Fig. 54

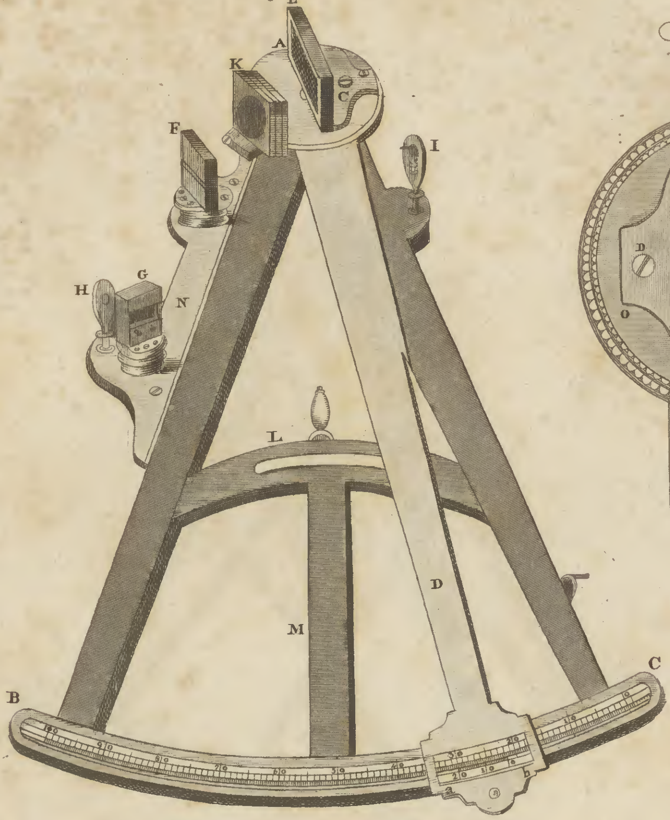


Fig. 59

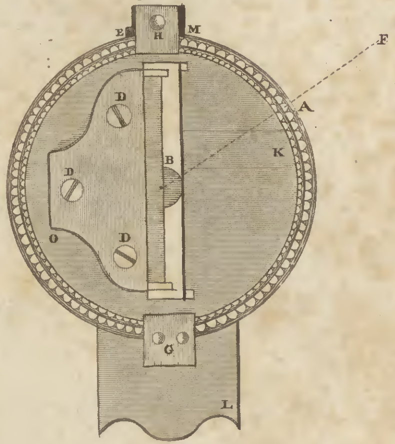


Fig. 56

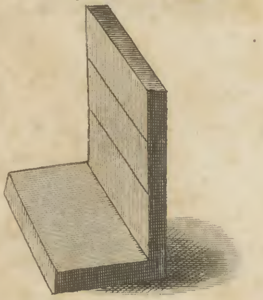


Fig. 57

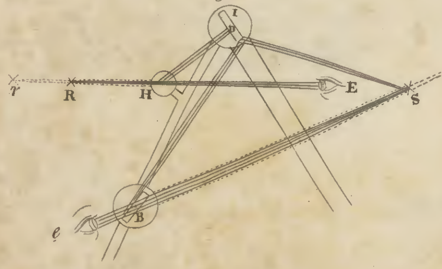


Fig. 60

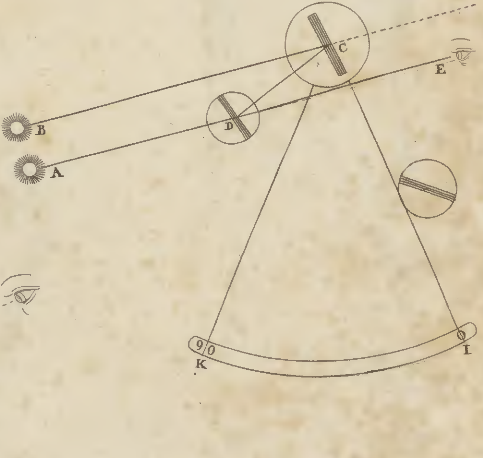
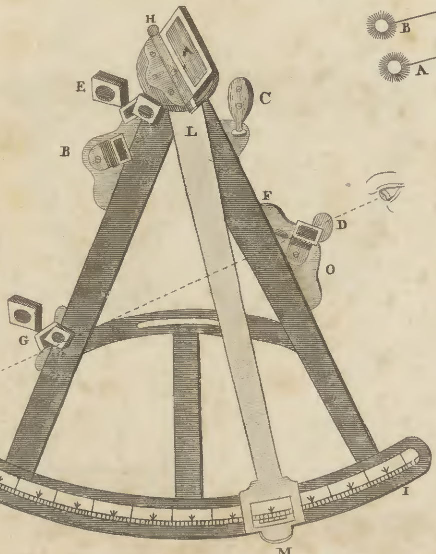


Fig. 58



W. Archibald Sculp.t

NAVIGATION.

PLATE CCCLXVIII.

Fig. 61

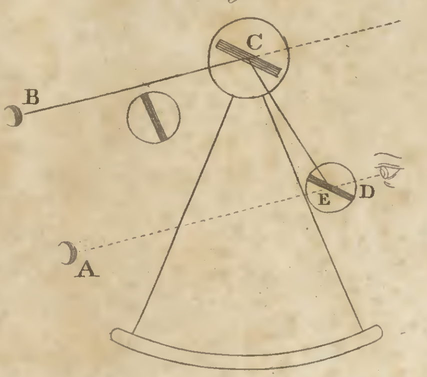


Fig. 62

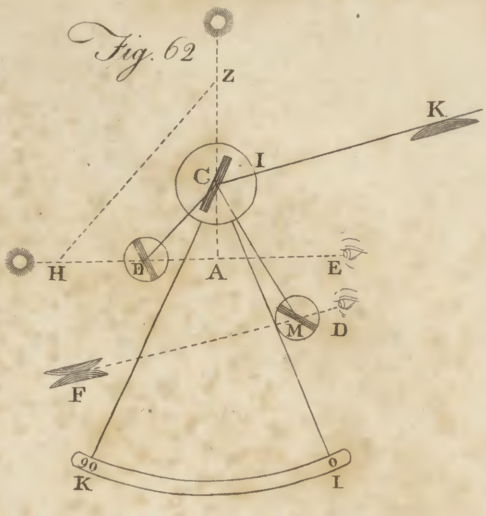


Fig. 63

Fig. 64

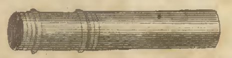


Fig. 67

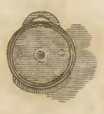


Fig. 65

Fig. 68

Fig. 66

Fig. 69

Fig. 75

Fig. 70

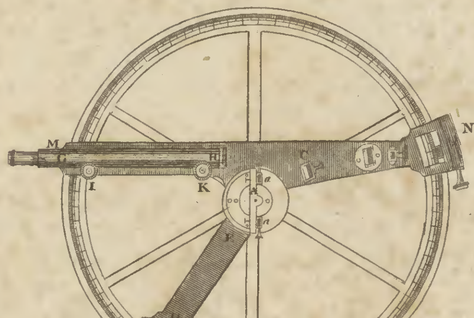


Fig. 72

Fig. 76

Fig. 73

Fig. 77

Fig. 71

Fig. 74

Fig. 78

W. Archibald Sculp.

Of finding the Longitude at Sea by Lunar Obſervations.

Ex. 1. Let 3h 4′ 28″ be reduced to degrees.

3h	4′	28″
		10
30	44	40
Half = 15	22	20
Correſponding deg. = 46	7	0

Ex. 2. Reduce 8h 42′ 36″ to degrees.

8h	42′	36″
		10
87	6	0
43	33	0
Anſwer. 130	39	0

Prob. III. Given the time under any known meridian, to find the correſponding time at Greenwich.

Rule. Let the given time be reckoned from the preceding noon, to which the longitude of the place in time is to be applied by addition or ſubtraction, according as it is eaſt or weſt; and the ſum or difference will be the correſponding time at Greenwich.

Ex. 1. What time at Greenwich anſwers to 6h 15′ at a ſhip in longitude 76° 45′ W?

Time at ſhip	6h	15′
Longitude in time	5	7 W.
Time at Greenwich	11	22

Ex. 2. Required the time at Greenwich anſwering to 5h 46′ 39″ of May 1ſt, at Canton, whoſe longitude is 113° 2′ 15″ E?

Time at Canton, May 1ſt,	5h	46′	39″
Longitude in time	7	32	9 E
Time at Greenwich, April 30.	22	14	30

Prob. IV. To reduce the time at Greenwich to that under any given meridian.

Rule. Reckon the given time from the preceding noon, to which add the longitude in time if eaſt, but ſubtract it if weſt; and the ſum or remainder will be the correſponding time under the given meridian.

Ex. 1. What is the expected time of the beginning of the lunar eclipſe of February 25. 1793, at a ſhip in longitude 109° 48′ E?

Beg. of eclipſe at Greenwich per Naut. Alm.	9h	23′	45′
Ship's longitude in time	7	19	12
Time of beginning of eclipſe at ſhip,	16	42	57

Ex. 2. At what time may the immerſion of the firſt ſatellite of Jupiter be obſerved at Port St Julian, in longitude 68° 44′ W, which, by the Nautical Almanack, happens at Greenwich 24th March 1792, at 17h 53′ 1″?

App. time of immerſion at Greenwich	17h	53′	1″
Longitude of Port St Julian in time	4	34	56 W.
App. time of immer. at Port St Julian	13	18	5

Prob. V. To find the equation of equal altitudes.

Rule. To the coſecant of half the interval of time in degrees add the tangent of the latitude, and to the cotangent of half the interval add the tangent of the declination. Now if the latitude and declination be of a contrary name, add the correſponding natural numbers; but if of the ſame name, ſubtract them.— Then to the ar. co. log. of this ſum or difference add the proportional logarithm of one-fourth of the interval expreſſed in time, and the proportional logarithm of the daily variation of declination; the ſum will be the proportional logarithm of the equation of equal altitudes in minutes and ſeconds, which are to be eſteemed ſeconds and thirds.

Of finding the Longitude at Sea by Lunar Obſervations.

Example. Let the latitude of the place of obſervation be 57° 9′ N, the interval of time between the obſervations of the equal altitudes 5h 17′, the ſun's declination 17° 48′ S, and the daily change of declination 16′ 19″½: Required the equation of equal altitudes?

Half the interval = 2h 38′½ = 39° 37′.

½ int. = 39° 37′ coſt.	0.19542	cotang.	0.08209
Lat. 57 9 tan.	0.18997	dec. 17° 48′ ta.	9.50659
	0.38539	2.4288	
		3879	9.58868
Sum - - -		2.8167	ar.co.lo.9.5503
One fourth interval -		1h 19′ 15″	P.L.0.3563
Daily variation of declination		16′ 19″½	P.L.1.0424
Equation of equal altitudes		20″ 14‴	P.L.0.9490

Prob. VI. To find the error of a watch by equal altitudes of the ſun.

Rule. In the morning, when the ſun is more than two hours diſtant from the meridian, let a ſet of obſervations be taken, conſiſting, for the ſake of greater accuracy, of at leaſt three altitudes, which, together with the correſponding times per watch, are to be wrote regularly, the time of each obſervation being increaſed by 12 hours. In the afternoon, obſerve the inſtants when the ſun comes to the ſame altitudes, and write down each oppoſite to its reſpective altitude. Now half the ſum of any two times anſwering to the ſame altitude will be the time of noon per watch uncorrected. Find the mean of all the times of noon thus deduced from each correſponding pair of obſervations, to which the equation of equal altitudes is to be applied by addition or ſubtraction according as the ſun is receding from or approaching to the elevated pole, and the ſum or difference will be the time per watch of apparent noon, the difference between which and noon will be the error of the watch for apparent time; and the watch will be faſt or ſlow according as the time of noon thereby is more or leſs than 12 hours.

Example. January 29. 1786, in lat. 57° 9′ N, the following equal altitudes of the ſun were obſerved: Required the error of the watch?

Alt. = 8°	5′	Time 21h	35′	8″ A.M.		2h	55′	43″ P.M.
8	10	-	36	8	-		54	42
8	20	-	38	9	-		52	41.2
8	25	-	39	12.5	-		51	38
				37.5				4.2
		21	37	9.37		2	53	41.05
						21	37	9.37
Sum - - - -						24	30	50.42
Time of noon per watch uncorrected						12	15	25.2
Equation of equal altitudes -						=0	0	20.2
Time per watch of apparent noon						12	15	5
Watch faſt - - -							15	5

The

Of finding the Longitude at Sea by Lunar Obſervations.

The mean time of noon per watch is found by applying the equation of time with a contrary ſine.

In practice it will be found convenient to put the index of the quadrant to a certain diviſion, and to wait till either limb of the ſun attains that altitude.

Prob. VII. Given the latitude of a place, the altitude and declination of the ſun, to find the apparent time, and the error of the watch.

Rule. If the latitude and declination are of different names, let their ſum be taken; otherwiſe, their difference. From the natural coſine of this ſum or difference ſubtract the natural ſine of the corrected altitude, and find the logarithm of the remainder; to which add the log. ſecants of the latitude and declination: the ſum will be the log. riſing of the horary diſtance of the object from the meridian, and hence the apparent time will be known.

Ex. 1. September 15. 1792, in latitude 33° 56′ S, and longitude 18° 22′ E, the mean of the times per watch was 8h 12′ 10″ A. M. and that of the altitudes of the ſun's lower limb 24° 48′; height of the eye 24 feet. Required the error of the watch?

Obſ. alt. Sun's lower limb	24° 48′	Sun's declin. at noon per Nautical Almanack		2° 40′.5 S
Semidiameter	+ 16.0	Equation to 3h 48 A. M.		+ 3.7
Dip	— 4.7	to 18° 22′ Eaſt		+ 1.2
Correction	— 1.9	Reduced declination		2 45.4 S
True altitude Sun's centre	24 57.4			
Latitude	33 56	ſecant		0.08109
Declination	2 45.4	ſecant		0.00050
Sum	36 41.4	nat. coſine	80188	
Sun's altitude	24 57.4	nat. ſine	42193	
		Difference	37995	log. 4.57973
Sun's meridian diſtance	3h 48′ 51″	riſing		4.66132
Apparent time	8 11 9			
Time per watch	8 12 10			
Watch faſt	1 1			

Ex. 2. May 6. 1793, in latitude 56° 4′ N, and longitude 38° 30′ W, at 4h 37′ 4″ P. M. per watch the altitude of the ſun's lower limb was 25° 6′.1, and height of the eye 18 feet. Required the error of the watch for apparent time?

Altitude ſun's lower limb	= 25° 6′.1	Sun's declin. per Nautical Almanack		16° 44′.3
Semidiameter	+ 15.9	Equation to 4h 37′ P. M.		+ 3.4
Dip	— 4.1	to 38° 30′ W.		+ 1.8
Correction	— 1.9	Reduced declination		16 49.5
True alt. ſun's centre	25 16.0			
Latitude	56 4.0 N.	ſecant		0.25319
Declination	16 49.5 N.	ſecant		0.01900
Difference	39 14.5	nat. coſine	77448	
Sun's altitude	25 16.0	nat. ſine	42683	
		Difference	34765	4.54114
Apparent time	4h 38′ 12″	riſing		4.81333
Time per watch	4 37 4			
Watch ſlow	1 8			

Prob. VIII. Given the latitude of a place, the altitude of a known fixed ſtar, and the ſun's right aſcenſion, to find the apparent time of obſervation and error of the watch.

Rule Correct the obſerved altitude of the ſtar, and reduce its right aſcenſion and declination to the time of obſervation.

With the latitude of the place, the true altitude and declination of the ſtar, compute its horary diſtance from the meridian by laſt problem; which being added to, or ſubtracted from, its right aſcenſion, according as it was obſerved in the weſtern or eaſtern hemiſphere, the ſum or remainder will be the right aſcenſion of the meridian.

From the right aſcenſion of the meridian ſubtract the ſun's right aſcenſion, as given in the Nautical Almanack

Of finding the Longitude at Sea by Lunar Obſervations.

nack for the noon of the given day; and the remainder will be the approximate time of obſervation; from which ſubtract the proportional part of the daily variation of right aſcenſion anſwering thereto, and let the proportional part anſwering to the longitude be added or ſubtracted, according as the longitude is eaſt or weſt, and the reſult will be the apparent time of obſervation; and hence the error of the watch will be known.

Ex. 1. December 12. 1792, in lat. 37° 46′ N, and longitude 21° 15′ E, the altitude of Arcturus eaſt of the meridian was 34° 6′.4, the height of the eye 10 feet. Required the apparent time of obſervation?

Obſerved alt. of Arcturus	34° 6′.4		
Dip and refraction -	— 4.4		
True altitude -	34 2.0		
Latitude -	37 46.0 N	- ſec.	0.10209
Declination -	20 14.4 N	- ſec.	0.02778
Difference	17 31.6	N. co. 95358	
Altitude of Arcturus	34 2.0	N. ſine 55968	
	Difference	39390	4.59539
Arcturus's merid. diſt.	4h 8′ 10″	- riſing	4.72526
right aſ. -	14 6 13		
Right aſ. of merid.	9 58 3		
Sun's right aſ. -	17 21 59		
Approximate time	16 36 4		
Eq. to approx. time	— 3 3		
Eq. to longitude	+ 16		
Ap. time of obſ.	16 33 17		

Ex. 2. January 29. 1792, in latitude 53° 24′ N, and longitude 25° 18′ W, by account, at 14h 58′ 38″, the altitude of Procyon weſt on the meridian was 19° 58′; height of the eye 20 feet. Required the error of the watch?

Obſ. alt. of Procyon	19° 58′		
Dip and refraction	7		
True altitude -	19 51		
Latitude -	53 24	- ſecant -	0.22459
Declination -	5 45	- ſecant -	0.00219
Difference -	47 39	nat. coſ. 67366	
Altitude of Procyon	19 51	nat. ſine 33956	
		Difference 33410	4.52388
Procyon's merid. diſt.	4h 16′ 24″	riſing	4.75066
right aſ. -	7 28 24		
Right aſ. of merid.	11 44 48		
Sun's right aſ. -	20 47 22		
Approximate time	14 57 26		
Eq. to ap. time	—0 2 36		
Eq. to long. -	— 0 17		
Apparent time -	14 54 33		
Time per watch -	14 58 38		
Watch faſt -	0 4 5		

Prob. IX. Given the altitude of the moon, the latitude of a place, and the apparent time at Greenwich; to find the apparent time at the place of obſervation.

Rule. Correct the altitude of the moon's limb by Problem V. p. 731, and reduce its right aſcenſion and declination, and the ſun's right aſcenſion, to the Greenwich time of obſervation. Now with the latitude of the place, the declination and altitude of the moon, compute its meridian diſtance as before: Which being applied to its right aſcenſion by addition or ſubtraction, according as it is in the weſtern or eaſtern hemiſphere, will give the right aſcenſion of the meridian. Then the ſun's right aſcenſion ſubtracted from the right aſcenſion of the meridian, will give the apparent time of obſervation.

Example. March 3. 1792, in latitude 51° 38′ N, at 11h 29′ 7″ P. M. per watch, the altitude of the moon's lower limb was 37° 31′, the height of the eye being 10 feet, and the time at Greenwich 13h 43′. Required the error of the watch?

Moon's right aſcenſion at Green. time -	7h 22′ 54″
declination - -	17 0 N
Sun's right aſcenſion - -	23h 2′ 0″

Altitude of the moon's lower limb	=37° 31′		
Semidiameter - -	+ 15		
Dip - - -	— 3		
Correction - -	+ 42		
Corrected alt. of moon's centre	38 25		
Latitude - -	51 38 N	- ſecant - -	0.20712
Declination - -	17 0 N	- ſecant - -	0.01940
Difference - -	34 38	Nat. coſine 82281	
Moon's altitude - -	38 25	Nat. ſine 62138	
		Difference 20143	4.30412
Moon's meridian diſtance -	3° 14′ 36″	riſing - - -	4.53064
right aſcenſion -	7 22 54		
Right aſcenſion of meridian	10 37 30		
Sun's right aſcenſion -	23 2 0		
Apparent time at ſhip -	11 35 30		
Time per watch -	11 29 7		
Watch ſlow - -	23		

Of finding the Longitude at Sea by Lunar Obſervations.

Prob.

Of finding the Longitude at Sea by Lunar Obſervations.

Prob. X. Given the apparent diſtance between the moon and the ſun or a fixed ſtar, to find the true diſtance.

Rule. To the logarithmic difference anſwering to the moon's apparent altitude and horizontal parallax, add the logarithmic ſines of half the ſum, and half the difference of the apparent diſtance and difference of the apparent altitudes; half the ſum will be the logarithmic coſine of an arch: now add the logarithm ſines of the ſum and difference of this arch, and half the difference of the true altitudes, and half the ſum will be the logarithmic coſine of half the true diſtance.

Of finding the Longitude at Sea by Lunar Obſervations.

Example. Let the apparent altitude of the moon's centre be 48° 22′, that of the ſun's 27° 43′, the apparent central diſtance 81° 23′ 40″, and the moon's horizontal parallax 58′ 45″. Required the true diſtance?

Apparent altitude ſun's centre	27° 43′ 0″
Correction	— 1 40
Sun's true altitude	27 41 20
Sun's apparent altitude	27 43
Moon's apparent altitude	48 22
Difference	20 39
Apparent diſtance	81 23 40
Sum	102 2 40
Difference	60 44 40
Half difference true altitudes	10 39 33
Arch	51 27 29
Sum	62 7 2
Difference	40 47 56
	40 32 16
	2
True diſtance	81 4 32

Apparent altitude moon's centre			48° 22′ 0″
Correction			+ 38 26
Moon's true altitude			49 0 26
Sun's true altitude			27 41 20
Difference			21 19 6
Half			10 39 33
Logarithmic difference			9·994638
Half	51° 1′ 20″	Sine	9·890639
Half	30 22 20	Sine	9·703820
			19·589097
		coſine	9·794548
		ſine	9·946417
		ſine	9·815183
			19·761600
		coſine	9·880800

Prob. XI. To find the time at Greenwich anſwering to a given diſtance between the moon and the ſun, or one of the ſtars, uſed in the Nautical Almanack.

Rule. If the given diſtance is found in the Nautical Almanack oppoſite to the given day of the month, or to that which immediately precedes or follows it, the time is found at the top of the page. But if this diſtance is not found exactly in the ephemeris, ſubtract the prop. log. of the difference between the diſtances which immediately precede and follow the given diſtance from the prop. log. of the difference between the given and preceding diſtances; the remainder will be the prop. log. of the exceſs of the time correſponding to the given diſtance, above that anſwering to the preceding diſtance: And hence the apparent time at Greenwich is known.

Example. September 21. 1792, the true diſtance between the centres of the ſun and moon was 68° 13′ 8″. Required the apparent time at Greenwich?

Given diſtance	68° 13′ 8″		
Diſt. at ix. hours	67 53 27	Diff.=0° 19′ 41″	P. log. 9612
Diſt. at xii. hours	69 30 6	Diff.=1 36 39	P. log. 2701
Exceſs		0 36 39	P. log. 6911
Preceding time		9 0 0	
App. time at Greenwich		9 36 39	

Prob. XII. The latitude of a place and its longitude by account being given, together with the diſtance between, and the altitude of the moon and the ſun, or one of the ſtars in the Nautical Almanack; to find the true longitude of the place of obſervation.

Rule. Reduce the eſtimate time of obſervation to the meridian of Greenwich by Problem III. and to this time, take from the Nautical Almanack, page 7. of the month, the moon's horizontal parallax and ſemidiameter. Increaſe the ſemidiameter by the augmentation anſwering to the moon's altitude.

Find the apparent and true altitudes of each object's centre, and the apparent central diſtance; with which compute the true diſtance by Problem X. and find the apparent time at Greenwich anſwering thereto by the laſt problem.

If the ſun or ſtar be at a proper diſtance from the meridian at the time of obſervation of the diſtance, compute the apparent time at the ſhip. If not, the error of the watch may be found from obſervations taken either before or after that of the diſtance; or the apparent time may be inferred from the moon's altitude taken with the diſtance, by Problem IX.

The difference between the apparent times of obſervation at the ſhip and Greenwich, will be the longitude of the ſhip in time; which is eaſt or weſt according as the time at the ſhip is later or earlier than the Greenwich time.

Ex. 1. March 17. 1792, in latitude 34° 53′ N, and longitude by account 27° W, about 9h. A. M. the diſtance between the neareſt limbs of the ſun and moon was 68° 3′¼; the altitude of the ſun's lower limb 33° 18′; that

Of finding the Longitude at Sea by Lunar Obſervations.

that of the moon's upper limb 31° 3′; and the height of the eye 12 feet. Required the true longitude of the ſhip?

Time at ſhip - -	9h 0′	A. M
Longitude in time -	1 48	
Reduced time - -	10 48	A. M
Altitude moon's upper limb	31 3 0	
Aug. ſemidiameter -	— 16 10	
Dip - - -	— 3 18	
Apparent altitude -	30 43 23	
Correction - -	+ 49 26	
Moon's true altitude -	31 32 49	

Diſt. ſun and moon's neareſt limbs -	68° 3′ 15″
Sun's ſemidiameter - -	+ 16 6
Moon's ſemidiameter - -	+ 16 10
Augmentation - - -	+ 0 9
Apparent central diſtance - -	68 35 40
Altitude ſun's lower limb - -	33 18
Sun's ſemidiameter - -	+ 16 6
Dip - - -	— 3 18
Sun's apparent altitude - -	33 30 48
Correction - - - -	−0 1 19
Sun's true altitude - - -	33 29 29
Moon's true altitude - - -	31 32 49
Difference - - -	1 56 40
Half - - - - -	0 58 20

Sun's apparent altitude -	33° 30′ 48″				
Moon's apparent altitude	30 43 23				
Difference - -	2 47 25				
Apparent diſtance -	68 35 40	Logarithmic difference - -			9.996336
Sum - - -	71 23 5	Half -	35° 41′ 32″$\frac{1}{2}$	Sine	9.765991
Difference - -	65 48 15	Half -	32 54 7$\frac{1}{2}$	Sine	9.734964
Half difference true altitudes	0 58 20				19.497291
Arch - - -	55 54 12			Coſine	9.748645
Sum - - -	56 52 32			Sine	9.922977
Difference - -	54 55 52			Sine	9.912998
					19.835975
Half true diſtance -	34 6 53 2			Coſine	9.917987
True diſtance -	68 13 46				
Diſtance at XXI hours -	69 11 20	Difference	0° 57′ 34″	P. log. -	4951
Diſtance at noon -	67 32 38	Difference	1 38 42	P. log. -	2610
Proportional part - - - -		-	1 45 0	Per log. -	2341
Preceding time - - - -		-	21 0 0		
Apparent time at Greenwich - - -			22 45 0		
Latitude -	34° 53′ .0 N	Secant - - -		- -	0.08602
Declination -	0 57 .9 S	Secant - - -		-	0.00006
Sum - -	35 50 .9	Nat. coſine -	81057		
Sun's altitude -	33 29 .5	Nat. ſine -	55181		
Difference - - - -		-	25876	- -	4.41291
Time from noon -	3h 7′ 13″	- -		Riſing - -	4.49899
Apparent time -	20 52 47				
App. time at Green.	22 45 0				
Longitude in time	1 52 13=28° 3′$\frac{1}{4}$ W.				

Of finding the Longitude at Sea by Lunar Obſervations.

Example 2. September 2. 1792, in latitude 13° 57′ N, and longitude by account 56° E, ſeveral obſervations of the moon and Altair were taken; the mean of the times per watch was 1h 18′ 59″ A. M. that of the diſtance between Altair and the moon's neareſt limb 58° 45′ 26″; the mean of the altitude of the moon's lower limb 70° 33′; and that of Altair 25° 27′ .4; height of the eye 13 feet. Required the true longitude?

Time per watch - -	1h 18′ 59″ A. M	Diſtance moon and Altair - - -			58° 45′ 26″
Longitude in time	3 44 0	Augmented ſemidiameter - -			+0 16 28
Reduced time -	9 34 59	Apparent central diſtance - - -			59 1 54
Altitude moon -	70° 33′	Altitude of Altair - -			25 27 .4
Semidiameter and dip	—0 13	Dip - - -			—0 3 .4
Apparent alt. moon	70 20	Apparent altitude Altair - - -			25 24 0
Correction -	+0 19 40	Refraction - - -			—0 2 0
True altitude moon	70 39 40	True altitude Altair - - -			25 22 0
Moon's apparent alt.	70 20	Moon's true altitude - - -			70 39 40
Altair's apparent alt.	25 24	Difference - - -			45 17 40
Difference -	44 56	Half - - - -			22 38 50
Apparent diſtance	59 1 54	Logarithmic difference - -			9.993101
Sum -	103 57 54	Half -	51° 58′ 57″	Sine -	9.896428
Difference -	14 5 54	Half -	7 2 57	Sine -	9.088919
Half diff. true alt.	22 38 50				18.978448
Arch - -	72 1 57			Coſine -	9.489224
Sum - -	94 40 47			Sine -	9.998548
Difference -	49 23 7			Sine -	9.880301
					19.878849
Half true diſtance	29 33 48½			Coſine -	9.939424
	2				
True diſtance -	59 7 37				
Diſtance at IX hours	58 51 17	Difference -	0° 16′ 20″	P. log. -	1.0422
——— at XII hours	60 24 34	Difference -	1 33 17	P. log. -	0.2855
Proportional part - -			0 31 31	P. log. -	0.7567
Preceding time - - -			9 0 0		
Apparent time at Greenwich - -			9 31 31		
Latitude -	13 57 N		Secant -		0.01300
Declination -	8 19.8 N		Secant - -		0.00461
Difference -	5 37.2	Nat. coſine -	99519		
Altitude Altair -	25 22.	Nat. ſine -	42841		
Difference - - -			56678	- -	4.75341
Altair's meridian diſtance	4h 23′ 14″	Riſing - - -			4.77102
——— right aſcenſion -	19 40 40				
Right aſcenſion meridian	0 3 54				
Sun's right aſcenſion -	10 46 17				
Apparent time at ſhip	13 17 37				
Apparent time at Greenwich	9 31 31				
Longitude in time -	4 46 6 = 56° 31½′ Eaſt.				

For various other methods of determining the longitude of a place, the reader is referred to Dr Mackay's Treatiſe on the Theory and Practice of finding the Longitude at Sea or Land.

Chap. III. *Of the Variation of the Compaſs.*

The variation of the compaſs is the deviation of the points of the mariner's compaſs from the correſponding points of the horizon; and is denominated *eaſt* or *weſt* variation, according as the north point of the compaſs is to the eaſt or weſt of the true north point of the horizon.

A particular account of the variation, and of the ſeveral inſtruments uſed for determining it from obſervation, may be ſeen under the articles Azimuth, Compass, and Variation: and for the method of communicating magnetiſm to compaſs needles, ſee Magnetism.

Prob. I. Given the latitude of a place, and the ſun's magnetic amplitude, to find the variation of the compaſs.

Rule. To the log. ſecant of the latitude, add the log. ſine of the ſun's declination, the ſum will be the log. coſine of the true amplitude; to be reckoned from the north or ſouth according as the declination is north or ſouth.

The difference between the true and obſerved amplitudes, reckoned from the ſame point, and if of the ſame name, is the variation; but if of a different name, their ſum is the variation.

If the obſervation be made in the eaſtern hemiſphere, the variation will be eaſt or weſt according as the obſerved amplitude is nearer to or more remote from the north than the true amplitude. The contrary rule holds good in obſervations taken in the weſtern hemiſphere.

Ex. 1. May 15. 1794, in latitude 33° 10′ N, longitude 18′ W, about 5h A. M. the ſun was obſerved to riſe E*b*N. Required the variation?

Sun's dec. May 15. at noon	18° 58′ N.		
Equation to 7h from noon	—0 4		
——— to 18° W	+0 1		
Reduced declination	18 55	Sine	9.51080
Latitude - -	33 10	Secant	0.07723
True amplitude -	N 67 13 E	Coſine	9.58803
Obſerved amplitude	N 78 45 E		
Variation - -	11 32		

True amplitude - N 67 13 E Coſine 9.58803
Obſerved amplitude N 78 45 E

Variation - - 11 32; which is *weſt*, becauſe the obſerved amplitude is more diſtant from the north than the true amplitude; the obſervation being made in the eaſtern hemiſphere.

Ex. 2. December 20. 1793, in latitude 31° 38′ S, longitude 83° W, the ſun was obſerved to ſet SW. Required the variation?

Latitude -	31° 38′	Secant	0.06985
Declination	23 28	Sine	9.60012
True amplitude ·	S 62 7 W	Coſine	9.66997
Obſerved ampl.	S 45 0 W		

Variation - 17 7; which is *eaſt*, as the obſerved amplitude is farther from the north than the true amplitude, the obſervation being made at ſunſetting.

It may be remarked, that the ſun's amplitude ought to be obſerved at the inſtant the altitude of its lower limb is equal to the ſum of 15 minutes and the dip of the horizon. Thus, if an obſerver be elevated 18 feet above the ſurface of the ſea, the amplitude ſhould be taken at the inſtant the altitude of the ſun's lower limb is 19 minutes.

Prob. II. Given the magnetic azimuth, the altitude and declination of the ſun, together with the latitude of the place of obſervation; to find the variation of the compaſs.

Rule. Reduce the ſun's declination to the time and place of obſervation, and compute the true altitude of the ſun's centre.

Find the ſum of the ſun's polar diſtance and altitude and the latitude of the place, take the difference between the half of this ſum and the polar diſtance.

To the log. ſecant of the altitude add the log. ſecant of the latitude, the log. coſine of the half ſum, and the log. coſine of the difference; half the ſum of theſe will be the log. ſine of half the ſun's true azimuth, to be reckoned from the ſouth in north latitude, but from the north in ſouth latitude.

The difference between the true and obſerved azimuths will be the variation as formerly.

Ex. 1. November 18. 1793, in latitude 50° 22′ N, longitude 24° 30′ W, about three quarters paſt eight A.M. the altitude of the ſun's lower limb was 8° 10′, and bearing per compaſs S, 23° 18′ E; height of the eye 20 feet′ Required the variation of the compaſs?

Sun's declin. 18th Nov. at noon	19° 25′ S	Obſerved alt. ſun's lower limb -	=° 10
Equation to $3\frac{1}{4}$h from noon -	— 2	Semidiameter - - - - -	+ 16
——— to 24° 30′ W -	+ 1	Dip and refraction - -	— 10
Reduced declination - -	19 24	True altitude - - -	8 16
Polar diſtance - - -	109 24		
Altitude - - -	8 16	- Secant - -	0.00454
Latitude - - - -	50 22	- Secant - -	0.19527
Sum - - -	168 2		
Half - - -	84 1	- Coſine - -	9.01803
Difference - -	25 23	- - Coſine - -	9.95591
			19.17375
Half true azimuth - -	22 43	- - Sine - -	9.58687

Half

Half true azimuth	22° 43′	Sine	9.58687
	2		
True azimuth	S 45 26 E.		
Obſerved azimuth	S 23 18 E.		
Variation	22 8 W.		

Ex. 2. January 3. 1794, in latitude 33° 52′ N, 53° 15′ E longitude, about half paſt three the altitude of the ſun's lower limb 41° 18′, and azimuth S 50° 25′ W, the height of the eye being 20 feet. Required the variation?

Sun's declination at noon	21° 24′ S.	Obſerved alt. ſun's lower limb	=41° 18′
Equation to time from noon	— 2	Sun's ſemidiameter	+ 16
——— to longitude	+ 2	Dip and refraction	— 6
Reduced declination	21 24 S.	True altitude	41 28
Polar diſtance	111 24		
Altitude	41 28	Secant	0.12532
Latitude	33 52	Secant	0.08075
Sum	186 44		
Half	93 22	Coſine	8.76883
Difference	18 2	Coſine	9.97558
			18.95048
	17 23	Sine	9.47524
	2		
True azimuth	S. 34 46 W.		
Obſerved azimuth	S. 50 25 W.		
Variation	15 39 W.		

Chap. IV. *Of a Ship's Journal.*

A journal is a regular and exact regiſter of all the various tranſactions that happen aboard a ſhip whether at ſea or land, and more particularly that which concerns a ſhip's way, from whence her place at noon or any other time may be juſtly aſcertained.

That part of the account which is kept at ſea is called *ſea work*; and the remarks taken down while the ſhip is in port are called *harbour work.*

At ſea, the day begins at noon, and ends at the noon of the following day: the firſt 12 hours, or thoſe contained between noon and midnight, are denoted by P. M. ſignifying *after mid day;* and the other 12 hours, or thoſe from midnight to noon, are denoted by A. M. ſignifying *before mid day.* A day's work marked Wedneſday March 6. began on Tueſday at noon, and ended on Wedneſday at noon. The days of the week are uſually repreſented by aſtronomical characters. Thus ☉ repreſent Sunday; ☽ Monday; ♂ Tueſday; ☿ Wedneſday; ♃ Thurſday; ♀ Friday; and ♄ Saturday.

When a ſhip is bound to a port ſo ſituated that ſhe will be out of ſight of land, the bearing and diſtance of the port muſt be found. This may be done by Mercator's or Middle-latitude Sailing; but the moſt expeditious method is by a chart. If iſlands, capes, or headlands intervene, it will be neceſſary to find the ſeveral courſes and diſtances between each ſucceſſively. The true courſe between the places muſt be reduced to the courſe per compaſs, by allowing the variation to the right or left of the true courſe, according as it is weſt or eaſt.

At the time of leaving the land, the bearing of ſome known place is to be obſerved, and its diſtance is uſually found by eſtimation. As perhaps the diſtance thus found will be liable to ſome error, particularly in hazy or foggy weather, or when that diſtance is conſiderable, it will therefore be proper to uſe the following method for this purpoſe.

Let the bearing be obſerved of the place from which the departure is to be taken; and the ſhip having run a certain diſtance on a direct courſe, the bearing of the ſame place is to be again obſerved. Now having one ſide of a plain triangle, namely the diſtance ſailed, and all the angles, the other diſtances may be found by Prob. I. of Oblique Sailing.

The method of finding the courſe and diſtance ſailed in a given time is by the compaſs, the log-line, and half-minute-glaſs. Theſe have been already deſcribed. In the royal navy, and in ſhips in the ſervice of the Eaſt India Company, the log is hove once every hour; but in moſt other trading veſſels only every two hours.

The ſeveral courſes and diſtances ſailed in the courſe of 24 hours, or between noon and noon, and whatever remarks are thought worthy of notice, are ſet down with chalk on a board painted black, called the *log-board*, which is uſually divided into ſix columns: the firſt column on the left hand contains the hours from noon to noon; the ſecond and third the knots and parts of a knot ſailed every hour, or every two hours, according as the log is marked; the fourth column contains the courſes ſteered; the fifth the winds; and in the ſixth the various

various remarks and phenomena are written. The log-board is tranſcribed every day at noon into the log-book, which is ruled and divided after the ſame manner.

The courſes ſteered muſt be corrected by the variation of the compaſs and leeway. If the variation is weſt, it muſt be allowed to the left hand of the courſe ſteered; but if eaſt, to the right hand, in order to obtain the true courſe. The leeway is to be allowed to the right or left of the courſe ſteered, according as the ſhip is on the larboard or ſtarboard tack. The method of finding the variation, which ſhould be determined daily if poſſible, is given in the preceding chapter; and the leeway may be underſtood from what follows.

When a ſhip is cloſe hauled, that part of the wind which acts upon the hull and rigging, together with a conſiderable part of the force which is exerted on the ſails, tends to drive her to the leeward. But ſince the bow of a ſhip expoſes leſs ſurface to the water than her ſide, the reſiſtance will be leſs in the firſt caſe than in the ſecond; the velocity in the direction of her head will therefore in moſt caſes be greater than the velocity in the direction of her ſide; and the ſhip's real courſe will be between the two directions. The angle formed between the line of her apparent courſe and the line ſhe really deſcribes through the water is called the *angle of leeway*, or ſimply the *leeway*.

There are many circumſtances which prevent the laying down rules for the allowance of leeway. The conſtruction of different veſſels, their trim with regard to the nature and quantity of their cargo, the poſition and magnitude of the ſail ſet, and the velocity of the ſhip, together with the ſwell of the ſea, are all ſuſceptible of great variation, and very much affect the leeway. The following rules, are, however, uſually given for this purpoſe.

1. When a ſhip is cloſe hauled, has all her ſails ſet, the water ſmooth, with a light breeze of wind, ſhe is then ſuppoſed to make little or no leeway.
2. Allow one point when the top-gallant ſails are handed.
3. Allow two points when under cloſe reefed top-ſails.
4. Allow two points and a half when one top-ſail is handed.
5. Allow three points and a half when both top-ſails are handed.
6. Allow four points when the fore courſe is handed.
7. Allow five points when under the main-ſail only.
8. Allow ſix points when under balanced mizen.
9. Allow ſeven points when under bare poles.

Theſe allowances may be of ſome uſe to work up the day's work of a journal which has been neglected; but a prudent navigator will never be guilty of this neglect. A very good method of eſtimating the leeway is to obſerve the bearing of the ſhip's wake as frequently as may be judged neceſſary; which may be conveniently enough done by drawing a ſmall ſemicircle on the tafferel, with its diameter at right angles to the ſhip's length, and dividing its circumference into points and quarters. The angle contained between the ſemidiameter which points right aft, and that which points in the direction of the wake, is the leeway. But the beſt and moſt rational way of bringing the leeway into the day's log is to have a compaſs or ſemicircle on the tafferel, as before deſcribed, with a low crutch or ſwivel in its centre; after heaving the log, the line may be ſlipped into the crutch juſt before it is drawn in, and the angle it makes on the limb with the line drawn right aft will ſhow the leeway very accurately; which as a neceſſary article, ought to be entered into a ſeparate column againſt the hourly diſtance on the log-board.

In hard blowing weather, with a contrary wind and a high ſea, it is impoſſible to gain any advantage by ſailing. In ſuch caſes, therefore, the object is to avoid as much as poſſible being driven back. With this intention it is uſual to lie to under no more ſail than is ſufficient to prevent the violent rolling which the veſſel would otherwiſe acquire, to the endangering her maſts, and ſtraining her timbers, &c. When a ſhip is brought to, the tiller is put cloſe over to the leeward, which brings her head round to the wind. The wind having then very little power on the ſails, the ſhip loſes her way through the water; which ceaſing to act on the rudder, her head falls off from the wind, the ſail which ſhe has ſet fills, and gives her freſh way through the water; which acting on the rudder brings her head again to the wind. Thus the ſhip has a kind of vibratory motion, coming up to the wind and falling off from it again alternately. Now the middle point between thoſe upon which ſhe comes up and falls off is taken for her apparent courſe, and the leeway and variation is to be allowed from thence, to find the true courſe.

The ſetting and drift of currents, and the heave of the ſea are to be marked down. Theſe are to be corrected by variation only.

The computation made from the ſeveral courſes corrected as above, and their correſponding diſtances, is called a *day's work*; and the ſhip's place as deduced therefrom, is called her place by *account*, or *dead reckoning*.

It is almoſt conſtantly found that the latitude by account does not agree with that by obſervation. From an attentive conſideration of the nature and form of the common log, that its place is alterable by the weight of the line, by currents, and other cauſes, and alſo the errors to which the courſe is liable, from the very often wrong poſition of the compaſs in the binnacle, the variation not being well aſcertained, an exact agreement of the latitudes cannot be expected.

When the difference of longitude is to be found by dead reckoning, if then the latitudes by account and obſervation diſagree, ſeveral writers on navigation have propoſed to apply a conjectural correction to the departure or difference of longitude. Thus, if the courſe be near the meridian, the error is wholly attributed to the diſtance, and the departure is to be increaſed or diminiſhed accordingly: if near the parallel, the courſe only is ſuppoſed to be erroneous; and if the courſe is towards the middle of the quadrant, the courſe and diſtance are both aſſumed wrong. This laſt correction will, according to different authors, place the ſhip upon oppoſite ſides of her meridian by account. As theſe corrections are, therefore, no better than gueſſing, they ſhould be abſolutely rejected.

If the latitudes are not found to agree, the navigator ought to examine his log-line and half-minute-glaſs, and correct the diſtance accordingly. He is then to conſider if the variation and leeway have been properly aſcertained; if not, the courſes are to be again corrected, and

and no other alteration whatever is to be made on them. He is next to obſerve if the ſhip's place has been affected by a current or heave of the ſea, and to allow for them according to the beſt of his judgment. By applying theſe corrections, the latitudes will generally be found to agree tolerably well; and the longitude is not to receive any farther alteration.

It will be proper, however, for the navigator to determine the longitude of the ſhip from obſervation as often as poſſible; and the reckoning is to be carried forward in the uſual manner from the laſt good obſervation; yet it will perhaps be very ſatisfactory to keep a ſeparate account of the longitude by dead reckoning.

General Rules for working a Day's Work.

Correct the ſeveral courſes for variation and leeway; place them, and the correſponding diſtances, in a table prepared for that purpoſe. From whence, by Traverſe Sailing, find the difference of latitude and departure made good: hence the correſponding courſe and diſtance, and the ſhip's preſent latitude, will be known.

Find the middle latitude at the top or bottom of the Traverſe Table, and the diſtance, anſwering to the departure found in a latitude column, will be the difference of longitude: Or, the departure anſwering to the courſe made good, and the meridional difference of latitude in a latitude column, is the difference of longitude. The ſum, or difference of which, and the longitude left, according as they are of the ſame or of a contrary name, will be the ſhip's preſent longitude of the ſame name with the greater.

Compute the difference of latitude between the ſhip and the intended port, or any other place whoſe bearing and diſtance may be required: find alſo the meridional difference of latitude and the difference of longitude. Now the courſe anſwering the meridional difference of latitude found in a latitude column, and the difference of longitude in a departure column, will be the bearing of the place, and the diſtance anſwering to the difference of latitude will be the diſtance of the ſhip from the propoſed place. If theſe numbers exceed the limits of the Table, it will be neceſſary to take aliquot parts of them; and the diſtance is to be multiplied by the number by which the difference of latitude is divided.

It will ſometimes be neceſſary to keep an account of the meridian diſtance, eſpecially in the Baltic or Mediterranean trade, where charts are uſed in which the longitude is not marked. The meridian diſtance on the firſt day is that day's departure; and any other day it is equal to the ſum or difference of the preceding day's meridian diſtance and the day's departure, according as they are of the ſame or of a contrary denomination.

A Journal

Ship's Journal.

A JOURNAL of a VOYAGE from London to Funchal in Madeira, in his Majeſty's Ship the Reſolution, A——— M——— Commander, anno 1793.

Ship's Journal.

Days of month.	Winds.	Remarks on board his Majeſty's ſhip Reſolution, 1793.
♄ Sept. 28.	SW	Strong gales and heavy rain. At 3 P. M. ſent down topgallant yards; at 11 A. M. the pilot came on board.
☉ Sept. 29.	SW	Moderate and cloudy, with rain. At 10 A. M. caſt looſe from the ſheer hulk at Deptford; got up topgallant yards, and made ſail down the river. At noon running through Blackwall reach.
☽ Sept. 30.	SW Variable.	The firſt part moderate, the latter ſqually, with rain. At half paſt one anchored at the Galleons, and moored ſhip with near a whole cable each way in 5 fathoms, a quarter of a mile off ſhore. At 3 A. M. ſtrong gales: got down topgallant yards. A. M. the people employed working up junk. Bent the ſheet cable.
♂ Octob. 1.	SSW SW	Freſh gales and ſqually. P. M. received the remainder of the boatſwain's and carpenter's ſtores on board. The clerk of the cheque muſtered the ſhip's company.
☿ Octob. 2.	Variable. N*b*E	Variable weather with rain. At noon weighed and made ſail; at 5 anchored in Long-reach in 8 fathoms. Received the powder on board. At 6 A. M. weighed and got down the river. At 10 A. M. paſt the Nore; brought too and hoiſted in the boats: double reefed the topſails, and made ſail for the Downs. At noon running for the flats of Margate.
♃ Octob. 3.	N*b*E N	Firſt part ſtormy weather; latter moderate and clear. At 4 P. M. got through Margate Roads. At 5 run through the Downs; and at 6 anchored in Dover Road, in 10 fathoms muddy ground. Dover Caſtle bore north, and the South Foreland NE*b*E½E off ſhore 1¼ miles. Diſcharged the pilot. Employed making points, &c. for the ſails. Scaled the guns.
♀ Octob. 4.	N NNE	Moderate and fair. Employed working up junk. Received from Deal a cutter of 17 feet, with materials. A. M. ſtrong gales and ſqually, with rain; got down topgallant yards.

Hours.	Kn.	Fa.	Courſes.	Winds.	Remarks, ♄ Octob. 5. 1793.
1				NNE	Freſh gales with rain.
2					Hove ſhort.
3					Weighed and made ſail.
4	4				
5	6		WSW		
6	7				
7	7				
8	7				Shortened ſail.—Dungeneſs light NE*b*E.
9	6	4	W*b*N	NE	
10	6				
11	6				
12	6				Freſh breezes and cloudy.
1	6				
2	6				
3	6				
4	6				Ditto weather.
5	6				
6	6				Got up topgallant yards.
7	6				Set ſtudding ſails.
8	7				Ditto weather.
9	7	5			
10	7	5			
11	7	6			
12	8				St Alban's Head N½E.

Ship's Journal.

Ship's Journal.

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courſes.	Winds.	Remarks, ☉ October 6. 1793.
1	8		W*b*N	NE	A freſh ſteady gale.
2	8				
3	8				
4	8				Do. weather.
5	8				Spoke the Ranger of London, from Carolina.
6	8				Took in ſtudding ſails.
7	8				
8	8				Do. weather.
9	8				
10	8				
11	8				Eddiſtone light N*b*W.
12	8				Do. weather.
1	8				Eddiſtone light NE.
2	7	5			
3	7	5			
4	7				Do. weather.
5	7		W*b*S		
6	7				Set lower ſtudding ſails.
7	7	4			
8	7	6			Freſh breeze and clear weather.
9	7	3			
10	7	5			
11	7	2			
12	7				Do. weather.

Courſe.	Diſt.	D.L.	Dep.	N. Latitude by		D. Long.	W. Lon. by		W. Var.		
				Acc.	Obſ.		Acc.	Obſ.			
S. 52° ½ W.	93	57	74	49° 11′	49° 9′	114′ W	6° 18′		2¼ pts.		

As there is no land in ſight this day at noon, and from the courſe and diſtance run ſince the laſt bearing of the Eddiſtone light was taken, it is not to be ſuppoſed that any part of England will be ſeen, the departure is therefore taken from the Eddiſtone ; and the diſtance of the ſhip from that place is found by reſolving an oblique-angled plane triangle, in which all the angles are given, and one ſide, namely, the diſtance run (16 miles) between the obſervations. Hence the diſtance of the Eddiſtone at the time the laſt bearing of the light was taken will be found equal to 18 miles ; and as the bearing of the Eddiſtone from the ſhip at that time was NE, the ſhip's bearing from the Eddiſtone was SE. Now the variation 2¼ points W, being allowed to the left of SW, gives S*b*W¾W, the true courſe. The other courſes are in like manner to be corrected, and inſerted in the following table, together with their reſpective diſtances, beginning at 10 o'clock A. M. the time when the laſt bearing of the Eddiſtone was taken. The difference of latitude, departure, courſe, and diſtance made good, are to be found by Traverſe Sailing.

Courſes.	Diſt.	Diff. of Lat.		Departure.	
		N.	S.	E.	W.
S*b*W¾W	18		17.0		6.1
W*b*S¼S	22		5.3		21.3
SW¾W	58		34.6		46.6
S 52½°W	93		56.9=57m.		74.0

Latitude of Eddiſtone - 58 8N.

Latitude by account - 49 11N.
Sum - - - - - 99 19
Middle latitude - - 49 40

Now to middle latitude as a courſe, and the departure 74m. in a latitude column, the difference of long. in a diſtance column is 114 = 1° 54′W.
Longitude of Eddiſtone - 4 24 W.

Longitude in by account - 6 18 W.

Ship's Journal.

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courſes.	Winds.	Remarks, ☽ October 7. 1793.
1	6	5	WSW	NE	Freſh breezes.
2	6	5			Sounded 62; fine ſand.
3	6				
4	5	3			Moderate and cloudy.
5	5				Unbent the cables, and coiled them.
6	5			N	Took in ſtudding ſails.
7	5				
8	4	7			Do. weather.
9	4	5			
10	4	5			
11	4				
12	4				Do. weather.
1	4				
2	4				
3	4				
4	4				Light breeze.
5	3		SW*b*W	NW	
6	3				A ſail S*b*E.
7	3				
8	3				Hazy weather.
9	3		SW	Var.	
10	3				
11	3				
12	2				Do. weather.

Courſe.	Diſt.	D.L.	Dep.	N. Latitude by		D. Long.	W. Long. by		W. Var. by acc.	Porto Sancto's	
				Acc.	Obſ.		Acc.	Obſ.		Bearing.	Diſtance.
S. 38° W.	99	78	92	47° 51′		93 W.	7° 51′		2½ pts.	S 23°½ W.	974 m.

The courſes being corrected for variation, and the diſtances ſummed up, the work will be as under.

Courſes.	Diſt.	Diff. of Lat.		Departure.	
		N.	S.	E.	W.
SW¼S	77		57.0		51.7
SSW¾W	12		10.3		6.2
S*b*W¾W	11		10.4		3.7
S 38° W	99		77.7		61.6
			1° 8′		

Yeſterday's lat. by obſer. = 49 9 N

Latitude by account = 47 51 N

Sum - - - 97 0

Middle latitude - 48 30

To middle latitude 48½°, and departure 61.6 in a latitude column, the correſponding difference of longitude in a diſtance column is 93′ = 1° 33′ W.

Yeſterday's longitude - 9 18 W.

Longitude in by account - 7 51 W.

It is now neceſſary to find the bearing and diſtance of the intended port, namely, Funchal; but as that place is on the oppoſite ſide of the iſland with reſpect to the ſhip, it is therefore more proper to find the bearing of the eaſt or weſt end of Madeira; the eaſt end is, however, preferable. But as the ſmall iſland of Porto Sancto lies a little to the NE of the eaſt end of Madeira, it therefore ſeems more eligible to find the bearing and diſtance of that iſland.

To find the bearing and diſtance of Porto Sancto.

Latitude of ſhip	47° 51′N.	Mer. parts	3278	Longitude of ſhip	7° 51′W.
Lat. of Porto Sancto	32 58 N.	Mer. parts	2097	Lon. of Porto Sancto	16 25 W.
Difference of latitude	14 53 = 893.	M. D. Lat.	1181	Difference of long.	8 34 = 514.

The courſe anſwering to the meridional difference of latitude and difference of longitude is about 23°½, and the diſtance correſponding to the difference of latitude is 974 miles. Now as Porto Sancto lies to the ſouthward and weſtward of the ſhip, the courſe is therefore S 23°½ W: and the variation, becauſe W. being allowed to the right hand, gives SW¼W nearly, the bearing per compaſs; and which is the courſe that ought to be ſteered.

Ship's Journal.

Ship's Journal.

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courſes.	Winds.	Remarks, ♂ October 8. 1793.
1	2		SW	NW	Little wind and cloudy.
2	1			Variable.	
3					Tried the current, and found none.
4			Ship's head to		
5			the SW		Calm.
6					
7					Calm; a long ſwell from the SW.
8			Ship's head		
9			from SW to SSE		
10	1		WSW	S	
11	1				
12	2				Light airs and hazy.
1	2				
2	2				
3	2				
4	3				Moderate wind and cloudy.
5	3		W	S*b*W	
6	4				Set top-gallant ſails.
7	5				
8	5				
9	5				
10	5		W½N	SSW	
11	5				By double altitudes of the ſun, the latitude
12	5				was found to be 47° 28′ N.

Courſe.	Diſt.	D.L.	Dep.	N. Latitude by		D. Long.	W. Long. by		W. Var.	Porto Sancto's	
				Acc.	Obſ.		Acc.	Obſ.		Bearing.	Diſtance.
S 61° W	51	25	45	47° 28′	47° 28′	67′ W.	8° 38′		2 points.	S 21° W	932

The ſeveral courſes corrected will be as under.

Courſes.	Diſt.	Diff. of Latit.		Departure.	
		N.	S.	E.	W.
SSW	3		2.8		1.1
SW	23		9.2		9.2
WSW	22		8.4		20.3
W*b*S½S	15		4.4		14.4
S 61° W	51		24.8 = 25		45.0

Yeſterday's latitude 47 51

Latitude by account 47 26
Sum - - 77
Middle latitude - 47 39

To middle latitude 37⅔°, and departure 45′ in a latitude column, the difference of longitude in a diſtance column is 67′ = 1° 7′ W.
Yeſterday's longitude 7 51 W.

Longitude in by account 8 58 W.

To find the bearing and diſtance of Porto Sancto.

Latitude of ſhip	47° 28 N.	Mer. parts	3244	Longitude	8° 58′ W.
Lat. of Porto Sancto	32 58 N.	Mer. parts	2097	Longitude	16 25 W.
Difference of latitude	14 30=870	M. D. lat.	1147	D. longitude	7 27=447′.

Hence the bearing of Porto Sancto is S 21° W, and diſtance 932 miles. The courſe per compaſs is therefore SW nearly.

Ship's Journal.

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courſes.	Winds.	Remarks, ☿ October 9. 1793.
1	5		W*b*N	SW*b*S	Squally with rain.
2	5				Handed top-gallant ſails.
3	5	5			In firſt reef topſails.
4	5	4			Dark gloomy weather. Tacked ſhip.
5	5	6	SE*b*S		In 2d reef topſails, and down top-gallant yards.
6	5				
7	4				Stormy weather; in fore and mizen top-ſails and 3d reef main top-ſail. Handed the main top-ſail, bent the main ſtay-ſail, and brought to with it and the mizen; reefed the mainſail; at 10, wore and lay to under the mainſail, got down top-gallant maſts; at 12 ſet the foreſail, and balanced the mizen.
8	4				
9	3				
10			up SE*b*S off ESE		
11	}		up WSW off WNW		
12					
1	3		W*b*W		
2	3	6			The ſea ſtove in ſeveral half ports.
3	3	5	WNW	SW	
4	3	5			The ſwell abates a little.
5	4				
6	4		W*b*N	SW*b*S	The ſwell abates faſt.
7	3	2			Up top-gallant maſts.
8	3	4			
9	3	4	W	SSW	Set the top-ſails.
10	4				
11	5				Clear weather; good obſervation.
12	5				

Courſe.	Diſt.	D.L.	Dep.	N. Latitude by		D. Long.	W. Long by		W. Var.	Porto Sancto's	
				Acc.	Obſ.		Acc.	Obſ.		Bearing.	Diſtance.
W*b*N½N	43	12	41	47° 40′	47° 39′	61′	9° 59′		2 points		

There is no leeway allowed until two o'clock P. M. when the top-gallant ſails are taken in; from 2 to 3 one point is allowed; from 3 to 6, one and a half points are allowed; from 6 to 8, one and three-fourth points are allowed; from 8 to 9, three points; from 9 to 10, four and a half points; from 10 to 12, five points; from 12 to 10 A. M. three and a half points; and from thence to noon two points leeway are allowed. Now the ſeveral courſes being corrected by variation and leeway will be as under; but as the corrected courſes from 2 to 3 P. M. and from 10 to 12 A. M. are the ſame, namely, weſt; this, therefore, is inſerted in the table, together with the ſum of the diſtances, as a ſingle courſe and diſtance. In like manner the courſes from 12 to 2, and from 5 to 8 being the ſame, are inſerted as a ſingle courſe and diſtance.

Courſes.	Diſt.	Diff. of Lat.		Departure.	
		N.	S.	E.	W.
W*b*S	10		2.0		9.8
W	15.5				15.5
W½N	5.4	0.5			5.4
E*b*S½S	10.6		3.1	10.1	
E*b*S¼S	8		1.9	7.8	
E	3			3.0	
NE*b*E	1	0.6		0.8	
NW*b*W	2	1.1			1.7
NW*b*W½W	17.2	8.1			15.2
NW½W	11	7.0			8.5
W*b*N½N	7.4	2.1			7.1
		19.4	7.0	21.7	63.2
		7.0			21.7
W*b*N½N	43	12.4			41.5

Yeſt. latitude 47 28 N.

Lat. by account 47 40 N.

To middle latitude 37° 34′, and departure 41.5 the difference of longitude is 61′=1° 1′W.

Yeſterday's longitude 8 58 W.

Longitude in by account 9 59 W.

Ship's Journal.

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courſes.	Winds.	Remarks, ♃ October 10. 1793.
1	5	3	W	SSW	Freſh gales with rain.
2	5	7			
3	6				
4	6				Do. weather.
5	6				Out 3d reef topſails.
6	6				Loſt a log and line.
7	5	6			
8	5	4			Do. weather.
9	5	5			
10	5	2			
11	5				
12	5				Do. weather.
1	5	5			
2	5				
3	5				
4	4				Moderate and cloudy, out all reefs.
5	4		WSW	S	
6	4				Sprung fore topgallant yard, got up another.
7	4	3			
8	4	4	SW*b*W	SSE	Do. weather.
9	4	6			A ſail NE.
10	5	3			Employed working up junk.
11	5	4		SE*b*S	A ſwell from the NW, which by eſtimation has
12	5				ſet ſhip 7 miles in the oppoſite direction.

Courſe.	Diſt.	D.L.	Dep.	N. Latitude by		D. Long.	W. Long. by		W. Var.	Porto Sancto's	
				Acc.	Obſ.		Acc.	Obſ.		Bearing.	Diſtance.
S 74° W.	108	36	104	47° 9′		153′ W.	12° 31′		2 Points.	S 12° W.	870 m.

Two points leeway are allowed on the firſt courſe, one on the ſecond; and as the ſhip is 7 points from the wind on the third courſe, there is no leeway allowed on it. The oppoſite point to NW, that from which the ſwell ſet, with the variation allowed upon it, is the laſt courſe in the Traverſe Table.

Courſes.	Diſt.	Diff. of Lat.		Departure.	
		N.	S.	E.	W.
W	86.2				86.2
SW*b*W	12.3		6.8		10.2
SW*b*S	24.7		20.5		13.7
ESE	7		1.7	6.5	
S 74 W	108		30.0	6.5	110.1
Yeſterday's latitude		47 39			6.5
Latitude by account		47 9			103.6
Sum - -			48		
Middle latitude		47 24			

To middle latitude 47 24, and departure 103.6, the difference of longitude is 153′ = 2° 33′ W.

Yeſterday's longitude	-	9 59 W.
Longitude in	-	12 32 W.

To find the bearing and diſtance of Porto Sancto.

Latitude of ſhip	-	47° 9′	Mer. parts	-	3216	Longitude	-	12° 32′W
Lat. Port Sancto	-	32 58	Mer. parts	-	2097	Longitude	-	16 25W
Difference of latitude		14 11=851′ M. D. lat.			1119	D. longitude		3 53=233

Hence the bearing of Porto Sancto is S 12° W, and diſtance 870 miles; the courſe per compaſs is therefore about SW*b*W.

A Journal from England to Madeira.

Hours.	Kn.	Fa.	Courſes.	Winds.	Remarks, ♀ October 11. 1793.
1	4		SW*b*S	ESE	Moderate wind and fair weather.
2	3				Shortened ſail and ſet up the topmaſt rigging,
3	2				
4	3				Do. weather.
5	4				Variation per amplitude 21° W.
6	4	6			
7	4	4			
8	4	5			A fine ſteady breeze.
9	5			E	By an obſervation of the moon's diſtance from
10	5				α Pegaſi, the ſhip's longitude at half paſt 8
11	5				was 12° 28′ W.
12	5	2			Clear weather.
1	5	7			
2	6				
3	6			ENE	
4	6				Do. weather.
5	6	2			
6	6				
7	6	3			
8	6				Set ſtudding ſails, &c,
9	7				
10	7				One ſail in ſight.
11	8				
12	8				Do. weather, good obſervation.

Courſe.	Diſt.	D.L.	Dep.	N. Latitude by		D. Long.	W. Long. by		W. Var. Obſerved.	Porto Sancto's	
				Acc.	Obſ.		Acc.	Obſ.		Bearing.	Diſtance.
S 12° 45′ W.	128	125	28	45° 4′	44° 59′	41° W.	13° 13′	12° 59′	21°	S 12° W.	737 miles.

The obſerved variation 21° being allowed to the left of SW*b*S gives S 12° 45′ W, the corrected courſe, and the diſtance ſummed up is 127.9, or 128 miles. Hence the difference of latitude is 124.8, and the departure 28.2. The latitude by account is therefore 45° 4′ N, and the middle latitude 46° 6′, to which, and the departure 28.2 in a latitude column, the difference of longitude in a diſtance column is 41′ W; which being added to 12° 32′W, the yeſterday's longitude gives 13° 13′ W, the longitude in by account. But the longitude by obſervation was 12° 28′ W at half paſt 8 P. M.; ſince that time the ſhip has run 96 miles; hence the departure in that interval is 21.2 m. Now half the difference of latitude 47 m. added to 44° 59′, the latitude by obſervation at noon, the ſum 45° 46′ is the middle latitude; with which and the departure 21.2, the difference of longitude is found to be 31′ W; which, therefore, added to 12° 28′, the longitude obſerved, the ſum is 12° 59′ W, the longitude by obſervation reduced to noon.

To find the bearing and diſtance of Porto Sancto..

Latitude ſhip - -	44° 59′ N.	Mer. parts -	3028	Longitude	-	12° 59′ W	
Lat. Porto Sancto -	32 58 N.	Mer. parts -	2097	Longitude	-	16 25 W	
Difference of latitude -	12 1=721	M. D. lat.	931	D. Longitude	- -	3 26=206′	

Hence the bearing of Porto Sancto is S 12° W, and diſtance 737 miles. The courſe to be ſteered is therefore S 33° W, or SW*b*S nearly.

A Journal from England to Madeira.

Hours.	Kn.	Fa.	Courſe.	Winds.	Remarks, ♄ October 12. 1793.
1	8		SW*b*S	E*b*N	Freſh gales, and cloudy.
2	7	5			
3	8				
4	8	6			Do. weather.
5	8	4			
6	8				Hauled down ſtudding ſails.
7	7	5			
8	7	3			Do. weather.
9	7	4			
10	7	2			
11	7	6			
12	7	5		ENE	A ſteady gale and fine weather.
1	7				
2	7	5			
3	7				
4	7	3			Do. weather.
5	7	2			
6	7				
7	7	4			Out ſtudding ſails alow and aloft.
8	8				Variation per azimuth 20° 14′ W.
9	8				A ſail in the SW quarter.
10	8				
11	7	6			Sailmaker altering a lower ſtudding ſail.
12	8				Fine weather, and cloudy.

Courſe.	Diſt.	D.L.	Dep.	N. Latitude by		D. Long.	W. Long. by		W. Var. Obſ.	Porto Sancto's	
				Acc.	Obſ.		Acc.	Obſ.		Bearing.	Diſtance.
S 13° 31′ W.	183	178	43	42° 1′		59′ W.	14° 12′	13° 58′	20° 14′	S 12° W.	555 m.

The courſe corrected by variation is S 23° 31′ W, and the diſtance run is 183 miles; hence the difference of latitude is 177.9, and the departure 42.8.

Yeſterday's latitude by obſervation	44° 59′ N.	Mer. parts - -	3028
Difference of latitude - -	2 58 S.		
Latitude in by account - -	42 1 N.	Mer. parts - -	2783
Meridional difference of latitude - - - - - - - - -			245

Now to courſe 13½°, and meridional difference of latitude 245 in a latitude column, the difference of longitude in a departure column is 59′ W: hence the longitudes of yeſterday by account and obſervation, reduced to the noon of this day, will be 14° 12′ W and 13° 58′ reſpectively.

To find the bearing and diſtance of Porto Sancto.

Latitude ſhip -	42° 1′ N.	Mer. parts -	2783	Longitude -	13° 58′ W
Lat. Port Sancto	32 58 N.	Mer. parts -	2097	Longitude -	16 25 W
Difference of latitude	9 3=543	M. D. latitude	686	D. Longitude	2 27=147.

The meridional difference of latitude and difference of longitude will be found to agree neareſt under 12, the correct bearing of Porto Sancto; and the variation being allowed to the right hand of S 12° W, gives S 32¼° W, the bearing per compaſs; and the diſtance anſwering to the difference of latitude 543, under 12 degrees, is 555 miles.

Ship's Journal.

Ship's Journal.

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courſes.	Winds.	Remarks, ⊙ October 13. 1793.
1	8		SW*b*S	ENE	A ſteady gale, and fine weather.
2	8	5			At 34 minutes paſt three, the diſtance between the neareſt limbs of the ſun and moon, together with the altitude of each, were obſerved; from whence the ſhip's longitude at that time is 14° 1' W.
3	8	6			
4	8				
5	8				
6	8				
7	8				Hauled in the lower ſtudding-ſails.
8	7				At 9^h 22', by an obſervation of the moon's diſtance from α Pegaſi, the longitude was 14° 20' W.
9	7				
10	7				
11	7				Freſh gales, and clear.
12	7			ESE	
1	7				
2	8				
3	7				Do. weather.
4	7				
5	7				
6	7				Variation per amplitude 19° 51' W.
7	8				Do. per azimuth 19° 28' W. Set ſtudding-ſails.
8	8	5			
9	8	4			Carried away a fore-top-maſt-ſtudding-ſail boom, got up another.
10	8	2			
11	8				Freſh gales. Took in ſtudding-ſails.
12	7	4			

Courſe.	Diſt.	D.L.	Dep.	N. Latitude by		D. Long.	W. Long. by		W. Var. by Obſ.	Porto Sancto's	
				Acc.	Obſ.		Acc.	Obſ.		Bearing.	Diſtance.
S*b*W$\frac{1}{4}$W	184	178	45	39° 3'		59' W.	15° 11'	14° 52'	$1\frac{3}{4}$ pts.		

The mean of the variation is about $1\frac{3}{4}$ points W: hence the courſe corrected is S*b*W$\frac{1}{4}$W; with which and the diſtance run 184 miles, the difference of latitude is 178.5, and the departure 44.7.

Yeſterday's latitude - - -	42° 1'N.	Mer. parts - - -	2783
Difference of latitude - - -	2 58 S.		
Latitude in by account - -	39 3 N.	Mer. parts - - -	2549
Meridional difference of latitude - - - - - - -			234

Now, to courſe $1\frac{3}{4}$ points, and meridional difference of latitude 234, the difference of longitude is about 59m.; which, added to the yeſterday's longitude by account 14° 12' W, the ſum 15° 11' W is the longitude in by account at noon. The longitudes by obſervation are reduced to noon as follow:

The diſtance run between noon and 3^h 34' P. M. is 29 miles; to which, and the courſe $1\frac{3}{4}$ points, the difference of latitude is - - 28'

Yeſterday's latitude at noon - -	42° 1'N.		
Latitude at time of obſervation - -	41 33 N.	Mer. parts - - -	2746
Latitude at noon - - - - -	39 3 N.	Mer. parts - - -	2549
Meridional difference of latitude - - - - - - -			197

Then, to courſe $1\frac{3}{4}$ points, and meridional difference of latitude 197 in a latitude column, the difference of longitude in a departure column is 49' W; which added to 14° 1' W, the longitude by obſervation, the ſum 14° 50' W is the longitude reduced to noon.

Again, The diſtance run between the preceding noon and 9^h 22' P. M. is 75 miles: hence the correſponding difference of latitude is 72.8, or 73 miles; the ſhip's latitude at that time is therefore 40° 48' N.

Latitude at time of obſervation -	40° 48' N	Mer. parts - - -	2686
Latitude at noon - - - -	39 3 N	Mer. parts - - -	2549
Meridional difference of latitude - - - - - - - -			137

Now, with the corrected courſe, and meridional difference of latitude, the difference of longitude is 34' W; which added to 40° 20' W, the ſum is 14° 54' W, the reduced longitude. The mean of which and the former reduced longitude is 14° 52' W, the correct longitude.

Ship's Journal.

Ship's Journal.

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courſes.	Winds.	Remarks, ☽ October 14. 1793.
1	8		SW*b*S	E*b*S	Freſh gales and hazy, ſingle reefed topſails.
2	7	5			
3	7	5			Got down topgallant yards.
4	7				Do. weather, and a confuſed ſwell running.
5	7	4	SSW		
6	7	1			
7	7				
8	6	5			More moderate.
9	6				
10	5			Variable	
11	5				
12	4				Do. with lightning all round the compaſs.
1	3				
2	3				
3	3	5	SW*b*S	SE*b*S	
4	4				Squally, with rain.
5	5				
6	4				
7	2	5			
8	2		SW	SSE	Moderate weather; out reefs, and up top-
9	3				gallant yards.
10	3	5			
11	4	5	WSW	S	At 11h 10′ A. M. the latitude from double alti-
12	5				tudes of the ſun was 37° 10′. Clear weather.

Courſe.	Diſt.	D.L.	Dep.	N. Latitude by		D. Long.	W. Long. by		W. Var.	Porto Sancto's	
				Acc.	Obſ.		Acc.	Obſ.		Bearing.	Diſtance.
S 16° W	116	111	32	37° 12′	37° 8′	41′ W.	15° 52′	15° 33′	$1\frac{3}{4}$ pts.	S 10° W.	254 m.

As the ſhip is cloſe hauled from 2 o'clock A. M. $1\frac{1}{4}$ points leeway are allowed upon that courſe and a point on the two following courſes.

Courſes.	Diſt.	Diff. of Lat.		Departure.	
		N.	S.	E.	W.
S*b*W$\frac{1}{4}$W	30		29.1		7.3
S$\frac{1}{4}$W	54		53.9		2.7
SSW$\frac{1}{2}$W	19		16.8		9.0
SW$\frac{3}{4}$S	8.5		6.8		5.1
SW*b*W$\frac{1}{4}$W	9.5		4.9		8.1
S 16° W	116		111.5=1° 51′		32.2

Yeſterday's latitude 39 3 } M. lat. 38° 7′
Latitude in by account 37 12 }

To middle latitude 38°, and departure 32.2 in a latitude column, the difference of longitude in a diſtance column is 41′.

Yeſterday's lon. by account	15° 11′ W.	by ob. 14° 52′ W.
Difference of longitude	41 W.	41 W.
Longitude in -	15 22	15 33 W.

The latitude by obſervation at 11 h 10′ A. M. is 37° 10′, and from that time till noon the ſhip has run about 4 miles. Hence the correſponding difference of latitude is 2 miles, which ſubtracted from the latitude obſerved, gives 37° 8′, the latitude reduced to noon.

To find the bearing and diſtance of Porto Sancto.

Latitude of ſhip -	37° 8′ N.	- Mer. parts.	2403	- Longitude -	15° 33′ W.
Latitude Porto Sancto	32 58 N.	- Mer. parts.	2097	- Longitude -	16 25 W.
Difference of latitude	4 10=250	M. D. lat.	306	Diff. longitude	52

Hence the bearing of Porto Sancto is S 10° W, or SSW$\frac{3}{4}$W nearly, per compaſs, and the diſtance is 254 miles.

A Journal

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courſes.	Winds.	Remarks, ♂ October 15. 1793.
1	4		WbS	SbW	Moderate and clear weather.
2	4				
3	3	6			Employed working points and rope-bands.
4	3				Ditto weather.
5	3	4			
6	3		WbN	SWbS	
7	3				
8	3	2			Fine clear weather.
9	4				
10	4				
11	3	5			
12	3	3		Variable.	Ditto weather.
1	3				
2	4		W		
3	3				
4	2		WNW		
5	2	4	NWbW	SWbW	
6	3				
7	3				Variation per mean of ſeveral azimuths 18° 0′ W.
8	3	6			Ditto weather. Tacked ſhip.
9	4		SbE		
10	5				Sail-makers making wind-ſails.
11	5	4			
12	5	6			A fine ſteady breeze. Cloudy.

Courſe.	Diſt.	D.L.	Dep.	N. Lat. by		D. Long.	W. Long. by		W.Var. by Obſ.	Porto Sancto's	
				Acc.	Obſ.		Account.	Obſerv.		Bearing.	Diſtance.
S 68°W	56	21	52	36°47′		65′ W	16° 57′	16° 38′	18°	S¼E	229

Half a point of leeway is allowed on each courſe; but as the variation is expreſſed in degrees, it will be more convenient and accurate to reduce the ſeveral courſes into one, leeway only being allowed upon them. The courſe thus found is then to be corrected for variation, with which and the diſtance made good the difference of latitude and departure are to be found.

Courſes.	Diſt.	Diff. of Latitude.		Departure.	
		N	S	E	W
W½S	18		1.8		17.9
WbN½N	27	7.8			25.8
W½N	7	0.7			7.0
NWbW½W	2	0.9			1.8
NW½W	12	7.6			9.3
SbE½E	20		19.1	5.8	
		17.0	20.9	5.8	61.8
			17.0		5.8
S 86° W.	56		3.9		56.0
Var. 18 W.					

Tr.cour. S 68 W. to which and the diſtance 56 m. the difference of latitude is 21 m. and the departure 51.9 m. Hence the latitude in at noon is 36° 47' W, and middle latitude 36° 58′, to which and the departure 51.9 in a latitude column, the difference of longitude in diſtance column is 65° W.

Yeſterday's long. by acc.	15° 52′W.	By obſ.	15° 33′ W.
Difference of longitude	1 5 W.		1 5 W.
Longitude in	16 57		16 38 W.

To find the bearing and diſtance of Porto Sancto.

Latitude ſhip	36° 47′N.	Mer. pts	2376	Longitude	16° 38′ W.
Lat. of Porto Sancto	32 58 N.	Mer. pts	2097	Longitude	16 25 W.
Diſt of latitude	3 49=229	M. D. Lat.	279	D. Longitude	0 13

Hence the courſe is S¼E, diſtance 229 miles; and the courſe per compaſs is SbW¾W nearly.

Ship's Journal.

Ship's Journal.

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courſes.	Winds.	Remarks, ☿ October 16. 1793.
1	6		S*b*E	SW*b*W	Freſh gales.
2	6	4			
3	7		S	W	
4	7				Do. and cloudy.
5	7				
6	7	4			
7	7	6			
8	7				A ſteady freſh gale.
9	8		S*b*W	NW	
10	8				
11	8				
12	8				Do. weather.
1	8				
2	8				
3	8				
4	9				Do. weather.
5	9		S*b*W½W		
6	9			N	
7	9				Variation *per* amplitude 1½ points W.
8	8	5			
9	9				People employed occaſionally.
10	9			NE*b*E	
11	7				
12	8				Do. weather. Obſerved ſun's meridian altitude.

Courſe.	Diſt.	D.L.	Dep.	N. Latit. by		D. Long.	W. Long. by		W. Var. Obſ.	Porto Sancto's	
				Acc.	Obſ.		Acc.	Obſ.		Bearing.	Diſtance.
S 8° E	186	185	26	33° 42′	33° 46′	31′ E.	16° 26′	16° 7′	1½ pts.	S 17° W.	50 miles.

Half a point of leeway is allowed on the firſt courſe; which, and the others, are corrected for variation as uſual.

Courſes.	Diſt.	Diff. of latit.		Departure.	
		N.	S.	E.	W.
SE*b*S	12.4		10.3	6.9	
S*b*E½E.	43.		41.2	12.5	
S½E	65.		64.7	6.4	
S.	68.5		68.5		
S8°E.	18.6		184.7	25.8	
			3° 5′		

Yeſterday's latitude	-	36 47 N.	
Latitude by account	-	33 42 N.	
Sum	- -	70 29	
Middle latitude	-	35 15	

To the middle latitude and the departure, the difference of longitude in a diſtance column is 31′ E.

Yeſterday's long. by acc.	16° 57′ W.	by obſ. 16° 38′ W.
Difference of long.	0 31 E.	- 0 31 E.
Longitude in	16 26 W.	16 7 W.

To find the bearing and diſtance of Porto Sancto.

Latitude ſhip -	33° 46′ N.	Mer. parts -	2155	Longitude -	16° 7′ W.
Lat. Porto Sancto	32 58 N.	Mer. parts -	2097	Longitude -	16 25 W.
Difference of latitude	48	Mer. diff. lat.	58	Diff. long. -	18

Hence the bearing of Porto Sancto is S 17° W. diſtance 50 miles.

A Journal from London towards Madeira.

Hours.	Kn.	Fa.	Courſes.	Winds.	Remarks, ♃ October 17. 1793.
1	5		SSW	N E*b*E.	Moderate wind and clear.
2	5				Saw the iſland of Porto Sancto, SW*b*S.
3	5		S		Hauled up to round the eaſt end of Porto Sancto.
4	5				Bent the cables.
5	5				
6	6				
7	6				
8	7				Squally weather.
9	8		SW*b*W		Porto Sancto SW*b*S.
10	7				
11	7		SW*b*W		
12	6				Ditto with rain. Porto Sancto NE.
1	6		SSW		The Deſerters SW*b*S.
2	5				
3	6				The Deſerters WSW. 3 or 4 leagues.
4	7				
5	6				
6			Various.		Hauled up round the eaſt end of the Deſerters.
7					
8			NNW		Violent ſqualls; clewed up all at times.
9			NW*b*N		Running into Funchal Roads.
10					
11					Anchored in Funchal Roads, with the beſt bower in 30 fathoms black ſand and mud. Brazen head E*b*S½S, Loo Rock NW, the Great Church NNE, and the ſouthermoſt Deſerter SE½S; off ſhore two-thirds of a mile. Saluted the fort with 13 guns; returned by ditto. Found here his majeſty's ſhip Venus, and 7 Engliſh merchant ſhips.
12					

This journal is performed by inſpection agreeable to the precepts given. Other methods might have been uſed for the ſame purpoſe; for which the two inſtruments already deſcribed and explained ſeem well adapted. We cannot, however, omit recommending the ſliding gunter, which will be found very expeditious, not only in performing a day's work, but alſo in reſolving moſt other nautical problems. See *SLIDING-Gunter*.

It will be found very ſatisfactory to lay down the ſhip's place on a chart at the noon of each day, and her ſituation with reſpect to the place bound to, and the neareſt land, will be obvious. The bearing and diſtance of the intended or any other port, and other requiſites, may be eaſily found by the chart as already explained; and indeed, every day's work may be performed on the chart; and thus the uſe of tables ſuperſeded.

EXPLANATION OF THE TABLES.

TABLE I. *To reduce points of the compaſs to degrees, and converſely.*

The two firſt and two laſt columns of this table contain the ſeveral points and quarter-points of the compaſs; the third column contains the correſponding number of points and quarters; and the fourth, the degrees &c. anſwering thereto. The manner of uſing this table is obvious.

TABLE II. *The miles and parts of a mile in a degree of longitude at every degree of latitude.*

The firſt column contains degrees of latitude, and the ſecond the correſponding miles in a degree of longitude; the other columns are a continuation of the firſt and ſecond. If the given latitude conſiſts of degrees and minutes, a proportional part of the difference between the miles anſwering to the given and following degrees of latitude is to be ſubtracted from the miles anſwering to the given degree.

Example. Required the number of miles in a degree of longitude, in latitude 57° 9′?

The difference between the miles anſwering to the latitudes of 57° and 58° is 0.89.

Then as 60′ : 9′ :: 0.89 : 0.13
Miles anſwering to 57° 32.68
Miles anſwering to 57° 9′ 32.55

This table may be uſed in Parallel and Middle Latitude Sailing.

TABLE III. *Of the Sun's Semidiameter.*

This table contains the angle ſubtended by the ſun's ſemidiameter at the earth, for every ſixth day of the year. The months and days are contained in the firſt column, and the ſemidiameter expreſſed in minutes and ſeconds in the ſecond column. It is uſeful in correcting altitudes of the ſun's limb, and diſtances between the ſun's limb and the moon.

TABLE

Explanation of the Tables.

TABLE IV. *Of the Refraction in Altitude.*

The refraction is neceſſary for correcting altitudes and diſtances obſerved at ſea; it is always to be ſubtracted from the obſerved altitude, or added to the zenith diſtance. This table is adapted to a mean ſtate of the atmoſphere in Britain, namely, to 29.6 inches of the barometer, and 50° of the thermometer. If the height of the mercury in theſe inſtruments be different from the mean, a correction is neceſſary to reduce the tabular to the true refraction. See REFRACTION.

TABLES V. VI. *Of the Dip of the Horizon.*

The firſt of theſe tables contains the dip anſwering to a free or unobſtructed horizon; and the numbers therein, as well as in the other table, are to be ſubtracted from the obſerved altitude when the fore-obſervation is uſed; but added, in the back-obſervation.

When the ſun is over the land, and the ſhip nearer it than the viſible horizon when unconfined: in this caſe, the ſun's limb is to be brought in contact with the line of ſeparation of the ſea and land; the diſtance of that place from the ſhip is to be found by eſtimation or otherwiſe; and the dip anſwering thereto, and the height of eye, is to be taken from Table VI.

TABLE VII. *Of the Correction to be applied to the time of high water at full and change of the moon, to find the time of high water on any other day of the moon.*

The uſe of this table is fully explained at Section II. Chap. I. Book I. of this article.

TABLES VIII. IX. X. *Of the Sun's Declination*, &c.

The firſt of theſe tables contains the ſun's declination, expreſſed in degrees, minutes, and tenths of a minute, for four ſucceſſive years, namely, 1793, 1794, 1795, and 1796: and by means of Table X. may eaſily be reduced to a future period; obſerving that, after the 28th of February 1800, the declination anſwering to the day preceding that given is to be taken.

Ex. I. Required the ſun's declination May 1. 1816?

May 1. 1812 is four years after the ſame day in 1812.

Sun's declination May 1. 1812 - 15° 6′.7 N
Equation from Table X. - +0 0.6
Sun's declination May 1. 1799 - 15 7.3 N

Ex. II. Required the ſun's declination Auguſt 20. 1805?

The given year is 12 years after 1793, and the time is after the end of February 1800.

Now, Sun's dec. Auguſt 19. 1793 - 12° 34′.6
Equation from Table X. to 12 years −0 1.9
Sun's declination Auguſt 20. 1805 - 12 32.7

The declination in Table VIII. is adapted to the meridian of Greenwich, and Table IX. is intended to reduce it to any other meridian, and to any given time of the day under that meridian. The titles at the top and bottom of this table direct when the reduction is to be added or ſubtracted.

TABLE XI. *Of the Right Aſcenſions and Declinations of Fixed Stars.*

This table contains the right aſcenſions and declinations of 60 principal fixed ſtars, adapted to the beginning of the year 1793. Columns fourth and ſixth contain the annual variation ariſing from the preceſſion of the equinoxes, and the proper motion of the ſtars; which ſerves to reduce the place of a ſtar to a period a few years after the epoch of the table with ſufficient accuracy. When the place of a ſtar is wanted, after the beginning of 1793, the variation in right aſcenſion is additive; and that in declination is to be applied according to its ſign. The contrary rule is to be uſed when the given time is before 1793.

Example. Required the right aſcenſion and declination of Bellatrix, May 1. 1798?

Right aſcenſion January 1. 1793 = 5h 14′ 3″
Variation = 3″.21 × $5\frac{1}{3}$ y. = +0 0 17
Right Aſcenſion, May 1. 1798 = 5 14 20
Declination 6° 8′ 53″ N
Variation = 4″ × $5\frac{1}{3}$ y. = +0 0 21
Declination May 1. 1798 = 6 9 14 N

The various other tables neceſſary in the practice of navigation are to be found in moſt treatiſes on that ſubject. Thoſe uſed in this article are in Mackay's Treatiſes on the Longitude and Navigation.

TABLE I. *To reduce Points of the Compaſs to Degrees, and converſely.*

North-eaſt Quadrant.	South-eaſt Quadrant.	Points.		D.	M.	S.	South-weſt Quadrant.	North-weſt Quadrant.
North.	South.	0	0	0	0	0	South.	North.
N¼E	S¼E	0	¼	2	48	45	S¼W	N¼W
N½E	S½E	0	½	5	37	30	S½W	N½W
N¾E	S¾E	0	¾	8	26	15	S¾W	N¾W
N*b*E	S*b*E	1	0	11	15	0	S*b*W	N*b*W
N*b*E¼E	S*b*E¼E	1	¼	14	3	45	S*b*W¼W	N*b*W¼W
N*b*E½E	S*b*E½E	1	½	16	52	30	S*b*W½W	N*b*W½W
N*b*E¾E	S*b*E¾E	1	¾	19	41	15	S*b*W¾W	N*b*W¾W
NNE	SSE	2	0	22	30	0	SSW	NNW
NNE¼E	SSE¼E	2	¼	25	18	45	SSW¼W	NNW¼W
NNE½E	SSE½E	2	½	28	7	30	SSW½W	NNW½W
NNE¾E	SSE¾E	2	¾	30	56	15	SSW¾W	NNW¾W
NE*b*N	SE*b*S	3	0	33	45	0	SW*b*S	NW*b*N
NE¾N	SE¾S	3	¼	36	33	45	SW¾S	NW¾N
NE½N	SE½S	3	½	39	22	30	SW½S	NW½N
NE¼N	SE¼S	3	¾	42	11	15	SW¼S	NW¼N
NE	SE	4	0	45	0	0	SW	NW
NE¼E	SE¼E	4	¼	47	48	45	SW¼W	NW¼W
NE½E	SE½E	4	½	50	37	30	SW½W	NW½W
NE¾E	SE¾E	4	¾	53	26	15	SW¾W	NW¾W
NE*b*E	SE*b*E	5	0	56	15	0	SW*b*W	NW*b*W
NE*b*E¼E	SE*b*E¼E	5	¼	59	3	45	SW*b*W¼W	NW*b*W¼W
NE*b*E½E	SE*b*E½E	5	½	61	52	30	SW*b*W½W	NW*b*W½W
NE*b*E¾E	SE*b*E¾E	5	¾	64	41	15	SW*b*W¾W	NW*b*W¾W
ENE	ESE	6	0	67	30	0	WSW	WNW
E*b*N¾N	E*b*S¾S	6	¼	70	18	45	W*b*S¾S	W*b*N¾N
E*b*N½N	E*b*S½S	6	½	73	7	30	W*b*S½S	W*b*N½N
E*b*N¼N	E*b*S¼S	6	¾	75	56	15	W*b*S¾S	W*b*N¼N
E*b*N	E*b*S	7	0	78	45	0	W*b*S	W*b*N
E¾N	E¾S	7	¼	81	33	45	W¾S	W¾N
E½N	E½S	7	½	84	22	30	W½S	W½N
E¼N	E¼S	7	¾	87	11	15	W¼S	W¼N
Eaſt.	Eaſt.	8	0	90	0	0	Weſt.	Weſt.

TABLE II. *The Miles and Parts of a Mile in a Degree of Longitude at every Degree of Latitude.*

D.L.	Miles.	D.L.	Miles.	D.L.	Miles.	D.L.	Miles.	D.L.	Miles.	D.L.	Miles.
1	59.99	16	57.67	31	51.43	46	41.68	61	29.09	76	14.51
2	59.97	17	57.36	32	50.88	47	40.92	62	28.17	77	13.50
3	59.92	18	57.06	33	50.32	48	40.15	63	27.24	78	12.48
4	59.86	19	56.73	34	49.74	49	39.36	64	26.30	79	11.45
5	59.77	20	56.38	35	49.15	50	38.57	65	25.36	80	10.42
6	59.67	21	56.01	36	48.54	51	37.76	66	24.41	81	9.38
7	59.56	22	55.63	37	47.92	52	36.94	67	23.45	82	8.35
8	59.44	23	55.23	38	47.28	53	36.11	68	22.48	83	7.32
9	59.26	24	54.81	39	46.62	54	35.26	69	21.50	84	6.28
10	59.08	25	54.38	40	45.95	55	34.41	70	20.52	85	5.23
11	58.89	26	53.93	41	45.28	56	33.55	71	19.54	86	4.18
12	58.68	27	53.46	42	44.95	57	32.68	72	18.54	87	3.14
13	58.46	28	52.97	43	43.88	58	31.79	73	17.54	88	2.09
14	58.22	29	52.47	44	43.16	59	30.90	74	16.53	89	1.05
15	57.95	30	51.96	45	42.43	60	30.00	75	15.52	90	0.00

TABLE III. *Sun's Semidia.*

Mon.	Day.	Sun's Semidiam.	
January.	1	16′	19
	7	16	19
	13	16	19
	19	16	18
	25	16	17
February.	1	16	16
	7	16	15
	13	16	14
	19	16	13
	25	16	12
March.	1	16	10
	7	16	9
	13	16	7
	19	16	6
	25	16	4
April.	1	16	2
	7	16	1
	13	15	59
	19	15	57
	25	15	56
May.	1	15	54
	7	15	53
	13	15	52
	19	15	51
	25	15	50
June.	1	15	49
	7	15	48
	13	15	47
	19	15	47
	25	15	47
July.	1	15	47
	7	15	47
	13	15	47
	19	15	48
	25	15	48
Auguſt.	1	15	49
	7	15	50
	13	15	51
	19	15	52
	25	15	53
September.	1	15	55
	7	15	56
	13	15	58
	19	15	59
	25	16	1
October.	1	16	3
	7	16	4
	13	16	6
	19	16	8
	25	16	9
November.	1	16	11
	7	16	13
	13	16	14
	19	16	15
	25	16	16
December.	1	16	17
	7	16	18
	13	16	18
	19	16	19
	25	16	19

TABLE IV.

Refraction in Altitude.

App. Alt.	Refrac.	App. Alt.	Refrac.	App. Alt.	Refrac.
D. M.	M. S.	D. M.	M. S.	D.	M. S.
0 0	33 0	6 30	7 51	30	1 38
0 5	32 10	6 40	7 40	31	1 35
0 10	31 22	6 50	7 30	32	1 31
0 15	30 35	7 0	7 20	33	1 28
0 20	29 50	7 10	7 11	34	1 24
0 25	29 6	7 20	7 2	35	1 21
0 30	28 22	7 30	6 53	36	1 18
0 35	27 41	7 40	6 45	37	1 16
0 40	27 0	7 50	6 37	38	1 13
0 45	26 20	8 0	6 29	39	1 10
0 50	25 42	8 10	6 22	40	1 8
0 55	25 5	8 20	6 15	41	1 5
1 0	24 49	8 30	6 8	42	1 3
1 5	23 54	8 40	6 1	43	1 1
1 10	23 20	8 50	5 55	44	0 59
1 15	22 47	9 0	5 48	45	0 57
1 20	22 15	9 10	5 42	46	0 55
1 25	21 44	9 20	5 36	47	0 53
1 30	21 15	9 30	5 31	48	0 51
1 35	20 46	9 40	5 25	49	0 49
1 40	20 18	9 50	5 20	50	0 48
1 45	19 51	10 0	5 15	51	0 46
1 50	19 25	10 15	5 7	52	0 44
1 55	19 0	10 30	5 0	53	0 43
2 0	18 35	10 45	4 53	54	0 41
2 5	18 11	11 0	4 47	55	0 40
2 10	17 48	11 15	4 40	56	0 38
2 15	17 26	11 30	4 34	57	0 37
2 20	17 4	11 45	4 29	58	0 35
2 25	16 44	12 0	4 23	59	0 34
2 30	16 24	12 20	4 16	60	0 33
2 35	16 4	12 40	4 9	61	0 32
2 40	15 45	13 0	4 3	62	0 30
2 45	15 27	13 20	3 57	63	0 29
2 50	15 9	13 40	3 51	64	0 28
2 55	14 52	14 0	3 45	65	0 26
3 0	14 36	14 20	3 40	66	0 25
3 5	14 20	14 40	3 35	67	0 24
3 10	14 4	15 0	3 30	68	0 23
3 15	13 49	15 30	3 24	69	0 22
3 20	13 34	16 0	3 17	70	0 21
3 25	13 20	16 30	3 10	71	0 19
3 30	13 6	17 0	3 4	72	0 18
3 40	12 40	17 30	2 59	73	0 17
3 50	12 15	18 0	2 54	74	0 16
4 0	11 51	18 30	2 49	75	0 15
4 10	11 29	19 0	2 44	76	0 14
4 20	11 8	19 30	2 39	77	0 13
4 30	10 48	20 0	2 35	78	0 12
4 40	10 29	20 30	2 31	79	0 11
4 50	10 11	21 0	2 27	80	0 10
5 0	9 54	21 30	2 24	81	0 9
5 10	9 38	22 0	2 20	82	0 8
5 20	9 23	23 0	2 14	83	0 7
5 30	9 8	24 0	2 7	84	0 6
5 40	8 54	25 0	2 2	85	0 5
5 50	8 41	26 0	1 56	86	0 4
6 0	8 28	27 0	1 51	87	0 3
6 10	8 15	28 0	1 47	88	0 2
6 20	8 3	29 0	1 42	89	0 1

TABLE V.

Dip of the Horizon.

Height of eye.	Dip of Horizon.	Height of eye.	Dip of Horizon.	Height of eye.	Dip of Horizon.	Height of eye.	Dip of Horizon.
Feet.	M. S.	Feet.	M. S.	Feet.	M. S.	Feet.	M. S.
1	0 57	11	3 10	21	4 22	35	5 39
2	1 21	12	3 18	22	4 28	40	6 2
3	1 39	13	3 26	23	4 34	45	6 24
4	1 55	14	3 34	24	4 40	50	6 44
5	2 8	15	3 42	25	4 46	55	7 4
6	2 20	16	3 49	26	4 52	60	7 23
7	2 31	17	3 56	27	4 58	70	7 59
8	2 42	18	4 3	28	5 3	80	8 32
9	2 52	19	4 10	29	5 9	90	9 3
10	3 1	20	4 16	30	5 14	100	9 33

TABLE VI.

Dip of the Sea at different diſtances from the Obſerver.

Diſt. of land in ſea miles.	Height of the eye above the ſea in feet.							
	5	10	15	20	25	30	35	40
	Dip.	Dip.	Dip.	Dip.	Dip.	Dip.	Dip.	Dip.
	M.	M.	M.	M.	M.	M.	M.	M.
0 ¼	11	22	34	45	56	68	79	90
0 ½	6	11	17	22	28	34	39	45
0 ¾	4	8	12	15	19	23	27	30
1 0	4	6	9	12	15	17	20	23
1 ¼	3	5	7	9	12	14	16	19
1 ½	3	4	6	8	10	11	14	15
2 0	2	3	5	6	8	10	11	12
2 ½	2	3	5	6	7	8	9	10
3 0	2	3	4	5	6	7	8	8
3 ½	2	3	4	5	6	6	7	7
4 0	2	3	4	4	5	6	7	7
5 0	2	3	4	4	5	5	6	6
6 0	2	3	4	4	5	5	6	6

TABLE VII.

The Correction to be applied to the time of High-water at Full and Change of the Moon, to find the time of High-water on any other day.

Interval of Time.	After New or Full Moon.	Before 1ſt or 3d Quarter.	After 1ſt or 3d Quarter.	Before New or Full Moon.
	Additive.	Additive.	Additive.	Subtractive.
D H.	H. M	H. M	H. M	H M.
0 0	0 0	5 6	5 6	0 0
0 6	0 8	4 51	5 22	0 9
1 12	0 17	4 37	5 40	0 18
0 18	0 26	4 23	6 0	0 27
1 0	0 36	4 9	6 20	0 37
1 6	0 45	3 56	6 39	0 47
1 12	0 54	3 44	6 58	0 57
1 18	1 2	3 32	7 18	1 7
2 0	1 11	3 21	7 37	1 17
2 6	1 19	3 11	7 56	1 28
2 12	1 28	3 1	8 14	1 39
2 18	1 37	2 50	8 31	1 51
3 0	1 46	2 40	8 47	2 4
3 6	1 54	2 30	9 2	2 16
3 12	2 3	2 21	9 17	2 29
3 18	2 12	2 12	9 31	2 44
4 0	2 21	2 3	9 44	2 58

TABLE VIII. *Sun's Declination for 1809, being the first after leap year.*

Days.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	23° 1'6S	17° 7'5S	7° 37'1S	4° 29'7N	15° 2'0N	22° 2'5N	23° 8'8N	18° 5'7N	8° 21'9N	3° 7'4S.	14° 24'3S	21° 48'7S.
2	22 56.4	16 50.3	7 14.3	4 52.8	15 20.0	22 10.6	23 4.7	17 50.5	8 0.0	3 30.7	14 43.5	21 57.9
3	22 50.8	16 32.8	6 51.4	5 15.8	15 37.9	22 18.3	23 0.1	17 35.0	7 38.1	3 54.0	15 2.4	22 6.6
4	22 44.7	16 15.0	6 28.4	5 38.7	15 55.4	22 25.6	22 55.2	17 19.2	7 16.0	4 17.3	15 21.1	22 14.9
5	22 38.2	15 56.9	6 5.2	6 1.5	16 12.7	22 32.4	22 49.9	17 3.2	6 53.8	4 40.4	15 39.6	22 22.8
6	22 31.2	15 38.6	5 42.0	6 24.2	16 29.7	22 38.9	22 44.1	16 46.8	6 31.4	5 3.6	15 57.7	22 30.3
7	22 23.8	15 19.9	5 18.8	6 46.8	16 46.5	22 45.0	22 38.0	16 30.2	6 9.0	5 26.7	16 15.7	22 37.3
8	22 15.9	15 1.1	4 55.4	7 9.3	17 2.9	22 50.7	22 31.5	16 13.3	5 46.4	5 49.7	16 33.3	22 43.9
9	22 7.6	14 41.9	4 32.0	7 31.7	17 19.1	22 56.0	22 24.6	15 56.2	5 23.8	6 12.6	16 50.7	22 50.0
10	21 58.9	14 22.6	4 8.6	7 53.9	17 35.0	23 0.9	22 17.3	15 38.8	5 1.0	6 35.4	17 7.8	22 55.7
11	21 49.7	14 2.9	3 45.0	8 16.0	17 50.6	23 5.3	22 9.6	15 21.2	4 38.2	6 58.2	17 24.6	23 0.9
12	21 40.1	13 43.1	3 21.5	8 38.0	18 5.9	23 9.4	22 1.5	15 3.3	4 15.3	7 20.9	17 41.0	23 5.6
13	21 30.1	13 23.0	2 57.9	8 59.9	18 20.9	23 13.1	21 53.0	14 45.1	3 52.3	7 43.4	17 57.2	23 10.0
14	21 19.7	13 2.7	2 34.2	9 21.6	18 35.6	23 16.4	21 44.2	14 26.7	3 29.3	8 5.9	18 13.1	23 13.8
15	21 8.9	13 42.3	2 10.6	9 43.1	18 50.0	23 19.2	21 35.0	14 8.1	3 6.2	8 28.2	18 28.6	23 17.2
16	20 57.6	12 21.5	1 46.9	10 4.5	19 4.1	23 21.7	21 25.4	13 49.3	2 43.0	8 50.4	18 43.9	23 20.0
17	20 46.0	12 0.6	1 23.2	10 25.7	19 17.9	23 23.7	21 15.5	13 30.3	2 19.8	9 12.5	18 58.7	23 22.5
18	20 33.9	11 39.6	0 59.5	10 46.7	19 31.3	23 25.3	21 5.3	13 11.0	1 56.6	9 34.5	19 13.3	23 24.5
19	20 21.5	11 18.3	0 35.7	11 7.5	19 44.4	23 26.5	20 54.6	12 51.5	1 33.3	9 56.3	19 27.5	23 26.0
20	20 8.7	10 56.9	0 12.0	11 28.3	19 57.1	23 27.3	20 43.6	12 31.9	1 10.0	10 18.0	19 41.3	23 27.0
21	19 55.5	10 35.2	0 11.6N	11 48.8	20 9.5	23 27.7	20 32.3	12 12.0	0 46.6	10 39.5	19 54.8	23 27.6
22	19 42.0	10 13.5	0 35.3	12 9.0	20 21.6	23 27.7	20 20.6	11 51.9	0 23.2	11 0.9	20 7.9	23 27.7
23	19 28.0	9 51.5	0 58.9	12 29.1	20 33.3	23 27.2	20 8.5	11 31.7	0 0.2S	11 22.0	20 20.7	23 27.3
24	19 13.8	9 29.5	1 22.5	12 49.0	20 44.7	23 26.3	19 56.2	11 11.3	0 23.6	11 43.0	20 33.0	23 26.4
25	18 59.2	9 7.3	1 46.1	13 8.7	20 55.7	23 25.0	19 43.5	10 50.7	0 47.0	12 3.9	20 45.0	23 25.1
26	18 44.2	8 44.9	2 9.7	13 28.2	21 6.4	23 23.4	19 30.5	10 29.9	1 10.4	12 24.6	20 56.6	23 23.3
27	18 28.9	8 22.4	2 33.2	13 47.4	21 16.7	23 21.3	19 17.1	10 9.0	1 33.9	12 45.0	21 7.9	23 21.0
28	18 13.2	7 59.8	2 56.6	14 6.4	21 26.6	23 18.8	19 3.4	9 47.9	1 57.3	13 5.3	21 18.7	23 18.3
29	17 57.3		3 20.0	14 25.2	21 36.1	23 15.9	18 49.5	9 26.6	2 20.7	13 25.4	21 29.1	23 15.1
30	17 41.0		3 43.3	14 43.7	21 45.3	23 12.5	18 35.2	9 5.2	2 44.0	13 45.2	21 39.1	23 11.5
31	17 24.4		4 6.5		21 54.1		18 20.6	8 43.6		14 4.9		23 7.3

TABLE VIII. *The Sun's Declination for 1810, being the second after leap year.*

Days.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	23° 2'7S.	17° 11'6S.	7° 42'7S.	4° 24'0N	14° 57'5N	22° 0'5N	23° 9'7N	18° 9'3N	8° 27'1N	3° 1'8S.	14° 19'6S.	21° 46'4S.
2	22 57.7	16 54.5	7 19.9	4 47.1	15 15.6	22 8.6	23 5.7	17 54.2	8 5.3	3 25.1	14 38.8	21 55.7
3	22 52.1	16 37.0	6 57.0	5 10.1	15 33.5	22 16.4	23 1.3	17 38.7	7 43.4	3 48.4	14 57.8	22 4.5
4	22 46.2	16 19.3	6 34.0	5 33.1	15 51.1	22 23.7	22 56.4	17 23.0	7 21.3	4 11.7	15 16.6	22 12.9
5	22 39.7	16 1.3	6 10.9	5 55.9	16 8.5	22 30.7	22 51.2	17 7.0	6 59.1	4 34.9	15 35.1	22 20.9
6	22 32.9	15 43.0	5 47.7	6 18.7	16 25.6	22 37.3	22 45.5	16 50.7	6 36.8	4 58.0	15 53.3	22 28.5
7	22 25.6	15 24.4	5 24.5	6 41.3	16 42.4	22 43.5	22 39.5	16 34.2	6 14.4	5 21.1	16 11.3	22 35.6
8	22 17.8	15 5.6	5 1.1	7 3.9	16 58.9	22 49.3	22 33.0	16 17.4	5 51.9	5 44.1	16 29.0	22 42.3
9	22 9.6	14 46.5	5 37.7	7 26.3	17 15.2	22 54.7	22 26.7	16 0.3	5 29.3	6 7.0	16 46.5	22 48.5
10	22 1.0	14 27.2	5 14.2	7 48.5	17 31.1	22 59.7	22 19.0	15 43.0	5 6.6	6 29.9	17 3.6	22 54.3
11	21 51.9	14 7.7	3 50.7	8 10.7	17 46.8	23 4.3	22 11.4	15 25.4	4 43.8	6 52.6	17 20.4	22 59.6
12	21 42.6	13 47.9	3 27.2	8 32.7	18 2.2	23 8.4	22 3.5	15 7.6	4 20.9	7 15.3	17 37.0	23 4.5
13	21 32.5	13 27.9	3 3.6	8 54.5	18 17.3	23 12.2	21 55.1	14 49.5	3 58.0	7 37.9	17 53.2	23 8.9
14	21 22.2	13 7.7	2 40.0	9 16.3	18 32.0	23 15.6	21 46.4	14 31.2	3 35.0	8 0.4	18 9.2	23 12.9
15	21 11.5	12 47.2	2 16.3	9 37.8	18 46.5	23 18.5	21 37.3	14 12.7	3 11.9	8 22.7	18 24.8	23 16.4
16	21 0.3	12 26.6	1 52.7	9 59.2	19 0.6	23 21.1	21 27.8	13 53.9	2 48.8	8 44.9	18 40.1	23 19.4
17	20 48.8	12 5.8	1 29.0	10 20.4	19 14.5	23 23.2	21 18.0	13 35.0	2 25.6	9 7.0	18 55.0	23 21.9
18	20 36.9	11 44.7	1 5.3	10 41.5	19 28.0	23 24.9	21 7.8	13 15.8	2 2.3	9 29.0	19 9.7	23 24.0
19	20 24.5	11 23.5	0 41.6	11 2.4	19 41.1	23 26.2	20 57.3	12 56.3	1 39.1	9 50.9	19 24.0	23 25.6
20	20 11.8	11 2.1	0 18.0	11 23.1	19 54.0	23 27.1	20 46.3	12 36.7	1 15.7	10 12.6	19 37.9	23 26.8
21	19 58.7	10 40.6	0 5.7	11 43.6	20 6.4	23 27.6	20 35.1	12 16.9	0 52.4	10 34.2	19 51.5	23 27.5
22	19 45.3	10 18.9	0 29.3	12 4.0	20 18.6	23 27.7	20 23.5	12 56.9	0 29.0	10 55.6	20 4.7	23 27.7
23	19 31.5	9 57.0	0 53.0	12 24.1	20 30.4	23 27.3	20 11.5	11 36.7	0 5.6	11 16.8	20 17.5	23 27.4
24	19 17.3	9 34.9	1 16.7	12 44.0	20 41.9	23 26.5	19 59.3	11 16.3	0 17.8S.	11 37.9	20 30.0	23 26.7
25	19 2.8	9 12.8	1 40.2	13 3.7	20 53.0	23 25.4	19 46.6	10 55.7	0 41.3	11 58.8	20 42.1	23 25.5
26	18 47.9	8 50.5	2 3.8	13 23.3	21 3.7	23 23.8	19 33.7	10 35.0	1 4.7	12 19.5	20 53.8	23 23.8
27	18 32.5	8 28.0	2 27.3	13 42.6	21 14.1	23 21.8	19 20.3	10 14.0	1 28.2	12 40.0	21 5.1	23 21.5
28	18 17.1	8 5.4	2 50.7	14 1.6	21 24.1	23 19.4	19 6.8	9 53.0	1 51.6	13 0.4	21 16.0	23 19.0
29	18 1.2		3 14.2	14 20.5	21 33.8	23 16.6	18 52.9	9 31.7	2 15.0	13 20.5	21 26.6	23 15.9
30	17 45.0		3 37.5	14 39.1	21 43.0	23 13.4	18 38.7	9 10.3	2 38.4	13 30.4	21 36.7	23 12.4
31	17 28.5		4 0.7		21 52.0		18 24.1	8 48.8		14 0.1		23 8.1

TABLE VIII. *Sun's Declination for 1811, being the third after leap year.*

Day.	January.	February.	March.	April.	May.	June.	July.	Auguſt.	September.	October.	November.	December.
1	23° 3'9S.	17° 15 7S.	7° 48'2 S	4° 18'4N	14° 53'1N	21° 58'5N	23° 10'6N	18° 12'8N	8° 32'3	2° 56'1S.	14° 14'8S.	21° 44'0S.
2	22 58.9	16 58.6	7 25.4	4 41.5	15 11.3	22 6.7	23 6.7	17 57.8	8 10.6	3 19.4	14 34.1	21 53.4
3	22 53.5	16 41.3	7 2.6	5 4.6	15 29.2	22 14.6	23 2.3	17 42.4	7 48.7	3 42.7	14 53.1	22 2.3
4	22 47.7	16 23.6	6 39.6	5 27.5	15 46.9	22 22.0	22 57.6	17 26.8	7 26.6	4 5.9	15 11.9	22 10.9
5	22 41.3	15 5.7	6 16.5	5 50.4	16 4.3	22 29.1	22 52.4	17 10.9	7 4.5	4 29.2	15 30.5	22 18.9
6	22 34.6	15 47.5	5 53.4	6 13.1	16 21.4	22 35.8	22 46.9	16 54.7	6 42.2	4 52.3	15 48.8	22 26.6
7	22 27.4	15 29.0	5 30.1	6 35.8	16 38.3	22 42.0	22 41.0	16 38.2	6 19.9	5 15.4	16 6.9	22 33.9
8	22 19.7	15 10.3	5 6.8	6 58.3	16 54.9	22 47.9	22 34.6	16 21.5	5 57.4	5 38.4	16 24.6	22 40.7
9	22 11.6	14 51.3	4 43.5	7 20.7	17 11.2	22 53.4	22 27.9	16 4.5	5 34.8	6 1.3	16 42.1	22 47.0
10	22 3.1	14 32.0	4 20.4	7 43.0	17 27.3	22 58.5	22 20.8	15 47.2	5 12.1	6 24.2	16 59.3	22 52.9
11	21 54.2	14 12.5	3 56.5	8 5.2	17 43.0	23 3.2	22 13.3	15 29.7	4 49.3	6 47.0	17 16.3	22 58.3
12	21 44.8	13 52.8	3 33.0	8 27.3	17 58.4	23 7.4	22 5.4	15 11.9	4 26.5	7 9.7	17 32.9	23 3.3
13	21 35.0	13 32.9	3 9.5	8 49.2	18 13.6	23 11.3	21 57.2	14 53.9	4 3.5	7 32.3	17 49.3	23 7.9
14	21 24.8	13 12.7	3 45.9	9 10.9	18 28.5	23 14.8	21 48.5	14 35.6	3 40.6	7 54.9	18 5.3	23 11.9
15	21 14.1	12 52.3	2 22.2	9 32.5	18 43.0	23 17.9	21 39.5	14 17.2	3 17.5	8 17.3	18 21.0	23 15.5
16	21 3.1	12 31.7	1 58.6	9 54.0	18 57.2	23 20.5	21 30.1	13 58.5	2 54.3	8 39.5	18 36.4	23 18.7
17	20 51.7	12 10.9	1 34.9	10 15.3	19 11.1	23 22.7	21 20.4	13 39.5	2 31.2	9 1.7	18 51.4	23 21.3
18	20 39.9	11 49.9	1 11.2	10 36.4	19 24.7	23 24.5	21 10.3	13 20.3	2 7.9	9 23.7	19 6.1	23 23.5
19	20 27.6	11 28.8	0 47.5	10 57.3	19 37.9	23 25.9	20 59.8	13 1.0	1 44.6	9 45.6	19 20.5	23 25.3
20	20 15.0	11 7.4	0 23.8	11 18.1	19 50.9	23 26.9	20 48.9	12 41.4	1 21.3	10 7.4	19 34.5	23 26.5
21	20 0.0	10 45.9	0 0.0	11 38.7	20 3.5	23 27.5	20 37.8	12 21.6	0 57.9	10 29.0	19 48.2	23 27.4
22	19 48.6	10 24.2	0 23.6N	11 59.0	20 15.7	23 27.7	20 26.2	12 1.6	0 34.5	10 50.4	20 1.5	23 27.7
23	19 34.9	10 2.3	0 47.2	12 19.3	20 27.6	23 27.4	20 14.4	11 41.5	0 11.1	11 11.7	20 14.4	23 27.5
24	19 20.8	9 40.3	1 10.9	12 39.3	20 39.2	23 26.8	20 2.2	11 21.1	0 12.3S.	11 32.8	20 27.1	23 26.9
25	19 6.3	9 18.1	1 34.5	12 59.0	20 50.4	23 25.7	19 49.6	11 0.6	0 35.7	11 53.8	20 39.2	23 25.8
26	18 51.5	8 55.8	2 58.0	13 18.6	21 1.2	23 24.2	19 36.7	10 39.9	0 59.1	12 14.5	20 51.0	23 24.2
27	18 36.3	8 33.4	2 21.6	13 38.0	21 11.7	23 22.2	19 23.5	10 19.0	1 22.5	12 35.0	21 2.4	23 22.2
28	18 20.9	8 10.9	2 45.1	13 57.1	21 21.8	23 20.0	19 10.0	9 58.0	1 45.9	12 55.4	21 13.4	23 19.7
29	18 5.0		3 8.5	14 16.0	21 31.5	23 17.3	18 56.2	9 36.8	2 9.3	13 15.6	21 24.0	23 16.7
30	17 48.9		3 31.9	14 34.7	21 40.9	23 14.2	18 42.0	9 15.5	2 32.7	13 55.5	21 34.2	23 13.3
31	17 32.5		3 55.2		21 49.9		18 27.6	8 54.0		13 55.3		23 9.4

TABLE VIII. *Sun's Declination for 1812, being leap year.*

Days.	January.	February.	March.	April.	May.	June.	July.	Auguſt.	September.	October	November.	December.
1	23 4'9S.	17° 19'8S.	7° 31'0S.	4° 35'7N	15° 6'7N	22° 4'6N	23° 7'6N	18° 1'5N	8° 15'9N	3° 13'7S.	14° 29'3S.	21° 51'0S
2	23 0.0	17 2.8	7 8.2	4 58.8	15 24.7	22 12.5	23 3.3	17 46.2	7 54.0	3 37.0	14 48.5	22 0.1
3	22 54.8	16 45.5	6 45.3	5 21.8	15 42.4	22 20.1	22 58.7	17 30.6	7 32.0	4 0.3	15 7.4	22 8.7
4	22 49.0	16 27.9	6 22.2	5 44.7	15 59.9	22 27.3	22 53.6	17 14.7	7 9.9	4 23.5	15 26.0	22 17.0
5	22 42.9	16 10.1	5 59.1	6 7.5	16 17.1	22 34.0	22 48.2	16 58.6	6 47.7	4 46.7	15 44.4	22 24.7
6	22 36.2	15 51.9	5 35.9	6 30.2	16 34.0	22 40.4	22 42.3	16 42.2	6 25.3	5 9.8	16 2.5	22 32.0
7	22 29.1	15 33.5	5 12.6	6 52.8	16 50.8	22 46.4	22 36.1	16 25.5	6 2.8	5 32.9	16 20.3	22 39.0
8	22 21.6	15 14.8	4 49.2	7 15.2	17 7.2	22 52.0	22 29.5	16 8.6	5 40.3	5 55.8	16 37.9	22 45.4
9	22 13.6	14 55.9	4 25.8	7 37.6	17 23.3	22 57.2	22 22.4	15 51.4	5 17.6	6 18.7	16 55.2	22 51.4
10	22 5.2	14 36.5	4 2.3	7 59.8	17 39.1	23 2.0	22 15.0	15 33.9	4 54.8	6 41.5	17 12.2	22 57.0
11	21 56.3	14 17.3	3 38.8	8 21.9	17 54.6	23 6.3	22 7.3	15 16.2	4 32.0	7 4.3	17 28.9	23 2.0
12	21 47.0	13 57.6	3 15.2	8 43.8	18 9.9	23 10.3	21 59.0	14 58.2	4 9.1	7 26.9	17 45.3	23 6.7
13	21 37.3	13 37.7	2 51.6	9 5.6	18 24.8	23 13.9	21 50.5	14 40.0	3 46.1	7 49.4	18 1.4	23 10.9
14	21 27.2	13 17.5	2 27.9	9 27.3	18 39.4	23 17.0	21 41.6	14 21.6	3 23.0	8 11.8	18 17.2	23 14.6
15	21 16.7	12 57.2	2 4.3	9 48.8	18 53.7	23 19.7	21 32.3	14 2.9	2 59.9	8 34.1	18 32.6	23 17.8
16	21 5.7	12 36.7	1 40.6	10 10.1	19 7.7	23 22.1	21 22.7	13 44.0	2 36.8	8 56.3	18 47.7	23 20.6
17	20 54.4	12 15.9	1 16.9	10 31.3	19 21.3	23 24.0	21 12.6	13 25.0	2 13.6	9 18.4	19 2.5	23 23.0
18	20 42.6	11 55.0	0 53.2	10 52.2	19 34.7	23 26.5	21 2.3	13 5.7	1 50.3	9 40.3	19 17.0	23 24.8
19	20 30.5	11 33.8	0 29.5	11 13.0	19 47.7	23 26.6	20 51.5	12 46.2	1 27.0	10 2.0	19 31.0	23 26.2
20	20 18.0	11 12.5	0 5.8	11 33.6	20 0.3	23 27.3	20 40.4	12 26.4	1 3.7	10 23.7	19 44.8	23 27.1
21	20 5.0	10 51.0	0 17.9N	11 54.0	20 12.7	23 27.6	20 29.0	12 6.5	0 40.3	10 45.1	19 58.2	23 27.5
22	19 51.8	10 29.4	0 41.5	12 14.3	20 24.6	23 27.4	20 17.2	11 46.4	0 16.9	11 6.4	20 11.2	23 27.5
23	19 38.2	10 7.6	1 5.2	12 34.3	20 36.3	23 26.9	20 5.1	11 26.1	0 6.5	11 27.6	20 23.9	23 27.0
24	19 24.1	9 45.6	1 28.8	12 54.2	20 47.5	23 25.9	19 52.7	11 5.7	0 29.9	11 48.6	20 36.1	23 26.0
25	19 9.8	9 23.5	1 52.3	13 13.8	20 58.4	23 24.5	19 39.9	10 45.0	0 53.3	12 9.4	20 48.0	23 24.5
26	18 55.0	9 1.3	2 15 8	13 33.2	21 9.0	23 22.7	19 26.8	10 24.2	1 16.7	12 30.0	20 59.5	23 22.6
27	18 40.0	8 38.9	2 39.3	13 52.3	21 19.2	23 20.5	19 13.3	10 3.2	1 40.1	12 50.4	21 10.6	23 20.3
28	18 24.6	8 16.4	3 2.7	14 11.3	21 29.0	23 17.9	18 59.6	9 42.0	2 3.5	13 10.6	21 21.4	23 17.4
29	18 8.9	7 53.8	3 26.1	14 30.0	21 38.5	23 14.8	18 45.5	9 20.7	2 26.9	13 30.6	21 31.7	23 14.0
30	17 52.9		3 49.4	14 48.5	21 47.6	23 11.4	18 31.1	8 59.3	2 50.3	13 50.4	21 41.6	23 10.3
31	17 36.5		4 12.6		21 56.3		18 16.4	8 37.7		14 10.0		23 6.0

TABLE IX. *To reduce the Sun's Declination to any other Meridian, and to any given Time under that Meridian.*

	Add in W. Sub. in E.		Sub. in W. Add in E.	LONGITUDE.																			Add in W. Sub. in E.		Sub. in W. Add in E.
				10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°	130°	140°	150°	160°	170°	180°				
December.	21	December.	21	0'0	0'0	0'0	0'0	0'0	0'0	0'0	0'0	0'0	0'0	0'0	0'0	0'0	0'0	0'0	0'0	0'0	0'0	June.	21	June.	21
	20		22	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2		20		22
	19		23	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4		19		23
	18		24	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.4	0.6	0.6	0.6		18		24
	17		25	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.8	0.8	0.9		17		25
	16		26	0.1	0.1	0.2	0.2	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7	0.8	0.8	0.9	1.0	1.0	1.1		16		26
	15		27	0.1	0.1	0.2	0.3	0.4	0.4	0.5	0.6	0.7	0.8	0.8	0.9	0.9	1.0	1.1	1.2	1.2	1.3		15		27
	14		28	0.1	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	0.9	1.0	1.1	1.2	1.3	1.4	1.4	1.5		14		28
	13		29	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8		13		29
	12		30	0.1	0.2	0.3	0.4	0.5	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.9	2.0		12		30
December.	11	January.	31	0.1	0.2	0.4	0.5	0.6	0.7	0.8	1.0	1.1	1.2	1.3	1.5	1.6	1.7	1.8	1.9	2.1	2.2	June.	11	July.	1
	10		1	0.1	0.3	0.4	0.5	0.7	0.8	0.9	1.1	1.2	1.3	1.5	1.6	1.7	1.9	2.0	2.1	2.3	2.4		10		2
	9		2	0.1	0.3	0.4	0.6	0.7	0.9	1.0	1.2	1.3	1.5	1.6	1.8	1.9	2.0	2.2	2.3	2.5	2.6		9		3
	8		3	0.1	0.3	0.5	0.6	0.8	0.9	1.1	1.3	1.4	1.6	1.7	1.9	2.1	2.2	2.4	2.5	2.7	2.8		8		4
	7		4	0.2	0.3	0.5	0.7	0.8	1.0	1.2	1.4	1.5	1.7	1.9	2.0	2.2	2.4	2.6	2.7	2.9	3.1		7		5
	6		5	0.2	0.4	0.5	0.7	0.9	1.1	1.3	1.4	1.6	1.8	2.0	2.2	2.4	2.5	2.7	2.9	3.1	3.3		6		6
	5		6	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.5	1.7	1.9	2.1	2.3	2.5	2.7	2.9	3.1	3.3	3.5		5		7
	4		7	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.3	2.5	2.7	2.9	3.1	3.3	3.5	3.7		4		8
	3		8	0.2	0.4	0.6	0.9	1.1	1.3	1.5	1.7	1.9	2.2	2.4	2.6	2.8	3.0	3.2	3.5	3.7	3.9		3		9
	2		9	0.2	0.4	0.7	0.9	1,1	1.4	1.6	1.8	2.0	2.3	2.5	2.7	3.0	3.2	3.4	3.6	3.9	4.1		2		10
November.	1	January.	10	0.2	0.5	0.7	0.9	1.2	1.4	1.7	1.9	2.1	2.4	2.6	2.9	3.1	3.3	3.6	3.8	4.1	4.3	May.	1	July.	11
	30		11	0.2	0.5	0.7	1.0	1.2	1.5	1.7	2.0	2.2	2,5	2.7	3.0	3.2	3.5	3.7	4.0	4.2	4.5		31		12
	29		12	0.3	0.5	0.8	1.0	1.3	1 6	1.8	2.1	2.3	2.6	2.9	3.1	3.4	3.6	3.9	4.2	4.4	4.7		30		13
	28		13	0.3	0.5	0.8	1.1	1.4	1.6	1.9	2.2	2.4	2.7	3.0	3.3	3.5	3.8	4.1	4.3	4.6	4.9		29		14
	27		14	0.3	0.6	0.8	1.1	1.4	1.7	2.0	2.3	2.5	2.8	3.1	3.4	3.7	4.0	4.2	4.5	4.8	5.1		28		15
	26		15	0.3	0.6	0.9	1.2	1.5	1.8	2.0	2.3	2.6	2.9	3.2	3.5	3.8	4.1	4.4	4.7	5.0	5.3		27		16
	25		16	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0	3.3	3.6	3.9	4.3	4.6	4.9	5.2	5.5		26		17
	24		17	0.3	0.6	0.9	1.3	1.6	1.9	2.2	2.5	2.8	3.1	3.5	3.8	4.1	4.4	4.7	5.0	5.3	5.7		25		18
	23		18	0.3	0.6	1.0	1.3	1.6	1.9	2.3	2.6	2.9	3.2	3.6	3.9	4.2	4.5	4.9	5.2	5.5	5.8		24		19
	22		19	0.3	0.7	1.0	1.3	1.7	2.0	2.3	2.7	3.0	3.3	3.7	4.1	4.3	4.7	5.0	5.4	5.7	6.0		23		20
November.	21	January.	20	0.3	0.7	1.0	1.4	1.7	2.1	2.4	2.8	3.1	3.4	3.8	4.1	4.5	4.8	5.2	5.5	5.9	6.2	May.	22	July.	21
	20		21	0.4	0.7	1.1	1.4	1.8	2.1	2.5	2.8	3.2	3.5	3.9	4.3	4.6	5.0	5.3	5.7	6.0	6.4		21		22
	19		22	0.4	0.7	1.1	1.5	1.8	2.2	2.5	2.9	3.3	3.6	4.0	4.4	4.7	5.1	5.5	5.8	6.2	6.6		20		23
	18		23	0.4	0.7	1.1	1,5	1.9	2.2	2.6	3.0	3.4	3.7	4.1	4.5	4.9	5.2	5.6	6.0	6.4	6.7		19		24
	17		24	0.4	0.8	1.1	1.5	1.9	2.3	2.7	3.1	3.4	3.8	4.2	4.6	5.0	5.4	5.7	6.1	6.5	6.9		18		25
	16		25	0.4	0.8	1.2	1.6	2.0	2.3	2.7	3.1	3.5	3.9	4.3	4.7	5.1	5.5	5.9	6.3	6.7	7.1		17		26
	15		26	0.4	0.8	1.2	1.6	2.0	2.4	2.8	3.2	3.6	4.0	4.4	4.8	5.2	5.6	6.0	6.4	6.8	7.2		16		27
	14		27	0.4	0.8	1.2	1.6	2.1	2.5	2.9	3.3	3.7	4.1	4.5	4.9	5.3	5.8	6.2	6.6	7.0	7.4		15		28
	13		28	0.4	0.8	1.3	1.7	2.1	2.5	2.9	3.4	3.8	4.2	4.6	5.0	5.5	5.9	6.3	6.7	7.1	7.6		14		29
	11		30	0.4	0.9	1.3	1.7	2.2	2.6	3.1	3.5	3.9	4.4	4.8	5.2	5.7	6.1	6.6	7.0	7.4	7.9		12		31
November.	9	February.	1	0.4	0.9	1.4	1.8	2.3	2.7	3.2	3.6	4.1	4.5	5.0	5.4	5.9	6.4	6.8	7.3	7.7	8.2	May.	10	August.	2
	7		3	0.5	0.9	1.4	1.9	2.3	2.8	3.3	3.8	4.2	4.7	5.2	5.6	6.1	6.6	7.0	7.5	8.0	8.5		8		4
	5		5	0.5	1.0	1.4	1.9	2.4	2.9	3.4	3.9	4.3	4.8	5.3	5.8	6.3	6.8	7.3	7.7	8.2	8.7		6		6
	3		7	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0		4		8
	1		9	0.5	1.0	1.5	2.0	2.5	3.1	3.6	4.1	4.6	5.1	5.6	6.1	6.7	7.2	7.7	8.2	8.7	9.2		2		10
October.	30		11	0.5	1.0	1.6	2.1	2.6	3.1	3.7	4.2	4.7	5.3	5.8	6.3	6.8	7.3	7.9	8.4	8.9	9.5	April.	30		12
	28		13	0.5	1.1	1.6	2.1	2.7	3.2	3.8	4.3	4.8	5.4	5.9	6.5	7.0	7.5	8.1	8.6	9.1	9.7		28		14
	26		15	0.5	1.1	1.6	2.2	2.7	3.3	3.8	4.4	4.9	5.5	6.0	6.6	7.2	7.7	8.2	8.8	9.3	9.9		26		16
	24		17	0.6	1.1	1.7	2.2	2.8	3.4	3.9	4.5	5.0	5.6	6.2	6.7	7.3	7.9	8.4	9.0	9.6	10.1		24		18
	21		20	0.6	1.1	1.7	2.3	2.9	3.5	4.0	4.6	5.2	5.8	6.3	6.9	7.5	8.1	8.7	9.2	9.8	10.4		21		21
October.	18	March.	23	0.6	1.2	1.8	2.4	3.0	3.5	4.1	4.7	5.3	5.9	6.5	7.1	7.7	8.3	8.9	9.5	10.0	10.6	April.	18	August.	24
	15		26	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6	7.2	7.9	8.5	9.1	9.7	10.3	10.9		15		27
	12		1	0.6	1.2	1.8	2.5	3.1	3.7	4.3	4.9	5.5	6.2	6.8	7.4	8.0	8.6	9.2	9.8	10.5	11.1		12		30
	9		4	0.6	1.2	1.9	2.5	3.1	3.7	4.4	5.0	5.6	6.3	6.9	7.5	8.1	8.8	9.4	10.0	10.6	11.3		9		2
	6		7	0.6	1.3	1.9	2.5	3.2	3.8	4.4	5.1	5.7	6.3	7.0	7.6	8.2	8.9	9.5	10.1	10.8	11.4		6	September.	5
September.	3		10	0.9	1.3	1.9	2.6	3.2	3.8	4.5	5.1	5.8	6.4	7.0	7.7	8.3	9.0	9.6	10.3	10.9	11.5	March.	3		8
	30		13	0.6	1.3	1.9	2.6	3.2	3.9	4.5	5.2	5.8	6.5	7.1	7.7	8.4	9.0	9.7	10.3	11.0	11.6		31		11
	27		16	0.7	1.3	1.9	2.6	3.2	3.9	4.5	5.2	5.8	6.5	7.1	7.8	8.4	9.1	9.7	10.4	11.0	11.7		28		14
	24		19	0.7	1.3	2.0	2.6	3.2	3.9	4.5	5.2	5.9	6.5	7.2	7.8	8.5	9.1	9.8	10.4	11.1	11.7		25		17
	21		22	0.7	1.3	2.0	2.6	3.3	3.9	4.6	5.2	5.9	6.5	7.2	7.8	8.5	9.1	9.8	10.4	11.1	11.7		22		20
	Add aft. N. Sub. bef. N.		Sub. aft. N. Add bef. N.	$0^{h}\frac{2}{3}$	$1^{h}\frac{1}{3}$	$2^{h}0$	$2^{h}\frac{2}{3}$	$3^{h}\frac{1}{3}$	$4^{h}0$	$4^{h}\frac{2}{3}$	$5^{h}\frac{1}{3}$	$6^{h}0$	$6^{h}\frac{2}{3}$	$7^{h}\frac{1}{3}$	$8^{h}0$	$8^{h}\frac{2}{3}$	$9^{h}\frac{1}{3}$	$10^{h}0$	$10^{h}\frac{2}{3}$	$11^{h}\frac{1}{3}$	$12^{h}0$		Add aft. N. Sub. bef. N.		Sub. aft. N. Add bef. N.

Time from Noon.

TABLE X. *Change of Sun's Dec.*

Month.	Days.	Complete Years.							
		4		8		12		16	
January.	1	0′	—1	0′	—3	0′	—4	0′	—6
	7	0	.2	0	.4	0	.7	0	.9
	13	0	.3	0	.6	0	.9	1	.2
	19	0	.4	0	.7	1	1	1	.4
	25	0	.4	0	.8	1	.3	1	.7
February.	1	0	.5	1	.0	1	.5	2	.0
	7	0	.5	1	.1	1	.6	2	.2
	13	0	.6	1	.2	1	.7	2	.3
	19	0	.6	1	.2	1	.9	2	.5
	25	0	.7	1	.3	2	.0	2	.6
March.	1	0	.7	1	.3	2	.0	2	.7
	7	0	.7	1	.4	2	.1	2	.7
	13	0	.7	1	.4	2	.1	2	.8
	19	0	.7	1	.4	2	.1	2	.8
	25	0	+ 7	1	+ 4	2	+ 1	2	+ 8
April.	1	0	.7	1	.4	2	.1	2	.8
	7	0	.7	1	.4	2	.1	2	.7
	13	0	.7	1	.3	2	.0	2	.6
	19	0	.6	1	.3	1	.9	2	.5
	25	0	.6	1	.2	1	.8	2	.4
May.	1	0	.6	1	.1	1	.7	2	.3
	7	0	.5	1	.0	1	.6	2	.1
	13	0	.5	0	.9	1	.4	1	.9
	19	0	.4	0	.8	1	.2	1	.6
	25	0	.3	0	.7	1	.0	1	.3
June.	1	0	.3	0	.5	0	.8	1	.0
	7	0	.2	0	.4	0	.5	0	.7
	13	0	.1	0	.2	0	.3	0	.4
	19	0	.0	0	.0	0	.1	0	.1
	25	0	— 1	0	— 1	0	— 2	0	— 3
July.	1	0	.1	0	.3	0	.4	0	.6
	7	0	.2	0	.4	0	.7	0	.9
	13	0	.3	0	.6	0	.9	1	.2
	19	0	.4	0	.7	1	.1	1	.4
	25	0	.4	0	.9	1	.3	1	.7
August.	1	0	.5	1.	0	1	.5	2	.0
	7	0	.5	1.	1	1	.6	2	.2
	13	0	.6	1.	2	1	.8	2	.4
	19	0	.6	1.	3	1	.9	2	.5
	25	0	.7	1.	3	2	.0	2	.6
September.	1	0	.7	1	.4	2	.0	2	.7
	7	0	.7	1	.4	2	.1	2	.8
	13	0	.7	1	.4	2	.1	2	.8
	19	0	.7	1	.4	2	.1	2	.9
	25	0	+ 7	1	+ 4	2	+ 1	2	+ 8
October.	1	0	.7	1	.4	2	.1	2	.8
	7	0	.7	1	.4	2	.0	2	.7
	13	0	.7	1	.3	2	.0	2	.6
	19	0	.6	1	.3	1	.9	2	.5
	25	0	.6	1	.2	1	.8	2	.4
November.	1	0	.5	1	.1	1	.6	2	.2
	7	0	.5	1	.0	1	.5	2	.0
	13	0	.4	0	9	1	.3	1	.8
	19	0	.4	0	.8	1	.2	1	.5
	25	0	.3	0	.7	1	.0	1	.3
December.	1	0	.2	0	.5	0	.7	1	.0
	7	0	.2	0	.4	0	.5	0	.7
	13	0	.1	0	.3	0	.3	0	.4
	19	0	.0	0	.1	0	.1	0	[illegible]
	25	0	.1	0	— 1	0	— 1	0	—.2

TABLE XI. *The Right Ascensions and Declinations of the Principal fixed Stars, adapted to the beginning of the Year* 1810.

Names of Stars.	Mag.	Right Ascen. in Time.			Ann. Var.		Declination.			Ann. Var.	
γ Pegaſi	2	0h	3′	57″	3″	.06	14°	7′	35″N	+20″	.0
β Ceti	2	0	34	2	3	.01	19	3	36 S	—19	.8
Alrucabah, pole ſtar	2.3	0	54	15	12	.42	88	17	41 N	+19	.6
Mirach	2	0	59	7	3	.31	34	36	45 N	+19	.4
Achernar	1	1	30	38	2	.25	58	11	19 S	—18	.5
Almaach	2	1	52	16	3	.62	41	24	47 N	+17	.7
Menkar	2	1	52	20	3	.11	3	20	27 N	+14	.7
Algol	Var.	2	56	0	3	.85	40	12	53 N	+14	.5
Algenib	1	3	10	49	4	.21	49	9	31 N	+13	.6
Aldebaran	2	4	25	1	3	.42	16	7	6 N	+ 8	.2
Capella	1	5	2	40	4	.41	45	47	41 N	+ 5	.1
Rigel	1	5	5	19	2	.87	8	25	48 S	— 4	.8
β Tauri	2	5	14	17	3	.78	28	26	10 N	+ 4	.1
Bellatrix	2	5	14	57	3	.21	6	10	1 N	+ 4	.0
δ Orionis	2	5	22	20	3	.07	0	26	53 S	— 3	.4
ε Orionis	2	5	26	35	3	.04	1	19	57 S	— 3	.0
ζ Orionis	2	5	31	11	3	.03	2	3	8 S	— 2	.6
α Columbæ	2	5	32	45	2	.17	34	10	54 S	— 2	.4
Betelgueſe	1	5	44	53	3	.24	7	21	40 N	+ 1	.4
β Canis Majoris	2.3	6	14	22	2	.65	17	52	16 S	+ 1	.2
Canopus	1	6	19	43	1	.33	51	35	44 S	+ 1	.7
Sirius	1	6	36	46	2	.65	15	27	48 S	+ 4	.3
δ Canis Majoris	2	7	0	40	2	.44	26	6	0 S	+ 5	.2
Caſtor	1.2	7	22	27	3	.85	32	17	33 N	— 6	.9
Procyon	1.2	7	29	20	3	.14	5	42	56 N	— 7	.5
Pollux	2.3	7	32	48	3	.69	28	27	28 N	— 7	.9
ζ Navis	2	7	56	44	2	.11	39	28	20 S	+ 9	.7
γ Navis	2	8	3	41	1	.85	46	46	39 S	+10	.3
Acubens	3	8	48	4	3	.30	12	35	19 N	—13	.4
β Navis	1	9	11	6	0	.75	68	56	13 S	+14	.8
Alphard	2	9	18	14	2	.93	7	50	25 S	+15	.2
Regulus	1	9	58	14	3	.20	12	53	29 N	—17	.2
η Navis	2	10	37	43	2	.30	58	41	20 S	+18	.7
β Urſæ Majoris	2	10	50	17	3	.71	57	23	53 N	—19	.1
Dubhe	2	10	51	54	3	.85	62	46	43 N	—19	.1
β Leonis	2	11	39	21	3	.06	15	37	9 N	—19	.9
γ Urſæ Majoris	2	11	47	45	3	.22	54	44	7 N	—20	.0
α Crucis	1	12	16	9	3	.24	62	2	46 S	+20	.0
γ Crucis	2	12	20	42	3	.24	52	2	42 S	+20	.0
β Crucis	2	12	36	44	3	.41	58	38	55 S	+19	.8
Aliath	2	12	45	36	2	.67	57	10	48 N	—19	.7
Spica Virginis	1	13	15	11	3	.13	10	9	54 S	+19	.0
ζ Urſæ Majoris	2	13	16	23	2	.43	55	54	8 N	—19	.0
Benetnach	2	13	40	4	2	.40	50	15	58 N	—18	.2
β Centauri	1.2	13	50	32	4	.11	59	26	51 S	+17	.8
Arcturus	1	14	6	59	2	.72	20	10	34 N	—19	.1
α Centauri	1	14	27	16	4	.45	60	3	17 S	+16	.1
Alphacca	2	15	26	38	2	.53	27	21	44 N	—12	.5
β Scorpii	2	15	54	26	3	.47	10	16	29 S	+10	.5
Antares	1	16	17	45	3	.64	25	59	49 S	+ 8	.7
Ras. Algethi	2	17	5	59	2	.73	14	36	57 N	— 4	.8
Ras. Alhague	2	17	26	7	2	.77	12	42	37 N	— 3	.0
Vega	1	18	30	30	2	.02	38	36	35 N	+ 2	.6
Altair	1.2	19	41	30	2	.92	8	22	13 N	+ 8	.5
Deneb	2	20	34	56	2	.03	44	36	13 N	+12	.5
Gruis	2	21	56	11	3	.85	48	1	58 S	—17	.1
Fomalhaut	1	22	47	6	3	.33	30	48	14 S	—19	.0
Scheat	2	22	54	34	2	.87	27	3	7 N	+19	.2
Markab	2	22	55	17	2	.96	27	3	7 N	+19	.2
α Andromedæ	[illegible]	23	58	34	3	.07	28	2	31 N	+20	.0

NAVIGATION of the Ancients. See PHOENICIA and TRADE.

Inland NAVIGATION, the method of conveying commodities from one part of a country to another by means of rivers, lakes, canals, or arms of the ſea. See CANAL.

We have already, under CANAL, taken notice of a method propoſed by Dr Anderſon of raiſing and lowering veſſels by means of mechanical powers, inſtead of dams and locks. We ſhall deſcribe another mechanical contrivance propoſed by Mr Leach for the ſame purpoſe. This machinery is compounded of an inclined plane and wheel in axis. The inclined plane is a parallelogram whoſe length reaches from the end of one canal to the beginning of another, or to the ſea or navigable river, to which the veſſel is next to be conveyed; the breadth ought to be 22½ feet. It may be made of good oak or deal plank, and ſufficiently ſtrong to bear the weight to be laid upon it; and it muſt be very ſtrongly ſupported by beams of oak or other wood. It ought to be divided in the middle by a ledge or rib of 12 inches ſquare, the ſide ribs being nine by 12 inches. The elevation muſt depend upon particular circumſtances. Fig. 1. ſhows the inclined part of the machine; AB being the wooden part juſt deſcribed, placed between the ſide of the hill W and the navigable river F. According to the dimenſions already given, the two paths A and B on which the veſſels move are exactly ten feet wide. G repreſents the canal, brought perhaps from the diſtance of ſeveral miles to the top of the precipice WW. At the end of the canal, and quite acroſs from R to R, muſt be built a very ſtrong wall; in which are two ſluices with flood gates at K and L, to let out the water occaſionally. Between the head of the plane AB, and the end of the canal G, is a horizontal platform divided into two parts, as is repreſented in the figure by the letters HI. At the end of the canal are ſix rollers M and N, of uſe in carrying the boats and lighters in and out of the canal. Near the end of the canal, at S, and T, are two other ſluices, with their flood-gates, for letting out a quantity of fluid to drive the other part of the machine. O and P repreſent the two ends of the towing paths, one on each ſide of the canal.

Plate CCCLXIX. fig. 1.

Fig. 2.

Fig. 2. ſhows the vehicle by which the lighters are conveyed up and down the inclined plane, by the two paths A and B, fig. 1. AA (fig. 2.) repreſents part of the inclined plane, B the vehicle in the poſition in which it rolls up and down the two paths. C is the body of the vehicle, which is made hollow, to contain a quantity of water occaſionally uſed as a counterbalance for its correſponding vehicle. DDD are three rollers between the bottom of the vehicle and the plane, for the purpoſe of rolling the boats up and down. HHH are ſix rollers; four by the horizontal part of the vehicle on which the boat E is to reſt in its paſſage up and down the plane; the other two rollers are in a moveable part, which is faſtened to the body of the vehicle with a pair of very ſtrong hinges: and in the paſſage of the vehicle up and down the plane, it turns up between the head of the boat and the plane, preventing the former from rubbing againſt the plane. When the vehicle gets up to the top, this moveable part falls down on the platform marked HI, becoming parallel with the horizontal part of the vehicle; after which it ſerves for a launch and paſſage to place the boat upon the rollers MN (fig. 1.) at the end of the canal. This paſſage part of the vehicle, together with the three rollers at the end of the canal, is likewiſe of great uſe in towing a boat out of the canal, in order to place it on the horizontal part. At the bottom of the cavity of the vehicle is a large hole F, with a valve opening inwardly. Through this hole the water enters when the vehicle ſinks into the navigable river F, for the purpoſe of receiving a boat on the top or horizontal part of the vehicle till it is quite full and then will ſink entirely under water, while the boat is towed in on the horizontal part. A ſmall rope K is faſtened to the valve, on purpoſe to lift it up and to keep it ſo, while the vehicle and boat are aſcending up the plane out of the canal; that ſo the water may diſcharge itſelf till as much as is neceſſary be got out, or till it becomes an equal balance for the correſponding vehicle and its contents, which are deſcending by the other path. Hence we ſee, that every machine muſt have two of theſe vehicles furniſhed with rollers as already deſcribed, and ſo conſtructed that one may be as nearly as poſſible a counterbalance to the other. As it is neceſſary that the vehicles ſhould be water tight, the inſides of them muſt be caulked very tight; and they ſhould be capacious enough to hold as much water as will balance the largeſt boat with its contents. Here it may be obſerved, that every veſſel will be balanced by as many cubic feet of water as it diſplaces by being put into the water when loaded. The quantity may eaſily be known, by obſerving how far the boat ſinks in the water, and calculating the bulk of the part immerſed.

The machine which puts the vehicles in motion, may either be conſtructed with an under-ſhot or breaſt-water wheel: or by an over-ſhot water-wheel: or by two walking-wheels, for men to walk in as in cranes, &c.

Fig. 3.

Fig. 3. ſhows a front view of the under-ſhot water-wheel movement; where A is the end of the axis or cylinder of the cog or ſpur wheel; the diameter of which axis is four feet, and its length not leſs than 22 feet, as it muſt be extended quite acroſs the canal from one ſide to the other, and placed on the top of very ſtrong ſupporters on each ſide of the canal, about ſeven feet above the ſurface of the water, as the loaded boat is to paſs backwards and forwards under the cylinder, and at a convenient diſtance from the wall RR (fig. 1.); and placed between the two ſluices S and T; on the end of which cylinder is the cog-wheel B (fig. 3.). The wheel B is ſuppoſed to be 20 feet of diameter, having on its edge 120 cogs; and underneath the cog-wheel is the breaſt-water one C, 24 feet in diameter, from the tip of one aller-board to the tip of its oppoſite. On the end of the axis of the water-wheel D is a trundle two feet and a half in diameter, with 15 rounds and ſtaves contained therein. This muſt be placed between the two ſluices S and T, to let the water out of the canal; which, falling on the float-boards, will turn the wheel round from the right hand towards the left, when the ſluice on the left hand of the wheel is opened; but the contrary way when that of the right is opened.—The water

falling

falling upon the boards paſſes along with the wheel in the circular cavity EGF, and is diſcharged at G, whatever way the wheel may turn.

To the axis or cylinder of this machine, which muſt always be horizontal, are fixed a pair of ſtrong ropes; the ends of each pair faſtened to the upper part of the cylinder; it being neceſſary that they ſhould act in contrary directions. Each muſt extend the whole length of the plane, and their ſtrength muſt be proportioned to the weight neceſſary to be ſuſtained. The two vehicles already mentioned are faſtened to the other ends of the ropes; ſo that one pair of the ropes are wound up by the cylinder turning one way, and the other by its turning the contrary way. Thus when Fig. 1. one of the vehicles is at the upper part of the path A, ready to diſcharge its boat and cargo into the upper canal, the other boat will be at the foot of the path B, all under water in the lower canal, and ready for the reception of a boat to be towed in on the horizontal part of it; ſo that as one vehicle rolls up on one ſide of the plane, the other will roll down on the other ſide, and *vice verſa.*

Fig. 4. Fig. 4. ſhows the movement by means of an overſhot water-wheel. It conſiſts of a water-wheel C, and two ſpur or cog-wheels A and B. The water-wheel is 18 feet in diameter, and has two rows of buckets placed contrariwiſe to one another, that it may turn round in contrary directions, according as the one or the other ſluice, S, or T, is opened. On its axis F is a trundle of three feet diameter, having 18 rounds or ſtaves which fall into the cogs of the ſecond ſpur-wheel B, cauſing it to turn round in a direction contrary to that of the water-wheel. This ſecond wheel is likewiſe 18 feet in diameter, with a trundle of three feet having 18 rounds or ſtaves.—The diameter of the upper ſpur-wheel A is alſo 18 feet, but the diameter of its axis is ſix feet. On the edge of the wheel are 108 cogs. Theſe fall in between the ſtaves of the axis of the other ſpur-wheel; and thus the third wheel turns round the ſame way with the water wheel C. The cylinder of this upper ſpur-wheel muſt be placed acroſs the canal betwixt the two ſluices, on very ſtrong ſupporters, as explained in the former movement, and the two pair of ropes in the ſame manner.

The movement of the walking wheel is ſhown (fig. Fig. 5. 5.). A1 and A2 are two wheels for men to walk in, each of them 24 feet in diameter. B1 and B2 are the axes or cylinders of the two wheels, of equal lengths; viz. 11 feet each, and four in diameter.—At one end of each of the two cylinders C1 and C2, is a wheel of the ſame diameter with the cylinder. On the edges of theſe wheels are teeth of an equal number in each wheel; and as the teeth of the wheels mutually fall into each other, the revolutions of both muſt be performed in the ſame time. By this contrivance alſo the cylinders will turn different ways; and the ropes on the two different cylinders will conſtantly one pair be wound up, and the other wound down, by the natural moving of the machine. DDD is the frame that ſupports the whole, which muſt be made very firm and ſecure.

Let us now ſuppoſe, that there is a boat in the upper canal to be brought down, but none to go up for a balance. In this caſe, as one of the vehicles muſt be at the top to receive the boat, the other will be at the bottom to take in water. Let then any of the movements juſt deſcribed be ſet to work, and it is plain, that as the upper vehicle with its boat deſcends, the under vehicle will aſcend with the water; the valve being in the mean time lifted up till a ſufficient quantity of water has flowed out, to make the one nearly a counterbalance to the other; ſo that the veſſel may ſlide down gently and without any violence.

If it happens that a boat is to go up while none is to come down, one of the vehicles being at the foot of the plane under water, and in readineſs to have the boat towed upon its horizontal part, one of the ſluices at K or L is to be opened, and a quantity of water let into the ciſtern of the upper vehicle ſufficient to counterbalance the boat with its contents which is to aſcend. This being done, the machine is ſet to work, the valve of the under vehicle kept open till the water is all diſcharged; and then the boat will roll up to the top of the plane.

From this deſcription of the canal and machinery for raiſing and lowering the veſſels, the reader can be at no loſs to underſtand the principles on which it depends. It would be ſuperfluous to adduce examples, or follow our author through his calculations relative to particular caſes. We ſhall only obſerve, that the difference of time in which veſſels may be raiſed or lowered by the machinery juſt deſcribed, in compariſon with what can be done in the common way by dams and locks, muſt give a very favourable idea of the new method. According to Mr Leach's computations, a boat with its cargo weighing 10 tons might be raiſed by the walking machine in 12 or 14 minutes, by the under-ſhot wheel in 15 minutes, and by the over-ſhot wheel in 30 minutes; and that through a ſpace of no leſs than 30 fathoms meaſured on the inclined plane, or 114 feet perpendicular.

NAVIGATORS ISLANDS. See OPOUN.

NAULUM, in Roman antiquity, a piece of money put into the mouth of a perſon deceaſed to enable him to pay Charon the ferryman for his paſſage. It was to be of the current coin of the reigning emperor; ſo that from this money the time of the perſon's death may be known. The ſum for poor men was a farthing, but the rich in general were very liberal to Charon, as appears from the number of coins often found in the neighbourhood of Rome on opening the graves of great men. Charon was looked upon as a very moroſe and obſtinate old fellow, who would not carry over any man without his fare: and hence the proverbial uſe of that verſe in Juvenal,

Furor eſt poſt omnia perdere naulum.

A ſimilar cuſtom took place among the Greeks: The money put into the mouth of the deceaſed was by them called Δανακη.

NAUMACHIA, in antiquity, a ſhow or ſpectacle among the ancient Romans, repreſenting a ſea fight. Theſe mock ſea fights are ſuppoſed to have originated at the time of the firſt Punic war, when the Romans firſt inſtructed their men in the knowledge of naval affairs. Afterwards they were intended to entertain the populace, as well as to improve the ſeamen. They were often, like other ſhows, exhibited at the expence of individuals, to increaſe their popularity.

INLAND NAVIGATION.

PLATE CCCLXIX.

Fig. 1.

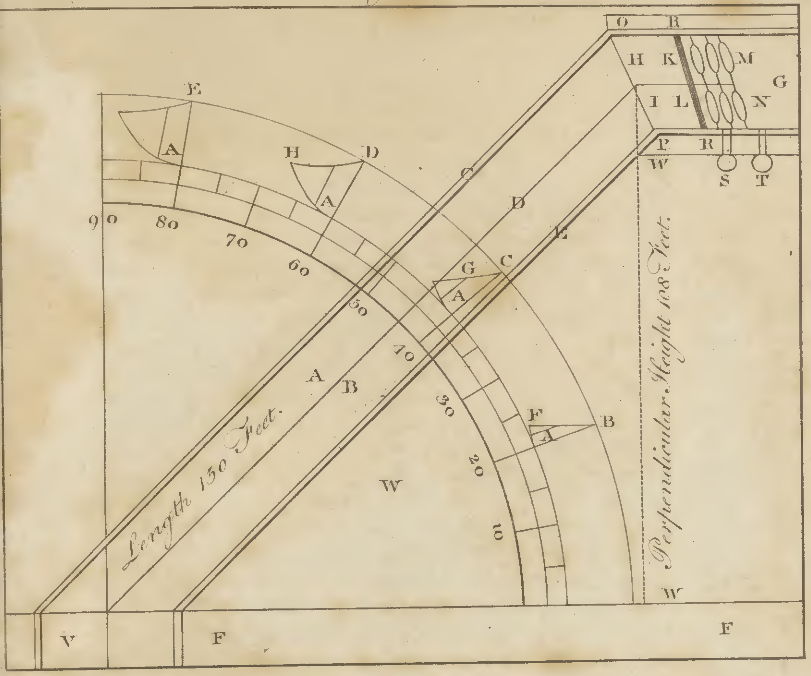


Fig. 2.

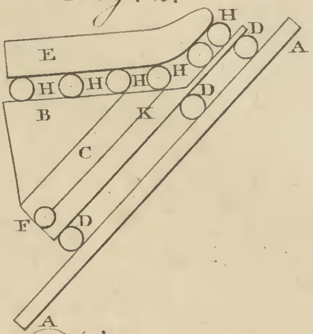


Fig. 3.

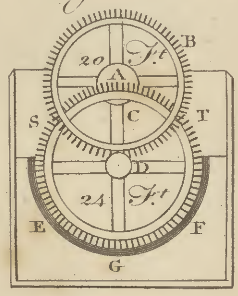


Fig. 4.

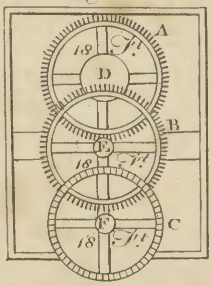
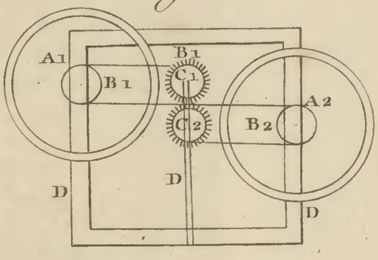


Fig. 5.



NAPIER'S RODS.

Fig. 1.

1	1	2	3	4	5	6	7	8	9	0
2	/2	/4	/6	/8	1/0	1/2	1/4	1/6	1/8	/0
3	/3	/6	/9	1/2	1/5	1/8	2/1	2/4	2/7	/0
4	/4	/8	1/2	1/6	2/0	2/4	2/8	3/2	3/6	/0
5	/5	1/0	1/5	2/0	2/5	3/0	3/5	4/0	4/5	/0
6	/6	1/2	1/8	2/4	3/0	3/6	4/2	4/8	5/4	/0
7	/7	1/4	2/1	2/8	3/5	4/2	4/9	5/6	6/3	/0
8	/8	1/6	2/4	3/2	4/0	4/8	5/6	6/4	7/2	/0
9	/9	1/8	2/7	3/6	4/5	5/4	6/3	7/2	8/1	/0

Fig. 2.

1	4	7	6	8
2	/8	1/4	1/2	1/6
3	1/2	2/1	1/8	2/4
4	1/6	2/8	2/4	3/2
5	2/0	3/5	3/0	4/0
6	2/4	4/2	3/6	4/8
7	2/8	4/9	4/2	5/6
8	3/2	5/6	4/8	6/4
9	3/6	6/3	5/4	7/2

DIPPING NEEDLE.

Fig. 1.

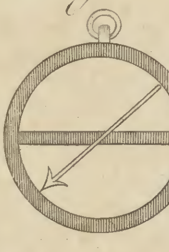
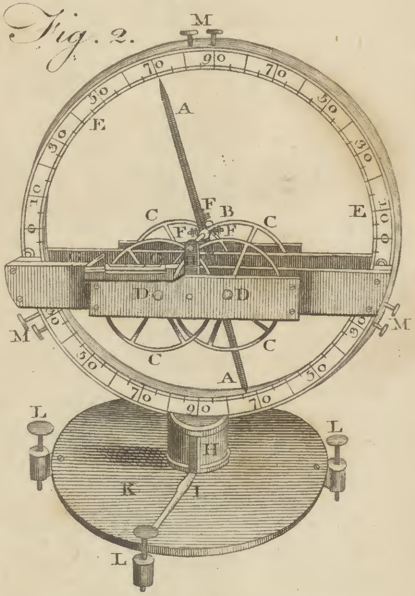
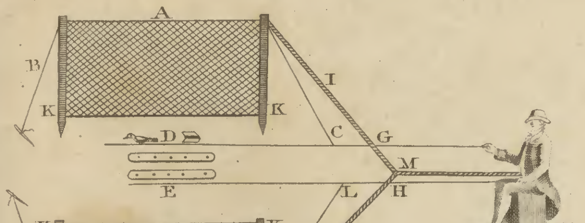


Fig. 2.



DAY NET.



NEWTONIAN PHILOSOPHY.

Fig. 1.

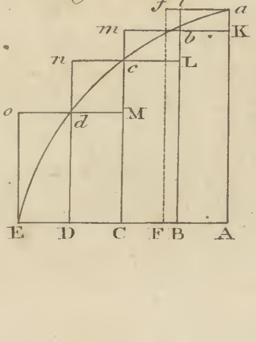
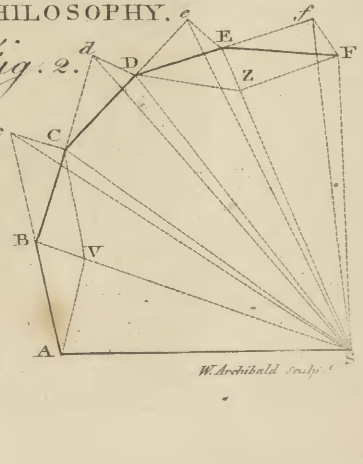


Fig. 2.



W. Archibald Sculpt.

In theſe ſpectacles they ſometimes ſtrove to excel each other in ſwiftneſs; and ſometimes engaged in a warlike manner. The naumachiæ of Claudius indeed was a moſt ſavage diverſion. The combatants uſed to deſtroy each other to amuſe a tyrant and a cruel mob. As they paſſed before him, they uſed this melancholy greeting, "*Ave Imperator, morituri te ſalutant.*" The emperor replied, "*Avete vos.*" This they underſtood as an anſwer of kindneſs, and a grant of their lives; but they ſoon diſcovered that it proceeded from wanton cruelty, and barbarous inſenſibility. In the time of the emperor Domitian, ſuch a vaſt number of veſſels engaged as would have nearly formed two regular fleets for a real fight, and the channel of water was equal in magnitude to a natural river. The emperor Heliogabalus is reported to have filled the channel where the veſſels were to ride with wine inſtead of water. Tritons and ſea monſters were frequently exhibited during the engagement. Suetonius and Dio Caſſius informs us, that at one of theſe ſea fights of Domitian a violent ſhower fell; the emperor, however, continued till the end of the engagement, often changing his clothes, nor would he ſuffer any one to depart; and as the rain continued for ſeveral hours, many were ſeized with diſtempers, and ſome even died, Suet. cap. 4. Dio. lib. lxvii. Naumachiæ were alſo places fitted up for theſe ſhows, a ſort of circi or amphitheatres, with ſeats and porticoes, &c. There were ſeveral of them at Rome; three built by Auguſtus, one by Claudius, another by Domitian, and another by Nero: which ſerved for the reverſe of his medals. Claudius uſed the lake Fucinus as a naumachia.

NAUMBURG, a town of Germany, in the circle of Upper Saxony, capital of the county of Saxe-Naumburg, ſituated on the river Sala, in E. Long. 11. 20. N. Lat. 51. 12.

NAUPACTUS, or NAUPACTUM, in *Ancient Geography*, a city of Ætolia, at the mouth of the Evenus. The word is derived from ναυς and πηγνυμι, becauſe it was there that the Heraclidæ built the firſt ſhip which carried them to Peloponneſus. It firſt belonged to the Locri Ozolæ, and afterwards fell into the hands of the Athenians, who gave it to the Meſſenians, who had been driven from Peloponneſus by the Lacedæmonians. It became the property of the Lacedæmonians after the battle of Ægoſpotamos, and it was reſtored to the Locri. Philip of Macedon afterwards took it, and gave it to the Ætolians; from which circumſtance it has generally been called one of the chief cities of their country. E. Long. 22. 20. N. Lat. 38. 0.

There was on the ſhore a temple of Neptune, and near it a cave filled with offerings, and dedicated to Venus, where widows reſorted to requeſt new huſbands of the goddeſs. Pauſan. lib. x. p. 898.

NAUPLIA, in *Ancient Geography*, a maritime city of Peloponneſus. It was the naval ſtation of the Argives. The fountain Canathos was in its neighbourhood.

NAUPLIUS, in fabulous hiſtory, a ſon of Neptune and Amymone, king of Eubœa. He was the father of the famous Palamedes, who was ſo unjuſtly ſacrificed to the artifice and reſentment of Ulyſſes by the Greeks at the Trojan war. The death of Palamedes highly enraged Nauplius; and to revenge the injuſtice of the Grecian princes, he endeavoured to debauch their wives, and ruin their characters. When the Greeks returned from the Trojan war, Nauplius was pleaſed to ſee them diſtreſſed in a ſtorm on the coaſts of Eubœa; and to make their diſaſter ſtill more univerſal, he lighted fires on ſuch places as were furrrounded with the moſt dangerous rocks, that the fleet might be ſhipwrecked upon the coaſt. This had the deſired effect; but Nauplius was ſo diſappointed when he ſaw Ulyſſes and Diomedes eſcape from the general diſtreſs, that he threw himſelf into the ſea. According to ſome mythologiſts there were two perſons of this name: one a native of Argos, who went to Colchis with Jaſon. He was ſon of Neptune and Amymone.—The other was king of Eubœa, and lived about the time of the Trojan war. He was, as ſome obſerve, ſon of Clytonas, one of the deſcendants of Nauplius the Argonaut. The Argonaut was remarkable for his knowledge of ſea affairs and of aſtronomy. He built the town of Nauplia, and ſold Auge daughter of Aleus to King Teuthras, to ſcreen her from her father's reſentment.

NAUPORTUS, or NAUPORTUM, in *Ancient Geography*, a town on a cognominal river, towards its ſource, in Pannonia Superior. The reaſon of the name, according to Pliny, is that the ſhip Argo, after coming up the Danube, the Save, and the Laubach, was thence carried on men's ſhoulders over the Alps into the Adriatic. The river Nauportus riſes in the Alps, near Longaticum, at the diſtance of ſix miles from the town Nauportum; which was a colony of the Tauriſei, a people on the confines of Noricum. Now *Upper Laubach* in Carinthia, on the river Laubach. E. Long. 14. 40. N. Lat. 46. 28.

NAUSCOPY, the art of diſcovering the approach of ſhips or the neighbourhood of land at a conſiderable diſtance. This pretended art was diſcovered by M. Bottineau, employed in the king and company's ſervice in the iſland of France, from the year 1782 to 1784; the account of it is as follows:

"This knowledge is not derived either from the undulation of the waves, or from the ſubtility of ſight, or from any particular ſenſation; but merely from obſervation of the *horizon*, which diſcovers ſigns indicating the proximity of ſhips or of land.

"On the *approximation* of a ſhip toward the land, or towards another ſhip, there appears in the atmoſphere a *meteor* of a particular nature, viſible to every one without any *painful attention*. It is not by any kind of accident that this meteor appears under theſe circumſtances; on the contrary, it is the neceſſary reſult of the approximation of one veſſel towards another, or towards the land. The exiſtence of the *meteor*, and the knowledge of its different modifications, are what conſtitute the certainty and the preciſion of my informations.

"If I am aſked, how it is poſſible that the approach of a ſhip towards land ſhould give birth to any *meteor* whatſoever in the atmoſphere, and what connexion there can be between two objects at ſuch a diſtance from each other? I reply, that I am not obliged to give an account of the *hows* and the *wherefores*: that it is ſufficient for me to have diſcovered the fact, without being obliged to account for its principle."

The writer concludes, by deſiring to be called on for experimental proofs, and by promiſing in future a complete treatiſe of Nauſcopy, with maps, plates, &c.

This complete treatiſe, as far as we know, has not yet been publiſhed; nor do we expect ever to ſee ſuch a treatiſe on the ſubject as will ſatisfy the minds of thoſe who are perſuaded that every effect muſt have an adequate cauſe. The whole ſeems to be the work of fancy.

NAUSEA, or Sickness; a retching or propenſity and endeavour to vomit, ariſing from ſomething which irritates the ſtomach.

NAUTILUS, a genus of animals belonging to the order of vermes teſtacea. See Conchology *Index*.

NAVY, the fleet or ſhipping of a prince or ſtate. See Marine.

The management of the Britiſh royal navy, under the lord high admiral of Great Britain, is intruſted to principal officers and commiſſioners of the navy, who hold their place by patent. The principal officers of the navy are four, viz. the treaſurer, whoſe buſineſs it is to receive money out of the exchequer, and to pay all the charges of the navy, by warrant from the principal officers: comptroller, who attends and controuls all payment of wages, is to know the rates of ſtores, to examine and audit all accounts, &c.: ſurveyor, who is to know the ſtates of all ſtores, and ſee wants ſupplied; to eſtimate repairs, charge boatſwains, &c. with what ſtores they receive, and at the end of each voyage to ſtate and audit accounts: clerk of the acts, whoſe buſineſs it is to record all orders, contracts, bills, warrants, &c.

The commiſſioners of the navy are five: The firſt executes that part of the comptroller's duty which relates to the comptrolling the victualler's accounts; the ſecond, another part of the ſaid comptroller's duty relating to the account of the ſtorekeepers of the yard; the third has the direction of the navy at the port of Portſmouth; the fourth has the ſame at Chatham; and the fifth at Plymouth. There are alſo other commiſſioners at large, the number more or leſs according to the exigencies of public affairs; and ſince the increaſe of the royal navy, theſe have ſeveral clerks under them, with ſalaries allowed by the king.

The victualling of the royal navy hath formerly been undertaken by contract; but is now managed by commiſſioners, who hold their office on Tower-hill, London. The navy office is where the whole buſineſs concerning the navy is managed by the principal officers and commiſſioners.

The royal navy of Great Britain is now in a very flouriſhing ſtate, having been diligently kept up in late reigns, as the natural ſtrength of the kingdom. When it is complete, it is divided into three ſquadrons, diſtinguiſhed by the colours of the flags carried by the reſpective admirals belonging to the ſame, viz. *red*, *white*, and *blue;* the principal commander of which bears the title of *admiral;* and each has under him a vice admiral and a rear admiral, who are likewiſe flag officers.

NAVY Exerciſe. See Exercise.

NAVY Diſcipline, or *Regulations*. See *Maritime State*.

NAWORTH castle, in Cumberland, 10 miles from Carliſle, near the Gelt. This caſtle is ſtill entire and inhabited. It is a large pile, ſquare, and built round a court. On the north it ſtands over the river Ithing, at a great height, the banks ſhagged with wood. The whole houſe is a very irregular building; the rooms numerous, acceſſible by 16 ſtaircaſes, with moſt frequent and ſudden aſcents and deſcents, &c.—The great hall has a gallery at one end, adorned with four vaſt creſts carved in wood, viz. a griffin and dolphin, with the ſcollops; an unicorn, and an ox with a coronet round his neck. In front is a figure in wood of an armed man; two others, perhaps vaſſals, in ſhort jackets and caps. The top and upper end of the room is painted in ſquares, repreſenting the Saxon kings and heroes. This caſtle was built by one of the Dacres about the reign of Henry III. In the garden walls were ſtones with Roman inſcriptions, which the late earl of Carliſle gave to Sir Thomas Robinſon, and were by him removed to his muſeum at Rookſby: On one of theſe ſtones is this inſcription, *peditum centum quinquaginta Britannorum;* whence it appears that the Romans, when in poſſeſſion of Britain, ſometimes indulged the national troops with the favour of garriſoning their own territories.

NAXIA, or Naxos, a conſiderable iſland of the Archipelago, 25 miles in length, and 88 in circumference. The whole iſland is covered with orange, olive, lemon, cedar, citron, pomegranate, fig, and mulberry trees; and there are a great many ſprings and brooks. This iſland has no harbour; and yet they carry on a conſiderable trade in barley, wine, figs, cotton, ſilk, flax, cheeſe, ſalt, oxen, ſheep, mules, and oil. They burn only oil of maſtich, though olive oil is exceedingly cheap. It is inhabited both by Greeks and Latins, who live in great dread of the Turks; for when the meaneſt of their ſhips appear here, they always wear red caps like galley-ſlaves, and tremble before the loweſt officer; but as ſoon as they are gone, they put on their caps of velvet. The ladies are ſo vain, that when they return out of the country, they have 40 women in their train, half on foot and half on aſſes, one of whom carries a napkin or two, another a petticoat, another a pair of ſtockings, and ſo on; which is a very ridiculous ſight to ſtrangers. There are four archbiſhops ſees in this iſland, and a great many villages; but ſo thin of people, that the whole iſland does not contain above 8000 inhabitants. The higheſt mountain is *Zia*, which ſignifies "the mountain of Jupiter." There are but few antiquities, except ſome ſmall remains of the temple of Bacchus. Some ſay they have mines of gold and ſilver; however, there is one of emery, which is ſo common here and ſo cheap, that the Engliſh often ballaſt their ſhips therewith.

NAXOS, or Naxia, a conſiderable town, and capital of the iſle of Naxos, over againſt the iſle of Paros, with a caſtle and two archbiſhops ſees, the one Greek and the other Latin. The greateſt part of the inhabitants are Greeks. E. Long. 25. 51. N. Lat. 37. 8.

NAXUS, now Naxia, formerly *Strongyle*, *Dia*, *Dionyſias*, *Callipolis*, and *Little Sicily*. It was called *Strongyle*, from a Greek word, ſignifying "round," though in reality it is rather ſquare than round. The names of *Dia* or *Divine*, and *Dionyſias*, were given it as being conſecrated in a peculiar manner to the fabulous god Dionyſus or Bacchus. The appellation of *Callipolis*, Pliny and Solinus derive from the metropolis of the iſland, formerly a moſt beautiful city, which

which is the import of the word Callipolis. The great fertility of the country gave riſe to the name of *Little Sicily*, Naxus being the moſt fruitful of all the Cyclades, as Agathamerus informs us, and no leſs fertile than Sicily itſelf. As for the name of *Naxus*, ſome aſſert that it was borrowed from one Naxus, under whoſe conduct the Carians poſſeſſed themſelves of the iſland; others pretend it received its name from Naxus, the ſon of Endymion. Stephanus, Suidas, and Phavorinus, derive the name of *Naxos*, from the Greek word *naxai*, ſignifying, "to ſacrifice," and will have it to have been ſo called from the many ſacrifices offered here to Bacchus. With theſe Bochart agrees, as to its being called *Naxos* from the ſacrifices performed here in honour of Bacchus, but will have the word *naxos* to be a corruption of the Phœnician *naſca*, or *nicſa*, ſignifying "a ſacrifice, offering." Naxos is, according to Pliny, 75, but reckoned by the preſent inhabitants 100 miles, in compaſs. It has Paros to the weſt, Myconos and Delos to the north, and Ios to the ſouth. This iſland is the moſt fruitful of the Archipelago, and was formerly famed for the excellent wines it produced. Archilochus, as quoted by Athenæus, compares them to the nectar of the gods; and Aſclepiades, cited by Stephanus, aſſures us, that Bacchus took more delight in Naxos than in any other place whatſoever, having himſelf taught the inhabitants to cultivate their vines. The wine of Naxos maintains to this day its ancient reputation, being by ſome deemed the beſt of the Levant. Beſides wine, this iſland abounds with all ſorts of delicious fruits, the plains being covered with orange, olive, lemon, cedar, citron, pomegranate, mulberry, and fig trees. It was formerly famous for quarries of that ſort of marble which the Greeks called *ophites*, from its being green, and ſpeckled with white ſpots like the ſkin of a ſerpent. The beſt emerald is found here on the mountains near the weſtern coaſt, whence the neighbouring cape is called by the Italians *capo ſmeriglio*, or the emerald cape. As to the inhabitants of Naxos, Diodorus relates that the iſland was firſt peopled by the Thracians. Theſe were in a little time ſubdued by a body of Theſſalians, who, having poſſeſſed the iſland for the ſpace of 200 years and upwards, were compelled to abandon it by a drought and famine.

After the Trojan war, the Carians ſettled here, and called the iſland *Naxos*, from their king, who was the ſon of Polemon. He was ſucceeded by his ſon Leucippus, and Leucippus by his ſon Smardius, in whoſe reign Theſeus, coming out of Crete, landed here with Ariadne, whom he was, in his ſleep, commanded by Bacchus to leave in this iſland. In proceſs of time a colony of Cnidians and Rhodians ſettled here under the conduct of Hippothous and Xuthus: and laſt of all the Ionians, who, in time, poſſeſſed the whole iſland; whence the Naxians are, by Herodotus, called *Ionians*, and ranged among the Athenian colonies. E. Long. 26. 5. N. Lat. 36. 30. It is about 105 miles in circumference, and about 30 broad.

NAXUS, in *Ancient Geography*, a town of Crete, famous for its hones, called *lapis Naxius*. Another of Sicily, built by the Chalcidians; ſituated on the ſouth ſide of Mount Taurus, deſtroyed by Dionyſius the tyrant: from its ruins Tauromenium, built by Timoleon, either aroſe or was increaſed, (Plutarch).

NAYRES, the nobility of the Malabar coaſt. We may with truth affirm that they are the oldeſt nobility in the world; for the moſt ancient writers mention them, and quote the law that permits the Nayre ladies to have many huſbands; every one being allowed four. Their houſes, which ſtand ſingle, have as many doors as the lady has huſbands. When one of them viſits her, he walks round the houſe, ſtriking with his ſabre on his buckler; he then opens his door, and leaves a domeſtic with his arms in a kind of porch, who ſerves to inform others that the lady is engaged. It is ſaid, that one day in the week the four doors are all opened, and all her huſbands viſit her, and dine together with her. Each huſband gives a ſum of money, or portion, at the time of marriage; and the wife only has the charge of the children. The Nayres, even the Samorin, and the other princes, have no other heirs than the children of their ſiſters. This law was eſtabliſhed, that the Nayres, having no family, might be always ready to march againſt the enemy. When the nephews are of age to bear arms, they follow their uncles. The name of *father* is unknown to a Nayre child. He ſpeaks of the huſbands of his mother and of his uncles, but never of his father.

NAZARETH, a little city in the tribe of Zebulun, in Lower Galilee, to the weſt of Tabor, and to the eaſt of Ptolemais. Euſebius ſays, it is 15 miles from Legion towards the eaſt. This city is much celebrated in the Scriptures, for having been the uſual place of the reſidence of Jeſus Chriſt for the firſt 33 years of his life, Luke ii. 51. It was there our Saviour became incarnate, where he lived in obedience to Joſeph and Mary, and from whence he took the name of a Nazarean. After he had begun to execute his miſſion, he preached there ſometimes in the ſynagogue, *Id.* iv. 16. But becauſe his countrymen had no faith in him, and were offended at the meanneſs of his original, he did not many miracles there, Matth. xiii. 54, 58. nor would he dwell therein; ſo he fixed his habitation at Capernaum for the latter part of his life, *Id.* iv. 13. The city of Nazareth was ſituated upon an eminence; and on one ſide there was a precipice, from whence the Nazareans one day had a deſign of throwing down our Saviour, becauſe he upbraided them with their incredulity, Luke iv. 29.

St Epiphanius ſays, that in his time Nazareth was only a village, and that to the reign of Conſtantine it was inhabited by Jews alone, excluſive of all Chriſtians. Adamnanus, a writer of the ſeventh age, ſays, that in his time there were two great churches to be ſeen at Nazareth, one in the midſt of the city, built upon two arches, in the place where our Saviour's houſe had ſtood. Under the two arches now mentioned, was a very fine fountain, which furniſhed water to the whole city, and from whence water was drawn alſo by the help of a pulley for the uſe of the church above. The ſecond church of Nazareth was built in a place where the houſe ſtood wherein the angel Gabriel revealed to the virgin Mary the myſtery of our Lord's incarnation; and we are aſſured that the church of Incarnation, which is ſupported by two arches, is ſtill in being to this day. Mr Maundrell tells us, that there is a convent built over what is ſaid to be the place of annunciation; for the chamber where ſhe received the angel's ſalutation was about 500 years ago removed from Nazareth, and, according to the Roman legends, tranſported by angels to Loretto, then a ſmall village in the pope's dominions, now become a biſhop's ſee.—However, Calmet's opinion (which is certainly the true one) upon the different tranſlations of this famous houſe of Loretto, is, that they were no other than ſo many different buildings made upon the model of the church of Nazareth, juſt as in ſeveral places ſepulchres have been built upon the model of that at Jeruſalem. Mariti tells us, that in the eaſtern part of the city ſtands the church dedicated to the Bleſſed Virgin: the zeal of the Cœnobites raiſed it from the ruins of that which had been deſtroyed by the Saracens. It is a very handſome building, and conſiſts of three naves; in the middle of which is the principal altar; to which there is an aſcent by two magnificent ſtairs, much admired for their iron balluſtrades, the work of an ingenious monk of the convent. The deſcent to the grotto or annunciation chapel below is by ſteps of beautiful marble, cut with great taſte. Two beautiful columns of oriental granite ſtrike the eye of the obſerver in the entrance. They appear to have been conſtructed both to ſupport and ornament the grotto. The altar of this ſubterranean chapel is extremely elegant; and the different kinds of marble with which it is ornamented, receive an additional luſtre from the combined light of ſeveral ſilver lamps preſented by Chriſtian princes. On ſolemn feſtivals, the walls and the pilaſters are ornamented with various pieces of tapeſtry, repreſenting the myſteries of the virgin; a ſuperb preſent from the Houſe of Auſtria. In the weſtern part of the city ſtands a Chriſtian church, built, as it is ſaid, on the ſite of the ancient ſynagogue where Jeſus ſhowed the Jews the accompliſhment of the prophecies in his perſon. This place ſerved a long time as a ſhelter for flocks, but at preſent it is in good repair. In the neighbourhood may be ſeen a fountain of excellent water, which is, however, eſteemed by the people on another account. They conjecture that it was contiguous to the habitation of the virgin, and that it was uſed by her. At ſome diſtance is a large ſtone of a round form, called *Chriſt's Table*. It is pretended that he came hither more than once with his diſciples to eat. The inhabitants of Nazareth pay it a kind of worſhip, burning perfumes and incenſe around it. It is ſituated in 35° E. Long. and in 32° N. Lat.; and formerly held the third rank under the patriarch of Jeruſalem. At preſent it is part of the domains of the chief of Acre. The ancient city, after the ravages of fanaticiſm, was reduced to a miſerable hamlet, containing only a few Arab huts.—Under the protection of Daher Omar, however, it recovered very conſiderably, and is now of far more importance.

NAZARITE, or NAZAREAN, or *Nazarines*, a term which may ſignify, 1. One that is of Nazareth, or any native of this city. 2. It was given to Jeſus Chriſt and his diſciples, and is commonly taken in a ſenſe of deriſion and contempt in ſuch authors as have written againſt Chriſtianity. 3. It has been taken for a ſect of heretics called Nazareans. 4. For a Nazarite, a man that has laid himſelf under the obligation of a vow to obſerve the rules of Nazariteſhip, whether it be for his whole life, as Samſon and John the Baptiſt, or only for a time, as thoſe mentioned in Numbers vi. 18, 19, 20. Amos ii. 11, 12. Laſtly, The name Nazarite, in ſome paſſages of Scripture, denotes a man of particular diſtinction and great dignity in the court of ſome prince. But we muſt ſpeak of theſe ſeveral ſorts of Nazarites ſomething more diſtinctly.

The name of Nazarene belongs to Jeſus Chriſt, not only becauſe of his having lived the greateſt part of his life at Nazareth, and becauſe this city has always been conſidered as his country, but alſo becauſe the prophets had foretold that he ſhould be called a Nazarene, Matth. ii. 23. "And he came and dwelt in a city "called Nazareth, that it might be fulfilled which was "ſpoken by the prophets, He ſhall be called a Nazarene." We find no particular place in the prophets in which it is ſaid that the Meſſiah ſhould be called a Nazarene; and St Matthew only quotes the prophets in general. Perhaps he would inſinuate, that the conſecration of the Nazarites, and the great purity of which they made profeſſion, was a type and a ſort of prophecy of thoſe of our Saviour, or elſe that the name כזיר *Nazir* or *Nazarite* given to the patriarch Joſeph, Gen. xlix. 26. Deut. xxxiii. 16. was a prophecy which was to be fulfilled in the perſon of Jeſus Chriſt, of whom Joſeph was a figure. Laſtly, St Jerome was of opinion, that St Matthew here alludes to that paſſage of Iſaiah xi. 1. and lx. 21. "And "there ſhall come forth a rod out of the ſtem of Jeſſe, "and a branch (in Hebrew *Nezer*) ſhall grow out of "his roots." This branch or *Nezer*, and this rod, are certainly intended to denote Jeſus Chriſt, by the general conſent of all the fathers and interpreters.

When the word Nazarean is put for the heretics known by this name, it denotes Chriſtians converted from Judaiſm, whoſe chief error conſiſted in defending the neceſſity or expediency of the works of the law, and who obſtinately adhered to the practice of the Jewiſh ceremonies. The name of Nazarenes at firſt had nothing odious in it, and it was often given to the firſt Chriſtians. The fathers frequently mention the goſpel of the Nazarenes, which differs nothing from that of St Matthew, which was either in Hebrew or Syriac, for the uſe of the firſt converts, but was afterwards corrupted by the Ebionites. Theſe Nazareans preſerved this firſt goſpel in its primitive purity. Some of them were ſtill in being in the time of St Jerome, who does not reproach them with any error. They were very zealous obſervers of the law of Moſes, but held the traditions of the Phariſees in very great contempt.

Nazarite, when put to ſignify thoſe under the ancient law who made a vow of obſerving a more than ordinary degree of purity (Numb. *ubi. cit.*), denotes a man or woman who engage themſelves by a vow to abſtain from wine and all intoxicating liquors, to let their hair grow without cutting or ſhaving, not to enter into any houſe that was polluted by having a dead corpſe in it, nor to be preſent at any funeral. And if by chance any one ſhould have died in their preſence, they began again the whole ceremony of their conſecration and Nazariteſhip. This ceremony generally laſted eight days, ſometimes a month, and ſometimes their whole lives. When the time of their Nazariteſhip

ſhip was accompliſhed, the prieſt brought the perſon to the door of the temple, who there offered to the Lord a he lamb for a burnt-offering, a ſhe lamb for an expiatory ſacrifice, and a ram for a peace-offering. They offered likewiſe loaves and cakes, with wine neceſſary for the libations. After all this was ſacrificed and offered to the Lord, the prieſt or ſome other ſhaved the head of the Nazarite at the door of the tabernacle, and burnt his hair, throwing it upon the fire of the altar. Then the prieſt put into the hand of the Nazarite the ſhoulder of the ram roaſted, with a loaf and a cake, which the Nazarite returning into the hands of the prieſt, he offered them to the Lord, lifting them up in the preſence of the Nazarite. And from this time he might again drink wine, his Nazariteſhip being now accompliſhed.

As to thoſe that were perpetual Nazarites, as were Samſon and John the Baptiſt, it appears that they were conſecrated to their Nazariteſhip by their parents, and continued all their lives in this ſtate without drinking wine or cutting their hair.

Thoſe that made a vow of Nazariteſhip out of Paleſtine, and could not come to the temple when their vow was expired, contented themſelves with obſerving the abſtinence required by the law, and after that cutting their hair in the place where they were: as to the offerings and ſacrifices preſcribed by Moſes, which were to be offered at the temple by themſelves, or by others for them, they deferred this till they could have a convenient opportunity. Hence it was, that St Paul being at Corinth, and having made the vow of a Nazarite, he had his hair cut off at Cenchrea, and put off fulfilling the reſt of his vow till he ſhould arrive at Jeruſalem, Acts xviii. 18. When a perſon found that he was not in a condition to make a vow of Nazariteſhip, or had not leiſure to perform the ceremonies belonging to it, he contented himſelf by contributing to the expence of the ſacrifice and offerings of thoſe that had made and fulfilled this vow; and by this means he became a partaker in the merit of ſuch Nazariteſhip. When St Paul came to Jeruſalem, in the year of Chriſt 58, the apoſtle St James the Leſs, with the other brethren, ſaid to him, Acts xxi. 23, 24. that to quiet the minds of the converted Jews, who had been informed that he everywhere preached up the entire abolition of the law of Moſes, he ought to join himſelf to four of the faithful who had a vow of Nazariteſhip upon them, and contribute to the charge of the ceremony at the ſhaving of their heads; by which the new converts would perceive that he continued to keep the law, and that what they had heard of him was not true.

The Hebrew word *Nazir*, or Nazarite, which is made uſe of to expreſs a man exalted to great dignity, as it is ſaid of the patriarch Joſeph, Gen. xlix. 26. and Deut. xxxiii. 16. "that he was ſeparated from his brethren," as it is in our tranſlation; or as the Vulgate and others underſtand the Hebrew, "that he was a Nazarite among his brethren," is variouſly underſtood. Some think that the Hebrew word בזיר, *Nazir*, in theſe places, ſignifies one who is crowned, choſen, ſeparated, or diſtinguiſhed: the word בזיר, *Nazir*, ſignifies a crown. The Septuagint tranſlate this word a chief, or him that is honoured. Calmet thinks that this was a term of dignity in the courts of eaſtern princes, and that at this day in the court of Perſia the word *Nazir* ſignifies the ſuperintendant general of the king's houſehold, the chief officer of the crown, the high ſteward of his family, treaſures, and revenues; and that in this ſenſe Joſeph was the Nazir of the court of Pharaoh. Le Clerc tranſlates the *Nazir*, a prince, and calls Joſeph "the prince of his brethren," in the two places already quoted. Mr Pool declares in favour of this laſt tranſlation. See *Joſeph. Chardin. Chryſoſt. St Jerome, &c.*

NAZIANZEN See *GREGORY Nazianzen.*

NAZIM, the lord lieutenant, viceroy, or governor of a province in Hindoſtan; the ſame as *Subahdar*, or *Nabob.*

NEALED, among ſeamen, is uſed when the ſounding is deep water cloſe to the ſhore; as alſo when the ſhore is ſandy, clayey, oozy, or foul and rocky ground.

NEALING, or rather ANNEALING, a term uſed for the preparing of ſeveral matters, by heating or baking them in the oven, or the like.

NEALING of glaſs, is the baking of glaſs, to dry, harden, and give it the due conſiſtence, after it has been blown, and faſhioned into the proper works.—This is uſually performed in a kind of a tower called the *leer*, built over the melting furnace. See GLASS.

Nealing of glaſs is alſo uſed for the art of ſtaining glaſs with metalline colours. "One fine uſe of ſilver (ſays Mr Boyle) was only diſcovered ſince the art of annealing upon glaſs came to be practiſed. For prepared ſilver, or even the crude metal, being burnt on a glaſs plate, will tinge it of a fine yellow or golden colour. And there are ſeveral mineral earths, and other coarſe matters, of uſe in this art, which by means of fire impart tranſparent colours to glaſs, and ſometimes very different ones from thoſe of the bodies themſelves.

NEALING of ſteel, is the heating it in the fire to a blood-red heat, and then taking it out, and letting it cool gently of itſelf. This is done to make it ſofter, in order to engrave and punch upon it. See TEMPERING and ENGRAVING.

NEALING is alſo uſed for the art or act of burning or baking earthen or other ware in an oven. The miners at Mendip, when they meet with a rock they cannot cut through, anneal it by laying on wood and coal, and contriving the fire ſo that they quit the mine before the operation begins, it being dangerous to enter it again before it be quite cleared of the ſmoke.

NEALING of tile is uſed in ancient ſtatutes for the burning of tile. The word is formed of the Saxon *onælan*, *accendere*, to light, burn.

NEAP or NEEP TIDES, are thoſe tides which happen when the moon is in the middle of the ſecond and fourth quarters. The neap tides are low tides, in reſpect of their oppoſites the ſpring tides. As the higheſt of the ſpring tides is three days after the full or change, ſo the loweſt of the neap is four days before the full or change. On which occaſion the ſeamen ſay that it is deep neap.

NEAPED. When a ſhip wants water, ſo that ſhe cannot get out of the harbour, off the ground, or out of the dock, the ſeamen ſay ſhe is *neaped*, or *beneaped.*

NEAPOLIS, in *Ancient Geography*, a city of the Higher Egypt, in the Nomos Panopolitanus, between Thebæ to the ſouth, and Panopolis to the north, on the eaſt ſide of the Nile; otherwiſe called *Cacne.* A ſecond Neapolis of Babylonia, ſituated near the Euphrates on the ſouth ſide.—A third of Campania, an ancient town and a colony from Cumæ. (See Velleius, Pliny, Strabo); accounted a Greek city, and a great ſtickler for Greek uſages, (See Livy, Tacitus). Its hot baths were in nothing inferior to thoſe of Baiæ, according to Strabo; at two miles diſtance from it ſtands the monument of Virgil, held in religious veneration by learned poſterity. The Younger Pliny relates, that Virgil's birth day was more religiouſly obſerved by Silius Italicus than his own, eſpecially at Naples, where he reſorted to his tomb as to a temple. The city is waſhed by the river Sebethus. Virgil feigns the nymph Sebethis to preſide over the ſtream. Now *Naples*, capital of the kingdom of that name. See NAPLES.—A fourth, Neapolis of Caria, near the Meander, (Ptolemy).—A fifth, an inland town of Cyrenaica, ſituated between Ptolemais and Arſinoe, (Ptolemy); and to be diſtinguiſhed from the Cænopolis, or Neapolis, on the eaſt border of the ſame province, (id.) A ſixth of Ionia, (Strabo); which belonged firſt to the Epheſians, but afterwards to the Samians, who exchanged Marătheſium, a more diſtant city, for a nearer.—A ſeventh, Neapolis of Macedonia Adjecta, ſituated at the diſtance of 12 miles to the eaſt of Philippi, (Antonine).—An eighth, Neapolis of Piſidia, on the borders of Galatia, ſituated between Amblada and Pappa, (Ptolemy).—A ninth of Samaria, the ancient *Sichem*, which ſee; ſo called upon its reſtoration by the Romans, (Coin, Pliny, Joſephus).—A tenth of Sardinia, ſituated on the ſouth-weſt ſide of the iſland, 30 miles to the north of Metalla; now called *Neapoli*.—An eleventh, of the Regio Syrtica, called alſo *Leptis*.—A twelfth, of Zeugitana on the Mediterranean, to the eaſt of Clypea, and ſouth of the Promontorium Mercurii.

NEAT, or *NET Weight*, the weight of a commodity alone, clear of the caſk, bag, caſe, or even filth. See NET.

NEBEL, or NABLUM, a muſical inſtrument among the Jews. See NABLUM.

NEBIO, or NEBBIO, a ruined city of Italy, on the north ſide of the iſland of Corſica, with a biſhop's ſee, whoſe biſhop reſides at San Fiorenzo, from which it is a mile diſtant.

NEBO, in *Ancient Geography*, a very high mountain, a part of the mountains of Abarim, and their higheſt top, whither Moſes was ordered to aſcend to take a view of the land of Canaan, and there die. Situated in the land of Moab over againſt Jericho: with a cognominal town at its foot (Iſaiah) belonging to the Reubenites, which afterwards returned to the Moabites; in Jerome's time deſolate; eight miles to the ſouth of Heſhbon.

NEBO, or *Nabo*. See NABO.

NEBUCHADNEZZAR. See NABUCHADNEZZAR.

NEBULY, or NEBULEE, in *Heraldry*, is when a coat is charged with ſeveral little figures, in form of words running within one another, or when the outline of a bordure, ordinary, &c. is indented or waved.

NECESSITY, whatever is done by a cauſe or power that is irreſiſtible; in which ſenſe it is oppoſed to freedom. Man is a neceſſary agent, if all his actions be ſo determined by the cauſes preceding each action, that not one paſt action could poſſibly not have come to paſs, or have been otherwiſe than it hath been; nor one future action can poſſibly not come to paſs, or be otherwiſe than it ſhall be. But he is a free agent, if he be able, at any time, under the circumſtances and cauſes he then is, to do different things; or, in other words, if he be not unavoidably determined in every point of time, by the circumſtances he is in, and the cauſes he is under, to do that one thing he does, and not poſſibly to do any other thing. Whether man is a neceſſary or a free agent, is a queſtion which has been debated with much ingenuity by writers of the firſt eminence, from Hobbes and Clarke, to Prieſtley and Gregory. See METAPHYSICS, Part III. chap. v. and PREDESTINATION.

NECESSITY, in *Mythology*, a power ſuperior to all other powers, and equally irreſiſtible by gods and by men. Herodotus, as he is quoted by Cudworth, mentions an oracle which declared that "God himſelf could not ſhun his deſtined fate." And among the fragments of Philemon collected by Le Clerc, is the following ſentence:

Δουλοι βασιλεων εσμεν, οἱ βασίλεις θεων, ὁ θεος αναγκης.

"We are ſubject to kings, kings to the gods, and God to Neceſſity." Hence it is, that, in the Iliad, we find Jove himſelf, the ſire of gods and men, regretting that he was reſtrained by *Neceſſity* from reſcuing his favourite ſon from the ſword of Patroclus. Nay to ſuch a height was this impiety carried in the earlieſt ages of Greece, that we find Heſiod and Homer teaching that the gods themſelves were generated by *Neceſſity*, of Night and Chaos.

This power, though always repreſented as blind and unintelligent, was however worſhipped as a goddeſs, bearing in her hand large iron nails, wedges, anchors, and melted lead *, as emblems of the inflexible ſeverity of her nature. "In the city of Corinth ſhe had a temple, in which the goddeſs *Violence* likewiſe reſided, and into which no perſon was ever permitted to enter but the prieſt who officiated *in ſacris* †."

Learned men have exerciſed their ingenuity in vain attempts to trace this portentous notion to its origin. Some, who wiſhed to interpret it in a pious ſenſe, have ſuppoſed that the gods who are ſubject to *Neceſſity* were only thoſe who were the miniſters of the ſupreme *numen*; and that by *neceſſity* itſelf was meant nothing more than divine providence. But this is not conſiſtent with Heſiod and Homer's Generation of the Gods, or with the epithets *ſæva neceſſitas*, *dura neceſſitas*, by which this power was perpetually diſtinguiſhed. Others, and among them Moſheim, have ſuppoſed that this monſtrous fable was invented by the Pagan prieſts, and diligently inculcated upon the minds of the people, in order to excuſe the villanies of the objects of their worſhip. For, ſays he, who could be indignant at Jupiter's numberleſs adulteries, after it was known that in all his actions he was the ſervant of blind Neceſſity: In the thefts of *Mercury*, the whoredoms of *Venus*, and the frequent ſquabbles of the other gods, there could be no moral turpitude, if they were under the influence of a ſuperior power.

Numina cum videas duris obnoxia fatis,
Invidia poſſis exonerare deos ‡.

This

---

* *Horace*, lib. i. ode 35.

† *Pauſanias in Corinth*. cap. iv.

‡ *Martial. Epigram.* lib. ix. N. 88 Ed. Amſtel. 1701.

This account of the matter is at leaſt as plauſible as any other which is uſually given; but the real caſe undoubtedly was, that when men "did not like to retain God in their knowledge, God gave them over to a reprobate mind to do thoſe things which are not convenient; when their fooliſh heart was darkened, and profeſſing themſelves to be wiſe, they became fools." See PARCÆ.

NECESSITY, in *Law*, as it implies a defect of will, excuſes from the guilt of crimes. See CRIME.

Compulſion and inevitable *neceſſity* are a conſtraint upon the will, whereby a man is urged to do that which his judgment diſapproves; and which, it is to be preſumed, his will (if left to itſelf) would reject. As puniſhments are therefore only inflicted for the abuſe of that free will which God has given to man, it is highly juſt and equitable that a man ſhould be excuſed for thoſe acts which are done through unavoidable force and compulſion.

1. Of this nature, in the firſt place, is the obligation of *civil ſubjection*, whereby the inferior is conſtrained by the ſuperior to act contrary to what his own reaſon and inclination would ſuggeſt: as when a legiſlator eſtabliſhes iniquity by a law, and commands the ſubject to do an act contrary to religion or ſound morality. How far this excuſe will be admitted *in foro conſcientiæ*, or whether the inferior in this caſe is not bound to obey the divine rather than the human law, it is not our buſineſs to decide; though, among the caſuiſts, it is believed the queſtion will hardly bear a doubt. But, however that may be, obedience to the laws in being is undoubtedly a ſufficient extenuation of civil guilt before the municipal tribunal. The ſheriff who burnt Latimer and Ridley, in the bigotted days of Queen Mary, was not liable to puniſhment from Elizabeth for executing ſo horrid an office; being juſtified by the commands of that magiſtracy which endeavoured to reſtore Superſtition, under the holy auſpices of its mercileſs ſiſter, Perſecution.

As to perſons in private relations, the principal caſe where conſtraint of a ſuperior is allowed as an excuſe for criminal miſconduct, is with regard to the matrimonial ſubjection of the wife to her huſband: for neither a ſon nor a ſervant are excuſed from the commiſſion of any crime, whether capital or otherwiſe, by the command or coercion of the parent or maſter; though in ſome caſes the command or authority of the huſband, either expreſs or implied, will privilege the wife from puniſhment, even from capital offences. And therefore, if a woman commit theft, burglary, or other civil offences againſt the law of ſociety, by the coercion of her huſband, or even in his company, which the law conſtrues a coercion, ſhe is not guilty of any crime; being conſidered as acting by compulſion, and not of her own will. This doctrine is at leaſt 1000 years old in this kingdom, being to be found among the laws of King Ina the Weſt Saxon. And it appears, that among the northern nations on the continent, this privilege extended to any woman tranſgreſſing in concert with a man, and to any ſervant that committed a joint offence with a freeman: the male or freeman only was puniſhed, the female or ſlave diſmiſſed; *procul dubio quod alterum libertas, alterum neceſſitas impelleret.* But (beſides that, in our law, which is a ſtranger to ſlavery, no impunity is given to ſervants, who are as much free agents as their maſters) even with regard to wives, this rule admits of an exception in crimes that are *mala in ſe*, and prohibited by the law of nature; as murder, and the like: not only becauſe theſe are of a deeper dye, but alſo, ſince in a ſtate of nature no one is in ſubjection to another, it would be unreaſonable to ſcreen an offender from the puniſhment due to natural crimes, by the refinements and ſubordinations of civil ſociety. In treaſon alſo (the higheſt crime which a member of ſociety can, as ſuch, be guilty of), no plea in coverture ſhall excuſe the wife; no preſumption of the huſband's coercion ſhall extenuate her guilt: as well becauſe of the odiouſneſs and dangerous conſequence of the crime itſelf, as becauſe the huſband, having broken through the moſt ſacred tie of ſocial community by rebellion againſt the ſtate, has no right to that obedience from a wife, which he himſelf as a ſubject has forgotten to pay. In inferior miſdemeanours alſo, we may remark another exception, that a wife may be indicted and ſet in the pillory with her huſband, for keeping a brothel: for this is an offence touching the domeſtic economy or government of the houſe, in which the wife has a principal ſhare; and is alſo ſuch an offence as the law preſumes to be generally conducted by the intrigues of the female ſex. And in all caſes where the wife offends alone, without the company or coercion of her huſband, ſhe is reſponſible for her offence as much as any femme-ſole.

2. Another ſpecies of compulſion or neceſſity is what our law calls *dureſs per minas*; or threats and menaces, which induce a fear of death or other bodily harm, and which take away for that reaſon the guilt of many crimes and miſdemeanors, at leaſt before the human tribunal. But then that fear which compels a man to do an unwarrantable action ought to be juſt and well grounded; ſuch, "*qui cadere poſſit in virum conſtantem, non timidum et meticuloſum*," as Bracton expreſſes it in the words of the civil law. Therefore in time of war or rebellion, a man may be juſtified in doing many treaſonable acts by compulſion of the enemy or rebels, which would admit of no excuſe in the time of peace. This, however, ſeems only, or at leaſt principally, to hold as to poſitive crimes, ſo created by the laws of ſociety, and which therefore ſociety may excuſe; but not as to natural offences, ſo declared by the law of God, wherein human magiſtrates are only the executioners of divine puniſhment. And therefore though a man be violently aſſaulted, and hath no other poſſible means of eſcaping death but by killing an innocent perſon, this fear and force ſhall not acquit him of murder; for he ought rather to die himſelf than eſcape by the murder of an innocent. But in ſuch a caſe he is permitted to kill the aſſailant; for there the law of nature, and ſelf-defence its primary canon, have made him his own protector.

3. There is a third ſpecies of neceſſity, which may be diſtinguiſhed from the actual compulſion of external force or fear; being the reſult of reaſon and reflection, which act upon and conſtrain a man's will, and oblige him to do an action which without ſuch obligation would be criminal. And that is, when a man has his choice of two evils ſet before him, and being under a neceſſity of chooſing one, he chooſes the leaſt

pernicious of the two. Here the will cannot be ſaid freely to exert itſelf, being rather paſſive than active; or, if active, it is rather in rejecting the greater evil than in chooſing the leſs. Of this ſort is that neceſſity, where a man by the commandment of the law is bound to arreſt another for any capital offence, or to diſperſe a riot, and reſiſtance is made to his authority: it is here juſtifiable, and even neceſſary, to beat, to wound, or perhaps to kill the offenders, rather than permit the murderer to eſcape, or the riot to continue. For the preſervation of the peace of the kingdom, and the apprehending of notorious malefactors, are of the utmoſt conſequencce to the public; and therefore excuſe the felony, which the killing would otherwiſe amount to.

4. There is yet another caſe of neceſſity, which has occaſioned great ſpeculation among the writers upon general law; viz. whether a man in extreme want of food or clothing may juſtify ſtealing either, to relieve his preſent neceſſities. And this both Grotius and Puffendorff, together with many other of the foreign juriſts, hold in the affirmative; maintaining by many ingenious, humane, and plauſible reaſons, that in ſuch caſes the community of goods, by a kind of tacit conceſſion of ſociety, is revived. And ſome even of our lawyers have held the ſame; though it ſeems to be an unwarranted doctrine, borrowed from the notions of ſome civilians; at leaſt it is now antiquated, the law of England admitting no ſuch excuſe at preſent. And this its doctrine is agreeable not only to the ſentiments of many of the wiſeſt ancients, particularly Cicero, who holds, That *ſuum cuique incommodum ferendum eſt, potius quam de alterius commodis detrahendum;* but alſo to the Jewiſh law, as certified by King Solomon himſelf: "If a thief ſteal to ſatisfy his ſoul when he is hungry, he ſhall reſtore ſevenfold, and ſhall give all the ſubſtance of his houſe:" which was the ordinary puniſhment for theft in that kingdom. And this is founded upon the higheſt reaſon: for men's properties would be under a ſtrange inſecurity, if liable to be invaded according to the wants of others; of which wants no man can poſſibly be an adequate judge but the party himſelf who pleads them. In England eſpecially, there would be a peculiar impropriety in admitting ſo dubious an abuſe: for by the laws ſuch ſufficient proviſion is made for the poor by the power of the civil magiſtrate, that it is impoſſible that the moſt needy ſtranger ſhould ever be reduced to the neceſſity of thieving to ſupport nature. The caſe of a ſtranger is, by the way, the ſtrongeſt inſtance put to Baron Puffendorff, and whereon he builds his principal arguments: which, however they may hold upon the continent, where the parſimonious induſtry of the natives orders every one to work or ſtarve, yet muſt loſe all their weight and efficacy in England, where charity is reduced to a ſyſtem, and interwoven in our very conſtitution. Therefore our laws ought by no means to be taxed with being unmerciful, for denying this privilege to the neceſſitous; eſpecially when we conſider, that the king, on the repreſentation of his miniſters of juſtice, hath a power to ſoften the law, and to extend mercy in caſes of peculiar hardſhip. An advantage which is wanting in many ſtates, particularly thoſe which are democratical: and theſe have in its ſtead introduced and adopted, in the body of the law itſelf, a multitude of circumſtances tending to alleviate its rigour. But the founders of our conſtitution thought it better to veſt in the crown the power of pardoning particular objects of compaſſion, than to countenance and eſtabliſh theft by one general undiſtinguiſhing law.

NECHO, king of Egypt, began his reign 690 B. C. and was killed eight years after by Sabacon king of Ethiopia. Pſammiticus his ſon ſucceeded him, and was the father, as Herodotus informs us, of Necho II. who reigned in the 616 B. C. This Necho II. is celebrated in hiſtory for attempting, though in vain, to cut a canal from the Nile to the Arabian gulf. He carried his arms as far as the Euphrates, and conquered the city of Carchemiſh. This prince is not only known in Scripture under the name of *Necho*, but alſo in profane hiſtory. He no ſooner ſucceeded to the crown than he raiſed great land armies, and fitted out vaſt fleets, as well upon the Mediterranean as upon the Red ſea: he gave battle to the Syrians near the city of Migdol; routed them, and made himſelf maſter of the city of Cadytis. The learned, however, are not agreed about this city Cadytis. Some will have it to be Cades in Arabia Petræa, others Jeruſalem; and others ſay it is the city of Cedes, or Kedeſh, in Galilee, in the tribe of Naphtali.

The Scriptures acquaint us with the whole expedition of Necho in all its particulars, 2 Kings xxiii. 29. &c. and 2 Chr. xxxv. 20, 21, &c. In the year of the world 3394, this prince having drawn out his army into the field to make war with the Aſſyrians or Babylonians, and to take the city of Carchemiſh, otherwiſe called *Circuſium*, upon the Euphrates, Joſiah king of Judah, who was a tributary to the king of Babylon, marched to oppoſe his paſſage. Necho, who had no deſigns againſt him, ſent to tell him, "What have I to do with you, king of Judah? It is not againſt you that I am come forth, but againſt another people, againſt whom the Lord has commanded me to make war. Leave off therefore to ſet yourſelf againſt me, for fear the Lord ſhould puniſh you for your reſiſtance." But Joſiah would not hearken to the remonſtrances of Necho, but gave him battle at Megiddo, where he received the wound of which he died. The people of Jeruſalem ſet up Jehoahaz for king of Judah, and Necho ſoon paſſed forwards, without making any longer ſtay in Judea.

But at his return from his expedition, which was very ſucceſsful, he halted at Riblah in Syria; and ſending for Jehoahaz king of the Jews, he depoſed him, loaded him with chains, and ſent him into Egypt. Then coming to Jeruſalem, he ſet up Eliakim, or Jehoiakim, in his place, and exacted the payment of 100 talents of ſilver and one talent of gold from the country. Jeremiah (xlvi. 2.) acquaints us that the city of Carchemiſh was taken from Necho by Nebuchadnezzar king of Babylon, in the fourth year of Jehoiakim king of Judah; ſo that Necho did not enjoy his conqueſt above four years. Joſephus adds, that the king of Babylon purſuing his victory, brought under his dominion all the country which is between the Euphrates and Egypt, excepting Judea. Thus Necho was again reduced within the limits of his own country.

NECK, in *Anatomy*, is the ſlender part ſituated between

tween the head and trunk of the body. See ANATOMY.

NECROLIUM, a word uſed by ſome of the alchemical writers to expreſs a remedy almoſt always capable of averting death, and continuing life to its utmoſt period.

NECROLOGY, *necrologium*, formed of νεκρος, "dead," and λογος "diſcourſe or enumeration," a book anciently kept in churches and monaſteries, wherein were regiſtered the benefactors of the ſame, the time of their deaths, and the days of their commemoration; as alſo the deaths of the priors, abbots, religious, canons, &c. This was otherwiſe called *calender* and *obituary*.

NECROMANCY, the art of revealing future events by a pretended communication with the dead.

This ſuperſtitious and impious impoſture appears to have had its origin at a very early period in Egypt, and to have been thence propagated in every nation with the manners of which hiſtory has made us acquainted. The conqueſts of Seſoſtris might introduce it into India; the Iſraelites would naturally borrow it from the people among whom they ſojourned 400 years; and it would eaſily find its way into Phœnicia, from the vicinity of that country to the land of its nativity. From the Egyptians and Phœnicians it was adopted, with the other rites of paganiſm, by the Greeks; and it was imported into Rome with Grecian literature and Grecian manners. It was not however confined to the pagan nations of antiquity: it ſpread itſelf through all the modern nations of Europe, and took ſuch deep root as to be long retained even after thoſe nations were converted to the Chriſtian faith.

Of its early antiquity we have complete evidence in the writings of Moſes, where it is ſeverely condemned as an abomination to the Lord *; and though it appears to have been even then ſpread into Phœnicia, we might yet conclude its birth-place to have been Egypt, becauſe, at their *exody*, the Iſraelites were corrupted only by Egyptian ſuperſtitions, and becauſe necromancy ſeems to be one of thoſe whoredoms which the prophet Ezekiel repreſents his countrymen as having brought with them from Egypt, and continued to practiſe till they were carried captives into Babylon.

If from ſacred we proceed to conſult profane authors, we ſhall find them not only affirming Egypt to have been the birthplace of necromancy, but in ſome degree accounting for the origin of ſo impious a deluſion. From Diodorus the Sicilian † we learn, that the Grecian fable of *Charon* the ferryman of hell, of *Styx*, *Cocytus*, the *Elyſian Fields*, *Tartarus*, the judgment of *Minos* and *Rhadamanthus*, &c. with the whole ſcenery of the infernal regions, were imported from Egypt into Greece. The ancient Egyptians, and indeed all the people of the eaſt, made uſe of caves for burying places, which were well ſuited to the ſolemn ſadneſs of the ſurviving friends, and proper receptacles for thoſe who were never more to behold the light. In Egypt, many of thoſe ſubterraneous cavities being dug out of the natural rock, ſtill remain, and command the admiration of travellers; and near to the pyramids in particular there are ſome apartments of a wonderful fabric, which though they extend in length 4400 feet, and are about 30 feet in depth, appear to have been, if not entirely dug, at leaſt reduced to form by the chiſel or pickaxe of the artiſt.

From the practice of burying in ſuch caverns ſprung the opinion that the infernal manſions were ſituated ſomewhere near the centre of the earth, which by the Egyptians was believed to be not very diſtant from its ſurface ‡. In theſe dreary manſions, it was very eaſy for ſuch adepts as the prieſts of Egypt to fabricate Erebus, Tartarus, the Elyſian Fields, and all thoſe ſcenes which were diſplayed before the initiated (ſee MYSTERIES), and by them deſcribed to the million of the people. As it was in thoſe dark abodes that necromancy was practiſed, it would be no difficult matter for ſuch magicians as withſtood Moſes to impoſe ſo far upon the credulous vulgar, as to make them believe, that in conſequence of their invocations they actually ſaw the ghoſts of their friends aſcend out of the earth. It appears from the book of Exodus, that the Iſraelitiſh women were, even in the wilderneſs, well acquainted with the uſe of the mirror, which was therefore undoubtedly known to the Egyptians. But a mirror of a particular form and properly illuminated at the inſtant required, might eaſily be made to reflect, in a cavern from which all other light was carefully excluded, the image of the deceaſed, who was called upon by the necromancer; and we can readily conceive, that with reſpect to the queſtion to be propoſed, a perſon might be concealed, prepared to give ſuch ambiguous anſwers as would ſatisfy the inquirer, and at the ſame time ſave the credit of the oracle. The terrified imaginations of the ſpectators would aid the deluſion, and make a very ſlight reſemblance paſs for the ghoſt or ειδωλον of their departed friend; or the necromancer might aſſign plauſible reaſons why a ſpectre, after having dwelt for ſome time in the infernal regions, ſhould loſe ſomething of its reſemblance to the body which it animated. Such juggling tricks, though performed by artiſts leſs accompliſhed than Jannes and Jambres, have gained credit among people much more enlightened than the Egyptians can poſſibly have been when the ſcience of necromancy was invented by their prieſts.

That the Iſraelites, notwithſtanding the prohibition of their legiſlator, continued to practiſe the rites of necromancy, is apparent from Saul's tranſaction with the witch of Endor (ſee MAGIC). From the ſame tranſaction, it is likewiſe apparent that the witches of Iſrael, and therefore in all probability the necromancers of Egypt, pretended to evocate the ghoſts of the dead by a *demon* or *familiar ſpirit*, which they had at their command to employ upon every emergency. This demon was called OB; and therefore Saul deſires his ſervants to find him a woman who was miſtreſs of an OB (A). It

* Deut. xviii. 10, 11, 12.

† Lib. i. § 2.

‡ Bryant's *Analyſis of Mythology*.

(A) The original, or radical, ſignification of this word occurs in Job xxxii. ver. 19.; where Elihu compares his belly to new bottles, which he calls *oboth*, the plural of *ob*. But as bottles were then made of leather, new bottles filled with wine and ready to burſt, as Elihu deſcribes them, would of courſe be of a form nearly globular.

It is probable that thoſe wretched impoſtors had in their pay ſome perſons who occaſionally acted the part of the demon, and when the execution of the plot required their agency, emitted, by means of a cavity dug for that purpoſe, a low hollow voice from below the ground. Hence we find Iſaiah, in his denunciations againſt Ariel *, ſaying, "Thou ſhalt be brought down, and ſhalt ſpeak out of the ground; and thy ſpeech ſhall be low out of the duſt, and thy voice ſhall be as of one that hath a familiar ſpirit (an OB) out of the ground, and thy ſpeech ſhall whiſper out of the duſt."

* Chap. xxix. 4.

But though the Egyptian prieſts were undoubtedly the inventors of the whole myſtery of necromancy, and though it was from them imported into Greece by the SELLI or prieſts of Dodona, it does not appear that the Grecian necromancers pretended to be maſters of OBS or familiar ſpirits. Mopſus, Orpheus, Linus, Eumolpus, &c. who either travelled into Egypt in queſt of knowledge, or were actually natives of that country, inſtructed the early Greeks in this occult ſcience: but whatever might be the practice of theſe apoſtles themſelves, their diſciples profeſſed to do all the feats of magic by performing certain rites, by offering certain ſacrifices, by muttering a certain form of words, by charms, ſpells, and exorciſms. By theſe they pretended to evocate the dead as certainly as the Egyptians and Jews did by their *familiar ſpirits*. By a ſmall diſplay of critical learning this might be eaſily proved from the popular ſtory of Orpheus and Eurydice, which certainly was founded on one of theſe necromantic deceptions exhibited in a cave near Dodona, where the prieſts had a *hades* or infernal manſion, in humble imitation of thoſe with which the firſt of them were well acquainted in Egypt. It is indeed evident, without the aid of criticiſm: no man of any letters is ignorant, that whatever ſuperſtitions of this kind prevailed among the Romans were borrowed from the Greeks. But we all know that Virgil makes one of his ſhepherds, by means of certain herbs, poiſons, and ſenſeleſs charms, raiſe up ghoſts from the bottoms of their graves; and Lucan has fabricated a ſtory of this kind, which may be conſidered as an exact parallel to the witch of Endor. Juſt before the battle of Pharſalia he makes † young Pompey travel by night to a Theſſalian ſorcereſs, and anxiouſly inquire of her the iſſue of the war. This female necromancer, by a tedious proceſs of charms and incantations, conjures up the ghoſt of a ſoldier who had been lately ſlain. The phantom, after a long preamble, denounces a prediction much of the ſame kind with that which the king of Iſrael received from Samuel at Endor; and though we have elſewhere ſhown, that nothing but the ſpirit of God could have foreſeen the inevitable deſtruction of Saul, his ſons, and his army (ſee MAGIC), it was very eaſy for any man of tolerable ſagacity to foreſee the defeat of Pompey's raw and undiſciplined troops by the hardy veterans of the victorious Cæſar.

† Lib. vi. ver. 570. et ſeq.

It would be endleſs to enumerate all the fallacious evocations of ghoſts, and the ambiguous reſponſes returned by thoſe pretended ſpirits, of which we have accounts from the poets and hiſtorians of the celebrated nations of antiquity. We ſhall therefore proceed to mention a few which occur in the fabulous hiſtory of more modern nations, and then leave the ſubject to the meditation of our readers. In Mallet's Northern Antiquities, we have the following account of a necromantic exploit, between which, and the deſcent of the ancient heroes into hell, it is impoſſible not to remark a ſtriking ſimilitude.

"Odin the ſovereign of man ariſes. He ſaddles his horſe Sleipner; he mounts, and is conveyed to the ſubterraneous abode of *Hela*. The dog which guards the gates of death meets him. His breaſt and his jaws are ſtained with blood. He opens his voracious mouth to bite, and barks a long time at the father of magic. Odin purſues his way; and the infernal cavern reſounds and trembles under his horſe's hoofs. At length he reaches the deep abode of death, and ſtops near the eaſtern gate, where ſtands the tomb of the propheteſs. He ſings with a voice adapted to call up the dead; he looks towards the world; he engraves Runic characters on her tomb; he utters myſterious words; and he demands an anſwer, until the propheteſs is conſtrained to ariſe and thus utter the words of the dead.—"Who is this unknown that dares to diſturb my repoſe, and drag me from the grave, in which I have been dead ſo long, all covered with ſnow, and moiſtened with the rains?" &c.

The Gaelic druids pretended to be maſters of the ſame ſecret. This is evident from the name of a ſpecies of divination, not uncommon among the Scotch Highlanders ſo lately as in the beginning of the 18th century. By a gentleman excellently verſed in the antiquities of that people, and a ſteady friend to the writer of this article, we have been informed, that not many years ago ſome of the Highlanders relied implicitly upon certain oracular reſponſes, called in their language *taghairm*. This word ſeems to be compounded of *ta*, which in ſome parts of the Highlands is ſtill uſed to denote a ſpirit or ghoſt, and *ghairm*, which ſignifies *calling upon* or invoking. *Taghairm*, therefore, in its original import, is *necromancy* in the moſt proper ſenſe of that word.

There were different kinds of *taghairm*, of which one was very lately practiſed in *Skye*. The diviner covered himſelf with a cow's hide, and repaired at night to ſome deep-ſounding cave, whither the perſon who conſulted

---

lar. Hence it may be inferred that the original import of *ob* was *round* or *globular*: but *b* and *p* being labials, are often changed into each other; and therefore, from the Hebrew *ob* is derived the Greek οψ, *oculus*, οπτομαι, *video*, and the Latin *ops*, a name under which the earth was worſhipped. *Upis* was a name of Diana or the moon: the father of one of the Dianas was likewiſe *Upis*; but this *Upis* was undoubtedly the ſun. Now the difference between *upis* and *opis* is nothing; hence we are led to believe, that as they are all derived from *ob*, this word was employed by the early idolaters of Egypt to denote the firſt and greateſt of Pagan gods, the ſun. If ſo, thoſe wretches who pretended to be miſtreſſes of *obs*, were exactly the ſame kind of impoſtors with the Pythoneſſes of the Greeks.

ſulted him followed ſoon after without any attendants. At the mouth of the cave he propoſed aloud the queſtions of which he wanted ſolutions; and the man within pronounced the reſponſes in a tone of voice ſimilar to that with which the OBS, or pretended demons of antiquity, gave from beneath the ground their oracular anſwers. That in the latter days of *taghairm*, the Gaelic diviners pretended to evocate ghoſts, and from them to extort ſolutions of difficulties propoſed, we have no poſitive evidence; but that ſuch was the original pretence there can be little doubt, when we reflect either upon the place where this ſpecies of divination was practiſed, or upon the import of the word by which it was denominated.

As we have been led to mention *taghairm*, we ſhall beg leave to make a few obſervations on another ſpecies of it, called *taghairm an uiſge*, or "*taghairm* by water." This too was laſt practiſed in the Iſle of Skye, by a man of the name of *M'Cuidhean*, whoſe anceſtors had long been famous for the art. He lived near a beautiful caſcade on a ſmall river; and when conſulted on any matter of conſequence, he covered his whole body with a cow's hide, that neceſſary implement of Highland divination, and placed himſelf between the water of the caſcade and the rock over which it flowed. Then another man with a heavy pole gave repeated ſtrokes to the water, and the diviner behind it crying out now and then in Gaelic, "Is this a ſtock of arn?" This operation was continued till M'Cuidhean was perceived to be frantic or furious, when he was conſidered as in a condition to anſwer the moſt important queſtions. He was frequently conſulted about futurity; and though he could not, in the proper ſenſe of the word, be called a *necromancer*, his reſponſes were liſtened to as proceeding from ſomething more than human. A degree of phrenzy, either real or affected, ſeems to have accompanied the predictions of certain kinds of diviners in all ages; and we cannot help remarking the ſimilarity between the madneſs of M'Cuidhean and that of the Sibyl in the ſixth book of the Æneid; though we cannot ſuppoſe the one to have been borrowed from the other.

At, Phœbi nondum patiens, immanis in antro
Bacchatur vates, magnum ſi pectore poſſit
Excuſſiſſe Deum: tanto magis ille fatigat
Os rabidum, fera corda domans, fingitque premendo.

Struggling in vain, impatient of her load,
And lab'ring underneath the pond'rous god;
The more ſhe ſtrove to ſhake him from her breaſt,
With more and far ſuperior force he preſs'd.
DRYDEN.

That all theſe pretences, whether ancient or modern, to the power of divination by means of familiar ſpirits, or by the art of necromancy, were groundleſs as well as impious, it would be affronting the underſtandings of our readers to offer any proof. Under the article MAGIC we have ſaid enough on the ſubject, and perhaps more than enough, to thoſe who know that demons, if they have any exiſtence, and the departed ſpirits of good and bad men, are all under the controul of Him who governs the intellectual as well as material world by fixed and equal laws.—Theſe details of ſuperſtition, however, will not be uſeleſs, if, by ſhowing how poor and wretched a creature man becomes when left to his own inventions, they ſhall make any one grateful for the benefits of good government, and the bleſſings of revealed religion.

NECROPOLIS, a ſuburb of Alexandria in Egypt. It ſignifies "the City of the Dead;" wherein there were temples, gardens, and ſuperb mauſoleums. Here Cleopatra is ſaid to have applied the aſpic to her breaſt, to prevent being led in triumph by Auguſtus, who endeavoured to ſave her.

NECROSIS, νεκρωσις, in *Medicine*, a complete mortification of any part; called alſo *ſideratio* and *ſphacelus*.

NECTANEBUS, or NECTANABIS, a king of Egypt, who defended his country againſt the Perſians. His grandſon of the ſame name made an alliance with Ageſilaus king of Sparta, and with his aſſiſtance he quelled a rebellion of his ſubjects. Some time after he was joined by the Sidonians, Phœnicians, and inhabitants of Cyprus, who had revolted from the king of Perſia. This powerful confederacy was ſoon attacked by Darius the king of Perſia, who marched at the head of his troops. Nectanebus, to defend his frontiers againſt ſo dangerous an enemy, levied 20,000 mercenary ſoldiers in Greece, the ſame number in Libya, and 60,000 were furniſhed in Egypt. This numerous body was not equal to the Perſian forces, and Nectanebus, defeated in a battle, gave up all hopes of reſiſtance, and fled into Ethiopia, where he found a ſafe aſylum. His kingdom of Egypt became from that time tributary to the king of Perſia.

NECTAR, among ancient poets, the drink of the fabulous deities of the heathens; in contradiſtinction from their ſolid food, which was called *ambroſia*.

NECTARINE, a fruit differing in nothing from the common peach, of which it is a ſpecies, but in having a ſmoother rind and a firmer pulp. See PERSICA.

NECTARIUM, from *nectar*, the fabled "drink of the gods;" defined by Linnæus to be a part of the corolla, or appendage to the petals, appropriated for containing the honey, a ſpecies of vegetable ſalt under a fluid form, that oozes from the plant, and is the principal food of bees and other inſects.

Notwithſtanding this definition, which ſeems to conſider the nectarium as neceſſary a part of the corolla as the petals, it is certain that all flowers are not provided with this appendage, neither indeed is it eſſential to fructification.

There is, beſides, a manifeſt impropriety in terming the nectarium a part of the corolla. Linnæus might, with equal propriety, have termed it a part or appendage of the ſtamina, calyx, or pointal, as the appearance in queſtion is confined to no particular part of the flower, but is as various in point of ſituation as of form. The truth is, the term *nectarium* is exceedingly vague; and, if any determinate meaning can be affixed to it, is expreſſive of all the ſingularities which are obſerved in the different parts of flowers. *Milne's Bot. Dict.*

The tube, or lower part of flowers with one petal, Linnæus conſiders as a true nectarium, becauſe it is generally found to contain the ſweet liquor formerly mentioned. This liquor Pontedera compares to that called *amnios* in pregnant animals, which enters the fertile or impregnated ſeeds: but that this is not at leaſt its ſole uſe, is evident from this circumſtance, that the honey or liquor in queſtion is to be found in flowers where there are either no ſeeds, or thoſe which, from the want of male organs, cannot be impregnated. Thus the male flowers of nettle and willow, the female flowers of ſea-ſide laurel and black bryony, the male and female flowers of clutia, kiggelaria, and butcher's broom, all abound with the honey or nectar alluded to.

Vaillant was of opinion, that the nectarium was an eſſential part of the corolla; for which reaſon he diſtinguiſhed the ſingular appearances in fennel flower and columbine by the name of *petals*: the coloured leaves which are now termed the *petals* he denominates the *flower cup*.

That the nectarium, however, is frequently diſtinct from the petals, is evident both from the well known examples juſt mentioned, as likewiſe from the flowers of monkſhood, hellebore, iſopyrum, fennel flower of Crete, barrenwort, graſs of Parnaſſus, chocolate nut, cherleria, and ſauvageſia.

Theſe general obſervations being premiſed, we proceed to take a nearer and more particular view of the principal diverſities, both in form and ſituation, of this ſtriking appendage to the flower. 1. In many flowers the nectarium is ſhaped like a ſpur or horn; and that either in flowers of one petal, as valerian, water milfoil (*utricularia*), butterwort, and calves-ſnout; or in ſuch as have more than one, as larkſpur, violet, fumitory, balſam, and orchis. 2. In the following plants, the nectarium is properly a part of the corolla, as lying within the ſubſtance of the petals: ranunculus, lily, iris, crown imperial, water leaf, mouſe tail, ananas or pine apple, dog's-tooth violet, piperidge buſh, valliſneria, hermannia, uvularia, and ſwertia. 3. The nectarium is frequently placed in a ſeries or row within the petals, though entirely unconnected with their ſubſtance. In this ſituation it often reſembles a cup, as in narciſſus. A nectarium of this kind is ſaid by Linnæus to crown the corolla. The following are examples: daffodil, ſea daffodil, campion, viſcous campion, ſwallow-wort, ſtapelia, cynanchum, nepenthes, cherleria, balſam-tree, African ſpiræa, witch-hazel, olax, and paſſion-flower. 4. In Indian-creſs, buckler, muſtard, Barbadoes cherry, and monotropa, the nectarium is ſituated upon or makes part of the calyx. 5. The nectarium in baſtard flower-fence is ſeated upon the antheræ or tops of the ſtamina; whence the name *adenanthera*, or *glandular anthera*, which has been given to this genus of plants. In the following liſt it is placed upon the filaments; bean-caper, bay, fraxinella, marvel of Peru, bell-flower, lead-wort, roella, and commelina. 6. In hyacinth, flowering-ruſh, ſtock July flower, and rocket, the nectarium is placed upon the ſeed-bud. 7. In honey-flower, orpine, buckwheat, collinſonia, lathræa, navelwort, mercury, clutia, kiggelaria, ſea-ſide laurel, and African ſpiræa, it is attached to the common receptacle. Laſtly, In ginger, nettle, dyer's weed, heart-ſeed, coſtus, turmeric, grewia, baſtard-orpine, vanelloe, ſhrew-tree, and willow, the nectarium is of a very ſingular conſtruction, and cannot properly fall under any of the foregoing heads.

In diſcriminating the genera, the nectarium often furniſhes an eſſential character.

Plants which have the nectarium diſtinct from the petals, that is, not lodged within their ſubſtance, are affirmed by Linnæus to be generally poiſonous. The following are adduced as examples: monkſhood, hellebore, columbine, fennel-flower, graſs of Parnaſſus, barren-wort, oleander, marvel of Peru, bean-caper, ſucculent ſwallow-wort, fraxinella, and honey-flower.

NECUIA, in *Botany*, a name given by the ancient Greeks to a ſpecies of mullein.

The Greeks and Romans both uſed the ſtalks of a peculiar kind of mullein, called *thryallis* by Nicander, for the making of wicks of lamps. We have a kind of mullein called *lychnites*, and candle-wick mullein, from the λυχνιτις of Dioſcorides; but it is not certain that ours is the ſame plant.

The ancients uſed the ſtalks of many different plants for the wicks of their candles and lamps. The ruſh, ſtripped of its bark, was as commonly in uſe with them as with us for that purpoſe; and they alſo uſed the nettle, this mullein, and many other plants, whoſe ſtalks were compoſed of tough filaments, for the ſame purpoſe; beating them out like hemp, and when dry dipping them in melted reſin, and other ſuch inflammable ſubſtances. When thus prepared, they are readily inflammable, like our flambeau; and this mullein, having ſtalks more long and large, and more firm than all the others, was uſed to make thoſe lights with which they ſet fire to the funeral pile, for conſuming the aſhes of their dead friends.

NECYDALIS, a genus of inſects belonging to the order of coleoptera. See ENTOMOLOGY *Index*.

NEEDHAM, JOHN TUBERVILLE, was born at London the 10th of September in the year 1713. His parents were deſcended from ancient and noble families. His father, who had once poſſeſſed a conſiderable patrimony at Hilſton, in the county of Monmouth, was of the younger and Catholic branch of the Needham family: the head of the elder and Proteſtant branch was Lord Kilmory, created viſcount in the year 1625. The father of Mr Needham died young, and left but a ſmall fortune to his four children. His eldeſt ſon, who is the ſubject of this article, proſecuted his ſtudies under the ſecular clergy of the Engliſh college of Douay, where he took orders, taught rhetoric for ſeveral years, gave eminent proofs of ſagacity and genius, and ſurpaſſed all the other profeſſors of that ſeminary in the knowledge of experimental philoſophy. In 1740, he was engaged by his ſuperiors in the ſervice of the Engliſh miſſion, and was intruſted with the direction of the ſchool erected at Twyford, near Wincheſter, for the education of the Roman Catholic youth. In 1744, he was appointed profeſſor of philoſophy in the Engliſh college at Liſbon, where, on account of his bad health, he remained only 15 months. After his return, he paſſed ſeveral years at London and Paris, which were principally employed in microſcopical obſervations, and in other branches of experimental philoſophy. The reſults of theſe obſervations and experiments were publiſhed in the Philoſophical Tranſactions of the Royal Society of London in 1749, and in a volume in 12mo at Paris in 1750; and an account of them was alſo given by M. de Buffon, in the firſt volumes of his Natural Hiſtory. There was an intimate connexion between this illuſtrious French naturaliſt and Mr Needham: they made their experiments and obſervations together;

gether; though the reſults and ſyſtems which they deduced from the ſame objects and operations were totally different. Mr Needham was admitted to a place in the Royal Society of London in the year 1747, and in the Antiquarian Society ſome time after. From the year 1751 to 1767 he was chiefly employed in finiſhing the education of ſeveral Engliſh and Iriſh noblemen, by attending them as tutor in their travels through France, Italy, and other countries. He then retired from this wandering life to the Engliſh ſeminary at Paris, and in 1768 was choſen by the Royal Academy of Sciences in that city a correſponding member.

When the regency of the Auſtrian Netherlands, in order to the revival of philoſophy and literature in that country, formed the project of an Imperial academy, which was preceded by the erection of a ſmall literary ſociety to prepare the way for its execution, Mr Needham was invited to Bruſſels by Count Cobentzel and the preſident Neny, and was appointed ſucceſſively chief director of both theſe foundations. He held this place, together with ſome eccleſiaſtical preferments in the Low Countries, until his death, which happened the 30th of December 1781. "His piety, temperance, and purity of manners (we follow the expreſſions of the abbé Mann) were eminent: his attachment to the doctrines and duties of Chriſtianity was inviolable. His zealous oppoſition to modern infidels was indefatigable, and even paſſionate. His probity was untainted. He was incapable of every ſpecies of duplicity; his beneficence was univerſal, and his unſuſpicious candour rendered him often a dupe to perfidy." Theſe and other good qualities the panegyriſt attributes to his deceaſed friend; and the learned authors of the Monthly Review, to whom Mr Needham was known, admit the juſtneſs of the panegyric. He was undoubtedly (ſay they), both an honeſt man and a worthy citizen; but though his death be a real loſs to the literary world, yet he died ſeaſonably for himſelf; for had he lived to ſee Joſeph II. and the Great making ſo free with the paint, patches, and trinkets of the mother church, confiſcating her lands, aboliſhing her convents, ſuppreſſing her holidays, introducing common ſenſe into her worſhip, erecting political conductors to diſperſe the thunder of the Vatican, and achieving many other things in this ſtyle of improvement, it would have vexed full ſore his feeling heart. For this honeſt man was narrow even to ſuperſtition and bigotry in his religious ſyſtem; and we never knew a man in whom there was ſuch an unaccountable mixture of implicit faith and philoſophical curioſity as in Mr Needham. He was a keen and judicious obſerver of nature, had a peculiar dexterity in confirming his obſervations by experiments, and he was always occupied (ſometimes indeed with too much fancy and precipitation) in generalizing facts, and reducing them to his ſyſtem. "His pen (ſays Abbé Mann) was neither remarkable for fecundity nor method: his writings are rather the great lines of a ſubject expreſſed with energy, and thrown upon paper in a hurry, than finiſhed treatiſes." His works are well known both in Britain and in France.

Needham, a town in Suffolk, 73 miles from London, ſtands on the Orwell, 9 miles from Ipſwich, in the road to Huntingdonſhire.

NEEDLE, a very common little inſtrument or utenſil made of ſteel, pointed at one end, and pierced at the other, uſed in ſewing, embroidery, tapeſtry, &c.

Needles make a very conſiderable article in commerce, though there is ſcarce any commodity cheaper, the conſumption of them being almoſt incredible.—The ſizes are from N° 1. the largeſt, to N° 25, the ſmalleſt. In the manufacture of needles, German and Hungarian ſteel is of moſt repute.

In the making of them, the firſt thing is to paſs the ſteel through a coal fire, and under a hammer, to bring it out of its ſquare figure into a cylindrical one. This done, it is drawn through a large hole of a wire-drawing iron, and returned into the fire, and drawn through a ſecond hole of the iron ſmaller than the firſt; and thus ſucceſſively from hole to hole, till it has acquired the degree of fineneſs required for that ſpecies of needles; obſerving every time it is to be drawn, that it be greaſed over with lard, to render it more manageable. The ſteel thus reduced to a fine wire, is cut in pieces of the length of the needles intended. Theſe pieces are flattened at one end on the anvil, in order to form the head and eye: they are then put into the fire to ſoften them farther; and thence taken out and pierced at each extreme of the flat part on the anvil, by force of a puncheon of well-tempered ſteel, and laid on a leaden block to bring out, with another puncheon, the little piece of ſteel remaining in the eye. The corners are then filed off the ſquare of the heads, and a little cavity filed on each ſide of the flat of the head; this done, the point is formed with a file, and the whole filed over: they are then laid to heat red hot on a long narrow iron, crooked at one end, in a charcoal fire; and when taken out thence, are thrown into a baſon of cold water to harden. On this operation a good deal depends; too much heat burns them, and too little leaves them ſoft; the medium is learned by experience. When they are thus hardened, they are laid in an iron ſhovel, on a fire more or leſs briſk in proportion to the thickneſs of the needles; taking care to move them from time to time. This ſerves to temper them, and take off their brittleneſs; great care here too muſt be taken of the degree of heat. They are then ſtraightened one after another with the hammer, the coldneſs of the water uſed in hardening them, having twiſted the greateſt part of them.

The next proceſs is the poliſhing them. To do this, they take 12,000 or 15,000 needles, and range them in little heaps againſt each other on a piece of new buckram ſprinkled with emery duſt. The needles thus diſpoſed, emery-duſt is thrown over them, which is again ſprinkled with oil of olives; at laſt the whole is made up into a roll, well bound at both ends. This roll is then laid on a poliſhing table, and over it a thick plank loaded with ſtones, which two men work backwards and forwards a day and a half, or two days, ſucceſſively; by which means the roll thus continually agitated by the weight and motion of the plank over it, the needles withinſide being rubbed againſt each other with oil and emery, are inſenſibly poliſhed. After poliſhing they are taken out, and the filth waſhed off them with hot water and ſoap: they are then wiped in hot bran, a little moiſtened, placed with the needles in a round box, ſuſpended in the air by a cord, which is kept ſtirring till the bran and needles be dry. The needles thus wiped in two or three different brans, are taken out and put in wooden veſſels, to have the good ſeparated from thoſe whoſe points or eyes have been broken either in poliſhing or wiping; the points are then all turned the ſame way, and ſmoothed with an emery ſtone turned with a wheel. This operation finiſhes them, and there remains nothing but to make them into packets of 250 each. Needles were firſt made in England by a native of India, in 1545, but the art was loſt at his death; it was, however, recovered by Chriſtopher Greening in 1560, who was ſettled with his three children, Elizabeth, John, and Thomas, by Mr Damar, anceſtor of the preſent Lord Milton, at Long Crendon in Bucks, where the manufactory has been carried on from that time to this preſent day.

Plate CCCLXIX. fig. 1.

*Dipping-*NEEDLE, or *Inclinatory Needle*, a magnetical needle, ſo hung, as that, inſtead of playing horizontally, and pointing out north and ſouth, one end dips, or inclines to the horizon, and the other points to a certain degree of elevation above it.

The dipping-needle was invented in the year 1576, by one Robert Norman, a compaſs-maker at Wapping. The occaſion of the diſcovery, according to his own account, was, that it being his cuſtom to finiſh and hang the needles of his compaſſes before he touched them, he always found, that immediately after the touch, the north-point would bend or incline downward, under the horizon; inſomuch that, to balance the needle again, he was always forced to put a piece of wax on the ſouth end as a counterpoiſe. The conſtancy of this effect led him at length to obſerve the preciſe quantity of the dip, or to meaſure the greateſt angle which the needle would make with the horizon; and this at London he found to be 71° 50′. In 1723 Mr Graham made a great many obſervations on the dipping-needle, and found the angle to be between 74 and 75 degrees. Mr Nairne, in 1772 found it to be ſomewhat above 72°. It is not certain whether the dip varies, as well as the horizontal direction, in the ſame place. The trifling difference between Mr Norman and Mr Nairne would lead us to imagine that the dip was unalterable; but Mr Graham, who was a very accurate obſerver, makes the difference more conſiderable. It is certain, however, from a great number of experiments and obſervations, that the dip is variable in different latitudes, and that it increaſes in going northwards. It appears from a table of obſervations made with the marine dipping-needle in a voyage towards the north pole in 1733, that in lat. 60. 18. the dip was 75°; and in lat. 70. 45. it was 77° 52′; in lat. 80. 12. it was 81° 52′; and in lat. 80. 27. it was 82° 2½′.

Several authors have endeavoured to apply this diſcovery of the dip to the finding of the latitude; and Mr Bond attempted to apply it to the finding of the longitude alſo; but for want of obſervations and experiments he could not make any progreſs. The affair was farther proſecuted by Mr Whiſton, who publiſhed a treatiſe on the longitude, and for ſome time imagined it was poſſible to find it exactly by means of the dip of the needle; yet he at laſt deſpaired of it, for the following reaſons; 1. The weakneſs of the magnetic power. 2. The concuſſion of the ſhip, which he found it exceedingly difficult to avoid ſo much as was neceſſary for the accuracy of the experiments. 3. The principal objection was an irregularity in the motions of all magnetic needles, both horizontal and dipping, by which they, within the compaſs of about a degree, vary uncertainly backward and forward; even ſometimes in a few hours time, without any evident cauſe. For a particular account of theſe variations, both of the horizontal and dipping needle, ſee the article VARIATION.

Fig. 2.

Mr Nairne made a dipping needle in 1772 for the Board of Longitude, which was uſed in the voyage towards the north pole. This is repreſented at fig. 2. The needle AA is 12 inches long, and its axis, the ends BB of which are made of gold, alloyed with copper, reſts on friction wheels CCCC, of four inches diameter, each end on two friction wheels; which wheels are balanced with great care. The ends of the axis of the friction wheels are likewiſe of gold alloyed with copper, and moved in ſmall holes made in bell metal; and oppoſite to the ends of the axes of the needle and the friction wheels, are flat agates, ſet in at DDD, finely poliſhed. The magnetic needle vibrates within a circle of bell metal, EEE, divided into degrees and half degrees; and a line, paſſing through the middle of the needle to the ends, points to the diviſions. The needle of this inſtrument was balanced before it was made magnetical; but by means of a croſs, the ends of which are FFFF, (contrived by the reverend Mr Mitchell) fixed on the axis of the needle, on the arms of which are cut very fine ſcrews to receive ſmall buttons, that may be ſcrewed nearer or farther from the axis, the needles may be adjuſted both ways to a great nicety, after being made magnetical, by reverſing the poles, and changing the ſides of the needle. GG are two levels, by which the line of 0 degrees of the inſtrument is ſet horizontal, by means of the four adjuſting ſcrews LLLL; H is the perpendicular axis, by which the inſtrument may be turned, that the divided face of the circle may front the eaſt or weſt; to this axis may be fixed an index I, which points to an oppoſite line on the horizontal plate K when the inſtrument is turned half round; MMMM are ſcrews which hold the glaſs cover to keep the needle from being diſturbed by the wind. When this needle is conſtructed for ſea, it is ſuſpended by an univerſal joint on a triangular ſtand, and adjuſted vertically by a plumb line and button above the divided circle and the dovetail work at the upper 90; and the diviſions on the circle are adjuſted ſo as to be perpendicular to the horizon by the ſame plumb line, and an adjoining ſcrew; and when it is adjuſted, a pointer annexed to a ſcrew, which ſerves to move the divided circle, is fixed at the loweſt 90. Whenever the inſtrument is uſed to find the dip, it muſt be ſo placed that the needle may vibrate exactly in the magnetic meridian.

Magnetical NEEDLE, in *Navigation*, a needle touched with a loadſtone, and ſuſtained on a pivot or centre; on which playing at liberty, it directs itſelf to certain points in or under the horizon; whence the magnetical needle is of two kinds, viz. horizontal or inclinatory. See the article MAGNET.

Horizontal needles are thoſe equally balanced on each ſide of the pivot that ſuſtains them, and which, playing horizontally with their two extremes, point out the north and ſouth points of the horizon. For their application and uſe, ſee the article COMPASS.

In the conſtruction of the horizontal needle, a piece of pure ſteel is provided; of a length not exceeding ſix inches, leſt its weight ſhould impede its volubility; very thin, to take its verticity the better; and not pierced with any holes, or the like, for ornament ſake, which prevent the equable diffuſion of the magnetic virtue. A perforation is then made, in the middle of its length, and a braſs cap or head ſoldered on, whoſe inner cavity is conical, ſo as to play freely on a ſtyle or pivot headed with a fine ſteel point. The north point of the needle in our hemiſphere is made a little lighter than the ſouthern; the touch always deſtroying the balance, if well adjuſted before, and rendering the north end heavier than the ſouth, and thus occaſioning the needle to dip.

The method of giving the needle its verticity or directive faculty has been ſhown already under the article MAGNET; but if, after touching, the needle be out of its equilibrium, ſomething muſt be filed off from the heavier ſide, till it balance evenly.

Needles in ſea compaſſes are uſually made of a rhomboidal or oblong form; we have given their ſtructure already under the article COMPASS.

The needle is not found to point preciſely to the north, except in very few places; but deviates from it more or leſs in different places, and that too at different times; which deviation is called its *declination* or *variation from the meridian*. See the article VARIATION.

Surgeons NEEDLES are generally made crooked, and their points triangular; however, they are of different forms and ſizes, and bear different names, according to the purpoſes they are uſed for.

The largeſt are needles for amputation; the next, needles for wounds; the fineſt, needles for ſutures. They have others, very ſhort and flat, for tendons; others, ſtill ſhorter, and the eye placed in the middle, for tying together of veſſels, &c. Needles for couching cataracts are of various kinds; all of which have a ſmall, broad, and ſharp point or tongue, and ſome with a ſulcus at the point. Surgeons have ſometimes uſed two needles in this operation; one with a ſharp point for perforating the coats of the eye, and another with a more obtuſe point for depreſſing or couching the opaque cryſtalline lens; but care ſhould be taken in the uſe of any of theſe, that they be firſt well poliſhed with cloth or leather, before they are applied to the eye.

Mr Warner obſerves, that the blade of the couching needle ſhould be at leaſt a third part larger than thoſe generally uſed upon this occaſion, as great advantages will be found in the depreſſing of the cataract, by the increaſed breadth of the blade of that inſtrument. The handle, alſo, if made ſomewhat ſhorter than uſual, will enable the operator to perform with greater ſteadineſs than he can do with a larger handled inſtrument.

It is to be obſerved, that needles of ſilver pierce more eaſily in ſtitching arteries after an amputation, than thoſe made of ſteel.

NEEDLE Fiſh. See SYNGNATHUS, ICHTHYOLOGY *Index*.

NEEDLES, ſharp pointed rocks north of the iſle of Wight. They are ſituated at the weſtern extremity of the iſland, which is an acute point of high land, from which they have been disjoined by the waſhing of the ſea. There were of theſe lofty white rocks formerly three, but about 14 years ago the talleſt of them, called *Lot's Wife*, which roſe 120 feet above low water mark, and in its ſhape reſembling a needle, being undermined by the conſtant efforts of the waves, was thrown down, and totally diſappeared.

NEEDS, or St NEOTS, ſix miles from Huntingdon, 58 miles from London, ſo called from the monument of a ſaint of that name in it, who was burnt by the Danes, is a large well built town, having a handſome ſtrong church, with a very fine ſteeple, and a ſtone bridge over the Ouſe.

NEEDWOOD FOREST, in Staffordſhire, between the Trent, Dove, and Blythe, and near Utoxeter, is ſaid to exceed all the foreſts in England in the excellence of its ſoil and the fineneſs of its turf.

NE EXEAT REGNO, in *Law*, is a writ to reſtrain a perſon from going out of the kingdom without the king's licenſe. F. N. B. 85. It may be directed to the ſheriff, to make the party find ſurety that he will not depart the realm, and on refuſal to commit him to priſon: or it may be directed to the party himſelf; and if he then goes, he may be fined. And this writ is granted on a ſuit being commenced againſt a man in the chancery, when the plaintiff fears the defendant will fly to ſome other country; and thereby avoid the juſtice and equity of the court; which hath been ſometimes practiſed: and when thus granted, the party muſt give bonds to the maſter of the rolls, in the penalty of 1000l. or ſome other large ſum, for yielding obedience to it; or ſatisfy the court, by anſwer, affidavit, or otherwiſe, that he hath no deſign of leaving the kingdom, and give ſecurity.

NEFASTI DIES, in Roman antiquity, an appellation given to thoſe days wherein it was not allowed to adminiſter juſtice, or hold courts. They were ſo called becauſe, *non fari licebat*, the prætor was not allowed to pronounce the three ſolemn words or formulas of the law, *do*, *dico*, *addico*, I give, I appoint, I adjudge. Theſe days were diſtinguiſhed in the calendar by the letter N. for *nefaſtus*; or N. P. *Nefaſtus Primo*, when the day was only *nefaſtus* in the forenoon, or firſt part. The days of a mixed kind were called *interciſi*.

NEGAPATAN, a town of Aſia, in the peninſula on this ſide the Ganges, and on the coaſt of Coromandel. It was firſt a colony of the Portugueſe, but was taken from them by the Dutch, and now forms part of the Britiſh territory. It is ſituated in E. Long. 79. 10. N. Lat. 11. 15.

NEGATION, in *Logic*, an act of the mind affirming one thing to be different from another; as that the ſoul is not matter. See LOGIC.

NEGATIVE, in general, ſomething that implies a negation: thus we ſay, negative quantities, negative powers, negative ſigns, &c.

NEGATIVE Sign. The uſe of the negative ſign, in algebra, is attended with ſeveral conſequences that at firſt ſight are admitted with difficulty, and has ſometimes given occaſion to notions that ſeem to have no real foundation. This ſign implies, that the real value of the quantity repreſented by the letter to which it is prefixed is to be ſubtracted; and it ſerves, with the poſitive ſign, to keep in view what elements or parts enter into the compoſition of quantities, and in what

what manner, whether as increments or decrements, (that is, whether by addition or ſubtraction), which is of the greateſt uſe in this art.

In conſequence of this, it ſerves to expreſs a quantity of an oppoſite quality to the poſitive, as a line in a contrary poſition; a motion with an oppoſite direction; or a centrifugal force in oppoſition to gravity; and thus often ſaves the trouble of diſtinguiſhing and demonſtrating ſeparately, the various caſes of proportions, and preſerves their analogy in view. But as the proportions of lines depend on their magnitude only, without regard to their poſition, and motions and forces are ſaid to be equal, or unequal, in any given ratio, without regard to their directions; and, in general, the proportion of quantity relates to their magnitude only, without determining whether they are to be conſidered as increments or decrements; ſo there is no ground to imagine any other proportion of $-b$ and $+a$ (or of -1 and 1) than that of the real magnitudes of the quantities repreſented by b and a, whether theſe quantities are, in any particular caſe, to be added or ſubtracted. It is the ſame thing to ſubtract the decrement, as to add an equal increment, or to ſubtract $-b$ from $a-b$, as to add $+b$ to it: and becauſe multiplying a quantity by a negative number implies only a repeated ſubtraction of it, the multiplying $-b$ by $-n$, is ſubtracting $-b$ as often as there are units in n; and is therefore equivalent to adding $+b$ ſo many times, or the ſame as adding $+nb$. But if we infer from this, that 1 is to $-n$ as $-b$ to nb, according to the rule, that unit is to one of the factors as the other factor is to the product, there is no ground to imagine, that there is any myſtery in this, or any other meaning than that the real magnitudes repreſented by 1, n, b, and nb are proportional. For that rule relates only to the magnitude of the factors and product, without determining whether any factor, or the product, is to be added or ſubtracted. But this likewiſe muſt be determined in algebraic computations; and this is the proper uſe of the rules concerning the ſigns, without which the operation could not proceed. Becauſe a quantity to be ſubtracted is never produced in compoſition by any repeated addition of a poſitive, or repeated ſubtraction of a negative, a negative ſquare number is never produced by compoſition from the root. Hence $\sqrt{-1}$, or the ſquare root of a negative, implies an imaginary quantity; and in reſolution, is a mark or character of the impoſſible caſes of a problem, unleſs it is compenſated by another imaginary ſymbol or ſuppoſition, when the whole expreſſion may have a real ſignification. Thus $1+\sqrt{-1}$, and $1-\sqrt{-1}$, taken ſeparately, are imaginary, but their ſum is 2; as the conditions that ſeparately would render the ſolution of a problem impoſſible, in ſome caſes deſtroy each others effect when conjoined. In the purſuit of general concluſions, and of ſimple forms repreſenting them, expreſſions of this kind muſt ſometimes ariſe where the imaginary ſymbol is compenſated in a manner that is not always ſo obvious.

By proper ſubſtitutions, however, the expreſſion may be transformed into another, wherein each particular term may have a real ſignification as well as the whole expreſſion. The theorems that are ſometimes briefly diſcovered by the uſe of this ſymbol, may be demonſtrated without it by the inverſe operation, or ſome other way; and though ſuch ſymbols are of ſome uſe in the computations by the method of fluxions, its evidence cannot be ſaid to depend upon arts of this kind. See ALGEBRA and FLUXIONS.

NEGATIVE Electricity. See the article ELECTRICITY, *paſſim*. See alſo *POSITIVE Electricity*.

NEGINOTH. This term is read before ſome of the Pſalms, as Pſalm lxvii. It ſignifies *ſtring inſtruments of muſic*, to be played on by the fingers, or women muſicians; and the titles of theſe Pſalms where this word is found, may be thus tranſlated, *A pſalm of David to the maſter of muſic, who preſides over the ſtring inſtruments*.

NEGOMBO, a ſea port town of Aſia, on the weſt coaſt of Ceylon. It has a fort built by the Portugueſe which was taken from them by the Dutch in 1640. E. Long. 80. 25. N. Lat. 17. 0.

NEGRIL POINT, the moſt weſterly promontory of the iſland of Jamaica.

NEGRO, *Homo pelli nigra*, a name given to a variety of the human ſpecies, who are entirely black, and are found in the torrid zone, eſpecially in that part of Africa which lies within the tropics. In the complexion of Negroes we meet with many various ſhades; but they likewiſe differ far from other men in all the features of their face. Round cheeks, high cheek-bones, a forehead ſomewhat elevated, a ſhort broad, flat noſe, thick lips, ſmall ears, uglineſs, and irregularity of ſhape, characterize their external appearance. The negro women have the loins greatly depreſſed, and very large buttocks, which gives the back the ſhape of a ſaddle. Vices the moſt notorious ſeem to be the portion of this unhappy race; idleneſs, treachery, revenge, cruelty, impudence, ſtealing, lying, profanity, debauchery, naſtineſs, and intemperance, are ſaid to have extinguiſhed the principles of natural law, and to have ſilenced the reproofs of conſcience. They are ſtrangers to every ſentiment of compaſſion, and are an awful example of the corruption of man when left to himſelf.

The origin of the negroes, and the cauſe of their remarkable difference from the reſt of the human ſpecies, has much perplexed the naturaliſts. Mr Boyle has obſerved, that it cannot be produced by the heat of the climate: for though the heat of the ſun may darken the colour of the ſkin, yet experience does not ſhow that it is ſufficient to produce a new blackneſs like that of the negroes.

In Africa itſelf, many nations of Ethiopia are not black; nor were there any blacks originally in the Weſt Indies. In many parts of Aſia under the ſame parallel with the African region inhabited by the blacks, the people are but tawney. He adds, that there are negroes in Africa beyond the ſouthern tropic; and that a river ſometimes parts nations, one of which is black, and the other only tawney. Dr Barriere alleges that the gall of negroes is black, and being mixed with their blood is depoſited between the ſkin and ſcarf-ſkin. However, Dr Mitchell of Virginia, in the Philoſophical Tranſactions, N° 476. has endeavoured by many learned arguments to prove, that the influence of the ſun in hot countries, and the manner of life of their inhabitants, are the remote cauſes of the colour of the negroes, Indians, &c. Lord Kames, on the other hand, and ſuch philoſophers as he, whoſe genius and imagination are too lively to ſubmit to a dry and painful inveſtigation of facts, have contended that no phyſical cauſe is ſufficient to change the colour, and what we call the regular features of white men, to the dark hue and deformity of the woolly-headed negro. Their arguments have been examined with much acuteneſs and ingenuity by Dr Stanhope Smith of New Jerſey, Dr Hunter, and Profeſſor Zimmerman, who have made it in a high degree probable, that the action of the ſun is the original and chief cauſe of the black colour, as well as diſtorted features of the negro. See AMERICA, N° 48—51. and COMPLEXION.

True negroes are found in no quarter of the globe where the heat of the climate is not very great. They exiſt nowhere but in the torrid zone, and only in three regions ſituated in that zone, viz. in Senegal, in Guinea, and on the weſtern ſhores of Africa, in Nubia, and the Papous land, or what is called *New Guinea*. In all theſe regions the atmoſphere is ſcorching, and the heat exceſſive. The inhabitants of the north are whiteſt; and as we advance ſouthwards towards the line, and thoſe countries on which the ſun's rays fall more perpendicularly, the complexion gradually aſſumes a darker ſhade. And the ſame men, whoſe colour has been rendered black by the powerful action of the ſun, if they remove to the north, gradually become whiter (at leaſt their poſterity), and loſe their burnt colour. Whites when tranſported into the burning regions of the torrid zone, are the firſt ſubject to fever; the ſkin of the face, hands, and feet, becomes burnt, hardens and falls off in ſcales. Hitherto the colour of negroes appears to be only local, extrinſic, and accidental, and their ſhort frizzled and ſparſe hair is to be accounted for in the very ſame manner.

Climate poſſeſſes great and evident influences on the hair, not only of men, but of all other animals. If in one caſe theſe tranſmutations are acknowledged to be conſiſtent with identity of kind, they ought not in the other to be eſteemed criterions of different ſpecies. Nature has adapted the pliancy of her work to the ſituations in which ſhe may require it to be placed. The beaver and ſheep removed to the warm latitudes exchange, the one its fur, and the other its wool, for a coarſe hair that preſerves the animal in a more moderate temperature. The coarſe and black ſhag of the bear is converted, in the arctic regions, into the fineſt and whiteſt fur. The colour of the hair is likewiſe changed by climate. The bear is white under the arctic circle; and, in high northern latitudes, foxes, hares, and rabbits, are found white. Similar effects of climate are diſcernible on mankind. The hair of the Danes is generally red; of the Engliſh, fair or brown; and of the French, commonly black. The hair of all people of colour is black, and that of the African negroes is likewiſe ſparſe and curled in a manner peculiar to themſelves; but this peculiarity is analogous to the effect which a warm climate has on almoſt every other animal. Cold, by obſtructing the perſpiration, tends to throw out the perſpirable matter accumulated at the ſkin in an additional coat of hair. A warm climate, by opening the pores, evaporates this matter before it can be concreted into the ſubſtance of hair; and the laxneſs and aperture of the pores render the hair liable to be eaſily eradicated by innumerable incidents. Its curl may reſult in part from the nature of the ſecretion by which it is nouriſhed, and in part from external heat. That it depends in ſome degree on the quality of the ſecretion is rendered highly probable from its appearance on the chin and other parts of the human body. Climate is as much diſtinguiſhed by the nature and proportion of the ſecretions as by the degree of heat. (See PHYSIOLOGY, ſect. 6.). Whatever be the nutriment of the hair, it is evidently combined in the torrid zone of Africa with ſome fluid of a highly volatile or ardent quality, which produces the rank ſmell of many African nations. Saline ſecretions tend to curl and to burn the hair. The evaporation of any volatile ſpirit would render its ſurface dry and diſpoſed to contract; whilſt the centre continuing diſtended by the vital motion, theſe oppoſite dilatations and contractions would neceſſarily produce a curve, and make the hair grow involved. External and violent heat parching the extremities of the hair, tends likewiſe to involve it. A hair held near the fire inſtantly coils itſelf up. Africa is the hotteſt country on the globe; and the influence of its heat, either external or internal, or both, in giving the peculiar form to the hair of the natives, appears, not only from its ſparſeneſs and its curl, but from its colour. It is not of a ſhining, but of an aduſt black; and its extremities tend to brown, as if it had been ſcorched by the fire.

The peculiarities of the negro features and form may likewiſe be accounted for from the exceſſive heat of the climate and the ſtate of African ſociety. Being ſavages, they have no arts to protect them from the rays of a burning ſun. The heat and ſerenity of the ſky preſerving the lives of the children without much care of the parents, they ſeem of courſe to be, in the interior parts of the country, negligent of their offſpring. Able themſelves to endure the extremes of that ardent climate, they inure their children to it from their moſt tender age. They ſuffer them to roll in the duſt and ſand beneath the direct rays of a vertical ſun. The mother, if ſhe be engaged, lays down the infant on the firſt ſpot ſhe finds, and is ſeldom at the pains to ſeek the miſerable ſhelter of a barren ſhrub, which is all that the interior country affords. When we reflect on the influence of a glare of light upon the eye, and on the contortions of countenance produced by our efforts to repel or prevent it, we need not wonder, that the pliant features of a negro infant ſhould, by conſtant expoſure, acquire that permanent irregularity which we term their characteriſtic uglineſs. But beſides the climate, food and clothing and modes of life have prodigious effects on the human form and features. This is apparent even in poliſhed ſocieties, where the poor and labouring part of the community are much more coarſe in their features, and ill formed in their limbs, than perſons of better fortune and more liberal means of ſubſiſtence. What an immenſe difference exiſts in Scotland, for inſtance, between the chiefs and the commonalty of the Highland clans? If they had been ſeparately found in different countries, they would have been ranged by ſome philoſophers under different ſpecies. A ſimilar diſtinction takes place between the nobility and peaſantry of France, of Spain, of Italy, and of Germany.

That food and clothing, and the different modes of life, have as great an influence upon the ſhapes and features of the Africans as upon the natives of Europe, is evident

evident from the different appearances of the negroes in the ſouthern republics of America according to the ſtations in which they are employed. "The field ſlaves (ſays Dr Smith) are badly fed, clothed, and lodged. They live in ſmall huts on the plantations, where they labour, remote from the ſociety and example of their ſuperiors. Living by themſelves, they retain many of the cuſtoms and manners of their African anceſtors. The domeſtic ſervants, on the other hand, who are kept near the perſons, or employed in the families of their maſters, are treated with great lenity; their ſervice is light; they are fed and clothed like their ſuperiors; they ſee their manners, adopt their habits, and inſenſibly receive the ſame ideas of elegance and beauty. The field ſlaves are, in conſequence, ſlow in changing the aſpect and figure of Africa. The domeſtic ſervants have advanced far before them in acquiring the agreeable and regular features, and the expreſſive countenance of civil ſociety. The former are frequently ill-ſhaped. They preſerve, in a great degree, the African lips, noſe, and hair. Their genius is dull, and their countenance ſleepy and ſtupid. The latter are ſtraight and well proportioned; their hair extended to three, four, and ſometimes even to ſix or eight inches; the ſize and ſhape of the mouth handſome, their features regular, their capacity good, and their look animated."

Upon the whole, we hope that the reader, who ſhall candidly weigh in his own mind what we have ſaid at preſent and under the article COMPLEXION, will agree with us, that the black colour in the torrid zone, the ſparſe criſp hair of the negroes, and the peculiarities of their features and form, proceed from cauſes altogether extrinſic; that they depend on local temperature and the ſtate of ſociety; and that they are as accidental as the various ſhades of colour which characterize the different nations of Europe. If the whites be conſidered as the ſtock whence all others have ſprung, it is eaſy to conceive how they have degenerated into negroes. Some have conjectured that the complete change may have taken place at the end of three centuries, whilſt others have thought that it could not be effected in leſs than double that period. Such conjectures can be formed from no certain data; and a much greater length of time is undoubtedly neceſſary before negroes, when tranſplanted into our temperate countries, can entirely loſe their black colour. By croſſing the breed with whites, every taint of the negro colour may be expelled we believe, from the fifth generation (A).

But the moſt ſerious charge brought againſt the poor negroes is, that of the *vices* ſaid to be natural to them. If they be, indeed, ſuch as their enemies repreſent them, treacherous, cruel, revengeful, and intemperate, by a neceſſity of *nature*, they muſt be a different race from the whites; for though all theſe vices abound in Europe, it is evident that they proceed not from nature, but from wrong education, which gives to the youthful mind ſuch deep impreſſions as no future exertions can completely eradicate. Let us inquire coolly if the vices of the negroes may not have a ſimilar origin.

In every part of Africa with which the nations of Europe have any commerce, ſlavery prevails of the worſt kind. Three fourths of the people are ſlaves to the reſt, and the children are born to no other inheritance. "Moſt parts of the coaſt differ in their governments; ſome are abſolute monarchies, whilſt others draw near to an ariſtocracy. In both the authority of the chief or chiefs is unlimited, extending to life, and it is exerciſed as often as criminal caſes require, unleſs death is commuted into ſlavery; in which caſe the offender is ſold, and if the ſhipping will not buy the criminal, he is immediately put to death. Fathers of free condition have power to ſell their children, but this power is very ſeldom enforced. In Congo, however, a father † will ſell a ſon or daughter, or perhaps both, for a piece of cloth, a collar or girdle of coral or beads, and often for a bottle of wine or brandy. A huſband may have as many wives as he pleaſes, and repudiate or even ſell them, though with child, at his pleaſure. The wives and concubines, though it be a capital crime for the former to break the conjugal faith, have a way to rid themſelves of their huſbands, if they have ſet their affections upon a new gallant, by accuſing them of ſome crime for which the puniſhment is death. In a word, the bulk of the people in every ſtate of Africa are born ſlaves to great men, reared as ſuch, held as property, and as property ſold (ſee SLAVERY). There are indeed many circumſtances by which a free man may become a ſlave: ſuch as being in debt, and not able to pay; and in ſome of ſuch caſes, if the debt be large, not only the debtor, but his family likewiſe, become the ſlaves of his creditor, and may be ſold. Adultery is commonly puniſhed in the ſame manner, both the offending parties being ſold, and the purchaſe-money paid to the injured huſband. *Obi*, or pretended witchcraft (in which all the negroes firmly believe, ſee WITCHCRAFT), is another, and a very common offence, for which ſlavery is adjudged the lawful puniſhment; and it extends to all the family of the offender. There are various other crimes which ſubject the offender and his

Edwards's Hiſtory of the Weſt Indies, vol. ii.

† *Mod. Univer. Hiſtory,* vol. xiii. p. 55.

Edwards's Hiſtory of the Weſt Indies.

(A) 1. A white man with a negro woman, or a negro man with a white woman, produce a mulatto, half white and half black, or of a yellow-blackiſh colour, with black, ſhort, frizzled hair. 2. A white man with a mulatto woman, or a negro with a mulatto woman, produce a *quadroon*, three fourths white and one fourth black, or three fourths black and one fourth white, or of a lighter yellow than the former. In America, they give the name of *cabres* to thoſe who are deſcended from a black man and a mulatto woman, or a mulatto man and a black woman, who are three fourths black and one fourth white, and who are not ſo black as a negro, but blacker than a mulatto. 3. A white man with a quadroon woman, or a negro with a quadroon woman, produce a *meſtizo*, ſeven eighths white and one eighth black, or ſeven eighths black and one eighth white. 4. A white man with a meſtizo woman, or a negro with a meſtizo woman, produce, the one almoſt a perfect white, the other almoſt a perfect black, called a *quinteroon*. This is the laſt gradation, there being no viſible difference between the fair quinteroons and the whites: and the children of a white and quinteroon conſider themſelves as free from all taint of the negro race.

his children to be ſold; and it is more than probable, that if there were no buyers, the poor wretches would be murdered without mercy.

In ſuch a ſtate of ſociety, what diſpoſitions can be looked for in the people, but cruelty, treachery, and revenge? Even in the civilized nations of Europe, bleſſed with the lights of law, ſcience, and religion, ſome of the lower orders of the community conſider it as a very trivial crime to defraud their ſuperiors; whilſt almoſt all look up to them with ſtupid malevolence or rancorous envy. That a depreſſed people, when they get power into their hands, are revengeful and cruel, the preſent age affords a dreadful proof in the conduct of the demagogues of a neighbouring nation; and is it wonderful that the negroes of Africa, unacquainted with moral principles, blinded by the cruelleſt and moſt abſurd ſuperſtitions, and whoſe cuſtoms tend to eradicate from the mind all natural affection, ſhould ſometimes diſplay to their lordly maſters of European extraction the ſame ſpirit that has been ſo generally diſplayed by the lower orders of Frenchmen to their eccleſiaſtics, their nobles, and the family of their murdered ſovereign! When we conſider that the majority of the negroes groan under the cruelleſt ſlavery, both in their own country, and in every other where they are to be found in conſiderable numbers, it can excite no ſurpriſe that they are in general treacherous, cruel, and vindictive. Such are the caprices of their tyrants at home, that they could not preſerve their own lives or the lives of their families for any length of time, but by a perpetual vigilance, which muſt neceſſarily degenerate, firſt into cunning, and afterwards into treachery; and it is not conceivable that habits formed in Africa ſhould be inſtantly thrown off in the Weſt Indies, where they are the property of men whom ſome of them muſt conſider as a different race of beings.

But the truth is, that the ill qualities of the negroes have been greatly exaggerated. Mr Edwards, in his valuable Hiſtory of the Weſt Indies, aſſures us that the Mandingo negroes diſplay ſuch gentleneſs of diſpoſition and demeanour, as would ſeem the reſult of early education and diſcipline, were it not that, generally ſpeaking, they are more prone to theft than any of the African tribes. It has been ſuppoſed that this propenſity, among other vices, is natural to a ſtate of ſlavery, which degrades and corrupts the human mind in a deplorable manner; but why the Mandingoes ſhould have become more vicious in this reſpect than the reſt of the natives of Africa in the ſame condition of life, is a queſtion he cannot anſwer.

"The circumſtances which (according to the ſame author) diſtinguiſh the Koromantyn or Gold Coaſt negroes from all others, are firmneſs both of body and mind; a ferociouſneſs of diſpoſition; but withal, activity, courage, and a ſtubbornneſs, or what an ancient Roman would have deemed an elevation of ſoul, which prompts them to enterpriſes of difficulty and danger, and enables them to meet death, in its moſt horrid ſhape, with fortitude or indifference. They ſometimes take to labour with great promptitude and alacrity, and have conſtitutions well adapted for it; for many of them have undoubtedly been ſlaves in Africa. But as the Gold Coaſt is inhabited by various tribes, which are engaged in perpetual warfare and hoſtility with each other, there cannot be a doubt that many of the captives taken in battle, and ſold in the European ſettlements, were of free condition in their native country, and perhaps the owners of ſlaves themſelves. It is not wonderful that ſuch men ſhould endeavour, even by means the moſt deſperate, to regain the freedom of which they have been deprived; nor do I conceive that any further circumſtances are neceſſary to prompt them to action, than that of being ſold into captivity in a diſtant country. One cannot ſurely but lament (ſays our author) that a people thus naturally intrepid, ſhould be ſunk into ſo deplorable a ſtate of barbarity and ſuperſtition; and that their ſpirits ſhould ever be broken down by the yoke of ſlavery. Whatever may be alleged concerning their ferociouſneſs and implacability in their preſent notions of right and wrong, I am perſuaded that they poſſeſs qualities which are capable of, and well deſerve, cultivation and improvement.

"Very different from the Koromantyns are the negroes imported from the Bight of Benin, and known in the Weſt Indies by the name of Eboes. So great is their conſtitutional timidity and deſpondency of mind, as to occaſion them very frequently to ſeek, in a voluntary death, a refuge from their own melancholy reflections. They require therefore the gentleſt and mildeſt treatment to reconcile them to their ſituation; but if their confidence be once obtained, they manifeſt as great fidelity, affection, and gratitude, as can reaſonably be expected from men in a ſtate of ſlavery. The females of this nation are better labourers than the men, probably from having been more hardly treated in Africa.

"The natives of Whidah, who, in the Weſt Indies, are generally called *Papaws*, are unqueſtionably the moſt docile and beſt diſpoſed ſlaves that are imported from any part of Africa. Without the fierce and ſavage manners of the Koromantyn negroes, they are alſo happily exempt from the timid and deſponding temper of the Eboes. The cheerful acquieſcence with which theſe people apply to the labours of the field, and their conſtitutional aptitude for ſuch employment, ariſe, without doubt, from the great attention paid to agriculture in their native country. Boſman ſpeaks with rapture of the improved ſtate of the ſoil, the number of villages, and the induſtry, riches, and obliging manners of the natives. He obſerves, however, that they are much greater thieves than thoſe of the Gold Coaſt, and very unlike them in another reſpect, namely, in the dread of pain, and the apprehenſion of death. They are, ſays he, ſo very apprehenſive of death, that they are unwilling to hear it mentioned, for fear *that* alone ſhould haſten their end; and no man dares to ſpeak of death in the preſence of the king, or any great man, under the penalty of ſuffering it himſelf, as a puniſhment for his preſumption. He relates further, that they are addicted to gaming beyond any people of Africa. All theſe propenſities are obſervable in the character of the Papaws in a ſtate of ſlavery in the Weſt Indies. That puniſhment which excites the Koromantyn to rebel, and drives the Ebo negro to ſuicide, is received by the Papaws as the chaſtiſement of legal authority, to which it is their duty to ſubmit patiently. The caſe ſeems to be, that the generality of theſe people are in a ſtate of abſolute ſlavery in Africa, and, having been habituated to a life of labour, they ſubmit to a change of ſituation with little reluctance."

Negro.

Having recited ſuch obſervations as occurred to him on contemplating the various tribes of negroes from each other, Mr Edwards thus eſtimates their general character, influenced as they are by circumſtances which ſoon efface the native and original impreſſions which diſtinguiſh one nation from another when newly imported into the Weſt Indies.

"Notwithſtanding what has been related of the firmneſs and courage of the natives of the Gold Coaſt, it is certain that the negroes in general in our iſlands (ſuch of them at leaſt as have been any length of time in a ſtate of ſervitude) are of a diſtruſtful and cowardly diſpoſition. So degrading is the nature of ſlavery, that fortitude of mind is loſt as free agency is reſtrained. To the ſame cauſe probably muſt be imputed their propenſity to conceal or violate the truth; which is ſo general, that the vice of falſehood is one of the moſt prominent features in their character. If a negro is aſked even an indifferent queſtion by his maſter, he ſeldom gives an immediate reply; but, affecting not to underſtand what is ſaid, compels a repetition of the queſtion, that he may have time to conſider, not what is the true anſwer, but what is the moſt politic one for him to give. The proneneſs obſervable in many of them to the vice of theft has already been noticed; and I am afraid (ſays our author), that evil communication makes it almoſt general. It is no eaſy matter, I confeſs, to diſcriminate thoſe circumſtances which are the reſult of proximate cauſes, from thoſe which are the effects of national cuſtoms and early habits in ſavage life; but I am afraid that cowardice and diſſimulation have been the properties of ſlavery in all ages, and will continue to be ſo to the end of the world. It is a ſituation that neceſſarily ſuppreſſes many of the beſt affections of the human heart.—If it calls forth any latent virtues, they are thoſe of ſympathy and compaſſion towards perſons in the ſame condition of life; and accordingly we find that the negroes in general are ſtrongly attached to their countrymen, but above all, to ſuch of their companions as came in the ſame ſhip with them from Africa. This is a ſtriking circumſtance: the term *ſhipmate* is underſtood among them as ſignifying a relationſhip of the moſt endearing nature; perhaps as recalling the time when the ſufferers were cut off together from their common country and kindred, and awakening reciprocal ſympathy from the remembrance of mutual affliction. But their benevolence, with a very few exceptions, extends no further. The ſofter virtues are ſeldom found in the boſom of the enſlaved African. Give him ſufficient authority, and he becomes the moſt remorſeleſs of tyrants. Of all the degrees of wretchedneſs endured by the ſons of men, the greateſt, aſſuredly, is the miſery which is felt by thoſe who are unhappily doomed to be the ſlaves of ſlaves; a moſt unnatural relation, which ſometimes takes place in the ſugar plantations. The ſame obſervation may be made concerning their conduct towards the animal creation. Their treatment of cattle under their direction is brutal beyond belief. Even the uſeful and ſocial qualities of the dog ſecure to him no kind uſage from an African maſter. One of the moſt pleaſing traits in their character is the reſpect and attention which they pay to their aged countrymen. The whole body of negroes on a plantation muſt be reduced to a deplorable ſtate of wretchedneſs, if at any time, they ſuffer their aged companions to want the common neceſſaries of life, or even many of its comforts, as far as they can procure them. They ſeem to be actuated on theſe occaſions by a kind of involuntary impulſe, operating as a primitive law of nature, which ſcorns to wait the cold dictates of reaſon: among them, it is the exerciſe of a common duty, which courts no obſervation, and looks for no applauſe."

Negro, Negroland.

As the colour and features, and moral qualities of the negroes, may be thus eaſily accounted for by the influence of climate and the modes of ſavage life, ſo there is good reaſon to believe that their intellectual endowments are equal to thoſe of the whites who have been found in the ſame circumſtances. Of thoſe imitative arts in which perfection can be attained only in an improved ſtate of ſociety, it is natural to ſuppoſe that they have but little knowledge; but the fabric and colours of the Guinea cloths are a proof of their native ingenuity. In the Weſt Indies many of them are expert carpenters, ſome watchmakers, and one or two have ſucceſsfully practiſed phyſic; while others have figured both in Latin and Engliſh poetry, ſo that we cannot doubt but that "God, who made the world, hath made of one blood all nations of men," and animated them with minds equally rational.

NEGROLAND, or Nigritia, a country of Africa, lying next to Guinea towards the north, and extending from 18° of weſt to 23° of eaſt longitude, and from 9° to 20° of north latitude. On the north it is bounded by Zaara or the Deſert; on the eaſt, by countries unknown; on the ſouth, by Guinea; and on the weſt, by the Atlantic ocean; and is watered by the great river Niger or Senegal, which runs through it from eaſt to weſt. The Europeans have ſettlements on the coaſts of this country, eſpecially near the mouths of the Niger and Gambia, which laſt is ſuppoſed to be a branch of the former. A great many nations inhabit the banks of the rivers; ſome Pagans, ſome Mohammedans, of different languages, and independent of one another. The country is fruitful, eſpecially along the rivers; abounding in rice, Guinea grain, and Indian corn, where it is cultivated; and with cocoa nuts, plantains, pulſe, palm trees, and tropical fruits; nor is it deſtitute of cattle, and a variety of other animals, particularly ſuch as abound in Guinea. See Guinea.

Negroland is fertilized by the overflowing of its rivers the Senegal and Gambia, as Egypt is by the Nile. It hath not yet been aſcertained whether the Gambia is a branch of the Senegal or not. As far as the Europeans have penetrated up the country, they appear to be diſtinct; and the Mandingo negroes report that the Gambia has a different origin. The entrance into the Niger, or Senegal river, is narrow and ſomewhat difficult, by reaſon of its immoveable bar, and ſandy ſhoals, as well as the ſeveral iſlands at the mouth of it, and the ſeveral canals and marſhes that clog it: but after ſailing up eight or ten leagues, it is found broad and deep, and fit to carry large veſſels; and, excepting about five or ſix leagues on each ſide above the mouth, which is ſandy and barren ground, the banks are covered with ſtately trees and villages, and the country in general is fertile and well watered; for, like the Nile, this river overflows its banks for many leagues, and enriches the land to a great degree,

gree, though, for want of ſkill, the inhabitants do not reap the advantages which they might obtain from its fertility. The people on both ſides of the river live as near to it as they can, and feed great herds of cattle, ſowing large and ſmall millet, the former of which is called by us *Turkey wheat*, in great quantities, and with great increaſe. If the river fails of overflowing at its uſual ſeaſon, a great ſcarcity enſues in the adjacent country; and, even when it overflows regularly, it breeds ſuch vaſt flights of graſhoppers and inſects, as quite darken the air, and frequently devour the whole produce of the ſoil: in which caſe the people kill thoſe inſects and eat them; which they do either by pounding in leather bags, and then boiling them in milk, or which is reckoned the more delicious method, by frying or broiling them over a light blaze in a fryingpan full of holes. Thus the legs and wings of the inſects are burnt off, and the reſt of the body is ſufficiently roaſted to be eaten as a dainty, which they look upon to be very wholeſome and nouriſhing.

To the eaſt, north-eaſt, and ſouth eaſt of the iſland of Senegal, the country, as far as it is known, is overrun with woods and marſhes: the Senegal, Gambia, and Sherbro, which are looked upon by ſome as branches of one immenſe river, paſſing through it in their way to the Atlantic ocean. During the rainy months, which begin in July, and continue to October, they lay the whole country under water; and indeed the ſudden riſe of theſe rivers is incredible to ſuch as are not acquainted with the violent rains that fall between the tropics. At Galam, 900 miles from the mouth of the Senegal, the waters riſe 150 feet perpendicular from the bed of the river. At the iſland of Senegal, the river riſes gradually, during the rainy ſeaſon, above 20 feet perpendicular over part of that flat coaſt; which of itſelf ſo freſhens the water, that ſhips lying at anchor, at the diſtance of three leagues from its mouth, generally make uſe of it, and fill their water there for their voyage home. When the rains are at an end, which ſoon happens in October, the intenſe heat of the ſun uſually dries up thoſe ſtagnating waters which lie on the higher parts, and the remainder from lakes and marſhes, in which are found all ſorts of dead animals. At laſt, thoſe too are quite dried up; and then the effluvia that ariſe are almoſt quite inſupportable. At this ſeaſon the winds blow ſo hot from the land, that they may be compared to the heat proceeding from the mouth of an oven, and they bring with them an intolerable ſmell. The wolves, tigers, lions, and other wild beaſts, then reſort to the river, ſteeping their body under water, and only their ſnout above it for the ſake of breathing. The birds ſoar to an immenſe height in the air, and fly a vaſt way over the ſea, where they continue till the wind changes, and comes from the weſt.

NEGROES, White. See HELIOPHOBI and ALBINO.

NEGROMANCY. See NECROMANCY.

NEGROPONT, anciently *Eubœa*, an iſland of the Archipelago, ſtretching along the eaſtern coaſt of Achaia or Livadia, from which it is ſeparated by a narrow channel called the *Euripus*. This ſtrait is ſo narrow, that the iſland is joined to the continent by a bridge thrown over it; and here, it is thought, there was formerly an iſthmus. The irregularity of the tides in the Euripus hath from the remoteſt antiquity been very remarkable, and this irregularity is found to be connected with the age of the moon. From the three laſt days of the old moon to the eighth day of the new moon, and from the 14th to the 20th day incluſive, they are regular; but on the other days they are irregular, flowing 12, 13, or 14 times in the ſpace of 24 hours, and ebbing as often. The iſland is 90 miles long and 25 broad in the wideſt part; and produces corn, oil, fruit, and cattle, in great abundance. The only place in the iſland worth notice is the capital, which is alſo called *Negropont;* and which is walled, and contains about 15,000 inhabitants; but the Chriſtians are ſaid to be much more numerous than the Turks. The captain baſhaw, or admiral of Turkey, who is alſo governor of the city, the iſland, and the adjacent continent of Greece, reſides here: and the harbour, which is very ſafe and ſpacious, is ſeldom without a fleet of galleys, ready to be put to ſea againſt the pirates and the Malteſe. A part of the bridge between the city and the coaſt of Greece, conſiſts of a draw bridge no longer than juſt to let a galley paſs through.

NEHEMIAH, or NEEMIAS, ſon of Hachaliah, was born at Babylon during the captivity, (Neh. i. 1, 2, &c.). He was, according to ſome, of the race of the prieſts, but according to others, of the tribe of Judah and the royal family. Thoſe who maintain the firſt opinion, ſupport it by a paſſage in Ezra, (x. 10.) where he is called a prieſt; but thoſe who believe that he was of the race of the kings of Judah, ſay, 1ſt, That Nehemiah having governed the republic of the Jews for a conſiderable time, there is great probability he was of that tribe of which the kings always were. 2dly, Nehemiah mentions his brethren Hanani, and ſome other Jews, who coming to Babylon during the captivity, acquainted him with the ſad condition of their country. 3dly, The office of cupbearer to the king of Perſia, to which Nehemiah was promoted, is a further proof that he was of an illuſtrious family. 4thly, He excuſes himſelf from entering into the inner part of the temple, probably becauſe he was only a laic, (Neh. vi. 11.) "Should ſuch a man as I flee? And who is there that, being as I am, would go into the temple to ſave his life?"

The Scripture (Ezra ii. 63. Nehem. vii. 65.) calls him תרשתא *tirſhatha*, that is to ſay, "cup-bearer;" for he had this employment at the court of Artaxerxes Longimanus. He had an exceeding great tenderneſs for the country of his fathers, though he had never ſeen it; and one day, as ſome Jews newly come from Jeruſalem acquainted him with the miſerable eſtate of that city, that its walls were beat down, its gates burnt, and the Jews were become a reproach among all nations; he was ſenſibly affected with this relation; he faſted, prayed, and humbled himſelf before the Lord, that he would be favourable to the deſign he had then conceived of aſking the king's permiſſion to rebuild Jeruſalem. The courſe of his attendance at court being come, he preſented the cup to the king according to cuſtom; but with a countenance ſad and dejected; which the king obſerving, entertained ſome ſuſpicion, as if he might have had ſome bad deſign; but Nehemiah (ii.) diſcovering the occaſion of his diſquiet, Artaxerxes gave him leave to go to Jeruſalem, and repair its walls and gates; but, however, upon this condition, that he ſhould return to court at a time appointed. Letters were made out, directed to the governors beyond the Euphrates, with orders to furniſh Nehemiah with timbers neceſſary for covering the towers and gates of the city, and the houſe deſigned for Nehemiah himſelf, who was now appointed governor of Judea, in the year of the world 3350.

Nehemiah being arrived at Jeruſalem with the king's commiſſion, went round the city; and having viewed the condition of the walls, aſſembled the chief of the people, produced his commiſſion, and exhorted them to undertake the reparation of the gates and walls of the city. He found every perſon ready to obey him; whereupon he immediately began the work. The enemies of the Jews obſerving theſe works in ſuch forwardneſs, made uſe of all the means in their power to deter Nehemiah from this undertaking, and made ſeveral attempts to ſurpriſe him; but finding that their deſigns were diſcovered, and that the Jews kept upon their guard, they had recourſe to craft and ſtratagem, endeavouring to draw him into an ambuſcade in the fields, where they pretended they would finiſh the diſpute at an amicable conference: but Nehemiah gave them to underſtand, that the work he had begun required his perſonal attendance; and therefore he could not come to them. He ſent the ſame anſwer to four ſeveral meſſages that they ſent one after another on the ſame ſubject, (*Id.* iv. and vi.).

Sanballat, the chief of the enemies of the Jews, together with his aſſociates, wrote word, that a report was ſpread that the Jews were building the walls of Jeruſalem only with a deſign to make it a place of ſtrength, to ſupport them in an intended revolt; that it was ſaid alſo that Nehemiah had ſuborned falſe prophets to favour his deſigns, and to encourage the people to chooſe him king; and to ſtop the courſe of theſe rumours, he adviſed him to come to him, that they might confer together, and take ſuch reſolutions as ſhould be found convenient. Nehemiah gave himſelf no trouble on this account, but returned for anſwer, that all thoſe accuſations were falſe and made at random. About the ſame time he diſcovered, that a falſe prophet, called *Shemaiah*, had been corrupted by his enemies, and that ſome of the chief of the city were ſecretly in confederacy with them. Yet all this did not diſcourage him; he went on with his work, and happily completed it in two and fifty days after it had been begun.

Then he made a dedication of the walls, of the towers, and of the gates of Jeruſalem, with the ſolemnity and magnificence that ſuch a work required. He ſeparated the prieſts, the Levites, and the princes of the people, into two companies, one of which walked to the ſouth and the other to the north, on the top of the walls. Theſe two companies were to meet at the temple. The proceſſion was accompanied with muſic both vocal and inſtrumental: and when they were all come to the temple, they there read the law, offered ſacrifices, and made great rejoicings. And as the feaſt of tabernacles happened at the ſame time, it was celebrated with great ſolemnity, (*Id.* viii.). Nehemiah obſerving that the compaſs of the city was too large for its inhabitants, he ordered that the chief of the nation ſhould fix their dwelling in the city; and cauſed them to draw lots, by which a tenth part of the whole people of Judah were to dwell at Jeruſalem, (*Id.* xi.). Then he applied himſelf to the reformation of ſuch abuſes as had crept into the adminiſtration of the public affairs. He curbed the inhumanity of the great ones, who held in a ſtate of ſlavery the ſons and daughters of thoſe who were poor or unfortunate, keeping their lands in poſſeſſion, which theſe poor people had been obliged either to mortgage or to ſell to the rich. Another abuſe there was, which Ezra had in vain attempted to redreſs, that they had contracted marriages with ſtrange and idolatrous women. Nehemiah undertook to diſſolve theſe marriages, ſucceeded in it, and ſent away all ſuch women as had been taken againſt the expreſs command of the law, (*Id.* ix.). Having likewiſe obſerved, that the prieſts and Levites were obliged to take refuge wherever they could, and ſo the miniſtry of the temple was not attended or performed with that decency it ought, becauſe they did not receive the revenues that the law had appointed for their ſubſiſtence; he obliged the people punctually to pay the miniſters of the Lord what was due to them, and enjoined the prieſts and Levites duly to attend on their reſpective duties, and to diſcharge their functions, (*Id.* xiii. 10, 11, &c.). He enforced the obſervation of the ſabbath, which had been much neglected at Jeruſalem, and would not permit ſtrangers to come in to buy and ſell, but kept the gates of the city ſhut all that day. And, to perpetuate as much as was poſſible theſe good regulations which he had newly eſtabliſhed, he engaged the chief men of the nation ſolemnly to renew the covenant with the Lord. This ceremony was performed in the temple, and an inſtrument was drawn up, which was ſigned by the principal men, both prieſts and people (*Id.* ix. x.), in the year of the world 3551.

We read in the books of Maccabees (2 Macc. i. 19, 20, 21. &c.), that Nehemiah ſent to ſearch for the holy fire, which before the captivity of Babylon the prieſts had hid in a dry and deep pit; but not finding any fire there, but inſtead thereof a thick and muddy water, he ſprinkled this upon the altar; whereupon the wood which had been ſprinkled with this water took fire preſently as ſoon as the ſun began to appear. Which miracle coming to the knowledge of the king of Perſia, he cauſed the place to be encompaſſed with walls where the fire had been hid, and granted great favours and privileges to the prieſts. It is recorded in the ſame books, (2 Macc. ii. 13, 14.), that Nehemiah erected a library, wherein he placed whatever he could find, either of the books of the prophets, of David, or of ſuch princes as had made preſents to the temple. Laſtly, He returned to Baylon (*Id.* v. 14. and xiii. 6.) according to the promiſe he had made to King Artaxerxes, about the thirty-ſecond year of this prince, in the year 3563. From thence he returned again to Jeruſalem, where he died in peace, about the year 3580, having governed the people of Judah for about thirty years.

The book which in the Engliſh Bible, as alſo in the Hebrew, has the name of *Nehemiah*, in the Latin Bible is called the book of *Eſdras*; and it muſt be confeſſed, that though this author ſpeaks in the firſt perſon, and though at firſt reading one would think that he had writ it day by day as the tranſactions occurred, yet there are ſome things in this book which could not have been written by Nehemiah himſelf; for example, memorials are quoted wherein were regiſtered the names of of the prieſts in the time of Jonathan the ſon of Eliaſhib, and even to the times of the high prieſt Jaddus, who met Alexander the Great. Theſe therefore muſt have been added afterwards.

It may well be queſtioned, whether this Nehemiah be the ſame that is mentioned in Ezra, (ii. 2. and Neh. vii. 7.) as one that returned from the Babyloniſh captivity under Zerubbabel; ſince from the firſt year of Cyrus to the twentieth of Artaxerxes Longimanus, there are no leſs than ninety-two years intervening; ſo that Nehemiah muſt at this time have been a very old man, upon the loweſt computation an hundred, conſequently utterly incapable of being the king's cup-bearer, of taking a journey from Shuſhan to Jeruſalem, and of behaving there with all the courage and activity that is recorded of him. Upon this preſumption, therefore, we may conclude that this was a different perſon, though of the ſame name, and that Tirſhatha (the other name by which he is called, Ezra ii. 63. and Neh. vii. 65.) denotes the title of his office, and both in the Perſian and Chaldean tongues was the general name given to the king's deputies and governors.

NEHOW, one of the Sandwich iſlands, diſcovered by Captain Cook in his laſt voyage to the Pacific ocean: theſe iſlands are eleven in number, and are ſituated from 18° 44′ to 22° 15′ N. Lat. and from 154° 56′ to 160° 24′ W. Long.

NEIGHBOUR, 1. One who dwells or is ſeated near to another (2 Kings iv. 3.). 2. Every man to whom we have an opportunity of doing good (Matt. xxii. 39.). 3. A fellow labourer of one and the ſame people (Acts vii. 27.). 4. A friend (Job. xvi. 21.). At the time of our Saviour, the Phariſees had reſtrained the word neighbour to ſignify thoſe of their own nation only, or their own friends; being of opinion that to hate their enemy was not forbidden by their law. But our Saviour informed them, that the whole world were their neighbours; that they ought not to do to another what they would not have done to themſelves; and that this charity ought to be extended even to their enemies, (Matt. v. 43. Luke x. 29, &c.).

NEISSE, a town of Sileſia in Germany, and the reſidence of the biſhop of Breſlaw, who has a magnificent palace here. The air is very wholeſome, and proviſions are cheap; the inhabitants carry on a great trade in wine and linen. This place ſuffered greatly by an inundation and fire in 1729. It was taken by the Pruſſians in 1741, who augmented the fortifications after the peace in 1742, and built a citadel to which they gave the name of *Pruſſia*. It is ſeated on a river of the ſame name, in E. Long. 17. 35. N. Lat. 50. 32.

NEIUS MONS, in *Ancient Geography*, at the foot of which ſtood Ithaca, a town of the iſland of that name, (Homer).

NELSON, The Right Honourable VISCOUNT, one of the moſt celebrated naval commanders, was the ſon of the reverend Edmund Nelſon, and was born at Burnham Thorpe, in Norfolk, where his father was rector, in the year 1758. He received his education at the ſchool of North Walſham; but we are unacquainted with the particulars relative to his childhood, and whether the progreſs he made in his ſtudies was in any reſpect extraordinary. It is certain, however, that he diſcovered a ſtrong predilection for the naval profeſſion at a very early period, and having quitted ſchool at the age of twelve years, went on board the Raiſonable of 64 guns, commanded by his mother's brother, Captain Maurice Suckling.

In the month of April 1773, a voyage of diſcovery to the north pole was undertaken by the honourable Conſtantine John Phipps, afterwards Lord Mulgrave, in conſequence of an application by the Royal Society to Lord Sandwich; and although the inſtructions which were iſſued, prohibited all boys from being received on board, yet the enterpriſing ſpirit of Horatio Nelſon earneſtly ſolicited to be appointed cockſwain to Captain Lutwidge, rather than ſubmit to be left behind; and his unſubdued ſpirit ſo forcibly ſtruck the captain, that his wiſh was complied with.

When the ſhip returned to England in the month of October 1773, Mr Nelſon having received information that a ſquadron was fitting out for the Eaſt Indies, employed all his intereſt to be appointed to one of the ſhips. It was not long before he was placed in the Seahorſe of 20 guns, commanded by the celebrated Captain Farmer, and ſtationed in the fore-top to keep watch, but ſoon after removed to the quarter-deck.

He obtained the profeſſional order of lieutenant on the 8th of April, 1777, and received his commiſſion the next day, as ſecond of the Loweſtoffe of 32 guns, Captain William Locker, in which ſhip he arrived at Jamaica; but feeling that his glowing mind was circumſcribed in ſo ſmall a frigate, he requeſted the command of a ſchooner, which acted as tender to the Loweſtoffe, thus availing himſelf of the opportunity of becoming an experienced pilot for every intricate paſſage through the iſlands, ſituated on the northern ſide of Hiſpaniola.

When Sir Peter Parker arrived at Jamaica in the year 1778, Lieutenant Nelſon was nominated by that gallant admiral to be the third of his own flag ſhip, the Briſtol, and by rotation he ſoon became the firſt. In this ſhip his ſervices terminated in the rank of a lieutenant.

On the 11th of June, 1779, he obtained the rank of poſt-captain; and during the nine years he had been in the ſervice he not only became an able officer by his conſtant attention to every part of his duty, and his keen obſervation, but he alſo laid the foundation of being a pilot of diſtinguiſhed eminence. The firſt ſhip to which he was appointed after being made a poſt captain, was the Hinchinbroke. On the arrival of Count d'Eſtaign at Hiſpaniola, as an attack upon Jamaica was immediately apprehended, Captain Nelſon was intruſted with the command of the batteries of Port Royal, with the concurring approbation of the Britiſh admiral and general. In the month of January 1780, it was reſolved on to reduce Fort Juan, on the river St John, in the gulf of Mexico, when Captain Nelſon was made choice of to command the naval department, and that of the military was committed to Major Polſon. In accompliſhing the object of this arduous and intereſting undertaking, Nelſon's uſual intrepidity was again exhibited. Having quitted the ſhip under his command, he ſuperintended the tranſporting of the troops in boats, 300 miles up a river, which none but Spaniards had ever navigated ſince the time of the buccaneers.

His great and vigorous exertions were repreſented by Major Polſon to General Dalling in their true colours, nor was his gallantry paſſed over by that officer in ſilence. After ſtorming an out-work belonging to the enemy, he conſtructed batteries, and fought the Spaniards; and it is to his conduct in the reduction of Fort Juan that the ſucceſs of Britain has been juſtly and chiefly aſcribed. He was next appointed to the Janus, at that time ſtationed at Jamaica; on his arrival at which place every medical aſſiſtance was given him which his ſituation required; but as his health ſtill continued on the decline, he deemed it expedient to return to England in his majeſty's ſhip Lion, the honourable William Cornwallis commander, to whoſe unremitting care and attention he owed the preſervation of his life. He obtained the command of the Albemarle in the month of Auguſt 1781, which put his delicate conſtitution to the ſevereſt trial, as he was ſtationed during the whole of the enſuing winter in the north ſeas.

He ſailed from Quebec in the month of October, 1782, with a convoy to New York, where he had an opportunity of joining the fleet under Sir Samuel Hood; and in the month following he ſailed with him to the Weſt Indies, where he was honourably employed until the termination of hoſtilities. He ſoon after received orders to repair to England, being directed to attend in his way, his royal highneſs Prince William Henry on his viſit to the Havannah. When he reached England, the Albemarle was paid off at Portſmouth on the 31ſt July, 1783. During the autumn of that year he paid a viſit to France, where he continued till the ſpring of the enſuing year, when he received the command of the Boreas frigate of 28 guns, and his deſtination was the Leeward Iſlands, where he continued until June 1787, and was then ordered to repair to England. In the month of March the ſame year he was married to the amiable and accompliſhed widow of Dr Neſbit, of the iſland of Nevis. When the Boreas frigate was paid off at Sheerneſs on the 30th November, 1787, he retired to the parſonage-houſe of Burnham Thorpe, which had been conferred upon him by his father for a place of reſidence, there to enjoy the conſolations which reſult from domeſtic felicity.

He again came forward on the 30th of January 1793, to ſhine forth more conſpicuous as a naval officer than he had ever done before, at which time he received the command of the Agamemnon of 64 guns, being ſoon placed under the orders of that truly great and illuſtrious character, Lord Hood, who at that period was deſtined to command in the Mediterranean. The unlimited confidence repoſed in him by this noble and gallant admiral, is an inconteſtable evidence of the high eſtimation in which his courage and naval abilities were held. If his ſuperior deſigned to attack batteries, or cut ſhips out of the harbours in which they were moored; if troops were to be landed in perilous ſituations, or paſſages of extreme difficulty to be explored, the great Nelſon took the lead on every ſuch occaſion, ſeconded by the brave officers and crew belonging to the Agamemnon. Toulon, Baſtia, and Calvi, witneſſed his gallant and intrepid deportment, of which Lord Hood did not fail to make honourable mention. At the ſiege of Calvi Captain Nelſon loſt the ſight of his right eye, a ſhot from the battery of the enemy having ſtruck that of which he had the command, and driven ſome particles of ſand againſt his face with irreſiſtible impetuoſity.

When Lord Hood left his ſtation in the Mediterranean in the month of October, 1794, the command devolved on Admiral Hotham, who honoured our hero with an equal ſhare of his confidence and eſteem. On the 13th and 14th of March, and 13th of July 1795, he again rendered himſelf conſpicuous in the actions which then took place with the French fleet; and ſoon after he was choſen by Admiral Hotham to cooperate with General De Vins, on the coaſt of Genoa, in which ſervice he continued ſo long as Hotham retained the command, who was ſuperſeded by Sir John Jervis. This officer ſo much applauded the conduct of Captain Nelſon, that he received the honour of wearing a pendant of diſtinction; and in the month of May he was removed from the Agamemnon to the Captain of 74 guns. On the 11th of Auguſt he had a captain appointed under him.

From April to October 1795, Commodore Nelſon was continually employed in the moſt active and arduous ſervice, the blockade of Leghorn, the taking of Porto Ferrajo, with the iſland of Caprea, and finally in the evacuation of Baſtia. In December 1796 he hoiſted his broad pendant on board La Minerve frigate, and was diſpatched with that ſhip, and La Blanche, to Porto Ferrajo, to bring the naval ſtores left there to Gibraltar, which the fleet was in much want of. While on this ſervice in the night of the 17th December, he fell in with two Spaniſh frigates, one of which he immediately attacked, and ordered the Blanche to bear down to engage the other. About half paſt ten the commodore brought his ſhip to cloſe action, which continued without interruption till half paſt one, when the Spaniſh frigate of 40 guns, 28 of which were 18 pounders, ſtruck to La Minerve.

After various other active and important ſervices during the three preceding months, Sir Horatio Nelſon, in April 1797, hoiſted his flag on board the Captain of 74 guns as rear-admiral of the blue, and in the end of May he ſhifted his flag from the Captain to the Theſeus, when he was appointed to the command of the inner ſquadron at the blockade of Cadiz. While on this ſervice he exhibited another remarkable proof of his undaunted perſonal courage. In the attack on the Spaniſh gun-boats in July, he was boarded in his barge, which had only the uſual complement of 10 men, and the cockſwain. The commander of the Spaniſh gunboats, in a barge with 30 men and officers, made a deſperate attack on the admiral and his brave companions. The conflict remained long doubtful, but after 18 of the Spaniards were killed, and almoſt the whole of the remainder wounded, the rear-admiral and his brave crew ſucceeded in carrying this ſuperior force.

On the 15th of July the ſame year, Admiral Nelſon was detached with a ſmall ſquadron to attack the town of Santa Cruz in the iſland of Teneriffe. A thouſand men, including marines, were landed in the courſe of a dark night, made themſelves maſters of the town, and retained poſſeſſion of it for ſeven hours; but finding it impoſſible to ſtorm the citadel, they prepared for their retreat, which the Spaniards allowed them to make unmoleſted, agreeable to the ſtipulations which had been entered into. In this unfortunate attack the brave Nelſon loſt his arm by a cannon ſhot.

But a more ſplendid ſcene of the life of our hero is now opening. On the 13th of April 1798 he was detached

tached from Earl St Vincent's fleet, in purſuit of the French to the coaſt of Egypt, with 12 ſail of the line and one 50 gun ſhip, while the enemy's fleet conſiſted of 13 ſail of the line and four frigates, protected by the batteries on the ſhore, and ſeveral gun-boats. This memorable action commenced at ſunſet, and terminated glorioully for the honour of our hero and that of the Britiſh navy. Nine ſail of the line fell into the hands of the conqueror, two were burnt, and two effected their eſcape. The brave Nelſon was wounded in the action, believing himſelf to have been ſhot through the head; but after his wound was examined by the ſurgeon, it was happily found not to be mortal, a circumſtance which diffuſed the moſt lively ſatisfaction through the whole fleet. To the honour of this great man it ought to be mentioned, that even under the conviction of approaching diſſolution, he prepared for the intereſting change with calmneſs and fortitude, deſired his chaplain to recommend him to Lady Nelſon, appointed the brave Hardy to the rank of poſt-captain and to the command of a ſhip, and took an affectionate leave of Captain Louis.

The French admiral's ſhip, L'Orient, was blown up during the action. From the mainmaſt of this ſhip Captain Hallowell ordered a coffin to be conſtructed, which was preſented to Admiral Nelſon, and gratefully accepted by the hero, as a token of affectionate regard. For ſome months he had it placed upright in his cabin; but in conſequence of the entreaties of an old ſervant, the admiral was at length prevailed on to allow it to be removed. Our readers will not be ſurpriſed that Lord Nelſon ſhould now be regarded as the great defence of the empire, and the ſupport of her national glory. It is to his gallantry and naval ſkill that we are indebted for the victory of Copenhagen, and the annihilation of that formidable northern confederacy which menaced the proſperity, the commerce, the very exiſtence of the reſt of Europe.

One of the moſt important ſervices which Lord Nelſon performed, was the purſuit of the combined fleets of France and Spain to the Weſt Indies. This fleet had ſailed from Cadiz on the 10th of April, and it was at firſt conjectured that Egypt was the place of their deſtination. In conſequence of this conjecture, Lord Nelſon ſailed in purſuit of the enemy for the coaſt of Egypt; and, having miſſed his object, after reconnoitring that coaſt, he paſſed the ſtraits of Gibraltar, and anchored in Lagos bay on the 10th of May; ſoon after which he ſailed for the Weſt Indies with ten ſhips of the line; arrived off Barbadoes on the 4th of June; and having touched at Tobago, Trinidad, and Grenada, at the latter of which places he was informed that the combined fleet had been ſeen on the 6th off Dominica; he reached Antigua on the 12th, where he received information that the enemy had been ſeen on the 8th ſtanding to the northward. Lord Nelſon, without the loſs of a moment, continued the purſuit of the enemy on their return to Europe, where they arrived about the end of July; and after taking in proviſions and water at Gibraltar, and reconnoitring the harbour of Cadiz; he returned to England, where he arrived in the Victory, on the 18th of Auguſt, after having been engaged for nearly four months in one of the moſt arduous, and, at the ſame time, one of the moſt important and beneficial, although, in its immediate object, unſucceſsful enterpriſes, for which his life was diſtinguiſhed. His lordſhip had now been abſent from England more than two years, on the Mediterranean ſtation.

The concluding ſcene of this extraordinary man's naval career, kindles emotions of admiration and regret; and at once excites both tranſport and extreme of ſorrow. Perhaps no action, in point of ſplendour and magnanimity, can equal that which deprived his country of one of the greateſt heroes it ever produced, Britons appear to be ſenſible of its vaſt importance; yet it is not improbable that poſterity will conſider it as ſtill more ſplendid, their love and admiration not being damped by the poignant recollection that they perſonally ſaw the man by whoſe loſs it was accompliſhed. When Lord Nelſon perceived that, in conſequence of his manœuvres, he had reduced the enemy to the abſolute neceſſity of engaging him, he exclaimed in the preſence of Captain Hardy and the other officers who ſurrounded him on the quarter deck; "Now they cannot eſcape us; I think we ſhall at leaſt make ſure of twenty of them.—I ſhall probably loſe a leg, but that will be purchaſing a victory cheaply." But alas! amidſt the inexpreſſible ſatisfaction and delight, which a victory ſo ſplendid could not fail to inſpire, he has left us to lament that it was purchaſed by the loſs of a life ſo incomparably valuable.

His lordſhip's flag ſhip fell on board the Redoubtable, by which means he was expoſed to the fire of the muſketry from the tops; and the inſignia of his grandeur and dignity, it is ſuppoſed, ſingled him out to the aims of the enemy, which in the iſſue were too fatally ſucceſsful. His ſecretary was cut in two by his ſide with a chain ſhot, and ſoon after a ball grazed his lordſhip's ſhoulder, entered his left breaſt, and paſſed through his lungs. He lived about three hours after this tragical event, during which he remained perfectly recollected, and he diſplayed the ſame heroic magnanimity in the arms of death, which had ſo eminently diſtinguiſhed him through the whole of his career. His laſt words to Captain Hardy were, "I know I am dying. I could have wiſhed to ſurvive to breathe my laſt upon Britiſh ground, but the will of God be done!" In a few moments he expired. His laſt ſignal ought not, and will not be forgotten, which was by telegraph,—"That England expected every man would do his duty." He ſpoke in raptures concerning the event of the day only a ſhort time before his diſſolution, and ſent word to Admiral Collingwood, deſiring that he would make his affectionate farewell to all his brother ſeamen throughout the fleet. In this manner died, in the 47th year of his age, the greateſt commander that perhaps ever adorned the Britiſh navy, leaving behind him a name dear to Great Britain, and an example of heroiſm which will inſpire his companions in arms to emulate his virtues, that they too may live in the remembrance of a grateful poſterity.

His ſingular plan of attack on this memorable occaſion was communicated by his lordſhip to all his captains, who unanimouſly gave it as their opinion that it could not poſſibly fail of ſucceſs, being concerted with ſuch conſummate wiſdom; and they even pledged their lives for the favourable reſult of it. His titles were, Viſcount Nelſon, and Duke of Bronté.—The united parliament voted him a penſion of 3000l. a year, to continue during his own life and his two next heirs; the

Eaſt

Eaſt India Company made him a preſent of 10,000l.; the grand ſignior gave him a diamond aigrette worth 4000l.; the emperor of Ruſſia gave him a diamond box worth 2500l.; the king of Naples made him preſents to the amount of 5000l. together with the dukedom of Bronté, and an eſtate of 3000l. per annum. Thus all Europe conſpired to teſtify the eſtimation in which they held this diſtinguiſhed hero; and the numerous monuments which have been, and ſtill are erecting to his memory throughout the Britiſh empire, will continue laſting evidences of the eſteem in which he was held by his grateful country. Parliament alſo voted a ſum for the purchaſe of an eſtate for his heirs, and his majeſty conferred the title of earl on his immediate ſucceſſor.

Nor were his talents wholly confined to the knowledge of naval tactics, for it is known that as a ſenator he was highly reſpectable, although he enjoyed few opportunities of coming forward in that capacity. When he did, his ſpeeches were heard by their lordſhips with reſpect, and the moſt profound attention. The few ſpecimens we have of his abilities as a politician, afford no mean proof that if he had devoted as much of his time to thoſe ſtudies as he did to his peculiar profeſſion, he would have made a diſtinguiſhed figure in the houſe of peers.

NEMAUSIS, or NEMAUSUM, in *Ancient Geography*, the capital of the Arecomici in Gallia Narbonenſis; a colony, (Coin), with the ſurname of *Auguſta*, (Inſcription). In it ſtands a Roman amphitheatre, which is ſtill almoſt entire. Now *Niſmes* in Languedoc.

NEMEA (Strabo, Livy); a river of Achaia, running between Sicyon and Corinth, the common boundary of both territories, and falling into the Corinthian bay.

NEMEA, in *Ancient Geography*, ſituated between Cleonæ and Philus in Argolis; whether town, diſtrict, or other thing, uncertain; there a grove ſtood in which the Argives celebrated the Nemean games, and there happened all the fabulous circumſtances of the Nemean lion. The diſtrict Nemea is called *Bembinadia*, (Pliny; a village, *Bembina*, ſtanding near Nemea, (Strabo). Stephanus places Nemea in Elis; though not in Elis, but on its borders; Pliny, erroneouſly, in Arcadia. In the adjoining mountain is ſtill ſhown the den of the lion, diſtant 15 ſtadia from the place *Nemea*, (Pauſanias); in which ſtands a conſiderable temple of Jupiter Nemæus and Cleonæus, from the vicinity of theſe two places. This place gave name to the Nemæan games, celebrated every third year.

NEMEAN GAMES, ſo called from Nemea, a village between the cities of Cleonæ and Philus, where they were celebrated every third year. The exerciſes were chariot-races, and all the parts of the Pentathlum. Theſe games were inſtituted in memory of Opheltes or Archemorus the ſon of Euphetes and Creuſa, and who was nurſed by Hypſipele; who leaving him in a meadow while ſhe went to ſhow the beſiegers of Thebes a fountain, at her return found him dead, and a ſerpent twined about his neck: whence the fountain, before called *Langia*, was named *Archemorus*; and the captains, to comfort Hypſipele, inſtituted theſe games.—Others aſcribe their inſtitution to Hercules, after his victory over the Nemean lion. Others allow, that they were inſtituted firſt in honour of Archemorus; but intermitted, and revived again by Hercules. The victors were crowned with parſley, an herb uſed at funerals, and feigned to have ſprung from Archemorus's blood. The Argives preſided at theſe games.

NEMESIANUS, AURELIUS OLYMPIUS, a Latin poet who was born at Carthage, and flouriſhed about the year 281, under the emperor Carus, and his ſons Carinus and Numerian: the laſt of which emperors was ſo fond of poetry, that he conteſted the glory with Nemeſianus, who had written a poem upon fiſhing and maritime affairs. We have ſtill remaining a poem of our author called *Cynegeticon*, and four eclogues: they were publiſhed by Paulus Manutius in 1538; by Barthelet in 1613; at Leyden in 1653; with the notes of Janus Vlitias. Giraldi hath preſerved a fragment of Nemeſianus, which was communicated to him by Sannazarius, to whom we are obliged for our poet's works: for having found them written in Gothic characters, he procured them to be put into the Roman, and then ſent them to Paulus Manutius. Although this poem hath acquired ſome reputation, it is greatly inferior to thoſe of Oppian and Gratian upon the ſame ſubject; yet Nemeſianus's ſtyle is natural enough, and has ſome degree of elegance. The world was ſo much poſſeſſed with an opinion of his poem in the eighth century, that it was read among the claſſics in the public ſchools, particularly in the time of Charlemagne, as appears from a letter of the celebrated Hincmar biſhop of Rheims, to his nephew Hincmar of Laon.

NEMESIS, in Pagan worſhip, the daughter of Jupiter and Neceſſity, or, according to others, of Oceanus and Nox, had the care of revenging the crimes which human juſtice left unpuniſhed. She was alſo called *Adraſtæa*, becauſe Adraſtus king of Argos firſt raiſed an altar to her; and *Rhamnuſia*, from her having a magnificent temple at Rhamnus in Attica. She had likewiſe a temple at Rome in the Capitol. She is repreſented with a ſtern countenance, holding a whip in one hand and a pair of ſcales in the other.

NEMESIUS, a Greek philoſopher who embraced Chriſtianity, and was made biſhop of Emeſa in Phœnicia, where he had his birth; he flouriſhed in the beginning of the fifth century. There is a work of his extant, entitled *De Natura Hominis*, in which he refutes the fatality of the Stoics and the errors of the Manichees, the Apollianariſts, and the Eunomians; but he eſpouſes the opinion of Origen concerning the pre-exiſtence of ſouls (A). This treatiſe was tranſlated by Valla, and printed in 1535. Another verſion was afterwards made of it by Ellebodius, and printed in 1665; it is alſo inſerted in the *Bibliotheca Patrum*, in Greek and Latin. Laſtly, Another edition was publiſhed at Oxford in 1671, folio, with a learned preface, wherein the editor endeavours to prove, from a paſſage in this book, that the

---

(A) It is much more probable that he and Origen both brought their opinion with them from the ſchools of philoſophy, than that either of them borrowed it from the other. See METAPHYSICS, Part III. Chap. IV.

the circulation of the blood was known to Nemeſius; which, however, was ſince ſhown to be a miſtake by Dr Freind, in his *Hiſtory of Phyſic*.

NEMINE CONTRADICENTE, "none contradicting it;" a term chiefly uſed in parliament when any thing is carried without oppoſition.

NEMOURS, a town of the Iſle of France, in the Gatinois, formerly with the title of a duchy. It is ſeated on the river Loing, in E. Long. 2. 45. N. Lat. 48. 15.

NENAGH, a poſt and fair town of Ireland, in the county of Tipperary, and province of Munſter, 75 miles from Dublin. It is ſituated on a branch of the river Shannon which runs into Lough-Derg. Here ſtand the ruins of an old caſtle called Nenagh-round. Alſo thoſe of an hoſpital founded in the year 1200, for canons following the rule of St Auguſtin. It was dedicated to St John the Baptiſt, and was uſually called *Teachon*, or St John's houſe. In the reign of Henry III. a friary for conventual Franciſcans was alſo founded here, and eſteemed the richeſt foundation of that order in the kingdom. Here is a barrack for two troops of horſe. This town was burnt on St Stephen's day, 1348, by the Iriſh. The fairs held here are four.

NENIA, or NÆNIA, in the ancient poetry, a kind of funeral ſong ſung to the muſic of flutes at the obſequies of the dead. Authors repreſent them as ſorry compoſitions, ſung by hired women mourners called *Præficæ*. The firſt riſe of theſe Nenia is aſcribed to the phyſicians. In the heathen antiquity, the goddeſs of tears and funerals was called *Nenia;* whom ſome ſuppoſe to have given that name to the funeral ſong, and others to have taken her name from it.

NEOCESARIA, (Pliny), a town of Pontus on the ſouth or the left ſide of the Lycus. About the year 342, when Leontius and Salluſtius were conſuls, it was entirely ruined by a dreadful earthquake, no edifice having withſtood the violence of the ſhock, except the church and the biſhop's habitation, who was ſaved, with the clergy and ſome other pious perſons, while the reſt of the inhabitants were buried in its ruins.

NEOMAGUS, (Ptolemy); NOVIOMAGUS, (Antonine); a town of the Regni in Britain: now thought to be Guildford in Surry, (Lhuyd); or Croydon, (Talbot). But Camden takes it to be Woodcote, two miles to the ſouth of Croydon, where traces of an ancient town are ſtill to be ſeen.

NEOMAGUS, (Ptolemy); *Noviomagus* (Antonine); a town of the Treviri on the Moſelle. Now *Numagen* 14 miles eaſt, below Triers.

NEOMAGUS, (Ptolemy); *Noviomagus Lexoviorum*, (Antonine); a town of Gallia Celtica. Now *Liſeux*, in Normandy.

NEOMAGUS, (Ptolemy); *Noviomagus Nemetum*, (Antonine). Now *Spire*, a city of the Palatinate, on the left or weſt ſide of the Rhine.

NEOMAGUS, (Ptolemy); a town of Gallia Narbonenſis, on the confines of the Tricaſtini. Now *Nyons* in Dauphine.

NEOMENIA, or NOUMENIA, a feſtival of the ancient Greeks, at the beginning of every lunar month, which, as the name imports, was obſerved upon the day of the new moon, in honour of all the gods, but eſpecially Apollo, who was called *Neomenios*, becauſe the ſun is the fountain of light; and whatever diſtinction of times and ſeaſons may be taken from other planets, yet they are all owing to him as the original of thoſe borrowed rays by which they ſhine.

The games and public entertainments at theſe feſtivals were made by the rich, to whoſe tables the poor flocked in great numbers. The Athenians at theſe times offered ſolemn prayers and ſacrifices for the proſperity of their country during the enſuing month. See GAMES.

The Jews had alſo their neomenia, or feaſt of the new moon, on which peculiar ſacrifices were appointed: and on this day they had a ſort of family entertainment and rejoicing. The moſt celebrated neomenia of all others was that at the beginning of the civil year, or firſt day of the month Tiſri, on which no ſervile labour was performed: they then offered particular burnt ſacrifices, and ſounded the trumpets of the temple. The modern Jews keep the neomenia only as a feaſt of devotion, which any one may obſerve or not as he pleaſes.

NEOPHYTES, "new plants;" a name given by the ancient Chriſtians to thoſe heathens who had newly embraced the faith; ſuch perſons being conſidered as regenerated, or born anew by baptiſm. The term *neophytes* has been alſo uſed for new prieſts, or thoſe juſt admitted into orders, and ſometimes for the novices in monaſteries. It is ſtill applied to the converts made by the miſſionaries among the infidels.

NEPA, a genus of inſects belonging to the order of hemiptera. See ENTOMOLOGY *Index*.

NEPAL, a kingdom of India, to the north-eaſt of the city of Patna, at the diſtance of about 12 days journey. The roads in the mountains are both narrow and dangerous, but in the plains they are allowed to be good. Some parts of it are obnoxious to a putrid fever, of which thoſe who are ſeized with it die in a few days; but the people in the plains are not obnoxious to it. The plain is about 200 miles in circumference, and the only entrance to it is by the mountains. It contains three principal cities; *Cat'hmandu*, having about 18,000 houſes; *Lelit Pattan* contains 24,000; and *B'hatgan* 12,000 families. Beſides theſe there are many large and populous towns, the chief of which are *Timi* and *Cipoli*. The religion of the inhabitants, like that of moſt other countries in a ſtate little removed from barbariſm, abounds with a number of abſurd rites and ceremonies, which it would be ſuperfluous to enumerate; but many of them adopt that of the Brahmins, the moral part of which, in many reſpects, muſt be allowed to be excellent.

The temple of Baghero in the city of Lelit Pattan, is ſaid to be ſuperior to the king's palace, on account of the immenſe quantities of gold, ſilver, and jewels which it contains; and the waters of a river about three miles from Cat'hmandu are conſidered as holy, to which people of rank are conveyed in the proſpect of death. This kingdom is believed to be of very great antiquity, as its language and independence have been preſerved from time immemorial; yet the diſſenſions of its nobles completely ruined it not many years ago, who could not agree about the choice of a proper ſucceſſor on the death of their ſovereign.

NEPENTHES, a genus of plants belonging to the gynandria claſs; and in the natural method ranking among thoſe of which the order is doubtful. See BOTANY *Index*.

NEPETA, CATMINT, or *Nep*, a genus of plants belonging to the didynamia claſs, and in the natural method ranking under the 42d order, *Verticillatæ*. See BOTANY *Index*.

NEPHELIUM, a genus of plants belonging to the monœcia claſs. See BOTANY *Index*.

NEPHEW, a term relative to uncle and aunt, ſignifying a brother's or ſiſter's ſon; who, according to the civil law, is in the third degree of conſanguinity, but according to the canon in the ſecond.

NEPHRITIC, ſomething that relates to the kidneys. See KIDNEY.

NEPHRITIC Wood, (*lignum nephriticum*), a wood of a very denſe and compact texture, and of a fine grain, brought to us from New Spain in ſmall blocks, in its natural ſtate, and covered with its bark.

This wood is ſaid to be a good diuretic; and we are told it is uſed among the Indians in all diſeaſes of the kidneys and bladder, and in ſuppreſſion of urine, from whatever cauſe. It is alſo recommended in fevers, and in obſtructions of the viſcera. The way of taking it among the Indians is only an infuſion in cold water. Theſe uſes are not however properly aſcertained. See GUILANDINA, BOTANY *Index*.

NEPHRITIC Stone. See NEPHRITE or *Jade*, MINERALOGY *Index*.

NEPHRITICS, in *Pharmacy*, medicines proper for diſeaſes of the kidneys. See MATERIA MEDICA *Index*.

NEPHRITIS, or inflammation of the kidneys. See MEDICINE *Index*.

NEPOS, CORNELIUS, a celebrated Latin biographer, who flouriſhed in the time of Julius Cæſar, and lived, according to St Jerome, to the ſixth year of Auguſtus. He was an Italian, if we may credit Catullus, and born at Hoſtilia, a ſmall town in the territory of Verona, in Ciſalpine Gaul. Auſonius, however, will have it that he was born in the Gauls: and in that they may both be in the right, provided that under the name of *Gaul* is comprehended *Gallia Ciſalpina*, which is in Italy. Leander Alberti thinks Nepos's country was Verona; and he is ſure that he was either born in that city or neighbourhood. For the reſt, Cicero and Atticus were friends of our author; who wrote the lives of the Greek hiſtorians, as he himſelf atteſts in that of Dion, ſpeaking of Philiſtus. What he ſays, alſo, in the lives of Cato and Hannibal, proves that he had alſo written the lives of the Latin captains and hiſtorians. He wrote ſome other excellent works which are loſt.

All that we have left of his at preſent is, "The Lives of the illuſtrious Greek and Roman Captains;" which were a long time aſcribed to Æmilius Probus, who publiſhed them, as it is ſaid, under his own name, to inſinuate himſelf thereby into the favour of the emperor Theodoſius; but, in the courſe of time, the fraud has been diſcovered, although ſeveral learned perſons have confounded the two authors. This piece has been tranſlated into French by the Sieur de Claveret, with a dedication to the duke of Longueville, in 1663; and again by M. le Gras, then of the congregation of the Oratory at Paris, 1729, 12mo. We have an excellent tranſlation of it into Engliſh, by ſeveral hands at Oxford, which has gone through ſeveral editions.

NEPTUNE, in Pagan worſhip, the god of the ſea, was the ſon of Saturn and Veſta or Ops, and the brother of Jupiter and Pluto. He aſſiſted Jupiter in his expeditions; on which that god, when he arrived at the ſupreme power, aſſigned him the ſea and the iſlands for his empire. He was, however, expelled from heaven with Apollo for conſpiring againſt Jupiter, when they were both employed by Laomedon king of Phrygia in building the walls of Troy; but that prince diſmiſſing Neptune without a reward, he ſent a ſea monſter to lay waſte the country, on which he was obliged to expoſe his daughter Heſione. He is ſaid to have been the firſt inventor of horſemanſhip and chariot racing; on which account Mithridates king of Pontus threw chariots drawn by four horſes into the ſea in honour of this god; and the Romans inſtituted horſe races in the circus at his feſtival, during which all other horſes left working, and the mules were adorned with wreaths of flowers.

In a conteſt with Minerva he produced a horſe by ſtriking the earth with his trident; and on another occaſion, in a trial of ſkill with Minerva and Vulcan, produced a bull, whence that animal was ſacrificed to him. His favourite wife was Amphytrite, whom he long courted in vain, till ſending a dolphin to intercede for him, he met with ſucceſs; on which he rewarded the dolphin by placing him among the ſtars. He had alſo two other wives, one of whom was called *Salaſia* from the ſalt water; the other *Venilia* from the ebbing and flowing of the tides. He had likewiſe many concubines, by whom he had a great number of children. He is repreſented with black hair, with a garment of an azure or ſea green: holding his trident in his hand, and ſeated in a large ſhell drawn by ſea horſes; attended by the ſea gods Palemon, Glaucus, and Phorcys, and the ſea goddeſſes Thetis, Melita, and Panopæa, and a long train of tritons and ſea nymphs.

This deity was known in Egypt by the name of *Cenobus* or *Canopus*, and was worſhipped as the *numen aquarum* or ſpirit of the Nile. His emblem was the figure of certain vaſes or pitchers, with which the Egyptians filtrated the water of their ſacred river, in order to purify and render it fit for uſe. From the mouth of each of theſe vaſes, which were charged with hieroglyphics, aroſe the head and ſometimes the head and hands, of a man or woman. Such are the emblems which ſtill remain of the Egyptian Neptune or Canobus; and it was by this emblem that the tutelar god of Egypt vanquiſhed the god of Chaldea in the ridiculous manner mentioned by Ruffinus in his Eccleſiaſtical Hiſtory*.

"The Chaldeans (ſays he) who adored the fire, carried their god into various countries that he might try his ſtrength in conteſts with other gods. He vanquiſhed, as we may eaſily conceive, the images made of gold, ſilver, braſs, and wood, &c. by reducing them to aſhes; and thus the worſhip of fire was everywhere eſtabliſhed. The prieſt of Canobus, unwilling, as became him, to admit the ſuperiority of ſtrange gods, contrived to make his god vanquiſh the god of Chaldæa in a pitched battle. The vaſes which were worſhipped as the emblems of Canobus being uſed for filtering the waters of the Nile, were of courſe perforated on all ſides with very ſmall holes. This faithful prieſt having ſtopped all the holes in one of theſe

---

* Lib. x. cap. 26.

theſe with wax, and painted the vaſe of different colours for a reaſon which the reader will admit to be a good one, filled it up with water, and fitted to its mouth the head of an idol. This emblem of Canobus was then placed in a ſmall fire brought by the Chaldæans as the emblem of their god; and thus the gods of Egypt and Chaldæa were forced into battle. The conteſt, however, was of ſhort duration. The heat melting the wax made way for the water to run out, which quickly extinguiſhed the fire; and thus Canobus vanquiſhed the god of the Chaldeans." Ridiculous as this ſtory is, it is perfectly ſuitable to the genius of Paganiſm, and the mean artifices of the Pagan prieſthood; but we ſuſpect that the hiſtorian laboured under one miſtake, and ſubſtituted the Chaldeans inſtead of the Perſians. See POLYTHEISM.

NEREIDS, in the Pagan theology, ſea nymphs, daughters of Nereus and Doris.—The Nereids were eſteemed very handſome; inſomuch that Caſſiope, the wife of Cepheus king of Ethiopia, having triumphed over all the beauties of the age, and daring to vie with the Nereids, they were ſo enraged that they ſent a prodigious ſea monſter into the country, and, to appeaſe them, ſhe was commanded by the oracle to expoſe her daughter Andromeda, bound to a rock, to be devoured by the monſter. In ancient monuments, the Nereids are repreſented riding upon ſea horſes; ſometimes with an entire human form, and at other times with the tail of a fiſh.

NEREIS, a genus of animals belonging to the order of vermes molluſca. See HELMINTHOLOGY *Index*.

NEREUS, in fabulous hiſtory, a marine deity, was ſon of Oceanus and Thetis. He ſettled in the Ægean ſea, was conſidered as a prophet, and had the power of aſſuming what form he pleaſed. He married his ſiſter Doris, by whom he had 50 daughters called the *Nereids*, who conſtantly attended on Neptune, and when he went abroad ſurrounded his chariot.

NERI, ANTHONY, a learned writer who publiſhed a curious book printed at Florence 1612, in 4to, with this title, *Dell' Arte Verraria Libri VII.*; or *the Art of Glaſsmaking*.

NERIUM, a genus of plants belonging to the pentandria claſs; and in the natural method ranking under the 30th order, *Contortæ*. See BOTANY and DYEING *Index*.

NERO, CLAUDIUS DOMITIUS CÆSAR, a celebrated Roman emperor, ſon of Caius Domitius Ahenobarbus and Agrippina the daughter of Germanicus. He was adopted by the emperor Claudius, A. D. 50, and four years after he ſucceeded him on the throne. In the beginning of his reign he ſhowed ſeveral marks of the greateſt kindneſs and condeſcenſion, affability, complaiſance, and popularity. The object of his adminiſtration ſeemed to be the good of his people; and when he was deſired to ſign his name to a liſt of malefactors that were to be executed, he exclaimed, *Would to heaven I could not write!* He hated flattery; and when the ſenate had liberally commended the wiſdom of his government, he deſired them to keep their praiſes till he deſerved them. Theſe promiſing virtues ſoon, however, proved to be artificial: Nero ſoon diſplayed the real propenſities of his nature. He delivered himſelf from the ſway of his mother, and at laſt ordered her to be murdered. This unnatural act of barbarity might aſtoniſh ſome, but Nero had his devoted adherents; and when he declared that he had taken away his mother's life to ſave himſelf from ruin, the ſenate applauded his meaſures, and the people ſignified their approbation. Many of his courtiers ſhared her unhappy fate; and Nero ſacrificed to his fury or caprice all ſuch as obſtructed his pleaſure or diverted his inclination. In the night he generally went from his palace to viſit the meaneſt taverns, and all the ſcenes of debauchery which Rome contained. In this nocturnal riot he was fond of inſulting the people in the ſtreets; and his attempts to offer violence to the wife of a Roman ſenator nearly coſt him his life. He alſo turned actor, and openly appeared on the Roman ſtage in the meaneſt characters. In his attempts to excel in muſic, and to conquer the diſadvantages of a hoarſe diſagreeable voice, he moderated his meals, and often paſſed the day without eating. The Olympian games attracted his notice: he went into Greece, and preſented himſelf a candidate for the public honour. He was defeated in wreſtling; but the flattery of the ſpectators adjudged him the victory, and he returned to Rome with all the ſplendour and pomp of an eaſtern conqueror, drawn in the chariot of Auguſtus, and attended by a band of muſicians, actors, and ſtage dancers from every part of the empire. Theſe private and public amuſements of the emperor were indeed innocent; his character only was injured, and not the lives of the people. His conduct, however, ſoon became more abominable: he diſguiſed himſelf in the habit of a woman, and was publicly married to one of his eunuchs. This violence to nature and decency was ſoon exchanged for another: Nero reſumed his ſex, and celebrated his nuptials with one of his meaneſt catamites: and it was on this occaſion that one of the Romans obſerved that the world would have been happy if Nero's father had had ſuch a wife. But his cruelty was now diſplayed in a ſtill higher degree, for he ſacrificed to his wantonneſs his wife Octavia Poppæa, and the celebrated writers Seneca, Luean, Petronius, &c. Nor did the Chriſtians eſcape his barbarity. He had heard of the burning of Troy; and as he wiſhed to renew that diſmal ſcene, he cauſed Rome to be ſet on fire in different places. The conflagration became ſoon univerſal, and during nine ſucceſſive days the fire continued. All was deſolation: nothing was heard but the lamentations of mothers whoſe children had periſhed in the flames, the groans of the dying, and the continual fall of palaces and buildings. Nero was the only one who enjoyed the general conſternation. He placed himſelf on the top of a high tower, and he ſung on his lyre the deſtruction of Troy, a dreadful ſcene which his barbarity had realized before his eyes. He attempted to avert the public odium from his head by a pretended commiſeration of the miſeries of his ſubjects. He began to repair the ſtreets and public buildings at his own expence. He built himſelf a celebrated palace, which he called his golden houſe. It was liberally adorned with gold, with precious ſtones, and with every thing rare and exquiſite. It contained ſpacious fields, artificial lakes, woods, gardens, orchards, and whatever exhibited a beautiful ſcene. The entrance of this edifice could admit a large coloſſus of the emperor 120 feet high; the galleries were each a mile long, and the whole was covered with gold. The roofs of the dining halls repreſented the firmament, in motion as well as in figure; and continually turned round night and day, ſhowering down all ſorts of perfumes and ſweet waters. When this grand edifice, which, according to Pliny, extended all round the city, was finiſhed, Nero ſaid, that now he could lodge like a man. His profuſion was not leſs remarkable in all his other actions. When he went a fiſhing, his nets were of gold and ſilk. He never appeared twice in the ſame garment; and when he took a voyage, there were thouſands of ſervants to take care of his wardrobe. This continuation of debauchery and extravagance at laſt rouſed the people. Many conſpiracies were formed againſt him; but they were generally diſcovered, and ſuch as were acceſſory ſuffered the ſevereſt puniſhments. The moſt dangerous conſpiracy againſt Nero's life was that of Piſo, from which he was ſaved by the confeſſion of a ſlave. The conſpiracy of Galba proved more ſucceſsful, who, when he was informed that his plot was known to Nero, declared himſelf emperor. The unpopularity of Nero favoured his cauſe; he was acknowledged by all the Roman empire, and the ſenate condemned the tyrant to be dragged naked through the ſtreets of Rome, and whipped to death, and afterwards to be thrown down from the Tarpeian rock like the meaneſt malefactor. This, however, was not executed; for Nero prevented it by a voluntary death. He killed himſelf, A. D. 68, in the 32d year of his age, after a reign of 13 years and eight months. Rome was filled with acclamations on the occaſion; and the citizens, more ſtrongly to indicate their joy, wore caps, ſuch as were generally uſed by ſlaves who had received their freedom. Their vengeance was not only exerciſed againſt the ſtatues of the deceaſed monſter, but many of his friends were the object of the public reſentment; and many were cruſhed to pieces in ſuch a violent manner, that one of the ſenators, amid the univerſal joy, ſaid that he was afraid they ſhould ſoon have cauſe to wiſh for Nero. The tyrant, as he expired, requeſted that his head might not be cut off from his body, and expoſed to the inſolence of the populace, but that the whole might be burned on the funeral pile. His requeſt was granted by one of Galba's freedmen, and his obſequies were performed with the uſual ceremonies. Though his death ſeemed to be the ſource of general gladneſs, yet many of his favourites lamented his fall, and were grieved to ſee that their pleaſures and amuſements were ſtopped by the death of this patron of debauchery and extravagance. Even the king of Parthia ſent ambaſſadors to Rome, to condole with the Romans, and to beg that they would honour and revere the memory of Nero. His ſtatues were alſo crowned with garlands of flowers; and many imagined that he was not dead, but that he would ſoon make his appearance and take vengeance on his enemies. It will be ſufficient to obſerve, in finiſhing the character of this tyrannical monſter, that the name of Nero is even now uſed emphatically to expreſs a barbarous and unfeeling oppreſſor. Pliny calls him the common enemy and fury of mankind; and ſo indeed he has been called by all writers, who exhibit Nero as a pattern of the moſt execrable barbarity and unpardonable wantonneſs. The ſame Pliny furniſhes us with this ſingular anecdote of him: "Nero had ordered himſelf to be painted under the figure of a coloſſus, upon cloth or canvas, 120 feet in height." He adds, "that this prepoſterous picture, when it was finiſhed, met with its fate from lightning, which conſumed it, and involved likewiſe the moſt beautiful part of the gardens where it was placed in the conflagration."

NERVA, COCCEIUS, a Roman emperor after Domitian, who was the laſt of the 12 Cæſars. He was a native of Narnia in Umbria; his family, however, was originally of Crete. Dion Caſſius ſays he was born on the 17th of March, in the 18th year of Tiberius's reign, and of the Chriſtian era the 32d. Nero in the 12th year of his reign made him prætor, and erected a ſtatue for him in the palace on account of his poems (for he was one of the beſt poets of his age), ſome of which were inſcribed to him. He was conſul in 71 with Veſpaſian, and in 90 with Domitian.

Ancient authors uniformly celebrate him as a prince of a moſt mild and humane temper, of great moderation and generoſity, who looked on his office as emperor, not as if it was for his own advantage, but for that of his people; and whilſt he reigned, which was however but for a ſhort time, he made the happineſs of his ſubjects his only end and purſuit. He narrowly eſcaped death under Domitian; was naturally of a weak and timorous diſpoſition; and, as ſome ſay, addicted to exceſſive drinking. The Romans unanimouſly choſe him emperor; and they had no cauſe to repent of their choice, for he was conſtantly attentive to what could make them happy; he was generous, merciful, and diſintereſted. An inſtance of his great lenity appears in his pardoning Calpurnius Craſſus who conſpired againſt him. In ſhort, he omitted nothing that might contribute to the reſtoring of the empire to its former luſtre: recalling thoſe who had been baniſhed for religion, and redreſſing all grievances that came to his knowledge. He however found his ſtrength failing, and that it would be impoſſible for him to finiſh his deſigns, in conſequence of which he adopted Trajan. After his death, which happened in the year 98, he was ranked among the gods. He was the firſt Roman emperor of foreign extraction.

NERVES, in *Anatomy*, certain white gliſtening cords, proceeding from the brain and ſpinal marrow, and dividing into very ſmall branches, which are ſent off throughout all parts of the body; and which are found to be the organs of ſenſation and motion. See ANATOMY *Index*.

NERVOUS FLUID. See ANATOMY *Index*.

NESSUS, in fabulous hiſtory, a celebrated Centaur, ſon of Ixion and a Cloud. He offered violence to Dejanira, whom Hercules had intruſted to his care, with orders to carry her acroſs the river Evenus. Hercules ſaw the diſtreſs of his wife from the oppoſite ſhore of the river, and immediately he let fly one of his poiſoned arrows, which ſtruck the Centaur to the heart. Neſſus, as he expired, gave the tunic he then wore to Dejanira, aſſuring her that from the poiſoned blood which had flowed from his wounds, it had received the power of calling a huſband away from unlawful loves. Dejanira received it with pleaſure, and this mournful preſent cauſed the death of Hercules.——A river which ſeparates Thrace from Macedonia. It is alſo called *Neſus*, *Neſtos*, and *Neſtus*.

Neſt,
Neſtor.

NEST. See NIDUS.

Eatable Birds NESTS. See BIRDS *Neſts*.

NESTOR, in fabulous hiſtory, a ſon of Neleus and Chloris, nephew to Pelias and grandſon to Neptune. He had eleven brothers, who were all killed with his father by Hercules. His tender age detained him at home, and was the cauſe of his preſervation. The conqueror ſpared his life and placed him upon the throne of Pylos. He married Eurydice the daughter of Clymenus; or, according to others, Anaxibia the daughter of Atreus. He ſoon diſtinguiſhed himſelf in the field of battle; and was preſent at the nuptials of Perithous, when a bloody engagement took place between the Lapithæ and Centaurs. As king of Pylos and Meſſenia he led his ſubjects to the Trojan war, where he diſtinguiſhed himſelf among the reſt of the Grecian chiefs, by eloquence, addreſs, wiſdom, juſtice, and uncommon prudence. Homer diſplays his character as the moſt perfect of all his heroes; and Agamemnon exclaims, that if he had 20 generals like Neſtor, he ſhould ſoon ſee the walls of Troy reduced to aſhes. After the Trojan war Neſtor retired to Greece, where he enjoyed in the boſom of his family the peace and tranquillity which were due to his wiſdom and to his age. The manner and the time of his death are unknown: the ancients are all agreed that he lived three generations of men; which length of time is ſuppoſed to be 300 years, though more probably only 90 years, allowing 30 years for each generation. From that circumſtance, therefore, it was uſual among the Greeks and the Latins, when they wiſhed a long and happy life to their friends, to wiſh them to ſee the years of Neſtor. He had many children; two daughters, Piſidice and Polycaſte: and ſeven ſons, Perſeus, Straticus, Aretus, Echephron, Piſiſtratus, Antilochus, and Thraſymedes. Neſtor was one of the Argonauts, according to Valerius Flaccus, v. 380, &c.—A poet of Lycaonia in the age of the emperor Severus. He was father to Piſander, who under the emperor Alexander wrote ſome fabulous ſtories——One of the body guards of Alexander.

NESTOR, whoſe ſecular name is not known, was a native of Ruſſia, and the earlieſt hiſtorian of the north. He was born in 1056 at Bielozero; and in the 19th year of his age he aſſumed the monaſtic habit in the convent of Petcherſki at Kiof, and took the name of *Neſtor*. He there made a conſiderable proficiency in the Greek language: but ſeems to have formed his ſtyle and manner rather from the Byzantine hiſtorians, Cedrenus, Zonaras, and Syncellus, than from the ancient claſſics. The time of Neſtor's death is not aſcertained; but he is ſuppoſed to have lived to an advanced age, and to have died about the year 1115.

His great work is his Chronicle, to which he has prefixed an introduction, which after a ſhort ſketch of the early ſtate of the world, taken from the Byzantine writers, contains a geographical deſcription of Ruſſia and the adjacent regions; an account of the Sclavonian nations, their manners, their emigrations from the banks of the Danube, their diſperſion, and ſettlement in the ſeveral countries wherein their deſcendants are now eſtabliſhed. He then enters upon a chronological ſeries of the Ruſſian annals, from the year 858 to about 1113. His ſtyle is ſimple and unadorned, ſuch as ſuits a mere recorder of facts; but his chronological exactneſs, though it renders his narrative dry and and tedious, contributes to aſcertain the era and authenticity of the events which he relates.

Neſtor,
Neſtorians.

It is remarkable (ſays Mr Coxe, from whom we have taken this narrative), that an author of ſuch importance, whoſe name frequently occurs in the early Ruſſian books, ſhould have remained in obſcurity above 600 years; and been ſcarcely known to his modern countrymen, the origin and actions of whoſe anceſtors he records with ſuch circumſtantial exactneſs. A copy of his Chronicle was given in 1668 by Prince Radzivil to the library of Konigſburg, where it lay unnoticed till Peter the Great, in his paſſage through that town, ordered a tranſcript of it to be ſent to Peterſburgh. But it ſtill was not known as the performance of Neſtor: for when Muller in 1732 publiſhed the firſt part of a German tranſlation, he mentioned it as the work of the abbot Theodoſius of Kiof; an error which aroſe from the following circumſtance: The ingenious editor not being at that time ſufficiently acquainted with the Sclavonian tongue, employed an interpreter, who, by miſtaking a letter in the title, ſuppoſed it to have been written by a perſon whoſe name was Theodoſius. This ridiculous blunder was ſoon circulated and copied by many foreign writers, even long after it had been candidly acknowledged and corrected by Muller.

NESTORIANS, a ſect of ancient Chriſtians, ſtill ſaid to be ſubſiſting in ſome parts of the Levant; whoſe diſtinguiſhing tenet is, that Mary is not the mother of God. They take their name from Neſtorius biſhop of Conſtantinople, whoſe doctrines were ſpread with much zeal through Syria, Egypt, and Perſia.

One of the chief promotors of the Neſtorian cauſe was Barſumas, created biſhop of Niſibis, A. D. 435. Such was his zeal and ſucceſs, that the Neſtorians, who ſtill remain in Chaldea, Perſia, Aſſyria, and the adjacent countries, conſider him alone as their parent and founder. By him Pherozes the Perſian monarch was perſuaded to expel thoſe Chriſtians who adopted the opinions of the Greeks, and to admit the Neſtorians in their place, putting them in poſſeſſion of the principal ſeat of eccleſiaſtical authority in Perſia, the ſee of Seleucia, which the patriarch of the Neſtorians has always filled even down to our time.—Barſumas alſo erected a ſchool at Niſibis, from which proceeded thoſe Neſtorian doctors who in the fifth and ſixth centuries ſpread abroad their tenets through Egypt, Syria, Arabia, India, Tartary, and China.

He differed conſiderably from Neſtorius, holding that there are two perſons in Jeſus Chriſt, as well as that the Virgin was not his mother, as God, but only as man.

The abettors of this doctrine refuſe the title Neſtorians; alleging that it had been handed down from the earlieſt times of the Chriſtian church.

In the tenth century, the Neſtorians in Chaldea, whence they are ſometimes called *Chaldeans*, extended their ſpiritual conqueſts beyond Mount Imaus, and introduced the Chriſtian religion into Tartary properly ſo called, and eſpecially into that country called *Karit*, bordering on the northern part of China. The prince of that country, whom the Neſtorians converted to the Chriſtian faith, aſſumed, according to the vulgar tradition, the name of *John* after his baptiſm, to which he added

Neſtorians, Neſtorius.

added the ſurname of *Preſbyter*, from a principle of modeſty; whence it is ſaid his ſucceſſors were each of them called *Preſter John* until the time of Gengis Khan. But Moſheim obſerves, that the famous Preſter John did not begin to reign in that part of Aſia before the concluſion of the 11th century. The Neſtorians formed ſo conſiderable a body of Chriſtians, that the miſſionaries of Rome were induſtrious in their endeavours to reduce them under the papal yoke. Innocent IV. in 1246, and Nicolas IV. in 1278, uſed their utmoſt efforts for this purpoſe, but without ſucceſs. Till the time of Pope Julius III. the Neſtorians acknowledged but one patriarch, who reſided firſt at Bagdad, and afterwards at Mouſul; but a diviſion ariſing among them, in 1551 the patriarchate became divided, at leaſt for a time, and a new patriarch was conſecrated by that pope, whoſe ſucceſſors fixed their reſidence in the city of Ormus in the mountainous part of Perſia, where they ſtill continue, diſtinguiſhed by the name of *Simeon;* and ſo far down as the laſt century, theſe patriarchs perſevered in their communion with the church of Rome, but ſeem at preſent to have withdrawn themſelves from it. The great Neſtorian pontiffs, who form the oppoſite party, and look with a hoſtile eye on this little patriarch, have ſince the year 1559 been diſtinguiſhed by the general denomination of Elias, and reſide conſtantly in the city of Mouſul. Their ſpiritual dominion is very extenſive, takes in a great part of Aſia, and comprehends alſo within its circuit the Arabian Neſtorians, and alſo the Chriſtians of St Thomas, who dwell along the coaſt of Malabar. It is obſerved, to the laſting honour of the Neſtorians, that of all the Chriſtian ſocieties eſtabliſhed in the Eaſt, they have been the moſt careful and ſucceſsful in avoiding a multitude of ſuperſtitious opinions and practices that have infected the Greek and Latin churches. About the middle of the 17th century, the Romiſh miſſionaries gained over to their communion a ſmall number of Neſtorians, whom they formed into a congregation or church; the patriarchs or biſhops of which reſide in the city of Amida, or Diarbekir, and all aſſume the denomination of *Joſeph*. Nevertheleſs the Neſtorians in general perſevere to our own times in their refuſal to enter into the communion of the Romiſh church, notwithſtanding the earneſt entreaties and alluring offers that have been made by the pope's legate to conquer their inflexible conſtancy.

NESTORIUS, from whom the ſect of Neſtorian Chriſtians derive their name, was born in Germanica a city of Syria. He received his education at Antioch, where he was likewiſe baptized; and ſoon after his baptiſm he withdrew himſelf to a monaſtery in the ſuburbs of that city. Upon his being admitted to the order of prieſthood, he quickly acquired ſo great reputation by the eloquence of his preaching, and the regularity of his life, that by the emperor Theodoſius he was deemed a fit perſon to fill the ſecond ſee in the Chriſtian church, and was accordingly conſecrated biſhop of Conſtantinople in the year 429.

In one of his firſt ſermons after his promotion, he publicly declared his intention to *make war upon heretics;* and with that intolerant ſpirit which has ſo often diſgraced the preachers of the mild religion of Jeſus, he called upon the emperor to *free the earth from heretics*, promiſing to give him heaven as a reward for his zeal. To this ſpiritual motive he added one, that, though carnal, he poſſibly judged of equal force:—"Join with me (ſaid he) in war againſt them, and I will aſſiſt you againſt the Perſians." Although the wiſer and better part of his audience were amazed to ſee a man, before he had taſted (as the hiſtorian * expreſſes himſelf) the water of his city, declare that he would perſecute all who were not of his opinion; yet the majority of the people approved of this diſcourſe, and encouraged him to execute his purpoſe. Accordingly, five days after his conſecration, he attempted to demoliſh the church in which the Arians ſecretly held their aſſemblies; and he ſucceeded ſo far in his deſign, that theſe people, growing deſperate, ſet it on fire themſelves, and conſumed with it ſome of the neighbouring houſes. This fire excited great commotions in the city, and Neſtorius was ever afterwards called an *incendiary*.

Neſtorius.

From the Arians he turned his perſecution againſt the Novatians, but was ſtopped in his career by the interpoſition of the emperor. He then let looſe his fury upon thoſe Chriſtians of *Aſia*, *Lydia*, and *Caria*, who celebrated the feaſt of Eaſter upon the 14th day of the moon; and for this unimportant deviation from the Catholic practice, many of thoſe people were murdered by his agents both at Miletum and Sardis.—One cannot be ſorry that ſuch a relentleſs perſecutor ſhould himſelf be afterwards condemned as a heretic, for holding an opinion which no man who ſpeaks or thinks with philoſophic accuracy will now venture to controvert. This obnoxious tenet which produced a ſchiſm in the church, and was condemned by a general council, was nothing more than that "the Virgin Mary cannot with propriety be called the mother of God." The people being accuſtomed to hear this expreſſion, were much inflamed againſt their biſhop, imagining that he had revived the error of *Paulus Samoſetenus* and *Photinus*, who taught that Jeſus Chriſt was a mere man. The monks declared openly againſt him, and, with ſome of the moſt conſiderable men of Conſtantinople, ſeparated themſelves from his communion. Several biſhops wrote to him earneſt perſuaſives to acknowledge that Mary was the mother of God; and when he would not comply, they procured his condemnation in the council of Epheſus, which deprived him of his ſee. He then retired to his ancient monaſtery at Antioch, whence he was taken four years afterwards by the emperor's order, and baniſhed in 435 to Tarſus. That city being taken and deſtroyed by the Barbarians, he was removed to Panopolis, a city of Thebais; where he was not ſuffered to remain long, but was compelled to go from place to place, till, being in one of his journeys mortally bruiſed by a fall, death relieved him from the fury of his perſecutors.

If we examine ſuch of his writings as remain, we ſhall find that he was very unjuſtly condemned. It appears that he rejected the errors of *Ebion*, *Paulus Samoſetenus*, and *Photinus;* that he maintaned in expreſs terms, that the divine Word was united to the human nature in Jeſus Chriſt in the moſt ſtrict and intimate ſenſe poſſible; that theſe two natures, in this ſtate of union, make but one Chriſt and one perſon; that the properties of the Divine and human natures may both be attributed to this perſon; and that Jeſus Chriſt may be ſaid to have been born of a virgin, to have ſuffered and

---

* Socrates.

and died; but he never would admit that God could be ſaid to have been born, to have ſuffered, or to have died.—When we conſider that every perſon partakes of the ſubſtance of his mother, and that it is this which conſtitutes the parental and filial relation between them, it is indeed ſurpriſing that the expreſſion "Mother of God" ſhould ever have been admitted into the Chriſtian church, or that any man who underſtands the meaning of the words ſhould condemn Neſtorius for not having uſed them.

NESTUS, or Nessus, a river which ſeparates Thrace from Macedonia. It falls into the Ægean ſea near the iſland Thaſos. It is ſometimes called *Neſus* and *Neſſus*.

NET, a device for catching fiſh and fowl. See the article Fishery.

The taking fowls by nets is the readieſt and moſt advantageous of all others, where numbers are to be taken. The making the nets is very eaſy, and what every true ſportſman ought to be able to do for himſelf. All the neceſſary tools are wooden needles, of which there ſhould be ſeveral of different ſizes, ſome round and others flat; a pair of round pointed and flat ſciſſars; and a wheel to wind off the thread. The packthread is to be of different ſtrength and thickneſs, according to the ſort of birds to be taken; and the general ſize of the meſhes, if not for very ſmall birds, is two inches from point to point. The nets ſhould neither be made too deep nor too long, for they are then difficult to manage; and they muſt be verged on each ſide with twiſted thread. The natural colour of the thread is too bright and pale, and is therefore in many caſes to be altered. The moſt uſual colour is the ruſſet; which is to be obtained by plunging the net, after it is made, into a tanners pit, and letting it lie there till it be ſufficiently tinged: this is of a double ſervice to the net, ſince it preſerves the thread as well as alters the colour. The green colour is given by chopping ſome green wheat and boiling it in water, and then ſoaking the net in this green tincture. The yellow colour is given in the ſame manner with the decoction of celandine; which gives a pale ſtraw-colour, which is the colour of ſtubble in the harveſt-time. The brown nets are to be uſed on ploughed lands, the green on graſs grounds, and the yellow on ſtubble lands.

Day-Net, among fowlers, a net generally uſed for taking ſuch ſmall birds as play in the air, and will ſtoop either to prey, gig, or the like; as larks, linnets, buntings, &c. The time of the year for uſing this net is from Auguſt to November; and the beſt time is very early in the morning: and it is to be obſerved, that the milder the air, and the brighter the ſun is, the better will be the ſport, and of longer continuance. The place where this net ſhould be laid, ought to be plain champaign, either on ſhort ſtubbles, green leas, or flat meadows, near corn fields, and ſomewhat remote from towns and villages: you muſt be ſure to let your net lie cloſe to the ground, that the birds creep not out and make their eſcape.—The net is made of a fine packthread with a ſmall meſh, not exceeding half an inch ſquare; it muſt be three fathoms long, and but one broad: it muſt be verged about with a ſmall but ſtrong cord; and the two ends extended upon two ſmall long poles, ſuitable to the breadth of the net, with four ſtakes, tail-ſtrings, and drawing-lines.—This net is compoſed of two, which muſt be exactly alike; and are to be laid oppoſite to one another, ſo even and cloſe, that when they are drawn and pulled over, the ſides muſt meet and touch each other. You muſt ſtake this net down with ſtrong ſtakes, very ſtiff on their lines, ſo that you may with a nimble touch caſt them to and fro at pleaſure; then faſten your drawing-cord or hand-lines (of which there muſt be a dozen at leaſt, and each two yards long) to the upper end of the foremoſt ſtaves: and ſo extend them of ſuch a ſtraitneſs, that with a little ſtrength they may riſe up in the nets and caſt them over.

Sportſman's Dictionary.

Your nets being thus laid, place your gigs, or playing-wantons, about 20 or 30 paces beyond, and as much on this ſide your nets: the gigs muſt be faſtened to the tops of long poles, and turned into the wind, ſo as they may play to make a noiſe therein. Theſe gigs are a ſort of toys made of long gooſe-feathers, like ſhuttle-cocks, and with little ſmall tunnels of wood running in broad and flat ſwan-quills, made round like a ſmall hoop; and ſo, with longer ſtrings faſtened to a pole, will, with any ſmall wind or air, move after ſuch a manner, that birds will come in great flocks to play about them.

When you have placed your gigs, then place your ſtale; which is a ſmall ſtake of wood, to prick down into the earth, having in it a mortice-hole, in which a ſmall and ſlender piece of wood, about two feet long, is faſtened, ſo as it may move up and down at pleaſure: and faſten to this longer ſtick a ſmall line, which, running through a hole in the ſtick abovementioned, and ſo coming up to the place where you are to ſit, you may, by drawing the line up and down with your right hand, raiſe up the longer ſtick as you ſee occaſion.

Faſten a live lark, or ſuch like bird, to this longer ſtick, which, with the line making it to ſtir up and down by your pulling, will entice the birds to come to your net.

There is another ſtale, or enticement, to draw on theſe birds, called a *looking-glaſs*; which is a round ſtake of wood, as big as man's arm, made very ſharp at the end, to thruſt it into the ground: they make it very hollow in the upper part, above five fingers deep; into which hollow they place a three-ſquare piece of wood about a foot long, and each two inches broad, lying upon the top of the ſtake, and going with a foot into the hollowneſs: which foot muſt have a great knob at the top, and another at the bottom, with a deep ſlenderneſs between; to which ſlenderneſs you are to faſten a ſmall packthread, which, running through a hole in the ſide of the ſtake, muſt come up to the place where you ſit. The three-ſquare piece of wood which lies on the top of the ſtake, muſt be of ſuch a poiſe and evenneſs, and the foot of the ſocket ſo ſmooth and round, that it may whirl and turn round upon the leaſt touch; winding the packthread ſo many times about it, which being ſuddenly drawn, and as ſuddenly let go, will keep the engine in a conſtant rotatory motion: then faſten with glue on the uppermoſt flat ſquares of the three-ſquare piece, about 20 ſmall pieces of looking-glaſs, and paint all the ſquare wood between them of a light and lively red; which, in the

Net, Netherlands.

the continual motion, will give ſuch a reflection, that the birds will play about to admiration until they are taken.

Both this and the other ſtale are to be placed in the middle between the two nets, about two or three feet diſtance from each other; ſo that in the falling of the nets, the cords may not touch or annoy them: neither muſt they ſtand one before or after another; the glaſs being kept in a continual motion, and the bird very often fluttering. Having placed your nets in this manner, as alſo your gigs and ſtales, go to the further end of your long drawing lines and ſtale lines; and having placed yourſelf, lay the main drawing line acroſs your thigh, and, with your left, pull the ſtale line to ſhow the birds; and when you perceive them to play near and about your nets and ſtales, then pull the net over with both hands, with a quick but not too haſty motion; for otherwiſe your ſport will be ſpoiled.

Plate CCCLXIX.

See Plate CCCLXIX. where A ſhows the bodies of the main net, and how they ought to be laid. B, the tail lines, or the hinder lines, ſtaked to the ground. C, the fore lines ſtaked alſo to the ground. D, the bird ſtale. E, the looking glaſs ſtale. G, the line which draws the bird ſtale. H, the line that draws the glaſs ſtale. I, the drawing double lines of the nets, which pulls them over. K, the ſtakes which ſtake down the four nether points of the nets and the two tail lines. L, the ſtakes that ſtake down the fore lines. M, the ſingle line, with the wooden button to pull the net over with. N, the ſtake that ſtakes down the ſingle line, and where the man ſhould ſit; and O, the gig.

NET, *Neat*, in commerce, ſomething pure, and unadulterated with any foreign mixture.

Thus wines are ſaid to be *net* when not falſified or balderdaſhed; and coffee, rice, pepper, &c. are *net* when the filth and ordures are ſeparated from them. See NEAT.

A diamond is ſaid to be *net* when it has no ſtains or flaws; a cryſtal, when tranſparent throughout.

NET is alſo uſed for what remains after the tare has been taken out of the weight of any merchandiſe, i. e. when it is weighed clear of all package. See TARE.

Thus we ſay, a barrel of cochineal weighs 450 pounds; the tare is 50 pounds, and there remain *net* 400 pounds.

NET Produce, a term uſed to expreſs what any commodity has yielded, all tare and charges deducted.

The merchants ſometimes uſe the Italian words *netto proceduto*, for net produce.

NETHERLANDS, anciently called *Belgia*, but ſince denominated *Low Countries* or *Netherlands*, from their low ſituation, are ſituated between 2° and 7° of eaſt longitude, and between 50° and 53° 30′ of north latitude: and are bounded by the German ſea on the north, Germany on the eaſt, by Lorrain and France on the ſouth, and by another part of France and the Britiſh ſeas on the weſt; extending near 300 miles in length from north to ſouth, and 200 miles in breadth from eaſt to weſt. They conſiſt of 17 provinces; 10 of which are called the *Auſtrian and French Netherlands*, and the other ſeven the *United Provinces*.

Netherlands.

The greateſt part of the Netherlands was conquered by the Romans; and that part which lies towards Gaul continued in their ſubjection till the decline of that empire; after which the Franks became maſters of it; and under the French monarchy, it was part of the kingdom of Metz or Auſtraſia.

Towards the end of the 15th century Maximilian of Auſtria, ſon of the emperor Ferdinand III. acquired, by marrying the only daughter of the duke of Burgundy, the duchies of Brabant, Limburg, and Luxemburg; the counties of Flanders, Burgundy, Hainault, Holland, Zealand, and Namur; and the lordſhip of Frieſland. Philip of Auſtria, ſon to Maximilian and Mary, married Jane the daughter of Ferdinand king of Arragon and of Iſabella queen of Caſtile; by which means their ſon Charles inherited not only almoſt all Spain and the great countries then lately diſcovered in America, but alſo thoſe noble provinces of the Netherlands, and was choſen emperor under the name of *Charles V.* Towards the latter end of the 1527, he added to his dominions the temporalities of the biſhoprick of Utrecht on both ſides of the Yſſel; and Henry of Bavaria, being diſtreſſed through war with the duke of Guelderland, and tired with the continued rebellion of his own ſubjects, ſurrendered to the emperor the temporalities of his dioceſe, which was confirmed by the pope, and the ſtates of the country. In 1536, Charles V. bought of Charles of Egmond the reverſion of the duchy of Guelderland and of the county of Zutphen, in caſe that prince ſhould die without iſſue. The ſame year the city of Groningen took the oath of allegiance, and ſubmitted to Charles V. and in 1543 he put a garriſon into the city of Cambray, and built a citadel there. Having thus united the 17 provinces, as it were in one body, he ordered that they ſhould continue for ever under the ſame prince, without being ever ſeparated or diſmembered; for which purpoſe he publiſhed in November 1549, with the conſent and at the requeſt of the ſtates of all the provinces, a perpetual and irrevocable edict or law, by which it was enacted, that in order to keep all thoſe provinees together under one and the ſame prince, the right of repreſentation, with regard to the ſucceſſion of a prince or princeſs, ſhould take place for ever both in a direct and collateral line, notwithſtanding the common laws of ſome provinces to the contrary. Charles had even a mind to incorporate theſe provinces with the Germanic body, and to make of them a circle of the empire, under the title of the circle of Burgundy, in order thereby to engage the princes of the empire to concern themſelves for the preſervation of thoſe provinces. But the Netherlands, always jealous of their liberty, did not ſeem to like that incorporation; and when they were demanded to pay their ſhare towards the expences of the empire, they refuſed it: whereupon the princes of Germany refuſed, in their turn, to take any part in the wars in Flanders, and looked upon thoſe provinces as by no means belonging to the Germanic body.

Philip of Auſtria and his ſon Charles, who were born in the Netherlands, had for theſe provinces that natural affection which men uſe to have for their native country; and, knowing how jealous the inhabitants were of their liberty, and of the privileges granted to them by their former princes, they took great care to preſerve them and ſuffered willingly that the ſtates, who were the guardians of the people's liberty and privileges,

ſhould

ſhould in a manner ſhare the ſupreme authority with them. Philip II. ſon to the emperor Charles V. had not the ſame affection for the Netherlands, nor thoſe generous ſentiments which his father had endeavoured to inſpire him with. Being born in Spain of a Portugueſe woman, he had no regard but for his native country; and, when he removed out of the Netherlands, he left them to the weak government of a woman, to the proud and haughty ſpirit of Cardinal de Grenville, and to the wild ambition of ſome lords of theſe provinces, who availing themſelves of the imprudent conduct and continual blunders of the council of Spain, found their private intereſt in the diſturbances they could not fail to produce. Philip II. alſo, inſtead of the mild and moderate meaſures which his predeceſſors had ſucceſsfully employed on many occaſions, as beſt ſuiting the genius and temper of the people, had recourſe to the moſt violent and cruel proceedings; which, far from curing the evil, ſerved only to exaſperate it the more and render it incurable. The Spaniards, whom he ſent thither, being born and educated in an abſolute monarchy, jealous of the liberties and envious of the riches of the people, broke through all their privileges, and uſed them almoſt after the ſame manner as they had done the inhabitants of their new and ill-gotten dominions in America. This treatment occaſioned a general inſurrection. The counts Hoorn, Egmont, and the prince of Orange, appeared at the head of it, and Luther's reformation gaining ground about the ſame time in the Netherlands, his diſciples joined the malecontents: whereupon King Philip introduced a kind of inquiſition in order to ſuppreſs them, and many thouſands were put to death by that court, beſides thoſe that periſhed by the ſword; for theſe perſecutions and encroachments had occaſioned a civil war, in which ſeveral battles were fought. The counts Hoorn and Egmont were taken and beheaded: but the prince of Orange, retiring into Holland, with the aſſiſtance of England and France, preſerved Holland and ſome of the adjacent provinces, which entered into a treaty for their mutual defence at Utrecht in 1579, and they have ever ſince been ſtyled the *United Provinces*; but the other provinces were reduced to the obedience of Spain by the duke of Alva and other Spaniſh generals. However, their ancient privileges were in a great meaſure reſtored; every province was allowed its great council or parliament, whoſe concurrence was required to the making of laws, and raiſing money for the government, though theſe aſſemblies were too often obliged to follow the dictates of the court.

The emperor Joſeph II. endeavoured to deprive them even of the form of their free conſtitution; and he might very probably have ſucceeded, had he not attempted at the ſame time a reformation of the church. The Auſtrian Netherlands are wholly Catholic, and ſo bigotted to the Romiſh ſuperſtition, that though they had tamely ſubmitted to many encroachments of the archducal houſe on their civil rights, no ſooner did the monarch encroach upon the property of the holy mother church than they reſiſted his authority, and claimed all their ancient privileges political and religious. The ſame attachment to their ancient faith and worſhip made them very lately contribute to expel from their territories the French whom they had invited to relieve them from the Auſtrian yoke. Thus her religious bigotry for once ſaved a free people from the iron rod of deſpotiſm on the one hand, and the cruelties of frantic democrates on the other. The provinces under the government of France were, till the late revolution, under the ſame ſevere arbitrary dominion as the other ſubjects of that crown, and they now experience the ſame miſeries with the reſt of the republic.

The Spaniards continued poſſeſſed of almoſt eight of theſe provinces, until the duke of Marlborough, general of the allies, gained the memorable victory of Ramillies. After which Bruſſels the capital, and great part of theſe provinces, acknowledged Charles VI. (afterwards emperor) their ſovereign; and his daughter, the late empreſs queen, remained poſſeſſed of them till the war that followed the death of her father, when the French made an entire conqueſt of them, except part of the province of Luxemburg; but they were reſtored by the peace of Aix-la-Chapelle in 1748, and the French retained only Artois, the Cambreſis, part of Flanders, part of Hainault, and part of Luxemburg, of which they have had the dominion now upwards of eighty years.

The ſoil is generally fruitful, but differs in the ſeveral parts. The climate alſo differs in the ſeveral provinces; in thoſe towards the ſouth it does not differ much from that of England, though the ſeaſons are more regular. In the northern provinces the winter is generally very ſharp, and the ſummer ſultry hot; but the exreme cold and exceſſive heat ſeldom continue above five or ſix weeks. The air is reckoned very wholeſome, but is ſubject to thick fogs in winter, through the moiſtneſs of the country, which would be very noxious, were it not for the dry eaſterly winds, which, blowing off a long continent for two or three months in the year, clear the air, and occaſion very ſharp froſts in January and February; during which, the ports, rivers, and canals are commonly ſhut up. The face of the country is low and flat: for, except ſome ſmall hills and a few riſing grounds in Utrecht and Guelderland, and in the parts lying towards Germany, there is no hill to be ſeen in the whole 17 provinces. This is the reaſon why they have been called the Low Countries. French Flanders abounds in grain, vegetables, flax, and cattle, but is in want of wood. For the hiſtory of the events which took place in the Netherlands during the French revolution, by which they were united to France, ſee FRANCE.

For the *Dutch Netherlands*, ſee *UNITED Provinces*.

NETHINIMS, among the Jews, the poſterity of the Gibeonites, who were condemned by Joſhua to be hewers of wood and drawers of water for the houſe of God.

NETOPION, a name given by the ancients to a very fragrant and coſtly ointment, conſiſting of a great number of the fineſt ſpicy ingredients. Hippocrates, in his Treatiſe of the Diſeaſes of Women, frequently preſcribes the netopion in diſeaſes of the uterus; and in other places he ſpeaks of its being poured into the ear as a remedy for deafneſs; theſe compoſitions, by their attenuating qualities, dividing the viſcous and thick humours. The word *netopion* is alſo ſometimes uſed to expreſs the *unguentum Egyptiacum*, and ſometimes ſimply for oil of almonds.

NETTINGS, in a ſhip, a ſort of grates made of ſmall ropes ſeized together with rope yarn or twine, and fixed on the quarters and in the tops; they are ſometimes ſtretched upon the ledges from the waſte trees to the roof trees, from the top of the forecaſtle to the poop, and ſometimes are laid in the waſte of a ſhip to ſerve inſtead of gratings.

NETTLE. See Urtica, Botany *Index*.

Sea-NETTLE. See Medusa, Helminthology *Index*, and *ANIMAL-Flower*.

NETTLE-Tree. See Celtis, Botany *Index*.

NETTUNO, a handſome town of Italy, in the Campagna di Roma. It is but thinly peopled, though ſeated in a fertile ſoil. The inhabitants are almoſt all hunters. E. Long. 12. 57. N. Lat. 41. 30.

NEVA, a river at Peterſburgh, in Ruſſia. The views upon the banks exhibit the grandeſt and moſt lively ſcenes. The river is in moſt places broader than the Thames at London. It is deep, rapid, and tranſparent as cryſtal, and its banks are lined on each ſide with a continued range of handſome buildings. On the north ſide the fortreſs, the academy of ſciences and that of art are the moſt ſtriking objects; on the oppoſite ſide are the imperial palace, the admiralty, the manſions of many Ruſſian nobles, and the Engliſh line, ſo called becauſe (a few houſes excepted) the whole row is occupied by the Engliſh merchants. In front of theſe buildings, on the ſouth ſide, is the quay, which ſtretches for three miles, except where it is interrupted by the admiralty; and the Neva, during the whole of that ſpace, has been lately embanked at the expence of the empreſs, by a wall, parapet, and pavement of hewn granite; a moſt elegant and durable monument of imperial magnificence. There is a communication between the oppoſite ſides of the river by a bridge of pontoons, which, when any thing is apprehended from the force of ice ruſhing down the ſtream, can be, and is generally indeed, removed. The great depth of the river, it appears, prevents the building of a ſtone bridge; and, if it could be built, there is no reaſon to ſuppoſe it could poſſibly reſiſt the force of thoſe vaſt ſhoals of ice which in the beginning of winter come down this rapid river. An attempt, however, has been made to remedy this inconvenience; and a Ruſſian peaſant has actually projected the plan of throwing a wooden bridge of one arch acroſs it, which, in its narroweſt part, is 980 feet in breadth. As we think this is a matter of very conſiderable importance, as well as of curioſity, we ſhall give the following copious account of the plan and its author, in Mr Coxe's own words; who tells us that the artiſt had then executed a model 98 feet in length, which he ſaw and examined with conſiderable attention.

“ The bridge is upon the ſame principle with that of Shaffhauſen, excepting that the mechaniſm is more complicated, and that the road is not ſo level. I ſhall attempt to deſcribe it by ſuppoſing it finiſhed, as that will convey the beſt idea of the plan. The bridge is roofed at the top, and covered at the ſides; it is formed by four frames of timber, two on each ſide, compoſed of various beams or truſſes, which ſupport the whole machine. The road is not, as is uſual, carried over the top of the arch, but is ſuſpended in the middle.

“ The following proportions I noted down with the greateſt exactneſs at the time when they were explained to me by the artiſt.

Length of the abutment on the north end,	658 feet.
Span of the arch, - -	980
Length of the abutment on the ſouth end,	658
Length of the whole ſtructure, including the abutments, - - -	2296
The plane of the road upon its firſt aſcent makes an angle of five degrees with the ordinary ſurface of the river.	
Mean level of the river to the top of the bridge in the centre, - -	168
Ditto to the bottom of the bridge in the centre, - - -	126
Height of the bridge from the bottom to the top in the centre, - -	42
Height from the bottom of the bridge in the centre to the road, - -	7
Height from the bottom of ditto to the water, - - -	84
Height from the water to the ſpring of the arch, - - -	56

So that there is a difference of 35 feet between the road at the ſpring of the arch and the road at the centre; in other words, an aſcent of 35 feet in half 980, or in the ſpace of 490 feet, which is little more than eight tenths of an inch to a foot. The bridge is broadeſt towards the ſides, and diminiſhes towards the centre.

In the broadeſt part it is - -	168 feet.
In the centre or narroweſt - -	42
The breadth of the road is - -	28

“ The artiſt informed me, that to complete the bridge would require 49,650 iron nails, 12,908 large trees, 5500 beams to ſtrengthen them: and that it would coſt 300,000 rubles or 60,000l. He ſpeaks of this bold project with the uſual warmth of genius; and is perfectly convinced that it would be practicable. I muſt own that I am of the ſame opinion, though I hazard it with great diffidence. What a noble effect would be produced by a bridge ſtriking acroſs the Neva, with an arch 980 feet wide, and towering 168 feet from the ſurface of the water! The deſcription of ſuch a bridge ſeems almoſt chimerical; and yet upon inſpection of the model we become reconciled to the idea. But whether the execution of this ſtupendous work may be deemed poſſible or not, the model itſelf is worthy of attention, and reflects the higheſt honour on the inventive faculties of that unimproved genius. It is ſo compactly conſtructed, and of ſuch uniform ſolidity, that it has ſupported 3540 pood, or 127,440 pounds, without having in the leaſt ſwerved from its direction, which I am told is far more, in proportion to its ſize, than the bridge if completed would have occaſion to ſuſtain from the preſſure of the carriages added to its own weight.

“ The perſon who projected this plan is a common Ruſſian peaſant. This extraordinary genius was apprentice to a ſhopkeeper at Niſhnei Novogorod: oppoſite to his dwelling was a wooden clock, which excited his curioſity. By repeated examination he comprehended the internal ſtructure, and without any aſſiſtance formed one exactly ſimilar in its proportion and materials. His ſucceſs in this firſt eſſay urged him to undertake the conſtruction of metal clocks and watches. The empreſs, hearing of theſe wonderful exertions of his native genius, took him under her protection, and ſent him to England; from whence, on account of the difficulties attending his ignorance of the language, he ſoon returned to Ruſſia. I ſaw a repeating watch of his workmanſhip at the Academy of Sciences: it is about the bigneſs of an egg; in the inſide is repreſented the tomb of our Saviour, with the ſtone at the entrance, and the centinels upon duty: ſuddenly the ſtone is removed, the centinels fall down, the angels appear, the women enter the ſepulchre, and the ſame chant is heard which is performed on Eaſter-eve. Theſe are trifling, although curious performances; but the very planning of the bridge was a moſt ſublime conception. This perſon, whoſe name is *Kulibin*, bears the appearance of a Ruſſian peaſant: he has a long beard, and wears the common dreſs of the country. He receives a penſion from the empreſs, and is encouraged to follow the bent of his mechanical genius (A).

NEVEL, or **Nebel**, in the Jewiſh antiquities, a kind of muſical inſtrument. See Nablum.

NEVERS, a town of France, in the department of Nievre, and ſituated in E. Long. 3. 14. N. Lat. 46. 59. on the river Loire, which here receives the rivulet *Nievre*, from which this city derives its name. It is a place of great antiquity, ſuppoſed to be Cæſar's Noviodunum in Æduis, where he erected magazines for his armies. Francis I. made it a duchy and peerage in 1521, in favour of Francis of Cleves, to whom it came by marriage. It devolved afterwards to the houſe of Mantua, and then to the Palatine family, who in 1651 ſold it to Cardinal Mazarine. The cardinal obtained a title of duke and peer for his nephew Philip Mancini, in whoſe family it continued till the late revolution. The town is fortified with walls, defended with many high towers and deep ditches, and is the ſeat of a biſhopric, ſuffragan of Sens, as likewiſe of a bailiwic and chamber of accounts. There is a ſtone bridge on the Loire, with 20 arches, a draw-bridge on each ſide, and towers to defend them. This town is famous for its manufacture of glaſs and earthen ware, and is ſaid to contain about 8000 inhabitants. In the centre of Nevers, on the ſummit of a hill, is built the palace of the ancient dukes. It appears to have been conſtructed in the ſixteenth century, and exhibits a model of the beauty and delicacy of Gothic architecture. The apartments are hung with tapeſtry of 200 years old, which have an air of groteſque and rude magnificence.

NEUCHATTEL, a town of Swiſſerland, capital of a county of the ſame name. There are ſeveral ancient ruins near it, which ſhow its former extent; and there are two large churches, beſides a caſtle where the governor reſides. The town contains about 3000 inhabitants. It is ſituated partly on a ſmall plain, between Mount Jura and the lake of Neuchattel, which is 17 miles long and five broad; the ſide of the harbour is the uſual walk of the inhabitants. Part of it too is built upon the ſide of the mountain; whence ſome of its ſtreets are very ſteep. In this ſmall place ſeveral public works have lately been executed, which Mr Coxe thinks are far beyond the revenues, or even the wants, of ſuch a little ſtate. Among theſe he inſtances a ſuperb cauſeway and a town-houſe "built (ſays he) of ſuch ſolid materials, as if it was intended to ſurvive to the moſt diſtant poſterity, and to rival the duration of the much-famed Roman capitol." At the beginning of the 18th century, commerce was very little followed in this town, owing to an abſurd opinion which prevailed among the inhabitants of its being diſgraceful; but this prejudice is now extinguiſhed, and the town in a much more flouriſhing ſituation than before. The chief article of exportation is wine, which is much eſteemed; and manufactures of printed linens and cottons have been eſtabliſhed with conſiderable ſucceſs. The flouriſhing ſtate of Neuchattel is principally owing to the benefactions of Mr David Pury, late banker of the court at Liſbon. He was born at Neuchattel in 1709; but having received his education there, he quitted it in great poverty, and repaired to Geneva, where he ſerved his apprenticeſhip, but in what line is not mentioned. From Geneva he went to London, where he acted as clerk to a dealer in precious ſtones, and acquired great reputation by eſtimating the value of diamonds at ſight. After a long reſidence in England he went to Liſbon, where he carried on a very extenſive commerce; and having been appointed court-banker, his fortune rapidly increaſed. His generoſity, however, kept pace with his wealth; and he not only remitted large ſums to Neuchattel while living, but left his country his heir when he died. His contributions in all are eſtimated by Mr Coxe at 200,000l.; a conſiderable part of which has been employed in conſtructing the public works already mentioned. Neuchattel has a grand and little council: the firſt is compoſed of 40 perſons, with two maſters of the keys; the little council conſiſts of 24 members, comprehending the mayor, who is preſident. Theſe two councils aſſemble regularly every month. The eccleſiaſtics likewiſe aſſemble every month, to conſult on affairs belonging to the church, and to fill up the places of miniſters that die. They chooſe a dean every year, who is preſident of the general aſſemblies, which are called *claſſes*; and ſometimes he is confirmed in this dignity. E. Long. 7. 10. N. Lat. 47. 5.

Neuchattel, a ſovereign county of Swiſſerland, bounded on the weſt by the Franche Compte, on the north by the biſhopric of Baſle, and on the eaſt and ſouth

---

(A) We have given this detail in Mr Coxe's own words, as it appears to us to deſerve attention on account of the greatneſs of the project, which would have excited admiration had it been attempted by one enlightened by ſcience and liberal arts, much more when it comes through the humble medium of a Ruſſian peaſant. It was never executed, as we are juſt informed by a gentleman who left St Peterſburgh about the beginning of June 1793; but the model remains, and is ſtill ſhown. The ſame gentleman (we quote his own words) adds, "that every mechanic thinks it practicable; and that the general belief is, that the empreſs would have built it, had ſhe not found uſe for all her money in carrying on her warlike and diplomatic tranſactions with other courts."

ſouth by the cantons of Berne and Friburg. This principality of Neuchattel and Vallengin extend from the lake of Neuchattel to the borders of Franche Compte, being in length about 12 leagues, and ſix in breadth. The plain with the lower part of the mountains is occupied by the diſtrict of Neuchattel, but Vallengin is totally encloſed by Jura. Parallel chains of theſe mountains run from eaſt to weſt, forming ſeveral valleys in the moſt elevated parts. The lower grounds of this chain conſiſt of arable lands and vineyards; the higher of large tracts of foreſt, which in many parts have been cleared and converted into paſture grounds, intermixed with fields of barley and oats. The inhabitants are numerous, and remarkable for their genius, politeneſs, and active induſtry. It contains three cities, one town, 90 villages, and about 300 houſes diſperſed in the mountains. The inhabitants are all Proteſtants, except two Roman catholic villages: and in 1529 they entered into a ſtrict alliance with the cantons of Berne, Friburg, Soleure, and Lucern. The air is healthy and temperate, but the ſoil not everywhere equally fertile: however, there are large vineyards, which produce white and red wine, which laſt is excellent. The paſtures on the mountains feed a great number of cattle; there are plenty of deer in the foreſts; the lakes and rivers abound with fiſh. The mildneſs of the government, and agreeable ſituation of the inhabitants in general in theſe diſtricts, is evident from the great increaſe of population in the ſpace of 32 years. In 1752 they contained only 28,017 ſubjects and 4318 aliens: but in 1784 the number was augmented to 31,576 ſubjects and 9704 aliens; being an increaſe of near a fourth part in that time. The facility with which the burgherſhip of Neuchattel is acquired, may alſo be accounted one of the means of augmenting its population; for between the years 1760 and 1770, the magiſtrates admitted 41 perſons to this privilege; from 1770 to 1780, 46; from 1780 to 1785, 51; in all 138; many of whom had children before they purchaſed their burgherſhip, and 38 of them were foreigners, either German, French, or Dutch. This country has experienced ſimilar changes with the reſt of Switzerland during the uſurpation of the French.

NEUFCHATTEAU, a commercial town of France, in the department of the Voſges; formerly having an abbey of the nuns of St Clair, a commandery of Malta, and ſeveral convents of monks and nuns. It is ſeated in a fertile ſoil, which produces corn, wine, and all the neceſſaries of life, on the river Mouzon. E. Long. 5. 45. N. Lat. 48. 20.

NEVIS, one of the Caribbee iſlands, lying about ſeven leagues north of Montſerrat, and ſeparated from St Chriſtopher's by a narrow channel. It makes a beautiful appearance from the ſea, being a large conical mountain covered with fine trees, of an eaſy aſcent on every ſide, and entirely cultivated. The circumference is about 21 miles, with a conſiderable tract of level ground all around. The climate in the lower part is reckoned to be warmer than Barbadoes, but it is more temperate towards the ſummit. The ſoil is very fine in the lower part, but grows coarſer as we aſcend. The productions are nearly the ſame with thoſe of St Chriſtopher's. There are three pretty good roads or bays, with ſmall towns in their vicinity; Charles Town, Moreton bay, and Newcaſtle. This pleaſant iſland was ſettled under the auſpices of Sir Thomas Warner from St Chriſtopher's. His ſucceſſor, Governor Lake, was conſidered as the Solon of this little country, in which he diſpoſed of every thing with ſuch prudence, wiſdom, and juſtice, as procured him a high reputation with the French as well as Engliſh. In the Dutch war they met with ſome diſturbance from the French; but by being covered by an Engliſh ſquadron, the enemy were obliged to deſiſt from their intended invaſion, after a ſmart engagement in ſight of the iſland. Sir William Stapleton ſometimes reſided here, and Sir Nathaniel Johnſon conſtantly, at which time the inhabitants of Nevis were computed at 30,000. In the war immediately after the revolution, they exerted themſelves gallantly, and and had two regiments of 300 men each. In that of Queen Anne they behaved equally well, though they were leſs fortunate; for the French landing with a ſuperior force, and having inveigled moſt of their ſlaves, they were forced to capitulate. About 4000 of theſe ſlaves the French carried away and ſold to the Spaniards, to work in their mines. The parliament, after making due inquiry into the loſſes they had ſuſtained, voted them about a third part of the ſum in which they had ſuffered. Theſe loſſes by war, an epidemic diſeaſe, and repeated hurricanes, exceedingly diminiſhed the number of the people. They are now thought not to exceed 2000 or 3000 whites, and 6000 blacks. There is here a lieutenant governor, with a council, and an aſſembly, which is compoſed of three members from each of the five pariſhes into which the iſland is divided. The commodities are cotton and ſugar; and about 20 ſail of ſhips are annually employed in this trade.

NEURADA, in *Botany*, a genus of plants belonging to the decandria claſs, and in the natural method ranking under the 13th order, *Succulentæ*. See BOTANY *Index*.

NEUROGRAPHY, ſignifies a deſcription of the nerves. See ANATOMY.

NEUROPTERA, the name of one of the orders into which the claſs of inſects is divided according to the Linnæan claſſification. See ENTOMOLOGY *Index*.

NEUTER, a perſon indifferent, who has eſpouſed neither party, and is neither friend nor foe.

A judge ought to be neuter in the cauſes he judges; in queſtions, where reaſon appears neuter, a man ſhould ever incline to the ſide of the unhappy.

NEUTER, in *Grammar*, denotes a ſort of gender of nouns, which are neither maſculine nor feminine. See GENDER.

The Latins have three kinds of genders, maſculine, feminine, and neuter. In Engliſh, and other modern tongues, there is no ſuch thing as neuter nouns. See NOUN.

Verbs NEUTER, by ſome grammarians called *intranſitive verbs*, are thoſe which govern nothing, and that are neither active nor poſitive. See VERB.

When the action expreſſed by the verb has no object to fall upon, but the verb alone ſupplies the whole idea of the action; the verb is ſaid to be *neuter*: as, I ſleep, thou yawneſt, he ſneezes, we walk, ye run, they ſtand ſtill.

Some divide verbs neuter into, 1. Such as do not ſignify any action, but a quality; as *albet*, "it is white;" or or a ſituation, as *ſedet*, "he ſits;" or have ſome relation to place; as *adeſt*, "he is preſent;" or to ſome other ſtate or attribute, as *regnat*, "he rules," &c. And, 2. Thoſe that do ſignify actions, though thoſe ſuch as do not paſs into any ſubject different from the actor; as to dine, to ſup, to play, &c.

But this latter kind ſometimes ceaſe to be *neuter*, and commence active; eſpecially in Greek and Latin, when a ſubject is given them; as, *vivere vitam, ambulare viam, pugnare pugnam.* Thus the old French poets ſay, *Soupirer ſon tourment;* the Engliſh, to *ſigh his woes*, &c.

But this is obſerved only to obtain where ſomething particular is to be expreſſed, not contained in the verb: as, *vivere vitam beatam*, to live a happy life; *pugnare bonam pugnam*, to fight a good fight, &c.

According to the abbot de Dangeau, *verbs neuter* may be divided into *active* and *paſſive;* the firſt, thoſe that form their tenſes in Engliſh, by the auxiliary verb *to have;* in French, by *avoir.* The ſecond, thoſe that form them in Engliſh with the verb *to be;* in French *étre.*—Thus, to ſleep, to yawn, *dormir* and *eternuer*, are *neuters active.*—To come, and to arrive, are *neuters paſſive.*

NEUTRAL Salts, in *Chemiſtry*, compounded of an acid with any other ſubſtance capable of uniting with it and deſtroying its acidity, as ſulphuric acid and ſoda, or Glauber's ſalt, muriatic acid and ſoda, or common ſalt.

NEUTRALITY, the ſtate of a perſon or thing that is neuter, or that takes part with neither ſide.

NEW-ABBEY, ſituated near Kilcullen bridge in the county of Kildare, and province of Leinſter, in Ireland. It was founded by Rowland Euſtace, of a great and ancient family in this county; the tower is ſtill ſtanding, and ſome part of the abbey; the ruins of the reſt have contributed to build ſeveral dwellings near it. In the inſide Rowland Euſtace and his lady lie buried; their figures, clothed in armour, are to be ſeen there. Near this is a handſome ſeat of the Carter family, on the oppoſite ſide of the river Liffey.

NEWARK *upon Trent*, in the county of Nottingham, is a great thoroughfare in the York road, 124 miles from London. It has bridges over the Trent, which forms an iſland here, by dividing itſelf into two ſtreams two miles above the town, which meet again two miles below it. A magnificent caſtle was built here in the reign of King Stephen, which held out ſtoutly in the barons wars for King John, who died here, October 19. 1216; and it alſo ſtood out for King Charles I. to the laſt; but after he had put himſelf into the hands of the Scots army then before it, the governor by his order ſurrendered it, after which it was demoliſhed.—It was ſituated near the river; the walls of the towers are very thick, and of a very great height; and were there no hiſtorical teſtimony, theſe remains are ſufficient evidence that it was formerly of great importance. In the court before theſe ruins is a very fine bowling green, and near it a manufactory of ſacking. The town being ſubject to inundations from the river Trent, and often from that circumſtance made impaſſable, a turnpike road, at the inſtigation of a publican, was made about twenty years ago, ſo high as to be paſſed with ſafety in the greateſt floods, by arches of brick being made in ſeveral places to carry off the water, conſtructed by Mr Smeaton, at the expence of 12,000l. Near the town there is a bridge conſtructed for the ſame purpoſe, made moſtly upon dry land, conſiſting of nine arches. Its church, which is reckoned one of the fineſt in the kingdom, was built by Henry VI. and has a lofty ſpire.

NEWBOROUGH, or NEWBURGH, in the iſle of Angleſey, North Wales, diſtant from London 254 miles, though but a ſmall town, ſituated over againſt Caernarvon in North Wales, about 17 miles ſouth-weſt from Beaumaris, is governed by a mayor, two bailiffs, and a recorder. Its Welſh name is *Rhôſſir, or Rhoſvair.*

NEWBURG, the name of ſeveral towns of Germany, two of which are the chief towns of duchies of the ſame name; one in Bavaria, and the other in the Palatinate.

NEWBURY, a town in the county of Berks in England, 16 miles from Reading, and 56 from London, aroſe on the decay of Spinham-Land. Notwithſtanding its name ſignifies *New-Borough*, it is as old almoſt as the Conqueſt. It made ſo much broad cloth formerly, that in the reign of Henry VIII. here flouriſhed John Winſcomb, commonly called *Jack of Newbury*, one of the greateſt clothiers that ever was in England, who kept 100 looms in his houſe; and in the expedition to Flowden Field againſt the Scots, marched with 100 of his own men, all armed and clothed at his own expence; and he built all the weſt part of the church. Alſo Mr Kenric, the ſon of a clothier here, though afterwards a merchant in London, left 4000l. to the town, as well as 7500l. to Reading, to encourage the woollen manufactory. It makes a great quantity of ſhalloons and druggets, but not near ſo much broad cloth now as formerly; yet it is a flouriſhing town, with ſpacious ſtreets, and a large market place, in which is the guild-hall. In the neighbourhood, on the banks of the Kennet, there is a ſtratum of petrified wood dug out for firing, where they frequently find trunks of large oaks yet undecayed, with petrified hazel nuts, fir cones, &c. with the bones and horns of ſtags, antelopes, &c. tuſks of boars, and heads of beavers. The river Kennet, which abounds with excellent trout, eels, and cray-fiſh, runs through the town; and here is plenty of all other proviſions. It was made a corporation by Queen Elizabeth, and is governed by a mayor, high ſteward, aldermen, &c.

NEWCASTLE-*under-Line*, a town in England, in the county of Stafford, on a branch of the Trent, is 15 miles north of Stafford, 33 ſouth ſouth-eaſt of Warrington, and 149 from London: had a caſtle, now in ruins; and is ſo called from an older caſtle, which formerly ſtood two miles off, at Cheſterton-under-Line. It was incorporated by King Henry I. and again by Queen Elizabeth and King Charles II. and is governed by a mayor, two juſtiees, two bailiffs, and 24 common council. The population in 1801 exceeded 4000. The clothing trade flouriſhes here; but its chief manufactory is hats, here being an incorporated company of felt-makers. A great quantity of ſtone ware is made near this place.

NEWCASTLE *on Tyne*, the capital of the county of Northumberland in England, 15 miles north of Durham, 94 north of York, 63 ſouth by eaſt of Berwick, 60 eaſt of Carliſle, and 271 from London, ſtands at the end of the Picts wall, on the north ſide of the Tyne, over

over which it has a ſtately bridge into the biſhopric of Durham, in which its ſuburb called *Gateſide* is ſituated; for the liberties of Newcaſtle extend no farther than the great iron gate upon the bridge which has the arms of the biſhop of Durham carved on the eaſt ſide and thoſe of Newcaſtle on the weſt ſide. W. Long. 1. 27. N. Lat. 55. 3. It is admitted to have been a Roman ſtation, though no evidence at preſent appears, except at Pandon-gate, whoſe ſuperſtructure is of different workmanſhip and model from any others of the town, the arches being circular. The Carpenter's tower is alſo of Roman original. In the Saxons time it was called *Moncaſter*, from the monks here, who all fled when it was depopulated by the Danes; and afterwards *Newcaſtle*, from a caſtle built here by William the Conqueror's ſon, Robert, in 1080, to defend the country againſt the Scots, whoſe kings had this town before the Norman conqueſt, and ſometimes reſided here.—Several monaſteries and houſes were built here ſoon after the caſtle; and it was greatly enlarged and enriched by a good trade to the coaſts of Germany, and by the ſale of its coal to other parts of England; for which, and for other merchandiſe, it is become the great emporium of the north of England, it being the neateſt and largeſt town in thoſe parts, next to York. In the reign of Edward I. it was burnt by the Scots; but a very rich burgher who was taken priſoner, ſoon ranſomed himſelf for a good ſum of money, and began the firſt fortifications of the place, which he extended from Sand-gate to Pampedon, and thence to the Auſtin friars gate; which the townſmen finiſhed, and encompaſſed with ſtout walls, which extended two miles, wherein are ſeven gates and many turrets, with ſeveral caſements bomb-proof. To which two other gates were added in more modern times, viz. Bridge-gate and Sand-gate: the wall between them was afterwards removed to open the quay. Edward III. granted the corporation the duties and cuſtoms of the town for ſeven years, to enable them to complete the fortification. It is a borough at leaſt as ancient as King Richard II. who granted that a ſword ſhould be carried before the mayor; and King Henry VI. made it a town and county incorporate of itſelf, independenent of Northumberland. Henry VII. built a monaſtery here for the Franciſcans. Beſides which, it had ſeveral religious foundations, ſeveral of which ſtructures have been converted to companies halls and private reſidences. In the reign of Henry VIII. this place is ſaid to have exceeded in the ſtrength and magnificence of its works all the cities of England, and moſt places in Europe. The town is governed by a mayor, 12 aldermen, a recorder, ſheriff, town clerk, a clerk of the chambers, two coroners, eight chamberlains, a ſword-bearer, a water bailiff, and ſeven ſerjeants at mace. Its ſituation, eſpecially the moſt buſy part of it towards the river, is very uneven, it being built on the declivity of a ſteep hill, and the houſes very cloſe. The caſtle overlooks the whole town. That part built by Robert was of great ſtrength, and ſquare, and ſurrounded by two walls; the ſquare was 62 feet by 54, and the walls 13 feet thick, within which was a chapel. The outward fortifications are now defaced, and their ſite crowded with buildings. The tower remains entire, and ſituated on a lofty eminence, and its principal entrance is to the ſouth. This caſtle belongs to the county, and makes no part of the liberties.—It is now the county priſon, and in the great hall the judges hold the aſſizes. Here Baliol king of Scotland did homage to King Edward I. in 1292: as did Edward Baliol in 1334 to King Edward III. Here is a magnificent exchange and a cuſtomhouſe; and a very fine quay. There is a handſome manſion houſe for the mayor, who is allowed 1000l. a-year, for his table, beſides a coach and barge. The old bridge was carried away in a flood, and the preſent was erected about 1775, of nine noble elliptic arches. With the old bridge 22 houſes were thrown down, and ſix lives loſt. It was originally built of wood; but having been deſtroyed by fire in 1248, was rebuilt of ſtone, and conſiſted of 12 arches, three of which on the north ſide were cloſed up, and ſerved for cellars: this was again rebuilt about 1450, and was crowded with wooden buildings; but near the middle was a tower with an iron gate, uſed as a town priſon. A ſtrong building croſſed the bridge, which was uſed as a magazine. On the ſouth front was a ſtatue of King Charles II. The water which deſtroyed this bridge, on November 11. 1771, was upwards of 12 feet above high water mark in ſpring tides.—On removing the foundations of the piers of the old bridge to erect the preſent, by obſervations made, and medals found, part of it is ſuppoſed to have exiſted from the time of the Romans. It is computed that above 6000 keelmen are employed here, who have formed themſelves into a friendly ſociety; and, by their own contributions, built a noble hoſpital containing 50 chambers, for ſuch of their fraternity as are poor, diſabled, or paſt their labour; and it is ſupported by the contribution of thoſe that are in health. The town is extremely populous; and, notwithſtanding the multitude of thoſe employed in and about the coal pits, with which the town is in a manner ſurrounded, has abundance of poor; but it has alſo many wealthy inhabitants, and it is ſaid they pay above 4000l. a-year to their relief. It is obſerved, that this town has the greateſt public revenue in its own right as a corporation, of any town in England, it being computed at no leſs than 8000l. a-year. In 1774, the receipts of the corporation were 20,360l. 9s. 8d.; and their diſburſements about 19,445l. The number of inhabitants is about 36,891, excluſive of a number of ſeamen who cannot be accurately eſtimated. Here are four churches or chapels. That of St Nicholas is the mother church, a curious fabric, built cathedral-wiſe by David king of Scots, 240 feet long, 75 broad, and proportionably high, with a tower ſteeple 194 feet in height, of Gothic architecture; alſo St Andrew's, St John's, and All Saints, lately rebuilt on the ſite of the old ſtructure, of a circular form. Here are alſo ſeveral meeting houſes, and four charity ſchools for 300 children; a fine hall for the ſurgeons, and a large priſon called *Newgate;* alſo an hoſpital for lunatics, another for the lying in of married women, as well as a fund raiſed for the relief of thoſe who are delivered at their own houſes. Here is a well endowed and large infirmary, and an aſſembly room that attracts attention, containing every uſeful apartment, and a ball room 93 feet by 40: The front is ornamented with ſix Ionic pillars, &c. In another part of the town is a new theatre. Here is a very neat ſet of baths. A free grammar ſchool was granted by James I. from an old foundation

Newcaſtle on Tyne

of St Mary's hoſpital, in the veſtry room of whoſe chapel is the election of the officers of the corporation. There were formerly ſeveral palaces in this city, viz. Pampedon hall, Lumley place, Earl's Place, Northumberland houſe, Weſtmoreland place, &c. The free maſons have lately erected an elegant hall, richly ornamented, to hold their lodge in, near High friar chair, capable of holding above 4000 of that ancient fraternity. Here is an hoſpital for 39 decayed freemen and their widows; and another for three clergymen's widows and three merchants widows. The Maidens hoſpital, built in 1753, is endowed with 2400l. for ſix maiden women and ſix poor men. Dr Thomlin, a prebendary of St Paul's, and rector of Whicham in the biſhopric of Durham, gave a library of above 6000 valuable books to the corporation, and ſettled a rent charge of 5l. a-year for ever for buying new ones; and Sir Walter Blacket, formerly one of its repreſentatives in parliament, built a neat repoſitory for them, and ſettled 25l. a-year for ever on a librarian. The upper or north part of the town, inhabited by the politer ſort of people, is much pleaſanter than that part next the river, and has three level, well built, and ſpacious ſtreets. The river all the way up from Shields to Newcaſtle is broad, the channel ſafe, and the tide flows with a ſtrong current to the town, and far beyond it. In the beginning of the civil wars, this town was taken and plundered by the *Scotch fanatics*, who here ſold their king, Charles I. for 200,000l. in hand, and ſecurity for as much more. The glaſs works are very curious, and have more buſineſs of the fine ſort than moſt other places: the duty on this article drawn by government is ſaid to amount to 200,000l. annually. Beſides, it has a conſiderable manufacture of broad and narrow cloths, and ſeveral ſoap boileries; and this place is famous for grindſtones, for which there is ſuch a demand, that ſcarce a ſhip ſtirs without them; from whence came the proverb, "That a Scotſman and a Newcaſtle grindſtone travel all the world over." Ships fit for the coal trade are built here to perfection, with great ſtrength. Here is a conſiderable manufactory of hardware and wrought iron, after the manner of that at Sheffield.—Its markets are on Tueſdays and Saturdays. Its fairs in Auguſt, which laſt nine days, and October 29th, which laſt nine days. By an act of Queen Mary, the price of the carriage of goods hither from London by waggons was ſettled at 2d. per lib. London alone is ſaid to conſume at leaſt 766,887 chaldrons of its coal every year; but as for the fiſh vended in that city by the name of *Newcaſtle ſalmon*, it is more properly called *Berwick ſalmon*, the freſh ſalmon being taken near 50 miles farther, as far as the Tweed, and brought on the backs of horſes to Shields, where it is cured, pickled, and ſent on board for London. It is worth remembering, that at the aſſizes here in 1743, two old men were ſubpœna'd hither as witneſſes from a neighbouring village, viz. one 135 years of age, and his ſon 95, both hearty, and having their ſight and hearing; and that in 1744, one Adam Turnbull died in this town aged 112, who had had four wives, the laſt of whom he had married when he was near 100 years old.

The annual amount of the revenue of cuſtoms at this port, which Mr Brand in his Hiſtory of Newcaſtle ſtates at 41,000l. is now very conſiderably upwards of 70,000l.

Newcaſtle on Tyne, Newcaſtle.

The coals carried out of it annually (on an average from 1785 to 1791) were nearly 448,000 Newcaſtle chaldrons; the weight of which is 1,187,200 tons. The following are the exports of coals from the Tyne for the years annexed.

Years.	Coaſt ways.	Over ſea.	Plantations.
1802	494,488	41,157	2844
1803	505,137	42,808	1516
1804	579,929	48,737	3852
1805	552,827	47,213	2360

The number of perſons employed in the coal trade of the rivers Tyne and Wear in 1792 exceeded 64,000.

The manufacture of earthen ware is greatly increaſed, and carried on to great perfection in its neighbourhood, in ſeven potteries; and their produce exported hence to foreign parts, as well as to the different ports of this kingdom; ſome of which potteries conſtantly employ upwards of 100 perſons, men, women, and children.

New works of conſiderable extent for the manufacture of iron have been eſtabliſhed; as alſo a very capital manufactory for white lead, milled lead, &c. Independent of red and white lead, the quantity of lead exported from the river Tyne during four years was as follows.

Years.	Tons.	Cwt.
1802	8609	18
1803	6364	6
1804	10352	2
1805	9163	3

The trade with the Weſt India iſlands is increaſing, and may in time become very conſiderable; as the port has great advantages, in being able to ſupply on the cheapeſt terms many articles wanted in thoſe iſlands; ſuch as coals, grindſtones, lime, bricks, tiles, iron wares, &c.; and is moſt advantageouſly ſituated for the re-exportation of the Weſt India produce to the ports on the Baltic, to Germany, the United Provinces, Flanders, and part of France; and moreover, the riſk of navigation, and the rate of inſurance, not being greater than between thoſe iſlands and Liverpool, and ſome other ports on the weſtern coaſt of this kingdom.

The population of Newcaſtle in 1801 exceeded 28,000, and it is daily increaſing in inhabitants and opulence. It has long been noted for hoſpitality and good living. Great improvements have been made in the town, by opening new ſtreets, and paving the principal ones, in the ſame manner as in London. To the liſt of public edifices of modern erection, and mentioned above, viz. the grand aſſembly rooms, and the elegant theatre, which were built by ſubſcription, and the ſuperb pariſh church of All Saints, built at a very great expence by the pariſhioners, may be added a commodious riding houſe, built alſo by ſubſcription.

Newcastle, a borough town of Ireland, in the county of Dublin, and province of Leinſter, which returns two members to parliament, and holds two fairs, 9th of May and 8th of October.

Newcastle is alſo the name of a handſome town

in

in the county of Limerick and province of Munſter, on the high road to Kerry, 114 miles from Dublin. Here was a religious houſe poſſeſſed by the knights templars. It is ſaid, they uſed ſome barbarous cuſtoms which greatly diſguſted the Iriſh, who, watching a favourable opportunity, attacked a number of the knights riding out together and put them to death; the place is ſtill remembered where their remains were interred. This order was ſuppreſſed in the famous council of Vienna, 22d of March 1312. Newcaſtle conſiſts of a large ſquare where markets and fairs are held; on the northern ſide ſtands a market houſe, with an aſſembly room; on the ſouth ſide is the church, which is the neateſt in the county; it was finiſhed in 1777 at the ſole expence of Lord Courtenay. It ſtands cloſe to the walls and fortifications of the knights templars, of which one of the caſtles is fitted up for Lord Courtenay's agent.

NEWCASTLE, a ſmall town in America, 35 miles below Philadelphia, on the weſt bank of Delaware river. It was firſt ſettled by the Swedes about the year 1627, and called *Stockholm*. It was afterwards taken by the Dutch, and called *New Amſterdam*. When it fell into the hands of the Engliſh, it was called by its preſent name. It contains about 60 houſes, which have the aſpect of decay, and was formerly the ſeat of government. This is the firſt town that was ſettled on Delaware river.

NEWCASTLE, *Duke of*. See CAVENDISH.

NEW England. See *ENGLAND, New*.

NEW Foreſt of Hampſhire in England, is a tract of at leaſt 40 miles in compaſs, which had many populous towns and villages, and 36 mother churches, till it was deſtroyed and turned into a foreſt by William the Conqueror. There are nine walks in it; and to every one a keeper, under a lord warden, beſides two rangers, and a bow-bearer. As this large tract lay many ages open and expoſed to invaſions from foreigners, King Henry VIII. built ſome caſtles in it; and it has now ſeveral pretty towns and villages. It is ſituated in that part of Hampſhire which is bounded on the eaſt by Southampton river, and on the ſouth by the Britiſh channel. It poſſeſſes advantages of ſituation, with reſpect to the convenience of water carriage and nearneſs to the dock yards, ſuperior to every other foreſt, having in its neighbourhood ſeveral ports and places of ſhelter for ſhipping timber, among which Lymington is at the diſtance of only two miles, Bewley about half a mile, and Redbridge three or four miles from the foreſt; and the navigation to Portſmouth, the moſt conſiderable dock yard in this kingdom, is only about 30 miles from the neareſt of thoſe places. This is the only foreſt belonging to the crown of which the origin is known. Doomſday-book contains the moſt diſtinct account of its afforeſtation by William the Conqueror: the contents of every field, farm, or eſtate afforeſted, in hides, carucates, or virgates, by which the extent of land was then computed, together with the names of the hundreds and villages, and of the former proprietors (which are for the moſt part Saxon), the rent or yearly value of each poſſeſſion, and the tax which had been paid for it to the crown during the reign of Edward the Confeſſor, before the inhabitants were expelled, and that part of the country laid waſte, are all to be found in that moſt curious and venerable record. Wiſhing to diſcover the original extent of the foreſt, we extracted, for our own information, all that relates to it in that ancient ſurvey. The extract is far too voluminous for inſertion. The names of many of the places having been changed ſince that time, it is difficult to aſcertain with preciſion what were then the limits of the foreſt. The oldeſt perambulation we have met with is among the Pleas of the Foreſt, in the eighth year of King Edward I. preſerved in the Chapter-houſe at Weſtminſter. The boundaries there deſcribed include all the country from Southampton river on the eaſt to the Avon on the weſt, following the ſea coaſt as far as the ſouthern boundary between thoſe rivers, and extending northwards as far as North Chadeford, or North Charford, on the weſt, and to Wade and Orebrugg, or Owerbridge, on the eaſt; and the greateſt part, if not the whole, of that extenſive diſtrict, is mentioned in Doomſday book to be the foreſt belonging to the crown. Another perambulation was however made in the 29th of the ſame king, which leaves out a great part of the country contained within the former. This perambulation, which is preſerved in the Tower of London, confines the foreſt to limits which, as far as we can trace them, appear to have been followed in the 22d year of Charles II. when the foreſt was again perambulated. By the *Charta de Foreſta*, all lands not belonging to the crown which had been afforeſted by Henry II. Richard I. or King John, were to be diſafforeſted; but as no proviſion was made for the reduction of the more ancient afforeſtations, it is eaſy to account for the great diminution of this foreſt in the reign of Edward I. who was not a prince likely to ſubmit to any encroachment on his rights. The perambulation of the 22d of Charles II. is the laſt which we find on record: it contains the preſent legal bounds of the foreſt, and was given to the ſurveyors as their guide, in taking the plan which they have made lately by direction. From that plan, with the approbation of the lords commiſſioners of his majeſty's treaſury, an engraving was made. According to the laſt-mentioned perambulation and the plan, the foreſt extends from Godſhill on the north-weſt to the ſea on the ſouth eaſt, about 20 miles; and from Hardley on the eaſt to Ringwood on the weſt, about 15 miles; and contains within thoſe limits about 92,365 acres ſtatute meaſure. The whole of that quantity, however, is not foreſt land, or now the property of the crown: there are ſeveral manors and other conſiderable freehold eſtates within the perambulation, belonging to individuals, to the amount of about 24,797 acres; about 625 acres are copyhold or cuſtomary lands belonging to his majeſty's manor of Lyndhurſt; about 1004 acres are leaſe hold under the crown, granted for certain terms of years, and forming part of the demiſed land revenue, under the management of the ſurveyor-general of crown lands; about 901 acres are purpreſtures or encroachments on the foreſt; about 1193 acres more are encloſed lands held by the maſter-keepers and groom-keepers, with their reſpective lodges; and the remainder, being about 63,845 acres, are woods and waſte lands of the foreſt. To perpetuate the ſpot where William Rufus was killed by the glance of an arrow ſhot at a ſtag, a triangular ſtone was erected in 1745. George III. viſited

ſited this ſpot in 1789. In Auguſt 1782, a curious ancient golden croſs was found here by a labouring man digging turf. It weighed above an ounce of gold, and had on one ſide an engraving of our Saviour, and on the other, the ladder, ſpear, nails, and other emblems of his ſufferings.

NEW Holland. See *HOLLAND, New*.

NEW York. See *YORK, New*.

NEW Zealand. See *ZEALAND, New*.

NEW Years Gifts, preſents made on the firſt day of the new year. Nonius Marcellus refers the origin of this cuſtom among the Romans to Tatius king of the Sabines, who reigned at Rome conjointly with Romulus, and who having conſidered as a good omen a preſent of ſome branches cut in a wood conſecrated to *Strenia*, the goddeſs of ſtrength, which he received on the firſt day of the new year, authorized this cuſtom afterwards, and gave to theſe preſents the name of *ſtrenæ*. However this may be, the Romans on that day celebrated a feſtival in honour of Janus, and paid their reſpects at the ſame time to Juno; but they did not paſs it in idleneſs, leſt they ſhould become indolent during the reſt of the year. They ſent preſents to one another of figs, dates, honey, &c. to ſhow their friends that they wiſhed for a happy and agreeable life. Clients, that is to ſay, thoſe who were under the protection of the great, carried preſents of this kind to their patrons, adding to them a ſmall piece of ſilver. Under Auguſtus, the ſenate, the knights, and the people, preſented ſuch gifts to him, and in his abſence depoſited them in the capitol. Of the ſucceeding princes ſome adopted this cuſtom and others aboliſhed it; but it always continued among the people. The early Chriſtians condemned it, becauſe it appeared to be a relick of Paganiſm and a ſpecies of ſuperſtition; but when it began to have no other object than that of being a mark of veneration and eſteem, the church ceaſed to diſapprove it.

NEWEL, in architecture, is the upright poſt which a pair of winding ſtairs turn about; this is properly a cylinder of ſtone, which bears on the ground, and is formed by the end of the ſteps of the winding ſtairs.

NEWFIDLER-SEA, a lake in Hungary, 17 miles in length and 6 in breadth.

NEWFOUNDLAND, a large iſland of North America, belonging to Great Britain, lying between 46. 50. and 51. 30. N. Lat. and between 53. 30. and 58. 20. W. Long. from London. The form is that of an irregular triangle, the baſe or ſouth ſide being 80 leagues in extent; the eaſt ſide is the longeſt; and the whole circumference about 150 leagues. It is bounded on the north by the ſtraits of Belleiſle, which ſeparate it from Labrador; on the eaſt and ſouth it hath the Atlantic ocean, and on the weſt the gulf of St Lawrence. The climate is rather ſevere; and the ſoil, at leaſt on the ſea coaſt, which is all that we know of it, is poor and barren. A few kitchen vegetables, with ſtrawberries and raſpberries, are all its produce. The country within land is mountainous, and abounds with timber; there are ſeveral rivers which are plentifully ſtored with various ſorts of fiſh, abundance of deep bays, and many good ports. St John's and Placentia are the two principal ſettlements, and at each of theſe there is a fort; the number of people who remain here in the winter hath been computed at 4000. The French, by the treaty of Utrecht, were permitted to fiſh from Cape Bonaviſta on the eaſt ſide round the north of the iſland to Point Rich on the weſt; and by the treaty of Paris, they are allowed the iſles of St Pierre and Miquelon, upon which they are to dry their fiſh, but not to erect fortifications of any kind.

The great importance of this place ariſes from its fiſhery, which is in part carried on by the inhabitants at the ſeveral harbours, which are about 20 in number, who take vaſt quantities of cod near the coaſt, which they bring in and cure at their leiſure, in order to have it ready for the ſhips when they arrive. But the great and extenſive fiſhery is on the banks at ſome diſtance from the iſland. The great bank lies 20 leagues from the neareſt point of land from the latitude 41° to 49°, ſtretching 300 miles in length and 75 in breadth.—To the eaſt of this lies the Falſe Bank; the next is ſtyled *Vert*, or *the Green Bank*, about 240 miles long, and 120 over; then Banquero, about the ſame ſize; the ſhoals of Sand Iſland, Whale Bank, and the Bank of St Peter's, with ſeveral others of leſs note, all abounding with fiſh.

The cod are caught only by a hook; an expert fiſher will take from 150 to 300 and upwards in a day; for the fiſh never bite in the night: the labour is very great. The ſeaſon is from May to October, in the height of which there are from 500 to 700 ſail upon the banks at a time. The fiſh caught in the ſpring months are beſt; they are cured in very different ways. Some are ſtyled *white fiſh*, others *mud fiſh*, which are ſtowed and ſalted in the hold, and will not keep long; but the beſt and moſt valuable are the dried cod. The quantity taken is prodigious: yet in ſome ſeaſons and in different places varies conſiderably, as the fiſh frequently change their ſtations. The *fiſhing ſhips*, as they are called, lie upon the banks, with the help of their boats take and cure their own fiſh, and as ſoon as they are full ſail for a market. The ſack ſhips proceed directly to the iſland, where they purchaſe fiſh from the inhabitants either by barter or bills of exchange. The principal markets for cod are Spain, Portugal, Italy, and the Weſt Indies. The value of this fiſhery is computed at ſome hundred thouſand pounds annually; employing, beſides ſeveral hundred ſhips, ſome thouſands of ſeamen, and affording a maintenance to a number of tradeſmen of different occupations, by which many large towns on the weſt ſide of England accumulate much wealth, and at the ſame time contribute in many reſpects to the benefit of the public.

The great utility of this fiſhery was very early ſeen, and very vigorouſly purſued; for in the beginning of the reign of King James I. we had two hundred and fifty ſail employed therein. It is computed, that three quintals of wet fiſh make one quintal of dried cod. Beſides, the livers of every hundred quintals make a hogſhead of oil; and excluſive of theſe there are many leſſer adventages that go in diminution of the expence. The fiſhery, as we have ſaid above, produces differently in different ſeaſons; but it is judged to be a very good one when it produces 300,000 quintals of fiſh and 3000 barrels of oil, both equally ſaleable and valuable commodities. As every ſhip carries twelve, and each of their boats eight men, and as theſe return home in ſixth months, there cannot be a more noble nurſery for ſeamen. The artificers and traders employed in building, victualling, and repairing theſe veſſels, are very numerous in the reſpective ports from which they ſail. Theſe circumſtances juſtify the particular attention paid by government to this branch of the public ſervice; in reſpect to which that they may be well informed, an annual and very diſtinct account, by which the whole is ſeen at one view, is delivered by the proper officer to the governor of Newfoundland, that is, to the commodore of his majeſty's ſquadron. Mr Pennant, in the appendix to his Arctic Zoology, gives us, from what appears to be very good authority, the following account of this iſland.

"Within the circuit of 60 miles of the ſouthern part, the country is hilly, but not mountainous. The hills increaſe in height as they recede from the ſea; their courſe is irregular, not forming a chain of hills, but riſing and falling abruptly. The coaſts are high, and the ſhores moſt remarkably bold. The ſame may be ſaid of almoſt every part of this vaſt iſland. The country is much wooded, and the hills (ſuch as have not flat tops to admit the rain to ſtagnate on them) are clothed with birch, with hazel, ſpruce, fir, and pine, all ſmall; which is chiefly owing to the inhabitants taking off the bark to cover the fiſh ſtages. This peninſula is ſo indented by the fine and deep bays of Placentia, St Mary, Conception, and Trinity, that it may be penetrated in all parts, which is done for the ſake of fowling, or the procuring of ſpars for maſts, oars, &c. The iſland is on all ſides pierced with deep bays, which peninſulate it in many places by iſthmuſes moſt remarkably narrow.—The mountains on the ſouth-weſt ſide, near the ſea, are very high, and terminate in lofty headlands; ſuch are Chapeau Rouge, a moſt remarkably high promontory, Cape St Mary's, and Cape le Hune. Such in general is the formation of the iſland; on the north-eaſt, moſt of the hills in the interior part of the country terminate pyramidically, but form no chain. The interior parts of the country conſiſt chiefly of moraſſes, or dry barren hummocks, or level land, with frequent lakes or ponds, and in ſome places covered with ſtunted black ſpruce. The rivers of Newfoundland are unfit for navigation, but they are of uſe in floating down the wood with the ſummer floods. Still the rivers and the brooks are excellent guides for the hunters of beavers and other animals, to penetrate up the country, which as yet has never been done deeper than 30 miles. Near the brooks it is that timber is commonly met with, but ſeldom above three or four miles inland, and in valleys; the hills in the northern diſtrict being naked and barren.

"In ſome parts of Newfoundland there is timber ſufficiently large for the building of merchant ſhips: the hulk is made of juniper, and the pine furniſhes maſts and yards; but as yet none has been found large enough for a maſt for a large cutter. The fiſhery is divided into two ſeaſons; that on the ſhore, or the ſhore ſeaſon, commences about the 20th of April, and ends about the 10th of October; the boats fiſh in from four to 20 fathoms of water. The moſt important, the bank fiſhing ſeaſon, begins the 10th of May, and continues till the laſt of September, and is carried on in 30 to 45 fathoms deep of water. Banking veſſels have failed from St John's to the bank as early as the 12th of April. At firſt they uſe pork or birds for a bait; but as they catch fiſh, they ſupply themſelves with a ſhell fiſh called clams, which is found in the belly of the cod. The next bait is the lobſter; after that the herring and the launce, which laſt till June, when the capelan comes on the coaſt, and is another bait. In Auguſt the ſquid comes into uſe, and finally the herring again. The greateſt number of cod fiſh taken by a ſingle fiſherman in the ſeaſon has been 12,000, but the average is 7000. The largeſt fiſh which has been taken was four feet three inches long, and weighed 46 pounds. A banking veſſel of 10,000 fiſh ought to be filled in three weeks, and ſo in proportion; and 80 quintals (112lb. each) for a boat in the ſame time.

"In 1785, 541 Engliſh veſſels fiſhed on the bank, a number exceeding that of the French. A heap of dried fiſh, 20 feet long and ten wide, and four deep, contains 300 quintals. Such a heap ſettles, in the courſe of 48 hours after it is made, about $\frac{1}{12}$. An extraordinary ſplitter will ſplit five quintals of fiſh in an hour. The average in that time is two. There is no fiſhing during winter, on account of the inclemency of the ſeaſon. It is ſuppoſed that the fiſh in a great meaſure quit the banks before that time, as in general they are very ſcarce when the fiſhing veſſels go upon the banks early in the ſpring.

"There are a few ſmall towns on the coaſts, which have gardens ſown with Engliſh pulſe; but many of the inhabitants quit the country in winter.

"An admiral or ſome ſea officer is generally governor of Newfoundland."

NEWMARKET, in Cambridgeſhire, 13 miles from Cambridge, 13 from St Edmundſbury, and 60 from London, is a town with one long ſtreet, the north ſide in Suffolk, the ſouth ſide in Cambridgeſhire. It is a healthy place, and a great thoroughfare in the road from London to Norfolk; but ſtands moſtly by the horſe races every year in April and October, here being the fineſt courſe in England; on which there is a houſe for the king when he comes to the races, which was built by Charles II. The king gives a plate or two every year, beſides thoſe given by the nobility; and wagers are laid upon the horſes, which are ſeldom under 500l. and often above 1000l. Here are two coffeehouſes, at which, every night and morning during the races, there is gaming, as there is alſo at the houſes of the nobility and gentry. Here are alſo cock matches. Here is a little chapel, which is a chapel of eaſe to the mother church at Ditton; and another in the Suffolk ſide, which is parochial. The town was burnt in 1683, but ſoon rebuilt; and in 1801 contained 1792 inhabitants.

NEWROSS, a borough town in the county of Wexford, and province of Leinſter in Ireland, 67 miles from Dublin. This town was formerly walled, and ſome of the gates ſtill remain. It lies on the river Barrow, which is here very deep, and ſhips of burden can come up to the quay even when the tide is out. The church is large, but the cuſtomhouſe and quay are both ſmall, and ſometimes overflooded many feet. It is one of the ſtaple ports for exporting wool, yet its trade is but inconſiderable; beef and butter are the principal articles exported. Here is a barrack for a troop of horſe, and a good ferry into the county of Kilkenny. Near this town is a charter ſchool. It is alſo a poſt town, and gives title of earl to the family of Gore. It was formerly fortified, and adorned with

with many religious houſes, among which was a crouched friary, built on the ſummit of a hill in the town; but one of the friars having killed a principal inhabitant, the whole body of the people aroſe, put the friars to death, and totally deſtroyed the friary; on the ſite of which the monaſtery of St Saviour, for conventual Franciſcans, was afterwards erected by Sir John Devereux; and the eaſt end of this laſt building is now the pariſh church. A friary for Eremites, following the rule of St Auguſtine, was alſo founded here in the reign of Edward III.

NEWSPAPERS, periodical publications, daily, weekly, &c. for the purpoſe of communicating to the world every thing of importance, whether political or literary, &c. which is going on. They have tended much to the diſſemination of learning, and have ſerved many other valuable purpoſes; and while they are carried on with candour, impartiality, and ability, they are unqueſtionably a great national benefit. When this, however, is not the caſe, and it often happens, they diſgrace their authors, and are highly injurious to the public. They were firſt publiſhed in England, Auguſt 22. 1642. *Journal de Sçavans*, a French paper, was firſt publiſhed in 1665, though one was printed in England, under the title of the *Public Intelligencer*, by Sir Roger L'Eſtrange, 1663, which he dropped, on the publication of the firſt London Gazette. Newſpapers and pamphlets were prohibited by royal proclamation 1680. Though at the Revolution prohibitions of this kind were done away, and the preſs ſet at liberty, yet newſpapers were afterwards made objects of taxation, and for this purpoſe were firſt ſtamped in 1713. The number of them, however, gradually increaſed; and there were printed in the whole kingdom during the years 1775, 12,680,000; 1776, 12,830,000; 1777, 13,150,642; 1778, 13,240,059; 1779, 14,106,842; 1780, 14,217,371; 1781, 14,397,620; 1782, 15,272,519. They are now ſtill more numerous. The average number of newſpapers printed in England at the cloſe of the reign of George II. was 9,464,790. The number in 1790, was 14,035,639; in 1792, it was 15,005,760. *Chalmers' Life of Ruddiman*, p. 442.

NEW STYLE, firſt uſed in England in 1753, was introduced into the weſtern world by Pope Gregory XIII. See CHRONOLOGY, N° 24.

NEWT, or EFT, the common lizard. See LACERTA, ERPETOLOGY *Index*.

NEWTON, SIR ISAAC, one of the greateſt philoſophers and mathematicians the world has ever produced, was the only child of Mr John Newton of Coleſworth, not far from Grantham in Lincolnſhire, who had an eſtate of about 120l. per annum, which he kept in his own hands. He was born at that place on Chriſtmas day 1642. His father dying when he was young, his mother's brother, a clergyman of the name of *Ayſcough*, or *Aſkew*, who lived near her, and directed all her affairs after the death of Mr Newton, put her ſon to ſchool at Grantham. When he had finiſhed his ſchool learning, his mother took him home, intending, as ſhe had no other child, to have the pleaſure of his company; and that he, as his father had done, ſhould occupy his own eſtate. But his uncle happening to find him in a hay loft at Grantham working a mathematical problem, and having otherwiſe obſerved the boy's mind to be uncommonly bent upon learning, he prevailed upon her to part with him; and ſhe ſent him to Trinity College in Cambridge, where her brother, having himſelf been a member of it, had ſtill many friends. Iſaac was ſoon taken notice of by Dr Iſaac Barrow; who, obſerving his bright genius, contracted a great friendſhip for him. M. de Fontenelle tells us, "That in learning mathematics he did not ſtudy Euclid, who ſeemed to him too plain and ſimple, and unworthy of taking up his time. He underſtood him almoſt before he read him; and a caſt of his eye upon the contents of his theorems was ſufficient to make him maſter of them. He advanced at once to the geometry of Des Cartes, Kepler's Optics, &c. It is certain that he had made his great diſcoveries in geometry, and laid the foundation of his two famous works, the *Principia* and *Optics*, by the time he was 24 years of age."

In 1664, he took the degree of bachelor of arts; and in 1668 that of maſter, being elected the year before, fellow of his college. He had before this time diſcovered the method of fluxions; and in 1669 he was choſen profeſſor of mathematics in the univerſity of Cambridge, upon the reſignation of Mr Barrow. The ſame year, and the two following, he read a courſe of optical lectures in Latin, in the public ſchools of the univerſity; an Engliſh tranſlation of which was printed at London in 1728, in 8vo, as was the Latin original the next year in 4to. From the year 1671 to 1679, he held a correſpondence by letters with Mr Henry Oldenburg ſecretary of the Royal Society, and Mr John Collins fellow of that ſociety; which letters contain a variety of curious obſervations.

Concerning the origin of his diſcoveries, we are told, that as he ſat alone in a garden, the falling of ſome apples from a tree led him into a ſpeculation on the power of gravity; that as this power is not diminiſhed at the remoteſt diſtance from the centre of the earth to which we can riſe, it appeared to him reaſonable to conclude, that it muſt extend much farther than was uſually thought; and purſuing this ſpeculation, by comparing the periods of the ſeveral planets with their diſtances from the ſun, he found, that if any power like gravity held them in their courſes, its ſtrength muſt decreaſe in the duplicate proportion of the increaſe of diſtance. This inquiry was dropped; but reſumed again, and gave riſe to his writing the treatiſe which he publiſhed in 1687, under the name of *Mathematical Principles of Natural Philoſophy*; a work looked upon as the production of a celeſtial intelligence rather than of a man. The very ſame year in which this great work was publiſhed, the univerſity of Cambridge was attacked by King James II. when Mr Newton was one of its moſt zealous defenders, and was accordingly nominated one of the delegates of that univerſity to the high-commiſſion court; and the next year he was choſen one of their members for the convention parliament, in which he ſat till it was diſſolved. In 1696, Mr Montague, then chancellor of the exchequer, and afterwards earl of Halifax, obtained for him of the king the office of warden of the mint; in which employment he was of ſignal ſervice, when the money was called in to be recoined. Three years after, he was appointed maſter of the mint; a place of very conſiderable profit, which he held till his death. In 1699, he was elected one of the members of the Royal Academy of Sciences at Paris. In 1701, he was a ſecond

Newton.

time choſen member of parliament for the univerſity of Cambridge. In 1704, he publiſhed his *Optics;* which is a piece of philoſophy ſo new, that the ſcience may be conſidered as entirely indebted to our author. In 1705, he was knighted by Queen Anne. In 1707, he publiſhed his *Arithmetica Univerſalis.* In 1711, his *Analyſis per Quantitatum Series, Fluxiones et Differentias,* &c. was publiſhed by William Jones, Eſq. In 1712, ſeveral letters of his were publiſhed in the *Commercium Epiſtolicum.* In the reign of George I. he was better known at court than before. The princeſs of Wales, afterwards queen conſort of England, uſed frequently to propoſe queſtions to him, and to declare that ſhe thought herſelf happy to live at the ſame time with him, and have the pleaſure and advantages of his converſation. He had written a treatiſe of ancient chronology, which he did not think of publiſhing; but the princeſs deſired an abſtract, which ſhe would never part with. However, a copy of it ſtole abroad, and was carried into France, where it was tranſlated and printed, with ſome obſervations, which were afterwards anſwered by Sir Iſaac. But, in 1728, the Chronology itſelf was publiſhed at London in quarto; and was attacked by ſeveral perſons, and as zealouſly defended by Sir Iſaac's friends. The main deſign of it was to find out, from ſome tracts of the moſt ancient Greek aſtronomy, what was the poſition of the colures with reſpect to the fixed ſtars, in the time of Chiron the centaur. As it is now known that theſe ſtars have a motion in longitude of one degree in 72 years, if it be once known through what fixed ſtars the colure paſſed in Chiron's time, by taking the diſtance of theſe ſtars from thoſe through which it now paſſes, we might determine what number of years has elapſed ſince Chiron's time. As Chiron was one of the Argonauts, this would fix the time of that famous expedition, and conſequently that of the Trojan war; the two great events upon which all ancient chronology depends. Sir Iſaac places them 500 years nearer the birth of Chriſt than other chronologers have done.

This great man had all along enjoyed a ſettled and equal ſtate of health to the age of 80, when he began to be afflicted with an incontinence of urine. However, for the five following years, he had great intervals of eaſe, which he procured by the obſervance of a ſtrict regimen. It was then believed that he certainly had the ſtone; and when the paroxyſms were ſo violent, that large drops of ſweat ran down his face, he never uttered the leaſt complaint, or expreſſed the ſmalleſt degree of impatience; but, as ſoon as he had a moment's eaſe, would ſmile and talk with his uſual cheerfulneſs. Till then he always read and wrote ſeveral hours in a day. He had the perfect uſe of all his ſenſes and underſtanding till the day before he died, which was on the 20th of March 1726-7, in the 85th year of his age. He lay in ſtate in the Jeruſalem chamber at Weſtminſter, and on the 28th of March his body was conveyed into Weſtminſter abbey; the pall being ſupported by the lord chancellor, the dukes of Montroſe and Roxburgh, and the earls of Pembroke, Suſſex, and Macclesfield. The biſhop of Rocheſter read the funeral ſervice, being attended by all the clergy of the church. The corpſe was interred juſt at the entrance into the choir, where a noble monument is erected to his memory.

Newton.

Sir Iſaac was of a middling ſtature, and in the latter part of his life ſomewhat inclined to be fat. His countenance was pleaſing, and at the ſame time venerable. He never made uſe of ſpectacles, and loſt but one tooth during his whole life.

His temper is ſaid to have been ſo equal and mild, that no accident could diſturb it. Of this the following remarkable inſtance is related. Sir Iſaac had a favourite little dog, which he called *Diamond;* and being one day called out of his ſtudy into the next room, Diamond was left behind. When Sir Iſaac returned, having been abſent but a few minutes, he had the mortification to find, that Diamond having thrown down a lighted candle among ſome papers, the nearly finiſhed labour of many years was in flames, and almoſt conſumed to aſhes. This loſs, as Sir Iſaac was then very far advanced in years, was irretrievable; yet without once ſtriking the dog, he only rebuked him with this exclamation, "Oh! Diamond! Diamond! thou little knoweſt the miſchief thou haſt done!"

He was a great lover of peace, and would rather have choſen to remain in obſcurity than to have the calm of life ruffled by thoſe ſtorms and diſputes which genius and learning always draw upon thoſe that are peculiarly eminent for them. In contemplating his genius it preſently becomes a doubt, which of theſe endowments had the greateſt ſhare, ſagacity, penetration, ſtrength or diligence: and after all, the mark that ſeems moſt to diſtinguiſh it is, that he himſelf made the juſteſt eſtimation of it, declaring, that, if he had done the world any ſervice, it was due to nothing but induſtry and patient thought; that he kept the ſubject under conſideration conſtantly before him, and waited till the firſt dawning opened gradually, by little and little, into a full and clear light. It is ſaid, that when he had any mathematical problems or ſolutions in his mind, he would never quit the ſubject on any account. Dinner has been often three hours ready for him before he could be brought to table: and his man often ſaid, when he has been getting up in a morning, he has ſometimes begun to dreſs, and with one leg in his breeches ſat down again on the bed, where he has remained for hours before he got his clothes on. From his love of peace, no doubt, aroſe that unuſual kind of horror which he had for all diſputes; a ſteady unbroken attention, free from thoſe frequent recoilings inſeparably incident to others, was his peculiar felicity; he knew it, and he knew the value of it. No wonder then that controverſy was looked on as his bane. When ſome objections, haſtily made to his diſcoveries concerning light and colours, induced him to lay aſide the deſign he had of publiſhing his optic lectures, we find him reflecting on that diſpute, into which he was unavoidably drawn thereby, in theſe terms: "I blamed my own imprudence for parting with ſo real a bleſſing as my quiet, to run after a ſhadow." It is true this ſhadow (as Mr Fontenelle obſerves) did not eſcape him afterwards, nor did it coſt him that quiet which he ſo much valued, but proved as much a real happineſs to him as his quiet itſelf; yet this was a happineſs of his own making: he took a reſolution, from theſe diſputes, not to publiſh any more about that theory till he had put it above the reach of controverſy, by the exacteſt experiments and the ſtricteſt demonſtrations; and accordingly it has never been called in queſtion ſince. In the ſame temper, after he had ſent the manuſcript of his *Principia* to the Royal Society, with his conſent to the printing of it by them, upon Mr Hook's injuriouſly inſiſting that himſelf had demonſtrated Kepler's problem before our author, he determined, rather than be involved again in a controverſy, to ſuppreſs the third book, and was very hardly prevailed upon to alter that reſolution. It is true, the public was thereby a gainer; that book, which is indeed no more than a corollary of ſome propoſitions in the firſt, being originally drawn up in the popular way, with the deſign to publiſh it in that form; whereas he was now convinced that it would be beſt not to let it go abroad without a ſtrict demonſtration.

After all, notwithſtanding his anxious care to avoid every occaſion of breaking his intenſe application to ſtudy, he was at a great diſtance from being ſteeped in philoſophy: on the contrary, he could lay aſide his thoughts, though engaged in the moſt intricate reſearches, when his other affairs required his attendance; and as ſoon as he had leiſure, reſume the ſubject at the point where he had left off. This he ſeems to have done not ſo much by any extraordinary ſtrength of memory, as by the force of his inventive faculty, to which every thing opened itſelf again with eaſe, if nothing intervened to ruffle him. The readineſs of his invention made him not think of putting his memory much to trial: but this was the offspring of a vigorous intenſeneſs of thought, out of which he was but a common man. He ſpent therefore, the prime of his age in thoſe abſtruſe reſearches, when his ſituation in a college gave him leiſure, and even while ſtudy was his proper profeſſion. But as ſoon as he was removed to the mint, he applied himſelf chiefly to the buſineſs of that office; and ſo far quitted mathematics and philoſophy, as not to engage in any purſuits of either kind afterwards.

The amiable quality of modeſty is repreſented as ſtanding foremoſt in the character of this great man's mind and manners. It was in reality greater than can be eaſily imagined, or will be readily believed; yet it always continued ſo without any alteration, though the whole world, ſays Fontenelle, conſpired againſt it; and let us add, though he was thereby robbed of his inventions of fluxions. Nicholas Mercator publiſhing his *Logarithmotechnia* in 1668, where he gave the quadrature of the hyperbola by an infinite ſeries, which was the firſt appearance in the learned world of a ſeries of this ſort drawn from the particular nature of the curve, and that in a manner very new and abſtracted; Dr Barrow, then at Cambridge, where Mr Newton, at that time about 26 years of age, reſided, recollected that he had met with the ſame thing in the writings of that young gentleman; and there not confined to the hyperbola only, but extended, by general forms, to all ſorts of curves, even ſuch as are mechanical; to their quadratures, their rectifications, and their centres of gravity; to the ſolids formed by their rotations, and to the ſuperficies of thoſe ſolids; ſo that, when their determinations were poſſible, the ſeries ſtopped at a certain point, or at leaſt their ſums were given by ſtated rules: and, if the abſolute determinations were impoſſible, they could yet be infinitely approximated; which is the happieſt and moſt refined method, ſays Mr Fontenelle, of ſupplying the defects of human knowledge that man's imagination could poſſibly invent. To be maſter of ſo fruitful and general a theory was a mine of gold to a geometrician; but it was a greater glory to have been the diſcoverer of ſo ſurpriſing and ingenious a ſyſtem. So that Mr Newton finding, by Mercator's book, that he was in the way to it, and that others might follow in his track, ſhould naturally have been forward to open his treaſures, and ſecure the property, which conſiſted in making the diſcovery; but he contented himſelf with his treaſure which he had found, without regarding the glory. What an idea does it give us of his unparaleled modeſty, when we ſee him declaring, that he thought Mercator had entirely diſcovered his ſecret, or that others would, before he was of a proper age for writing? His MS. upon infinite ſeries was communicated to none but Mr John Collins and the lord Brounker; and even that had not been complied with, but for Dr Barrow, who would not ſuffer him to indulge his modeſty ſo much as he deſired.

It is further obſerved, concerning this part of his character, that he never talked either of himſelf or others, nor ever behaved, in ſuch a manner as to give the moſt malicious cenſurers the leaſt occaſion even to ſuſpect him of vanity. He was candid and affable, and always put himſelf upon a level with his company. He never thought either his merit or his reputation ſufficient to excuſe him from any of the common offices of ſocial life; no ſingularities, either natural or affected, diſtinguiſhed him from other men. Though he was firmly attached to the church of England, he was averſe to the perſecution of the non-conformiſts. He judged of men by their manners; and the true ſchiſmatics, in his opinion, were the vicious and the wicked. Not that he confined his principles to natural religion, for he was thoroughly perſuaded of the truth of revelation; and amidſt the great variety of books which he had conſtantly before him, that which he ſtudied with the greateſt application was the Bible: and he underſtood the nature and force of moral certainty as well as he did that of a ſtrict demonſtration.

Sir Iſaac did not neglect the opportunities of doing good, when the revenues of his patrimony, and a profitable employment, improved by a prudent economy, put it in his power. We have two remarkable inſtances of his bounty and generoſity; one to Mr M‘Laurin, profeſſor of mathematics at Edinburgh, to whom he offered 20l. per annum, and the other to his niece Barton, on whom he ſettled an annuity of 100l. When decency upon any occaſion required expence and ſhow, he was magnificent without grudging it, and with a very good grace; at all other times, that pomp which ſeems great to low minds only, was utterly retrenched, and the expence reſerved for better uſes. He never married, and perhaps he never had leiſure to think of it. Being immerſed in profound ſtudies during the prime of his age, and afterwards engaged in an employment of great importance, and even quite taken up with the company which his merit drew to him, he was not ſenſible of any vacancy in life, or of the want of a companion at home. He left 32,000l. at his death; but made no will, which Mr Fontenelle tells us was becauſe he thought a legacy was no gift. As to his works, beſides what were publiſhed in his lifetime, there were found after his death, among his papers, ſeveral diſcourſes upon ſubjects of antiquity, hiſtory, divinity, chemiſtry,

ſtry, and mathematics, ſeveral of which were publiſhed at different times.

NEWTONIAN-Philoſophy, the doctrine of the univerſe, and particularly of the heavenly bodies, their laws, affections, &c. as delivered by Sir Iſaac Newton.

1 Different opinions concerning this philoſophy.

The term *Newtonian Philoſophy* is applied very differently; whence divers confuſed notions relating thereto. Some authors under this philoſophy include all the corpuſcular philoſophy, conſidered as it now ſtands corrected and reformed by the diſcoveries and improvements made in ſeveral parts thereof by Sir Iſaac Newton. In which ſenſe it is that Graveſande calls his elements of phyſics, *Introductio ad Philoſophiam Newtonianam.* And in this ſenſe the Newtonian is the ſame with the new philoſophy; and ſtands contradiſtinguiſhed from the Carteſian, the Peripatetic, and the ancient Corpuſcular.

Others, by *Newtonian philoſophy*, mean the method or order which Sir Iſaac Newton obſerves in philoſophizing; viz. the reaſoning and drawing of concluſions directly from phenomena, excluſive of all previous hypotheſes; the beginning from ſimple principles; deducing the firſt powers and laws of nature from a few ſelect phenomena, and then applying thoſe laws, &c. to account for other things. And in this ſenſe the *Newtonian philoſophy* is the ſame with the *experimental philoſophy*, and ſtands oppoſed to the ancient *corpuſcular.*

Others, by *Newtonian philoſophy*, mean that wherein phyſical bodies are conſidered mathematically, and where geometry and mechanics are applied to the ſolution of the appearances of nature. In which ſenſe the Newtonian is the ſame with the *mechanical* and *mathematical philoſophy*.

Others again, by *Newtonian philoſophy*, underſtand that part of phyſical knowledge which Sir Iſaac Newton has handled, improved, and demonſtrated, in his *Principia.*

Others, laſtly, by *Newtonian philoſophy*, mean the new principles which Sir Iſaac Newton has brought into philoſophy; the new ſyſtem founded thereon; and the new ſolutions of phenomena thence deduced; or that which characterizes and diſtinguiſhes his philoſophy from all others.—Which is the ſenſe wherein we ſhall chiefly conſider it.

As to the hiſtory of this philoſophy, we have nothing to add to what has been given in the preceding article. It was firſt made public in the year 1687, by the author, then a fellow of Trinity College, Cambridge, and in the year 1713, republiſhed with conſiderable improvements.—Several authors have ſince attempted to make it plainer; by ſetting aſide many of the more ſublime mathematical reſearches, and ſubſtituting either more obvious reaſonings or experiments in lieu thereof; particularly Whiſton in his *Prælect. Phyſ. Mathemat.* Graveſande in *Element. et Inſtit.* and Dr Pemberton in his *View.*

2 Definitions on which the philoſophy is founded.

The whole of the *Newtonian philoſophy*, as delivered by the author, is contained in his *Principia* or *Mathematical Principles of Natural Philoſophy.* He founds his ſyſtem on the following definitions:

1. The quantity of matter is the meaſure of the ſame, ariſing from its denſity and bulk conjunctly.—Thus air of a double denſity, in a double ſpace, is quadruple in quantity; in a triple ſpace, ſextuple in quantity, &c.

2. The quantity of motion is the meaſure of the ſame, ariſing from the velocity and quantity of matter conjunctly. This is evident, becauſe the motion of the whole is the motion of all its parts; and therefore in a body double in quantity, with equal velocity, the motion is double, &c.

3 *Vis inſita* defined and objected to.

3. The *vis inſita*, or innate force of matter, is a power of reſiſting, by which every body, as much as in it lies, endeavours to perſevere in its preſent ſtate, whether it be of reſt, or moving uniformly forward in a right line.—This definition is proved to be juſt, only by the difficulty we find in moving any thing out of its place; and this difficulty is by ſome reckoned to proceed only from gravity. They contend, that in thoſe caſes where we can prevent the force of gravity from acting upon bodies, this power of reſiſtance becomes inſenſible, and the greateſt quantities of matter may be put in motion by the very leaſt force. Thus there have been balances formed ſo exact, that when loaded with 200 weight in each ſcale, they would turn by the addition of a ſingle drachm. In this caſe 400lb. of matter was put in motion by a ſingle drachm, i. e. by $\frac{1}{31200}$ part of its own quantity: and even this ſmall weight, they ſay, is only neceſſary on account of the inaccuracy of the machine: ſo that we have no reaſon to ſuppoſe, that, if the friction could be entirely removed, it would take more force to move a tun weight than a grain of ſand. This objection, however, is not taken notice of by Sir Iſaac: and he beſtows on the reſiſting power above mentioned the name of *vis inertiæ;* a phraſe which is perhaps not well choſen, and with which inferior writers have endeavoured to make their readers merry at the expence of Newton. A *force of inactivity*, it has been ſaid, is a *forceleſs* force; and analogous to a *black white*, a *cold heat*, and a *tempeſtuous calm.*

But objections of more importance have been made to the whole of this doctrine than thoſe which merely reſpect the term *vis inertiæ.* "An endeavour to remain at reſt (we are told *) is unneceſſary, whilſt nothing attempts to diſturb the reſt. It is likewiſe impoſſible to be conceived, as it implies a contradiction. A man, by oppoſing force to force, may endeavour not to be moved; but this oppoſition is an endeavour to *move*, not with a deſign to *move*, but by counteracting another force to *prevent* being moved. An endeavour not to move therefore cannot exiſt in bodies, becauſe it is abſurd; and if we appeal to fact, we ſhall find every body in an actual and conſtant endeavour to move." It has been likewiſe obſerved, and we think juſtly, that "if bodies could *continue* to move by any innate force, they might alſo *begin* to move by that force. For the ſame cauſe which can move a body with a given velocity at one time, could do it, if preſent, at any other time; and therefore if the force by which bodies continue in motion were innate and eſſential to them, they would begin to move of themſelves, which is not true." Newton indeed ſays that this innate force is the cauſe of motion under certain circumſtances only, or when the body is acted upon by a force impreſſed *ab extra.* But if this impreſſed force do not continue as well

* *Young's Examination of the third and fourth Definitions of the firſt Book of the Principia,* &c.

as begin the motion, if it ceaſe the inſtant that the impreſſion is over, and the body continue to move by its *vis inertiæ*, why is the body ever ſtopped? "If in the beginning of the motion the body, by its innate force, overcomes a certain reſiſtance of friction and air, in any following times, the force being undiminiſhed, it will overcome the ſame reſiſtance for ever. Theſe reſiſtances, therefore, could never change the ſtate of a moving body, becauſe they cannot change the quantity of its motive force. But this is contrary to univerſal experience." For theſe reaſons we are inclined to think that bodies are wholly paſſive; that they endeavour nothing; and that they continue in motion not by any innate force or *vis inſita*, but by that force, whatever it be, which begins the motion, and which, whilſt it remains with the moving body, is gradually diminiſhed, and at laſt overcome by oppoſite forces, when the body of courſe ceaſes to move.

4. An impreſſed force is an action exerted upon a body, in order to change its ſtate, either of reſt or of moving uniformly forward in a right line.—This force conſiſts in the action only; and remains no longer in the body when the action is over. For a body maintains every new ſtate it acquires by its *vis inertiæ* only.

It is here implied, and indeed fully expreſſed, that motion is not continued by the ſame power that produced it. Now there are two grounds on which the truth of this doctrine may be ſuppoſed to reſt.

"*Firſt*, On a direct proof that the impreſſed force does not remain in the body, either by ſhowing the nature of the force to be tranſitory and incapable of more than its firſt action; or that it acts only on the ſurface, and that the body eſcapes from it; or that the force is ſomewhere elſe, and not remaining in the body. But none of theſe direct proofs are offered.

"*Secondly*, It may reſt on an indirect proof, that there is in the nature of body a ſufficient cauſe for the continuance of every new ſtate acquired; and that therefore any adventitious force to continue motion, though neceſſary for its production, is ſuperfluous and inadmiſſible. As this is the very ground on which the ſuppoſition ſtands, it ought to have been indubitably certain that the innate force of the body is ſufficient to perpetuate the motion it has once acquired, before the other agent, by which the motion was communicated, had been diſmiſſed from the office. But the innate force of body has been ſhown not to be that which continues its motion; and therefore the proof, that the impreſſed force does not remain in the body, fails. Nor indeed is it in this caſe deſirable to ſupport the proof, becauſe we ſhould then be left without any reaſon for the continuance of motion *." When we mention an impreſſed force, we mean ſuch a force as is communicated either at the ſurface of the body or by being diffuſed through the maſs.

5. A centripetal force is that by which bodies are drawn, impelled, or any way tend towards a point, as to a centre.—The quantity of any centripetal force may be conſidered as of three kinds, abſolute, accelerative, and motive.

6. The abſolute quantity of a centrifugal force is the meaſure of the ſame, proportional to the efficacy of the cauſe that propagates it from the centre, through the ſpaces round it.

7. The accelerative quantity of a centripetal force is the meaſure of the ſame, proportional to the velocity which it generates in a given time.

8. The motive quantity of a centripetal force is a meaſure of the ſame, proportional to the motion which it generates in a given time. This is always known by the quantity of a force equal and contrary to it, that is juſt ſufficient to hinder the deſcent of the body.

SCHOLIA.

4 Of Time. I. Abſolute, true, and mathematical time, of itſelf, and from its own nature, flows equably, without regard to any thing external, and, by another name, is called *duration*. Relative, apparent, and common time, is ſome ſenſible and external meaſure of duration, whether accurate or not, which is commonly uſed inſtead of true time; ſuch as an hour, a day, a month, a year, &c.

5 Space. II. Abſolute ſpace, in its own nature, without regard to any thing external, remains always ſimilar and immoveable. Relative ſpace is ſome moveable dimenſion or meaſure of the abſolute ſpaces; and which is vulgarly taken for immoveable ſpace. Such is the dimenſion of a ſubterraneous, an aerial, or celeſtial ſpace, determined by its poſition to bodies, and which is vulgarly taken for immoveable ſpace; as the diſtance of a ſubterraneous, an aerial, or celeſtial ſpace, determined by its poſition in reſpect of the earth. Abſolute and relative ſpace are the ſame in figure and magnitude; but they do not remain always numerically the ſame. For if the earth, for inſtance, moves, a ſpace of our air which, relatively and in reſpect of the earth, remains always the ſame, will at one time be one part of the abſolute ſpace into which the earth paſſes; at another time it will be another part of the ſame; and ſo, abſolutely underſtood, it will be perpetually mutable.

6 Place defined. III. Place is a part of ſpace which a body takes up; and is, according to the ſpace, either abſolute or relative. Our author ſays it is *part* of ſpace; not the ſituation, nor the external ſurface of the body. For the places of equal ſolids are always equal; but their ſuperficies, by reaſon of their diſſimilar figures, are often unequal. Poſitions properly have no quantity, nor are they ſo much the places themſelves as the properties of places. The motion of the whole is the ſame thing with the ſum of the motions of the parts; that is, the tranſlation of the whole out of its place is the ſame thing with the ſum of the tranſlations of the parts out of their places: and therefore the place of the whole is the ſame thing with the ſum of the places of the parts; and for that reaſon it is internal, and in the whole body.

7 Of Motion. IV. Abſolute motion is the tranſlation of a body from one abſolute place into another, and relative motion the tranſlation from one relative place into another. Thus, in a ſhip under ſail, the relative place of a body is that part of the ſhip which the body poſſeſſes, or that part of its cavity which the body fills, and which therefore moves together with the ſhip; and relative reſt is the continuance of the body in the ſame part of the ſhip, or of its cavity. But real abſolute

---

* *Young's Examination*, &c.

abſolute reſt is the continuance of the body in the ſame part of that immoveable ſpace in which the ſhip itſelf, its cavity, and all that it contains, is moved. Wherefore, if the earth is really at reſt, the body which relatively reſts in the ſhip will really and abſolutely move with the ſame velocity which the ſhip has on the earth. But if the earth alſo moves, the true and abſolute motion of the body will ariſe, partly from the true motion of the earth in immoveable ſpace; partly from the relative motion of the ſhip on the earth: and if the body moves alſo relatively in the ſhip, its true motion will ariſe partly from the true motion of the earth in immoveable ſpace, and partly from the relative motions as well of the ſhip on the earth as of the body in the ſhip; and from theſe relative motions will ariſe the relative motion of the body on the earth. As if that part of the earth where the ſhip is, was truly moved towards the eaſt, with a velocity of 10010 parts; while the ſhip itſelf with a freſh gale is carried towards the weſt, with a velocity expreſſed by 10 of theſe parts; but a ſailor walks in the ſhip towards the eaſt with one part of the ſaid velocity: then the ſailor will be moved truly and abſolutely in immoveable ſpace towards the eaſt with a velocity of 1001 parts: and relatively on the earth towards the weſt, with a velocity of 9 of thoſe parts.

Abſolute time, in aſtronomy, is diſtinguiſhed from relative, by the equation or correction of the vulgar time. For the natural days are truly unequal, though they are commonly conſidered as equal, and uſed for a meaſure of time: aſtronomers correct this inequality for their more accurate deducing of the celeſtial motions. It may be that there is no ſuch thing as an equable motion whereby time may be accurately meaſured. All motions may be accelerated or retarded; but the true or equable progreſs of abſolute time is liable to no change. The duration or perſeverance of the exiſtence of things remains the ſame, whether the motions are ſwift or ſlow, or none at all; and therefore ought to be diſtinguiſhed from what are only ſenſible meaſures thereof, and out of which we collect it by means of the aſtronomical equation. The neceſſity of which equation for determining the times of a phenomenon is evinced, as well from the experiments of the pendulum clock as by eclipſes of the ſatellites of Jupiter.

8
Immutability of time and ſpace.

As the order of the parts of time is immutable, ſo alſo is the order of the parts of ſpace. Suppoſe thoſe parts to be moved out of their places, and they will be moved (if we may be allowed the expreſſion) out of themſelves. For times and ſpaces are, as it were, the places of themſelves as of all other things. All things are placed in time as to order of ſucceſſion; and in ſpace as to order of ſituation. It is from their eſſence or nature that they are places; and that the primary places of things ſhould be moveable, is abſurd. Theſe are therefore the abſolute places; and tranſlations out of thoſe places are the only abſolute motions.

But becauſe the parts of ſpace cannot be ſeen, or diſtinguiſhed from one another by the ſenſes, therefore in their ſtead we uſe ſenſible meaſures of them. For, from the poſitions and diſtances of things from any body, conſidered as immoveable, we define all places; and then with reſpect to ſuch places, we eſtimate all motions, conſidering bodies as transferred from ſome of thoſe places into others. And ſo, inſtead of abſolute places and motions, we uſe relative ones; and that without any inconvenience in common affairs: but in philoſophical diſquiſitions we ought to abſtract from our ſenſes, and conſider things themſelves diſtinct from what are only ſenſible meaſures of them. For it may be, that there is no body really at reſt, to which the places and motions of others may be referred.

But we may diſtinguiſh reſt and motion, abſolute and relative, one from the other, by their properties, cauſes, and effects. It is a property of reſt, that bodies really at reſt do reſt in reſpect of each other. And therefore, as it is poſſible, that in the remote regions of the fixed ſtars, or perhaps far beyond them, there may be ſome body abſolutely at reſt, though it be impoſſible to know from the poſition of bodies to one another in our regions, whether any of theſe do keep the ſame poſition to that remote body; it follows, that abſolute reſt cannot be determined from the poſition of bodies in our regions.

9
Of the motion of different bodies with reſpect to one another.

It is a property of motion, that the parts which retain given poſitions to their wholes do partake of the motion of their wholes. For all parts of revolving bodies endeavour to recede from the axis of motion; and the impetus of bodies moving forwards ariſes from the joint impetus of all the parts. Therefore if ſurrounding bodies are moved, thoſe that are relatively at reſt within them will partake of their motion. Upon which account the true and abſolute motion of a body cannot be determined by the tranſlation of it from thoſe only which ſeem to reſt; for the external bodies ought not only to appear at reſt, but to be really at reſt. For otherwiſe all included bodies, beſide their tranſlation from near the ſurrounding ones, partake likewiſe of their true motions; and though that tranſlation was not made, they would not really be at reſt, but only ſeem to be ſo. For the ſurrounding bodies ſtand in the like relation to the ſurrounded, as the exterior part of a whole does to the interior, or as the ſhell does to the kernel; but if the ſhell moves, the kernel will alſo move, as being part of the whole, without any removal from near the ſhell.

A property near akin to the preceding is, that if a place is moved, whatever is placed therein moves along with it; and therefore a body which is moved from a place in motion, partakes alſo of the motion of its place. Upon which account all motions from places in motion, are no other than parts of entire and abſolute motions; and every entire motion is compoſed of the motion of the body out of its firſt place, and the motion of this place out of its place; and ſo on, until we come to ſome immoveable place, as in the above-mentioned example of the ſailor. Wherefore entire and abſolute motions can be no otherwiſe determined than by immoveable places. Now, no other places are immoveable but thoſe that from infinity to infinity do all retain the ſame given poſitions one to another; and upon this account muſt ever remain unmoved, and do thereby conſtitute what we call *immoveable ſpace*.

The cauſes by which true and relative motions are diſtinguiſhed one from the other, are the forces impreſſed

preſſed upon bodies to generate motion. True motion is neither generated nor altered, but by ſome force impreſſed upon the body moved: but relative motion may be generated or altered without any force impreſſed upon the body. For it is ſufficient only to impreſs ſome force on other bodies with which the former is compared, that by their giving way, that relation may be changed, in which the relative reſt or motion of the other body did conſiſt. Again, True motion ſuffers always ſome change from any force impreſſed upon the moving body; but relative motion does not neceſſarily undergo any changes by ſuch force. For if the ſame forces are likewiſe impreſſed on thoſe other bodies with which the compariſon is made, that the relative poſition may be preſerved; then that condition will be preſerved, in which the relative motion conſiſts. And therefore any relative motion may be changed when the true motion remains unaltered, and the relative may be preſerved when the true motion ſuffers ſome change. Upon which account true motion does by no means conſiſt in ſuch relations.

10
Abſolute and relative motion diſtinguiſhed.

The effects which diſtinguiſh abſolute from relative motion are, the forces of receding from the axis of circular motion. For there are no ſuch forces in a circular motion purely relative: but in a true and abſolute circular motion, they are greater or leſs according to the quantity of the motion. If a veſſel hung by a long cord, is ſo often turned about that the cord is ſtrongly twiſted, then filled with water, and let go, it will be whirled about the contrary way; and while the cord is untwiſting itſelf, the ſurface of the water will at firſt be plain, as before the veſſel began to move; but the veſſel, by gradually communicating its motion to the water, will make it begin ſenſibly to revolve, and recede by little and little from the middle, and aſcend to the ſides of the veſſel, forming itſelf into a concave figure; and the ſwifter the motion becomes, the higher will the water riſe, till at laſt, performing its revolutions in the ſame times with the veſſel, it becomes relatively at reſt in it. This aſcent of the water ſhows its endeavour to recede from the axis of its motion; and the true and abſolute circular motion of the water, which is here directly contrary to the relative, diſcovers itſelf, and may be meaſured by this endeavour. At firſt, when the relative motion in the water was greateſt, it produced no endeavour to recede from the axis; the water ſhowed no tendency to the circumference, nor any aſcent towards the ſides of the veſſel, but remained of a plane ſurface; and therefore its true circular motion had not yet begun. But afterwards, when the relative motion of the water had decreaſed, the aſcent thereof towards the ſides of the veſſel proved its endeavour to recede from the axis; and this endeavour ſhowed the real circular motion of the water perpetually increaſing, till it had acquired its greateſt quantity, when the water reſted relatively in the veſſel. And therefore this endeavour does not depend upon any tranſlation of the water in reſpect of the ambient bodies; nor can true circular motion be defined by ſuch tranſlations. There is only one real circular motion of any one revolving body, correſponding to only one power of endeavouring to recede from its axis of motion, as its proper and adequate effect: but relative motions in one and the ſame body are innumerable, according to the various relations it bears to external bodies; and, like other relations, are altogether deſtitute of any real effect, otherwiſe than they may perhaps participate of that only true motion. And therefore, in the ſyſtem which ſuppoſes that our heavens, revolving below the ſphere of the fixed ſtars, carry the planets along with them, the ſeveral parts of thoſe heavens and the planets, which are indeed relatively at reſt in their heavens, do yet really move. For they change their poſition one to another, which never happens to bodies truly at reſt; and being carried together with the heavens, participate of their motions, and, as parts of revolving wholes, endeavour to recede from the axis of their motion.

Wherefore relative quantities are not the quantities themſelves whoſe names they bear, but thoſe ſenſible meaſures of them, either accurate or inaccurate, which are commonly uſed inſtead of the meaſured quantities themſelves. And then, if the meaning of words be determined by their uſe, by the names *time*, *ſpace*, *place*, and *motion*, their meaſures are properly to be underſtood; and the expreſſion will be unuſual and purely mathematical, if the meaſured quantities themſelves are meant.

It is indeed a matter of great difficulty to diſcover, and effectually to diſtinguiſh, the true motions of particular bodies from thoſe that are only apparent: becauſe the parts of that immoveable ſpace in which thoſe motions are performed, do by no means come under the obſervation of our ſenſes. Yet we have ſome things to direct us in this intricate affair; and theſe ariſe partly from the apparent motions which are the difference of the true motions, partly from the forces which are the cauſes and effects of the true motions. For inſtance, if two globes kept at a given diſtance one from the other by means of a cord that connects them, were revolved about their common centre of gravity; we might, from the tenſion of the cord, diſcover the endeavour of the globes to recede from the axis of motion, and from thence we might compute the quantity of their circular motions. And then, if any equal forces ſhould be impreſſed at once on the alternate faces of the globes to augment or diminiſh their circular motions, from the increaſe or decreaſe of the tenſion of the cord we might infer the increment or decrement of their motions; and thence would be found on what faces thoſe forces ought to be impreſſed, that the motions of the globes might be moſt augmented; that is, we might diſcover their hindermoſt faces, or thoſe which follow in the circular motion. But the faces which follow being known, and conſequently the oppoſite ones that precede, we ſhould likewiſe know the determination of their motions. And thus we might find both the quantity and determination of this circular motion, even in an immenſe vacuum, where there was nothing external or ſenſible with which the globes might be compared. But now, if in that ſpace ſome remote bodies were placed that kept always a given poſition one to another, as the fixed ſtars do in our regions; we could not indeed determine from the relative tranſlation of the globes among thoſe bodies, whether the motion did belong to the globes or to the bodies. But if we obſerved the cord, and found that its tenſion was that very tenſion which the motions of the globes required, we might conclude the motion to be in the globes, and the bodies to be at reſt; and then, laſtly, from the tranſlation of the globes among the bodies, we ſhould find the determination of their motions.

Having thus explained himſelf, Sir Iſaac propoſes to ſhow how we are to collect the true motions from their cauſes, effects, and apparent differences; and *vice verſa*, how, from the motion, either true or apparent, we may come to the knowledge of their cauſes and effects. In order to this, he lays down the following axioms or laws of motion.

11 Laws of motion.

1. EVERY BODY PERSEVERES IN ITS STATE OF REST, OR OF UNIFORM MOTION IN A RIGHT LINE, UNLESS IT IS COMPELLED TO CHANGE THAT STATE BY FORCES IMPRESSED UPON IT.—Sir Iſaac's proof of this axiom is as follows: "Projectiles perſevere in their motions, ſo far as they are not retarded by the reſiſtance of the air, or impelled downwards by the force of gravity. A top, whoſe parts, by their coheſion, are perpetually drawn aſide from rectilinear motion, does not ceaſe its rotation otherwiſe than as it is retarded by the air. The greater bodies of the planets and comets, meeting with leſs reſiſtance in more free ſpaces, preſerve their motions, both progreſſive and circular, for a much longer time."—Notwithſtanding this demonſtration, however, the axiom hath been violently diſputed. It hath been argued, that bodies continue in their ſtate of motion becauſe they are ſubjected to the continual impulſe of an inviſible and ſubtile fluid, which always pours in from behind, and of which all places are full. It hath been affirmed, that motion is as natural to this fluid as reſt is to all other matter. It is ſaid, moreover, that it is impoſſible we can know in what manner a body would be influenced by moving forces if it was entirely deſtitute of gravity. According to what we can obſerve, the momentum of a body, or its tendency to move, depends very much on its gravity. A heavy cannon-ball will fly to a much greater diſtance than a light one, though both are actuated by an equal force. It is by no means clear, therefore, that a body totally deſtitute of gravity would have any proper momentum of its own; and if it had no momentum, it could not continue its motion for the ſmalleſt ſpace of time after the moving power was withdrawn. Some have imagined that matter was capable of beginning motion of itſelf and conſequently that the axiom was falſe; becauſe we ſee plainly that matter in ſome caſes hath a tendency to change from a ſtate of motion to a ſtate of reſt, and from a ſtate of reſt to a ſtate of motion. A paper appeared on this ſubject in the firſt volume of the Edinburgh Phyſical and Literary Eſſays; but the hypotheſis never gained any ground.

12 Objections to the firſt law.

2. THE ALTERATION OF MOTION IS EVER PROPORTIONAL TO THE MOTIVE FORCE IMPRESSED; AND IS MADE IN THE DIRECTION OF THE RIGHT LINE IN WHICH THAT FORCE IS IMPRESSED.—Thus, if any force generates a certain quantity of motion, a double force will generate a double quantity, whether that force be impreſſed all at once, or in ſucceſſive moments. To this law no objection of conſequence has ever been made. It is founded on this ſelf-evident truth, that every effect muſt be proportional to its cauſe. Mr. Young, who ſeems to be very ambitious of detecting the errors of Newton, finds fault indeed with the expreſſions in which the law is ſtated; but he owns, that if thus expreſſed, *The alteration of motion is proportional to the actions or reſiſtance which produces it, and is in the direction in which the actions or reſiſtances are made,* it would be unexceptionable.

13 Objections to the third law.

3. TO EVERY ACTION THERE ALWAYS IS OPPOSED AN EQUAL RE-ACTION: OR, THE MUTUAL ACTION OF TWO BODIES UPON EACH OTHER IS ALWAYS EQUAL, AND DIRECTED TO CONTRARY PARTS.—This axiom is alſo diſputed by many. In the above-mentioned paper in the Phyſical Eſſays, the author endeavours to make a diſtinction between re-action and reſiſtance; and the ſame attempt has been made by Mr Young. "When an action generates no motion (ſays he) it is certain that its effects have been deſtroyed by a contrary and equal action. When an action generates two contrary and equal motions, it is alſo evident that mutual actions were exerted, equal and contrary to each other. All caſes where one of theſe conditions is not found, are exceptions to the truth of the law. If a finger preſſes againſt a ſtone, the ſtone, if it does not yield to the preſſure, preſſes as much upon the finger; but if the ſtone yields, it re-acts leſs than the finger acts; and if it ſhould yield with all the momentum that the force of the preſſure ought to generate, which it would do if it were not impeded by friction, or a medium, it would not re-act at all. So if the ſtone drawn by a horſe, follows after the horſe, it does not re-act ſo much as the horſe acts; but only ſo much as the velocity of the ſtone is diminiſhed by friction, and it is the re-action of friction only, not of the ſtone. The ſtone does not re-act, becauſe it does not act; it reſiſts, but reſiſtance is not action.

"In the loſs of motion from a ſtriking body, equal to the gain in the body ſtruck, there is a plain ſolution without requiring any re-action. The motion *loſt* is identically that which is *found* in the other body; this ſuppoſition accounts for the whole phenomenon in the moſt ſimple manner. If it be not admitted, but the ſolution by re-action is inſiſted upon, it will be incumbent on the party to account for the whole effect of communication of motion; otherwiſe he will lie under the imputation of rejecting a ſolution which is ſimple, obvious, and perfect; for one complex, unnatural, and incomplete. However this may be determined, it will be allowed, that the circumſtances mentioned, afford no ground for the inference, that action and re-action are equal, ſince appearances may be explained in another way" (A.)

(A) If there be a perfect reciprocity betwixt an impinging body and a body at reſt ſuſtaining its impulſe, may we not at our pleaſure conſider either body as the agent, and the other as the reſiſtant? Let a moving body, A, paſs from north to ſouth, an equal body B at reſt, which receives the ſtroke of A, act upon A from ſouth to north, and A reſiſt in a contrary direction, both inelaſtic: let the motion reciprocally communicated be called ſix. Then B at reſt communicates to A ſix degrees of motion towards the north, and receives ſix degrees towards the ſouth. B having no other motion than the ſix degrees it communicated, will, by its

Others grant that Sir Iſaac's axiom is very true in reſpect to terreſtrial ſubſtances; but they affirm, that, in theſe, both action and re-action are the effects of gravity. Subſtances void of gravity would have no momentum; and without this they could not act; they ſhould be moved by the leaſt force, and therefore could not reſiſt or re-act. If therefore there is any fluid which is the cauſe of gravity, though ſuch fluid could act upon terreſtrial ſubſtances, yet theſe could not re-act upon it; becauſe they have no force of their own, but depend entirely upon it for their momentum. In this manner, ſay they, we may conceive that the planets circulate, and all the operations of nature are carried on by means of a ſubtile fluid; which being perfectly active, and the reſt of matter altogether paſſive, there is neither reſiſtance nor loſs of motion. See MOTION.

From the preceding axiom Sir Iſaac draws the following corollaries.

1. A body by two forces conjoined will deſcribe the diagonal of a parallelogram in the ſame time that it would deſcribe the ſides by thoſe forces apart.

2. Hence we may explain the compoſition of any one direct force out of any two oblique ones, viz. by making the two oblique forces the ſides of a parallelogram, and the direct one the diagonal.

3. The quantity of motion, which is collected by taking the ſum of the motions directed towards the ſame parts, and the difference of thoſe that are directed to contrary parts, ſuffers no change from the action of bodies among themſelves: becauſe the motion which one body loſes is communicated to another; and if we ſuppoſe friction and the reſiſtance of the air to be abſent, the motion of a number of bodies which mutually impelled one another would be perpetual, and its quantity always equal.

4. The common centre of gravity of two or more bodies do not alter its ſtate of motion or reſt by the actions of the bodies among themſelves; and therefore the common centre of gravity of all bodies acting upon each other (excluding outward actions and impediments) is either at reſt, or moves uniformly in a right line.

5. The motions of bodies included in a given ſpace are the ſame among themſelves, whether that ſpace is at reſt, or moves uniformly forward in a right line without any circular motion. The truth of this is evidently ſhown by the experiment of a ſhip; where all motions happen after the ſame manner, whether the ſhip is at reſt, or proceeds uniformly forward in a ſtraight line.

6. If bodies, anyhow moved among themſelves, are urged in the direction of parallel lines by equal accelerative forces, they will all continue to move among themſelves, after the ſame manner as if they had been urged by no ſuch forces.

The whole of the mathematical part of the Newtonian philoſophy depends on the following lemmas; of which the firſt is the principal.

LEM. I. Quantities, and the ratios of quantities, which in any finite time converge continually to equality, and before that time approach nearer the one to the other than by any given difference, become ultimately equal. If you deny it; ſuppoſe them to be ultimately unequal, and let D be their ultimate difference. Therefore they cannot approach nearer to equality than by that given difference D; which is againſt the ſuppoſition.

14
Objections to the firſt lemma,

Concerning the meaning of this lemma philoſophers are not agreed; and unhappily it is the very fundamental poſition on which the whole of the ſyſtem reſts. Many objections have been raiſed to it by people who

---

equal and contrary loſs and gain, remain in equilibrio. Let the original motion of A have been twelve, then A having received a contrary action equal to ſix, ſix degrees of its motion will be deſtroyed or in equilibrio; conſequently, a motive force as ſix will remain to A towards the ſouth, and B will be in equilibrio, or at reſt. A will then endeavour to move with ſix degrees, or half its original motion, and B will remain at reſt as before. A and B being equal maſſes, by the laws of communication three degrees of motion will be communicated to B, or A with its ſix degrees will act with three, and B will re-act alſo with three. B then will act on A from ſouth to north equal to three, while it is acted upon or reſiſted by A from north to ſouth, equal alſo to three, and B will remain at reſt as before; A will alſo have its ſix degrees of motion reduced to one half by the contrary action of B, and only three degrees of motion will remain to A, with which it will yet endeavour to move; and finding B ſtill at reſt, the ſame proceſs will be repeated till the whole motion of A is reduced to an infinitely ſmall quantity, B all the while remaining at reſt, and there will be no communication of motion from A to B, which is contrary to experience.

Let a body, A, whoſe maſs is twelve, at reſt, be impinged upon firſt by B, having a maſs as twelve, and a velocity as four, making a momentum of 48; and ſecondly by C, whoſe maſs is ſix, and velocity eight, making a momentum of 48 equal to B, the three bodies being inelaſtic. In the firſt caſe, A will become poſſeſſed of a momentum of 24, and 24 will remain to B; and, in the ſecond caſe, A will become poſſeſſed of a momentum of 32, and 16 will remain to C, both bodies moving with equal velocities after the ſhock, in both caſes, by the laws of percuſſion. It is required to know, if in both caſes A reſiſts equally, and if B and C act equally? if the actions and reſiſtances are equal, how does A in one caſe deſtroy 24 parts of B's motion, and in the other caſe 32 parts of C's motion, by an equal reſiſtance? And how does B communicate in one caſe 24 degrees of motion, and C 32, by equal actions? If the actions and reſiſtances are unequal, it is aſked how the ſame maſs can reſiſt differently to bodies impinging upon it with equal momenta, and how bodies poſſeſſed of equal momenta can exert different actions, it being admitted that bodies reſiſt proportional to their maſſes, and that their power of overcoming reſiſtance is proportional to their momenta?

It is incumbent on thoſe who maintain the doctrine of univerſal re-action, to free it from theſe difficulties and apparent contradictions.

ſuppoſed themſelves capable of underſtanding it. They ſay, that it is impoſſible we can come to an end of any infinite ſeries, and therefore that the word *ultimate* can in this caſe have no meaning. In ſome caſes the lemma is evidently falſe. Thus, ſuppoſe there are two quantities of matter A and B, the one containing half a pound, and the other a third part of one. Let both be continually divided by 2; and though their ratio, or the proportion of the one to the other, doth not vary, yet the difference between them perpetually becomes leſs, as well as the quantities themſelves, until both the difference and quantities themſelves become leſs than any aſſignable quantity: yet the difference will never totally vaniſh, nor the quantities become equal, as is evident from the two following ſeries:

$$\begin{array}{lllllllllll} & \frac{1}{2} & \frac{1}{4} & \frac{1}{8} & \frac{1}{16} & \frac{1}{32} & \frac{1}{64} & \frac{1}{128} & \frac{1}{256} & \frac{1}{512} & \frac{1}{1024}, \text{ \&c.} \\ & \frac{1}{3} & \frac{1}{6} & \frac{1}{12} & \frac{1}{24} & \frac{1}{48} & \frac{1}{96} & \frac{1}{192} & \frac{1}{384} & \frac{1}{768} & \frac{1}{1536}, \text{ \&c.} \\ \text{Diff.} & \frac{1}{6} & \frac{1}{12} & \frac{1}{24} & \frac{1}{48} & \frac{1}{96} & \frac{1}{192} & \frac{1}{384} & \frac{1}{768} & \frac{1}{1536} & \frac{1}{3072}, \text{ \&c.} \end{array}$$

Thus we ſee, that though the difference is continually diminiſhing, and that in a very large proportion, there is no hope of its vaniſhing, or the quantities becoming equal. In like manner, let us take the proportions or ratios of quantities, and we ſhall be equally unſucceſsful. Suppoſe two quantities of matter, one containing 8 and the other 10 pounds; theſe quantities already have to each other the ratio of 8 to 10, or of 4 to 5; but let us add 2 continually to each of them, and though the ratios continually come nearer to that of equality, it is in vain to hope for a perfect coincidence. Thus,

$$\begin{array}{llllllllll} & 8 & 10 & 12 & 14 & 16 & 18 & 20 & 22 & 24, \text{ \&c.} \\ & 10 & 12 & 14 & 16 & 18 & 20 & 22 & 24 & 26, \text{ \&c.} \\ \text{Ratio} & \frac{4}{5} & \frac{5}{6} & \frac{6}{7} & \frac{7}{8} & \frac{8}{9} & \frac{9}{10} & \frac{10}{11} & \frac{11}{12} & \frac{12}{13}, \text{ \&c.} \end{array}$$

15 anſwered. For this and his other lemmas Sir Iſaac makes the following apology: "Theſe lemmas are premiſed, to avoid the tedioutſneſs of deducing perplexed demonſtrations *ad abſurdum*, according to the method of ancient geometers. For demonſtrations are more contracted by the method of indiviſibles: but becauſe the hypotheſis of indiviſibles ſeems ſomewhat harſh, and therefore that method is reckoned leſs geometrical, I choſe rather to reduce the demonſtrations of the following propoſitions to the firſt and laſt ſums and ratios of naſcent and evaneſcent quantities, that is, to the limits of thoſe ſums and ratios; and ſo to premiſe, as ſhort as I could, the demonſtrations of thoſe limits. For hereby the ſame thing is performed as by the method of indiviſibles; and now thoſe principles being demonſtrated, we may uſe them with more ſafety.—Therefore, if hereafter I ſhould happen to conſider quantities as made of particles, or ſhould uſe little curve lines for right ones; I would not be underſtood to mean indiviſibles, but evaneſcent diviſible quantities; not the ſums and ratios of determinate parts, but always the limits of ſums and ratios; and that the force of ſuch demonſtrations always depends on the method laid down in the foregoing lemmas.

"Perhaps it may be objected, that there is no ultimate proportion of evaneſcent quantities, becauſe the proportion, before the quantities have vaniſhed, is not the ultimate, and, when they are vaniſhed, is none.—But by the ſame argument it may be alleged, that a body arriving at a certain place, and there ſtopping, has no ultimate velocity; becauſe the velocity before the body comes to the place is not its ultimate velocity; when it is arrived, it has none. But the anſwer is eaſy: for by the ultimate velocity is meant that with which the body is moved, neither before it arrives at its place and the motion ceaſes, nor after; but at the very inſtant it arrives, that is, that velocity with which the body arrives at its laſt place, and with which the motion ceaſes. And in like manner, by the ultimate ratio of evaneſcent quantities is to be underſtood the ratio of the quantities, not before they vaniſh, nor afterwards, but with which they vaniſh. In like manner, the firſt ratio of naſcent quantities is that with which they begin to be. And the firſt or laſt ſum is that with which they begin and ceaſe to be (or to be augmented and diminiſhed). There is a limit which the velocity at the end of the motion may attain, but not exceed; and this is the ultimate velocity. And there is the like limit in all quantities and proportions that begin and ceaſe to be. And, ſince ſuch limits are certain and definite, to determine the ſame is a problem ſtrictly geometrical. But whatever is geometrical we may be allowed to make uſe of in determining and demonſtrating any other thing that is likewiſe geometrical.

"It may alſo be objected, that if the ultimate ratios of evaneſcent quantities are given, their ultimate magnitudes will be alſo given; and ſo all quantities will conſiſt of indiviſibles, which is contrary to what Euclid has demonſtrated concerning incommenſurables, in the 10th book of his Elements. But this objection is founded on a falſe ſuppoſition. For thoſe ultimate ratios with which quantities vaniſh are not truly the ratios of ultimate quantities, but limits towards which the ratios of quantities decreaſing continually approach."

Plate CCCLXIX. fig. 1.

Lem. II. If in any figure A *a c* E terminated by the right line A *a*, AE, and the curve *a c* E, there be inſcribed any number of parallelograms A *b*, B *c*, C *d*, &c. comprehended under equal baſes AB, BC, CD, &c. and the ſides B *b*, C *c*, D *d*, &c. parallel to one ſide A *a* of the figure; and the parallelograms *a* K *b l*, *b* L *c m*, *c* M *d n*, &c. are completed.—Then if the breadth of thoſe parallelograms be ſuppoſed to be diminiſhed, and their number augmented *in infinitum*; the ultimate ratios which the inſcribed figure AK *b* L *c* M *d* D, the circumſcribed figure A *a l b m c n d o* E, and curvilineal figure A *a b c d* E, will have to one another, are ratios of equality.—For the difference of the inſcribed and circumſcribed figures is the ſum of the parallelograms K *l*, L *m*, M *n*, D *o*; that is (from the equality of all their baſes), the rectangle under one of their baſes K *b*, and the ſum of their altitudes A *a*, that is, the rectangle AB *l a*.—But this rectangle, becauſe its breadth AB is ſuppoſed diminiſhed *in infinitum*, becomes leſs than any given ſpace. And therefore by Lem. I. the figures inſcribed and circumſcribed become ultimately equal the one to the other; and much more will the intermediate curvilineal figure be ultimately equal to either.

Lem. III. The ſame ultimate ratios are alſo ratios of equality, when the breadths AB, BC, CD, &c. of the parallelograms are unequal, and are all diminiſhed *in infinitum*.—The demonſtration of this differs but little from that of the former.

In his ſucceeding lemmas, Sir Iſaac goes on to prove, in a manner ſimilar to the above, that the ultimate ratios of the ſine, chord, and tangent of arcs infinitely diminiſhed, are ratios of equality, and therefore that in all our reaſonings about theſe we may ſafely uſe the one for the other :—that the ultimate form of evaneſcent triangles made by the arc, chord, and tangent, is that of ſimilitude, and their ultimate ratio is that of equality ; and hence, in reaſonings about ultimate ratios, we may ſafely uſe theſe triangles for each other, whether made with the ſine, the arc, or the tangent.—He then ſhows ſome properties of the ordinates of curvilinear figures ; and proves that the ſpaces which a body deſcribes by any finite force urging it, whether that force is determinate and immutable, or is continually augmented or continually diminiſhed, are, in the very beginning of the motion, one to the other in the duplicate ratio of the powers. And, laſtly, Having added ſome demonſtrations concerning the evaneſcence of angles of contact, he proceeds to lay down the mathematical part of his ſyſtem, and which depends on the following theorems :

Fig. 2.

THEOR. I. The areas which revolving bodies deſcribe by radii drawn to an immoveable centre of force, lie in the ſame immoveable planes, and are proportional to the times in which they are deſcribed.—For, ſuppoſe the time to be divided into equal parts, and in the firſt part of that time, let the body by its innate force deſcribe the right line AB (fig. 2.) ; in the ſecond part of that time, the ſame would, by Law 1. if not hindered, proceed directly to *c* along the line B *c*=AB ; ſo that by the radii AS, BS, *c* S, drawn to the centre, the equal areas ASB, BS *c*, would be deſcribed. But, when the body is arrived at B, ſuppoſe the centripetal force acts at once with a great impulſe, and turning aſide the body from the right line B *c*, compels it afterwards to continue its motion along the right line BC. Draw *c* C parallel to BS, meeting BC in C ; and at the end of the ſecond part of the time, the body, by Cor. 1. of the Laws, will be found in C, in the ſame plane with the triangle ASB. Join SC ; and becauſe SB and *c* C are parallel, the triangle SBC will be equal to the triangle SBC, and therefore alſo to the triangle SAB. By the like argument, if the centripetal force acts ſucceſſively in C, D, E, &c. and makes the body in each ſingle particle of time to deſcribe the right lines CD, DE, EF, &c. they will all lie in the ſame plane ; and the triangle SCD will be equal to the triangle SBC, and SDE to SCD, and SEF to SDE. And therefore, in equal times, equal areas are deſcribed in one immoveable plane ; and, by compoſition, any ſums SADS, SAFS, of thoſe areas are, one to the other, as the times in which they are deſcribed. Now, let the number of thoſe triangles be augmented, and their ſize diminiſhed *in infinitum* ; and then, by the preceding lemmas, their ultimate perimeter ADF will be a curve line : and therefore the centripetal force by which the body is perpetually drawn back from the tangent of this curve will act continually ; and any deſcribed areas SADS, SAFS, which are always proportional to the times of deſcription, will, in this caſe alſo, be proportional to thoſe times. Q. E. D.

COR. 1. The velocity of a body attracted towards an immoveable centre, in ſpaces void of reſiſtance, is reciprocally as the perpendicular let fall from that centre on the right line which touches the orbit. For the velocities in theſe places, A, B, C, D, E, are as the baſes AB, BC, DE, EF, of equal triangles ; and theſe baſes are reciprocally as the perpendiculars let fall upon them.

COR. 2. If the chords AB, BC, of two arcs, ſucceſſively deſcribed in equal times by the ſame body, in ſpaces void of reſiſtance, are completed into a parallelogram ABCV, and the diagonal BV of this parallelogram, in the poſition which it ultimately acquires when thoſe arcs are diminiſhed *in infinitum*, is produced both ways, it will paſs through the centre of force.

COR. 3. If the chords AB, BC, and DE, EF, of arcs deſcribed in equal times, in ſpaces void of reſiſtance, are completed into the parallelograms ABCV, DEFZ, the forces in B and E are one to the other in the ultimate ratio of the diagonals BV, EZ, when thoſe arcs are diminiſhed *in infinitum*. For the motions BC and EF of the body (by Cor. 1. of the Laws), are compounded of the motions B *c*, BV and E *f*, EZ ; but BV and EZ, which are equal to C *c*= and F *f*, in the demonſtration of this propoſition, were generated by the impulſes of the centripetal force in B and E, and are therefore proportional to thoſe impulſes.

COR. 4. The forces by which bodies, in ſpaces void of reſiſtance, are drawn back from rectilinear motions, and turned into curvilinear orbits, are one to another as the verſed ſines of arcs deſcribed in equal times ; which verſed ſines tend to the centre of force, and biſect the chords when theſe arcs are diminiſhed to infinity. For ſuch verſed ſines are the halfs of the diagonals mentioned in Cor. 3.

COR. 5. And therefore thoſe forces are to the force of gravity, as the ſaid verſed ſines to the verſed ſines perpendicular to the horizon of thoſe parabolic arcs which projectiles deſcribe in the ſame time.

COR. 6. And the ſame things do all hold good (by Cor. 5. of the laws) when the planes in which the bodies are moved, together with the centres of force, which are placed in thoſe planes, are not at reſt, but move uniformly forward in right lines.

THEOR. II. Every body that moves in any curve line deſcribed in a plane, and, by a radius drawn to a point either immoveable or moving forward with an uniform rectilinear motion, deſcribes about that point areas proportional to the times, is urged by a centripetal force directed to that point.

CASE I. For every body that moves in a curve line is (by Law 1.) turned aſide from its rectilinear courſe by the action of ſome force that impels it ; and that force by which the body is turned off from its rectilinear courſe, and made to deſcribe in equal times the leaſt equal triangles SAB, SBC, SCD, &c. about the immoveable point S, (by Prop. 40. E. 1. and Law 2.) acts in the place B according to the direction of a line parallel to C ; that is, in the direction of the line BS ; and in the place C according to the direction of a line parallel to *d* D, that is, in the direction of the line CS, &c. ; and therefore acts always in the direction of lines tending to the immoveable point S. Q. E. D.

CASE II. And (by Cor. 5. of the laws) it is indifferent whether the ſuperficies in which a body deſcribes a curvilinear figure be quieſcent, or moves together with the body, the figure deſcribed, and its point S, uniformly forward in right lines.

Cor. I. In non-reſiſting ſpaces or mediums, if the areas are not proportional to the times, the forces are not directed to the point in which the radii meet; but deviate therefrom *in conſequentia*, or towards the parts to which the motion is directed, if the deſcription of the areas is accelerated; but *in antecedentia* if retarded.

Cor. 2. And even in reſiſting mediums, if the deſcription of the areas is accelerated, the directions of the forces deviate from the point in which the radii meet, towards the parts to which the motion tends.

Scholium.

A body may be urged by a centripetal force compounded of ſeveral forces. In which caſe the meaning of the propoſition is, that the force which reſults out of all tends to the point S. But if any force acts perpetually in the direction of lines perpendicular to the deſcribed ſurface, this force will make the body to deviate from the plane of its motion, but will neither augment nor diminiſh the quantity of the deſcribed ſurface; and is therefore not to be neglected in the compoſition of forces.

Theor. III. Every body that, by a radius drawn to the centre of another body, howſoever moved, deſcribes areas about that centre proportional to the times, is urged by a force compounded of the centripetal forces tending to that other body, and of all the accelerative force by which that other body is impelled.—The demonſtration of this is a natural conſequence of the theorem immediately preceding.

Hence, if the one body L, by a radius drawn to the other body T, deſcribes areas proportional to the times, and from the whole force by which the firſt body L is urged, (whether that force is ſimple, or, according to Cor. 2. of the laws, compounded of ſeveral forces), we ſubduct that whole accelerative force by which the other body is urged; the whole remaining force by which the firſt body is urged will tend to the other body T, as its centre.

And *vice verſa*, if the remaining force tends nearly to the other body T, thoſe areas will be nearly proportional to the times.

If the body L, by a radius drawn to the other body T, deſcribes areas, which, compared with the times, are very unequal, and that other body T be either at reſt, or moves uniformly forward in a right line, the action of the centripetal force tending to that other body T is either none at all, or it is mixed and combined with very powerful actions of other forces: and the whole force compounded of them all, if they are many, is directed to another (immoveable or moveable) centre. The ſame thing obtains when the other body is actuated by any other motion whatever; provided that centripetal force is taken which remains after ſubducting that whole force acting upon that other body T.

Scholium.

Becauſe the equable deſcription of areas indicates that a centre is reſpected by that force with which the body is moſt affected, and by which it is drawn back from its rectilinear motion, and retained in its orbit, we may always be allowed to uſe the equable deſcription of areas as an indication of a centre about which all circular motion is performed in free ſpaces.

Theor. IV. The centripetal forces of bodies which by equable motions deſcribe different circles, tend to the centres of the ſame circles; and are one to the other as the ſquares of the arcs deſcribed in equal times applied to the radii of circles.—For theſe forces tend to the centres of the circles, (by Theor. 2. and Cor. 2. Theor. 1.) and are to one another as the verſed ſines of the leaſt arcs deſcribed in equal times, (by Cor. 4. Theor. 1.) that is, as the ſquares of the ſame arcs applied to the diameters of the circles, by one of the lemmas; and therefore, ſince thoſe arcs are as arcs deſcribed in any equal times, and the diameters are as the radii, the forces will be as the ſquares of any arcs deſcribed in the ſame time, applied to the radii of the circles. Q. E. D.

Cor. 1. Therefore, ſince thoſe arcs are as the velocities of the bodies, the centripetal forces are in a ratio compounded of the duplicate ratio of the velocities directly, and of the ſimple ratio of the radii inverſely.

Cor. 2. And ſince the periodic times are in a ratio compounded of the ratio of the radii directly, and the ratio of the velocities inverſely; the centripetal forces are in a ratio compounded of the ratio of the radii directly, and the duplicate ratio of the periodic times inverſely.

Cor. 3. Whence, if the periodic times are equal, and the velocities therefore as the radii, the centripetal forces will be equal among themſelves; and the contrary.

Cor. 4. If the periodic times and the velocities are both in the ſubduplicate ratio of the radii, the centripetal forces will be equal among themſelves; and the contrary.

Cor. 5. If the periodic times are as the radii, and therefore the velocities equal, the centripetal forces will be reciprocally as the radii; and the contrary.

Cor. 6. If the periodic times are in the ſeſquiplicate ratio of the radii, and therefore the velocities reciprocally in the ſubduplicate ratio of the radii, the centripetal forces will be in the duplicate ratio of the radii inverſely; and the contrary.

Cor. 7. And univerſally, if the periodic time is as any power R^n of the radius R, and therefore the velocity reciprocally as the power R^{n-1} of the radius, the centripetal force will be reciprocally as the power R^{2n-1} of the radius; and the contrary.

Cor. 8. The ſame things all hold concerning the times, the velocities, and forces, by which bodies deſcribe the ſimilar parts of any ſimilar figures, that have their centres in a ſimilar poſition within thoſe figures, as appears by applying the demonſtrations of the preceding caſes to thoſe. And the application is eaſy, by only ſubſtituting the equable deſcription of areas in the place of equable motion, and uſing the diſtances of the bodies from the centres inſtead of the radii.

Cor. 9. From the ſame demonſtration it likewiſe follows, that the arc which a body uniformly revolving in a circle by means of a given centripetal force deſcribes in any time, is a mean proportional between the diameter of the circle, and the ſpace which the ſame body, falling by the ſame given force, would deſcend through in the ſame given time.

“By means of the preceding propoſition and its corollaries (ſays Sir Iſaac), we may diſcover the proportion of a centripetal force to any other known force, ſuch as that of gravity. For if a body by means of its gravity revolves in a circle concentric to the earth, this gravity is the centripetal force of that body. But from the deſcent of heavy bodies, the time of one entire revolution, as well as the arc deſcribed in any given time, is given (by Cor. 9. of this theorem). And by ſuch propoſitions Mr Huygens, in his excellent book *De Horologio Oſcillatorio*, has compared the force of gravity with the centrifugal forces of revolving bodies.

The preceding propoſition may alſo be demonſtrated in the following manner. In any circle ſuppoſe a polygon to be inſcribed of any number of ſides. And if a body, moved with a given velocity along the ſides of the polygon, is reflected from the circle at the ſeveral angular points; the force with which, at every reflection it ſtrikes the circle, will be as its velocity: and therefore the ſum of the forces, in a given time, will be as that velocity and the number of reflections conjunctly; that is, (if the ſpecies of the polygon be given), as the length deſcribed in that given time, and increaſed or diminiſhed in the ratio of the ſame length to the radius of the circle; that is, as the ſquare of that length applied to the radius; and therefore, if the polygon, by having its ſides diminiſhed *in infinitum*, coincides with the circle, as the ſquare of the arc deſcribed in a given time applied to the radius. This is the centrifugal force, with which the body impels the circle; and to which the contrary force, wherewith the circle continually repels the body towards the centre, is equal.

On theſe principles hangs the whole of Sir Iſaac Newton's mathematical philoſophy. He now ſhows how to find the centre to which the forces impelling any body are directed, having the velocity of the body given: and finds the centrifugal force to be always as the verſed ſine of the naſcent arc directly, and as the ſquare of the time inverſely; or directly as the ſquare of the velocity, and inverſely as the chord of the naſcent arc. From theſe premiſes he deduces the method of finding the centripetal force directed to any given point when the body revolves in a circle; and this whether the central point is near or at an immenſe diſtance; ſo that all the lines drawn from it may be taken for parallels. The ſame thing he ſhows with regard to bodies revolving in ſpirals, ellipſes, hyperbolas, or parabolas.—Having the figures of the orbits given, he ſhows alſo how to find the velocities and moving powers; and, in ſhort, ſolves all the moſt difficult problems relating to the celeſtial bodies with an aſtoniſhing degree of mathematical ſkill. Theſe problems and demonſtrations are all contained in the firſt book of the *Principia:* but to give an account of them here would far exceed our limits; neither would many of them be intelligible, excepting to firſt-rate mathematicians.

16
Rules for philoſophical reaſoning.

In the ſecond book, Sir Iſaac treats of the properties of fluids, and their powers of reſiſtance: and here he lays down ſuch principles as entirely overthrow the doctrine of Des Cartes's vortices, which was the faſhionable ſyſtem in his time. In the third book, he begins particularly to treat of the natural phenomena, and apply them to the mathematical principles formerly demonſtrated; and, as a neceſſary preliminary to this part, he lays down the following rules for reaſoning in natural philoſophy.

1. We are to admit no more cauſes of natural things than ſuch as are both true and ſufficient to explain their natural appearances.

2. Therefore to the ſame natural effects we muſt always aſſign, as far as poſſible, the ſame cauſes.

3. The qualities of bodies which admit neither intenſion nor remiſſion of degrees, and which are found to belong to all bodies within the reach of our experiments, are to be eſteemed the univerſal qualities of all bodies whatſoever.

4. In experimental philoſophy, we are to look upon propoſitions collected by general induction from phenomena as accurately or very nearly true, notwithſtanding any contrary hypotheſes that may be imagined, till ſuch time as other phenomena occur, by which they may either be made more accurate, or liable to exceptions.

The phenomena firſt conſidered are, 1. That the ſatellites of Jupiter by radii drawn to the centre of their primary, deſcribe areas proportional to the times of their deſcription; and that their periodic times, the fixed ſtars being at reſt, are in the ſeſquiplicate ratio of their diſtances from its centre. 2. The ſame thing is likewiſe obſerved of the phenomena of Saturn. 3. The five primary planets, Mercury, Venus, Mars, Jupiter, and Saturn, with their ſeveral orbits encompaſs the ſun. 4. The fixed ſtars being ſuppoſed at reſt, the periodic times of the five primary planets, and of the earth, about the ſun, are in the ſeſquiplicate proportion of their mean diſtances from the ſun. 5. The primary planets, by radii drawn to the earth, deſcribe areas no ways proportionable to the times: but the areas which they deſcribe by radii drawn to the ſun are proportional to the times of deſcription. 6. The moon, by a radius drawn to the centre of the earth, deſcribes an area proportional to the time of deſcription. All theſe phenomena are undeniable from aſtronomical obſervations, and are explained at large under the article ASTRONOMY. The mathematical demonſtrations are next applied by Sir Iſaac Newton in the following propoſitions:

PROP. I. The forces by which the ſatellites of Jupiter are continually drawn off from rectilinear motions, and retained in their proper orbits, tend to the centre of that planet; and are reciprocally as the ſquares of the diſtances of thoſe ſatellites from that centre. The former part of this propoſition appears from Theor. 2. or 3. and the latter from Cor. 6. of Theor. 5.; and the ſame thing we are to underſtand of the ſatellites of Saturn.

PROP. II. The forces by which the primary planets are continually drawn off from rectilinear motions, and retained in their proper orbits, tend to the ſun; and are reciprocally as the ſquares of the diſtances from the ſun's centre. The former part of this propoſition is manifeſt from Phenomenon 5. juſt mentioned, and from Theor. 2.; the latter from Phenomenon 4. and Cor. 6. of Theor. 4. But this part of the propoſition is with great accuracy deducible from the quieſcence of the aphelion points. For a very ſmall aberration from the reciprocal duplicate proportion would produce a motion of the apſides, ſenſible in every ſingle revolution, and in many of them enormouſly great.

PROP. III. The force by which the moon is retained in in its orbit, tends towards the earth; and is reciprocally as the ſquare of the diſtance of its place from the centre of the earth. The former part of this propoſition is evident from Phenom. 5. and Theor. 2; the latter from Phenom. 6. and Theor. 2. or 3. It is alſo evident from the very ſlow motion of the moon's apogee; which, in every ſingle revolution, amounting but to 3° 3′ *in conſequentia*, may be neglected: and this more fully appears from the next propoſition.

PROP. IV. The moon gravitates towards the earth, and by the force of gravity is continually drawn off from a rectilinear motion, and retained in its orbit.—The mean diſtance of the moon from the earth in the ſyzigies in ſemidiameters of the latter, is about $60\frac{1}{2}$. Let us aſſume the mean diſtance of 60 ſemidiameters in the ſyzigies; and ſuppoſe one revolution of the moon in reſpect of the fixed ſtars to be completed in $27^d\ 7^h\ 43'$, as aſtronomers have determined; and the circumference of the earth to amount to 123,249,600 Paris feet. Now, if we imagine the moon, deprived of all motion, to be let go, ſo as to deſcend towards the earth with the impulſe of all that force by which it is retained in its orbit, it will, in the ſpace of one minute of time, deſcribe in its fall $15\frac{1}{4}$ Paris feet. For the verſed ſine of that arc which the moon, in the ſpace of one minute of time, deſcribes by its mean motion at the diſtance of 60 ſemidiameters of the earth, is nearly $15\frac{1}{12}$ Paris feet; or more accurately, 15 feet one inch and one line $\frac{4}{9}$. Wherefore ſince that force, in approaching to the earth, increaſes in the reciprocal duplicate proportion of the diſtance; and, upon that account, at the ſurface of the earth, is 60×60 times greater than that at the moon; a body in our regions, falling with that force, ought, in the ſpace of one minute of time, to deſcribe $60 \times 60 \times 15\frac{1}{12}$ Paris feet; and in the ſpace of one ſecond of time to deſcribe $15\frac{1}{12}$ of thoſe feet; or, more accurately, 15 feet 1 inch, 1 line $\frac{4}{9}$. And with this very force we actually find that bodies here on earth do really deſcend.—For a pendulum oſcillating ſeconds in the latitude of Paris, will be three Paris feet and $8\frac{1}{2}$ lines in length, as Mr Huygens has obſerved. And the ſpace which a heavy body deſcribes by falling one ſecond of time is to half the length of the pendulum in the duplicate ratio of the circumference of the circle to its diameter; and is therefore 15 Paris feet, 1 inch 1 line $\frac{7}{6}$. And therefore the force by which the moon is retained in its orbit, becomes at the very ſurface of the earth, equal to the force of gravity which we obſerve in heavy bodies there. And therefore (by Rule 1. and 2.) the force by which the moon is retained in its orbit is that very ſame force which we commonly call *gravity*. For were gravity another force different from that, then bodies deſcending to the earth with the joint impulſe of both forces would fall with a double velocity, and, in the ſpace of one ſecond of time, would deſcribe $30\frac{1}{6}$ Paris feet; altogether againſt experience.

The demonſtration of this propoſition may be more diffuſely explained after the following manner: Suppoſe ſeveral moons to revolve about the earth, as in the ſyſtem of Jupiter or Saturn, the periodic times of thoſe moons would (by the argument of induction) obſerve the ſame law which Kepler found to obtain among the planets; and therefore their centripetal forces would be reciprocally as the ſquares of the diſtances from the centre of the earth, by Prop. I. Now, if the loweſt of theſe were very ſmall, and were ſo near the earth as almoſt to touch the tops of the higheſt mountains, the centripetal force thereof, retaining it in its orbit, would be very nearly equal to the weights of any terreſtrial bodies that ſhould be found upon the tops of theſe mountains; as may be known from the foregoing calculation. Therefore, if the ſame little moon ſhould be deſerted by its centrifugal force that carries it through its orbit, it would deſcend to the earth; and that with the ſame velocity as heavy bodies do actually deſcend with upon the tops of thoſe very mountains, becauſe of the equality of forces that oblige them both to deſcend. And if the force by which that loweſt moon would deſcend were different from that of gravity, and if that moon were to gravitate towards the earth, as we find terreſtrial bodies do on the tops of mountains, it would then deſcend with twice the velocity, as being impelled by both theſe forces conſpiring together. Therefore, ſince both theſe forces, that is, the gravity of heavy bodies, and the centripetal forces of the moons, reſpect the centre of the earth, and are ſimilar and equal between themſelves, they will (by Rule 1. and 2.) have the ſame cauſe. And therefore the force which retains the moon in its orbit, is that very force which we commonly call *gravity*; becauſe otherwiſe, this little moon at the top of a mountain muſt either be without gravity, or fall twice as ſwiftly as heavy bodies uſe to do.

Having thus demonſtrated that the moon is retained in its orbit by its gravitation towards the earth, it is eaſy to apply the ſame demonſtration to the motions of the other ſecondary planets, and of the primary planets round the ſun, and thus to ſhow that gravitation prevails throughout the whole creation; after which, Sir Iſaac proceeds to ſhow from the ſame principles that the heavenly bodies gravitate towards each other, and contain different quantities of matter, or have different denſities in proportion to their bulks.

PROB. V. All bodies gravitate towards every planet; and the weights of bodies towards the ſame planet, at equal diſtances from its centre, are proportional to the quantities of matter they contain.

It has been confirmed by many experiments, that all ſorts of heavy bodies (allowance being made for the inequality of retardation by ſome ſmall reſiſtance of the air), deſcend to the earth from equal heights in equal times; and that equality of times we may diſtinguiſh to a great accuracy by the help of pendulums. Sir Iſaac Newton tried the thing in gold, ſilver, lead, glaſs, ſand, common ſalt, wood, water, and wheat. He provided two wooden boxes, round and equal, filled the one with wood, and ſuſpended an equal weight of gold in the centre of oſcillation of the other. The boxes hanging by equal threads of 11 feet, made a couple of pendulums, perfectly equal in weight and figure, and equally receiving the reſiſtance of the air. And placing the one by the other, he obſerved them to play together forwards and backward, for a long time, with equal vibrations. And therefore the quantity of matter in the gold was to the quantity of matter in the wood, as the action of the motive force (or *vis motrix*) upon all the gold, to the action of the ſame upon all the wood; that is, as the weight

weight of the one to the weight of the other. And the like happened in the other bodies. By theſe experiments, in bodies of the ſame weight, he could manifeſtly have diſcovered a difference of matter leſs than the thouſandth part of the whole, had any ſuch been. But without all doubt, the nature of gravity towards the planets, is the ſame as towards the earth. For ſhould we imagine our terreſtrial bodies removed to the orb of the moon, and there, together with the moon, deprived of all motion, to be let go, ſo as to fall together towards the earth; it is certain from what we have demonſtrated before, that in equal times, they would deſcribe equal ſpaces with the moon, and of conſequence are to the moon in quantity of matter, as their weights to its weight. Moreover, ſince the ſatellites of Jupiter perform their revolutions in times which obſerve the ſeſquiplicate proportion of their diſtances from Jupiter's centre, their accelerative gravities towards Jupiter will be reciprocally as the ſquares of their diſtances from Jupiter's centre; that is, equal at equal diſtances. And therefore, theſe ſatellites, if ſuppoſed to fall towards Jupiter from equal heights, would deſcribe equal ſpaces in equal times, in like manner as heavy bodies do on our earth. And by the ſame argument if the circumſolar planets were ſuppoſed to be let fall at equal diſtances from the ſun, they would, in their deſcent towards the ſun, deſcribe equal ſpaces in equal times. But forces, which equally accelerate unequal bodies, muſt be as thoſe bodies: that is to ſay, the weights of the planets towards the ſun muſt be as their quantities of matter. Further, That the weights of Jupiter and his ſatellites towards the ſun are proportional to the ſeveral quantities of their matter, appears from the exceeding regular motions of the ſatellites. For if ſome of the bodies were more ſtrongly attracted to the ſun in proportion to their quantity of matter than others, the motions of the ſatellites would be diſturbed by that inequality of attraction. If, at equal diſtances from the ſun, any ſatellite, in proportion to the quantity of its matter, did gravitate towards the ſun, with a force greater than Jupiter in proportion to his, according to any given proportion, ſuppoſe *d* to *e*; then the diſtance beween the centres of the ſun and of the ſatellite's orbit would be always greater than the diſtance between the centres of the ſun and of Jupiter nearly in the ſubduplicate of that proportion. And if the ſatellite gravitated towards the ſun with a force leſs in the proportion of *e* to *d*, the diſtance of the centre of the ſatellite's orb from the ſun would be leſs than the diſtance of the centre of Jupiter's from the ſun in the ſubduplicate of the ſame proportion. Therefore, if, at equal diſtances from the ſun, the accelerative gravity of any ſatellite towards the ſun were greater or leſs than the accelerating gravity of Jupiter towards the ſun but by $\frac{1}{1000}$ part of the whole gravity; the diſtance of the centre of the ſatellite's orbit from the ſun would be greater or leſs than the diſtance of Jupiter from the ſun by $\frac{1}{2000}$ part of the whole diſtance; that is, by a fifth part of the diſtance of the utmoſt ſatellite from the centre of Jupiter; an eccentricity of the orbit which would be very ſenſible. But the orbits of the ſatellites are concentric to Jupiter; therefore the accelerative gravities of Jupiter, and of all its ſatellites, towards the ſun, are equal among themſelves. And by the ſame argument, the weight of Saturn and of his ſatellites towards the ſun, at equal diſtances from the ſun, are as their ſeveral quantities of matter; and the weights of the moon and of the earth towards the ſun, are either none, or accurately proportional to the maſſes of matter which they contain.

But further, the weights of all the parts of every planet towards any other planet are one to another as the matter in the ſeveral parts. For if ſome parts gravitated more, others leſs, than in proportion to the quantity of their matter; then the whole planet, according to the ſort of parts with which it moſt abounds, would gravitate more or leſs than in proportion to the quantity of matter in the whole. Nor is it of any moment whether theſe parts are external or internal. For if, as an inſtance, we ſhould imagine the terreſtrial bodies with us to be raiſed up to the orb of the moon, to be there compared with its body; if the weights of ſuch bodies were to the weights of the external parts of the moon as the quantities of matter in the one and in the other reſpectively, but to the weights of the internal parts in a greater or leſs proportion; then likewiſe the weights of thoſe bodies would be to the weight of the whole moon in a greater or leſs proportion; againſt what we have ſhowed above.

Cor. 1. Hence the weights of bodies do not depend upon their forms and textures. For if the weights could be altered with the forms, they would be greater or leſs, according to the variety of forms in equal matter; altogether againſt experience.

Cor. 2. Univerſally, all bodies about the earth gravitate towards the earth; and the weights of all, at equal diſtances from the earth's centre, are as the quantities of matter which they ſeverally contain. This is the quality of all bodies within the reach of our experiments; and therefore (by Rule 3.) to be affirmed of all bodies whatſoever. If ether, or any other body, were either altogether void of gravity, or were to gravitate leſs in proportion to its quantity of matter; then, becauſe (according to Ariſtotle, Des Cartes, and others) there is no difference betwixt that and other bodies, but in mere form of matter, by a ſucceſſive change from form to form, it might be changed at laſt into a body of the ſame condition with thoſe which gravitate moſt in proportion to their quantity of matter; and, on the other hand, the heavieſt bodies, acquiring the firſt form of that body, might by degrees quite loſe their gravity. And therefore the weights would depend upon the forms of bodies, and with thoſe forms might be changed, contrary to what was proved in the preceding corollary.

Cor. 3. All ſpaces are not equally full. For if all ſpaces were equally full, then the ſpecific gravity of the fluid which fills the region of the air, on account of the extreme denſity of the matter, would fall nothing ſhort of the ſpecific gravity of quickſilver or gold, or any other the moſt denſe body; and therefore, neither gold, nor any other body, could deſcend in air. For bodies do not deſcend in fluids, unleſs they are ſpecifically heavier than the fluids. And if the quantity of matter in a given ſpace can by any rarefaction be diminiſhed, what ſhould hinder a diminution to infinity?

Cor. 4. If all the ſolid particles of all bodies are of the ſame denſity, nor can be rarefied without pores, a void ſpace or vacuum muſt be granted. [By bodies

Newtonian Philoſophy.

of the ſame denſity, our author means thoſe whoſe *vires inertiæ* are in the proportion of their bulks.]

Prob. VI. That there is a power of gravity tending to all bodies, proportional to the ſeveral quantities of matter which they contain.

That all the planets mutually gravitate one towards another, we have proved before: as well as that the force of gravity towards every one of them, conſidered apart, is reciprocally as the ſquare of the diſtance of places from the centre of the planet. And thence it follows, that the gravity tending towards all the planets is proportional to the matter which they contain.

Moreover, ſince all the parts of any planet A gravitate towards any other planet B, and the gravity of every part is to the gravity of the whole as the matter of the part to the matter of the whole; and (by Law 3.) to every action correſponds an equal re-action: therefore the planet B will, on the other hand, gravitate towards all the parts of the planet A; and its gravity towards any one part will be to the gravity towards the whole, as the matter of the part to the matter of the whole. Q. E. D.

Cor. 1. Therefore the force of gravity towards any whole planet, ariſes from, and is compounded of, the forces of gravity towards all its parts. Magnetic and electric attractions afford us examples of this. For all attraction towards the whole ariſes from the attractions towards the ſeveral parts. The thing may be eaſily underſtood in gravity, if we conſider a greater planet as formed of a number of leſſer planets, meeting together in one globe. For hence it would appear that the force of the whole muſt ariſe from the forces of the component parts. If it be objected, that, according to this law, all bodies with us muſt mutually gravitate one towards another, whereas no ſuch gravitation anywhere appears; it is anſwered, that, ſince the gravitation towards theſe bodies is to the gravitation towards the whole earth, as theſe bodies are to the whole earth, the gravitation towards them muſt be far leſs than to fall under the obſervation of our ſenſes. [The experiments with regard to the attraction of mountains, however, have now further elucidated this point.]

Cor. 2. The force of gravity towards the ſeveral equal particles of any body, is reciprocally as the ſquare of the diſtance of places from the particles.

Prop. VII. In two ſpheres mutually gravitating each towards the other, if the matter, in places on all ſides round about and equidiſtant from the centres, is ſimilar; the weight of either ſphere towards the other will be reciprocally as the ſquare of the diſtance between their centres.

For the demonſtration of this, ſee the *Principia*, Book I. Prop. lxxv. and lxxvi.

Cor. 1. Hence we may find and compare together the weights of bodies towards different planets. For the weights of bodies revolving in circles about planets are as the diameters of the circles directly, and the ſquares of their periodic times reciprocally; and their weights at the ſurfaces of the planets, or at any other diſtances from their centres, are (by this prop.) greater or leſs, in the reciprocal duplicate proportion of the diſtances. Thus from the periodic times of Venus, revolving about the ſun, in 224d. 16$\frac{3}{4}$h.; of the utmoſt circumjovial ſatellite revolving about Jupiter, in

Newtonian Philoſophy.

16d. 16$\frac{8}{15}$h.; of the Huygenian ſatellite about Saturn in 15d. 22$\frac{2}{3}$h.; and of the moon about the earth in 27d. 7h. 43′; compared with the mean diſtance of Venus from the ſun, and with the greateſt heliocentric elongations of the outmoſt circumjovial ſatellite from Jupiter's centre, 8′ 16″; of the Huygenian ſatellite from the centre of Saturn, 3′ 4″; and of the moon from the earth, 10′ 33″; by computation our author found, that the weight of equal bodies, at equal diſtances from the centres of the ſun, of Jupiter, of Saturn, and of the earth, towards the ſun, Jupiter, Saturn, and the earth, were one to another as $\frac{1}{1067}$, $\frac{1}{3021}$, and $\frac{1}{169282}$ reſpectively. Then, becauſe as the diſtances are increaſed or diminiſhed, the weights are diminiſhed or increaſed in a duplicate ratio; the weights of equal bodies towards the ſun, Jupiter, Saturn, and the earth, at the diſtances 10000, 997, 791, and 109, from their centres, that is, at their very ſuperficies, will be as 10000, 943, 529, and 435 reſpectively.

Cor. 2. Hence likewiſe we diſcover the quantity of matter in the ſeveral planets. For their quantities of matter are as the forces of gravity at equal diſtances from their centres, that is, in the ſun, Jupiter, Saturn, and the earth, as 1, $\frac{1}{1067}$, $\frac{1}{3021}$, and $\frac{1}{169282}$, reſpectively. If the parallax of the ſun be taken greater or leſs than 10″ 30‴, the quantity of matter in the earth muſt be augmented or diminiſhed in the triplicate of that proportion.

Cor. 3. Hence alſo we find the denſities of the planets. For (by Prop. lxxii. Book I.) the weights of equal and ſimilar bodies towards ſimilar ſpheres, are, at the ſurfaces of thoſe ſpheres, as the diameters of the ſpheres. And therefore the denſities of diſſimilar ſpheres are as thoſe weights applied to the diameters of the ſpheres. But the true diameters of the ſun, Jupiter, Saturn, and the earth were one to another as 10000, 997, 791, and 109; and the weights towards the ſame, as 10000, 943, 529, and 435 reſpectively; and therefore their denſities are as 120, 94$\frac{1}{2}$, 67, and 400. The denſity of the earth, which comes out by this computation, does not depend upon the parallax of the ſun, but it is determined by the parallax of the moon, and therefore is here truly defined. The ſun therefore is a little denſer than Jupiter, and Jupiter than Saturn, and the earth four times denſer than the ſun; for the ſun, by its great heat, is kept in a ſort of a rarefied ſtate. The moon alſo is denſer than the earth.

Cor. 4. The ſmaller the planets are, they are, *cæteris paribus*, of ſo much the greater denſity. For ſo the powers of gravity on their ſeveral ſurfaces come nearer to equality. They are likewiſe, *cæteris paribus*, of the greater denſity as they are nearer to the ſun. So Jupiter is more denſe than Saturn, and the earth than Jupiter. For the planets were placed at different diſtances from the ſun, that, according to their degrees of denſity, they might enjoy a greater or leſs proportion of the ſun's heat. Our water, if it were removed as far as the orb of Saturn, would be converted into ice, and in the orb of Mercury would quickly fly away in vapour. For the light of the ſun, to which its heat is proportional, is ſeven times denſer in the orb of Mercury than with us: and by the thermometer Sir Iſaac found, that a ſevenfold heat of our ſummer ſun will make water boil. Nor are we to doubt, that

Newtonian Philoſophy, Newton.

that the matter of Mercury is adapted to its heat, and is therefore more denſe than the matter of our earth; ſince, in a denſer matter, the operations of nature require a ſtronger heat.

It is ſhown in the ſcholium of Prop. xxii. Book II. of the *Principia*, that, at the height of 200 miles above the earth, the air is more rare than it is at the ſuperficies of the earth, in the ratio of 30 to 0,0000000000003998, or as 75,000000000000 to 1 nearly. And hence the planet Jupiter, revolving in a medium of the ſame denſity with that ſuperior air, would not loſe by the reſiſtance of the medium the 1000000th part of its motion in 1000000 years. In the ſpaces near the earth, the reſiſtance is produced only by the air, exhalations, and vapours. When theſe are carefully exhauſted by the air pump from under the receiver, heavy bodies fall within the receiver with perfect freedom, and without the leaſt ſenſible reſiſtance; gold itſelf, and the lighteſt down, let fall together, will deſcend with equal velocity; and though they fall through a ſpace of four, ſix, and eight feet, they will come to the bottom at the ſame time; as appears from experiments that have often been made. And therefore the celeſtial regions being perfectly void of air and exhalations, the planets and comets meeting no ſenſible reſiſtance in thoſe ſpaces, will continue their motions through them for an immenſe ſpace of time.

Newton, *Thomas*, lord biſhop of Briſtol and dean of St Paul's London, was born on the firſt of January 1704. His father, John Newton, was a conſiderable brandy and cyder merchant, who, by his induſtry and integrity, having acquired what he thought a competent fortune, left off trade ſeveral years before he died.

He received the firſt part of his education in the free ſchool of Litchfield; a ſchool which, the biſhop obſerves with ſome kind of exultation, had at all times ſent forth ſeveral perſons of note and eminence; from Biſhop Smaldridge and Mr Wollaſton, to Dr Johnſon and Mr Garrick.

From Litchfield he was removed to Weſtminſter ſchool, in 1717, under the care of Dr Freind and Dr Nicoll.

During the time he was at Weſtminſter, there were, he obſerves, more young men who made a diſtinguiſhed figure afterwards in the world, than perhaps at any other period, either before or ſince. He particularly mentions William Murray, the late earl of Mansfield, with whom he lived on terms of the higheſt friendſhip to the laſt.

He continued ſix years at Weſtminſter ſchool, five of which he paſſed in the college. He afterwards went to Cambridge, and entered at Trinity college. Here he conſtantly reſided eight months at leaſt in every year, till he had taken his Bachelor of Arts degree. Being choſen fellow of his college, he came afterwards to ſettle in London. As it had been his inclination from a child, and as he was alſo deſigned for holy orders, he had ſufficient time to prepare himſelf, and compoſed ſome ſermons, that he might have a ſtock in hand when he entered on the miniſtry. His title for orders was his fellowſhip; and he was ordained deacon in December 1729, and prieſt in the February following, by Biſhop Gibſon.

At his firſt ſetting out in his office, he was curate at

Newton.

St George's, Hanover-ſquare; and continued for ſeveral years aſſiſtant preacher to Dr Trebeck. His firſt preferment was that of reader and afternoon preacher at Groſvenor Chapel, in South Audley ſtreet.

This introduced him to the family of Lord Tyrconnel, to whoſe ſon he became tutor. He continued in this ſituation for many years, very much at his eaſe, and on terms of great intimacy and friendſhip with Lord and Lady Tyrconnel, "without ſo much (ſays he) as an unkind word or a cool look intervening."

In the ſpring of 1744, he was, through the intereſt of the earl of Bath (who was his great friend and patron, and whoſe friendſhip and patronage were returned by grateful acknowledgements and the warmeſt encomiums), preſented to the rectory of St Mary Le Bow; ſo that he was 40 years old before he obtained any living.

At the commencement of 1745, he took his doctor's degree. In the ſpring of 1747 he was choſen lecturer of St George's, Hanover-ſquare, by a moſt reſpectable veſtry of noblemen and gentlemen of high diſtinction. In Auguſt following he married his firſt wife, the eldeſt daughter of Dr Trebeck; an unaffected, modeſt, decent young woman, with whom he lived very happy in mutual love and harmony for near ſeven years.

In 1749 he publiſhed his edition of Milton's Paradiſe Loſt, which, (ſays he, very modeſtly) it is hoped hath not been ill received by the public, having, in 1775, gone through eight editions. After the Paradiſe Loſt, it was judged (ſays he) proper that Dr Newton ſhould alſo publiſh the Paradiſe Regained, and other poems of Milton; but theſe things he thought detained him from other more material ſtudies, though he had the good fortune to gain by them more than Milton did by all his works put together. But his greateſt gain (he ſays) was their firſt introducing him to the friendſhip and intimacy of two ſuch men as Biſhop Warburton and Dr Jortin, whoſe works will ſpeak for them better than any private commendation.

In 1754 he loſt his father at the age of 83; and within a few days his wife, at the age of 38. This was the ſevereſt trial he ever underwent, and almoſt overwhelmed him. At that time he was engaged in writing his Diſſertations on the Prophecies; and happy it was for him: for in any affliction he never found a better or more effectual remedy than plunging deep into ſtudy, and fixing his thoughts as intenſely as he poſſibly could upon other ſubjects. The firſt volume wa publiſhed the following winter; but the other did not appear till three years afterwards; and as a reward for his paſt and an incitement to future labours, he was appointed, in the mean time, to preach Boyle's lecture. The biſhop informs us, that 1250 copies of the Diſſertations were taken at the firſt impreſſion, and 1000 at every other edition: and "though (ſays he) ſome things have been ſince publiſhed upon the ſame ſubjects, yet, they ſtill hold up their head above water, and having gone through five editions, are again prepared for another. Abroad, too, their reception hath not been unfavourable, if accounts from thence may be depended upon." They were tranſlated into the German and Daniſh languages; and received the warmeſt encomiums from perſons of learning and rank.

In the ſpring of 1757, he was made prebendary of Weſtminſter, in the room of Dr Green, and promoted to the deanery of Saliſbury. In October following, he was made ſub-almoner to his majeſty. This he owed to Biſhop Gilbert. He married a ſecond wife in September 1761. She was the widow of the Rev. Mr Hand, and daughter of John Lord Viſcount Liſburn. In the ſame month he kiſſed his majeſty's hand for his biſhopric.

In the winter of 1764, Dr Stone, the primate of Ireland, died. Mr Grenville ſent for Biſhop Newton, and in the moſt obliging manner deſired his acceptance of the primacy. Having maturely weighed the matter in his mind, he declined the offer.

In 1768 he was made dean of St Paul's. His ambition was now fully ſatisfied; and he firmly reſolved never to aſk for any thing more.

From this time to his death, ill health was almoſt his conſtant companion. It was wonderful that ſuch a poor, weak, and ſlender thread as the biſhop's life, ſhould be ſpun out to ſuch an amazing length as it really was. In the autumn of 1781 (uſually the moſt favourable part of the year to him) he laboured under repeated illneſſes: and on Saturday the 9th of February 1782, he began to find his breath much affected by the froſt. His complaints grew worſe and worſe till the Thurſday following. He got up at five o'clock, and was placed in a chair by the fire; complained to his wife how much he had ſuffered in bed, and repeated to himſelf that portion of the Pſalms, "O my God, I cry unto thee in the day time," &c. &c. About ſix o'clock he was left by his apothecary in a quiet ſleep. Between ſeven and eight he awoke, and appeared rather more eaſy, and took a little refreſhment. He continued dozing till near nine, when he ordered his ſervant to come and dreſs him, and help him down ſtairs. As ſoon as he was dreſſed, he inquired the hour, and bid his ſervant open the ſhutter and look at the dial of St Paul's. The ſervant anſwered, it was upon the ſtroke of nine. The biſhop made an effort to take out his watch; with an intent to ſet it; but ſunk down in his chair, and expired without a ſigh or the leaſt viſible emotion, his countenance ſtill retaining the ſame placid appearance which was ſo peculiar to him when alive. Of his numerous works, his Diſſertations on the Prophecies are by much the moſt valuable. His learning was undoubtedly very conſiderable; but he ſeldom exhibits evidence of a very vigorous mind. On one occaſion, indeed, he appears to have thought with freedom; for we believe he was the firſt dignitary of the church of England who avowed his belief of the final reſtitution of all things to harmony and happineſs.

NEWTYA, a port little known, on the coaſt between Goa the capital of the Portugueſe ſettlements in India, and the Engliſh ſettlement of Bombay. Mr Rennel conjectures it to be the *Nitrias* of Pliny; near which the pirates cruized for the Roman ſhip. The ſame writer places it near to 15° 52′ 30″ north latitude, and 73° 16′ 30″ eaſt longitude.

NEXI, among the Romans, perſons free born, who for debt were reduced to a ſtate of ſlavery. By the laws of the twelve tables it was ordained, that inſolvent debtors ſhould be given up to their creditors to be bound in fetters and cords, whence they were called *Nexi;* and though they did not entirely loſe the rights of freemen, yet they were often treated more harſhly than the ſlaves themſelves. If any one was indebted to ſeveral perſons, and could not within 60 days find a cautioner, his body according to ſome, but according to others his effects, might be cut in pieces, and divided among his creditors. The latter opinion ſeems by much the moſt probable, as Livy mentions a law by which creditors had a right to attach the goods but not the perſons of their debtors.

NEYTRECHT, a town of Upper Hungary, capital of a county of the ſame name, with a biſhop's ſee; ſeated on the river *Neitra*, 40 miles north-eaſt of Preſburg. E. Long. 17. 49. N. Lat. 48. 28.

NGAN-KING-FOU, a city of China, and capital of the weſtern part of the province of Kiang-nan. It is governed by a particular viceroy, who keeps a large garriſon in a fort built on the banks of the river Yang-tſe-kiang. Its ſituation is delightful; its commerce and riches render it very conſiderable; and every thing that goes from the ſouthern part of China to Nan-king muſt paſs through it. All the country belonging to it is level, pleaſant, and fertile. It has under its juriſdiction only ſix cities of the third claſs.

NGO-KIA, a Chineſe drug, of which the compoſition will no doubt appear as ſingular as the numerous properties aſcribed to it. In the province Chang tong, near Ngo-hien, a city of the third claſs, is a well formed by nature, which is reckoned to be ſeventy feet in depth, and which has a communication, as the Chineſe ſay, with ſome ſubterranean lake, or other large reſervoir. The water drawn from it is exceedingly clear, and much heavier than common; and if it be mixed with muddy water, it purifies it and renders it limpid, by precipitating all its impurities to the bottom of the veſſel. This water is employed in making the ngo-kia, which is nothing elſe but a kind of glue procured from the ſkin of a black aſs.

The animal is killed and flayed, and the ſkin is ſteeped for five days in water drawn from this well. At the end of that time, it is taken out to be ſcraped and cleaned; it is afterwards cut into ſmall pieces, which are boiled over a ſlow fire, in the ſame kind of water, until it is reduced to a jelly, which is ſtrained, while warm, through a cloth, to free it from all the groſs matter which could not be melted. When this glue is cool, and has acquired a conſiſtence, it is formed into ſquare cakes, upon which the Chineſe imprint characters and coats of arms, or the ſigns of their ſhops.

This well is the only one of the kind in China; it is always ſhut, and ſealed by the governor of the place with his own ſeal, until the cuſtomary day of making the emperor's glue. This operation generally laſts from the autumnal harveſt till the month of March. During that time, the neighbouring people and merchants treat for the purchaſe of the glue with thoſe who guard the well, and with the people who make it. The latter manufacture as much of it as they can, on their own account, with this difference, that it is not ſo pure, and that they are leſs ſcrupulous in examining whether the aſs be fat, or of a very black colour: however, all the glue made here is as much eſteemed at Peking as that which the mandarins who are on the ſpot tranſmit to court and to their friends.

As this drug is in the greateſt requeſt, and as the quantity of it made at Ngo-hien is not ſufficient to ſupply

ſupply the whole empire, there are not wanting people who counterfeit it elſewhere, and who manufacture a ſpurious kind from the ſkins of mules, horſes, and camels, and ſometimes even from old boots; it is, however, very eaſy to diſtinguiſh that which is genuine; it has neither a bad ſmell nor a diſagreeable taſte when applied to the mouth; it is brittle and friable, and always of a deep black colour, ſometimes inclining to red. The qualities of the counterfeit kind are entirely different; both its taſte and ſmell are diſagreeable, and it is viſcous and flabby even when made of the ſkin of a hog, which is that which imitates the true kind the beſt.

The Chineſe attribute a great number of virtues to this drug. They aſſure us that it diſſolves phlegm, facilitates the play and elaſticity of the lungs, gives a free reſpiration to thoſe who breathe with difficulty; that it comforts the breaſt, increaſes the blood, ſtops dyſenteries, provokes urine, and ſtrengthens children in the womb. Without warranting the truth of all theſe properties, it appears, at leaſt, certain, by the teſtimony of the miſſionaries, that this drug is ſerviceable in all diſeaſes of the lungs. It is taken with a decoction of ſimples, and ſometimes in powder, but very ſeldom.

NIAGARA, a fort of North America, which was taken from the French in 1759. According to the treaty of 1794, it was delivered up by Britain to the United States in 1796. It is ſituated on a ſmall peninſula formed by the river Niagara as it flows into the lake Ontario. About ſix leagues from the fort is the greateſt cataract in the world, known by the name of the *Waterfall of Niagara*. The river at this fall runs from SSE to NNW; and the rock of the fall croſſes it not in a right line, but forms a kind of figure like a hollow ſemicircle or horſe ſhoe. Above the fall, in the middle of the river, is an iſland about 800 or 1000 feet long; the lower end of which is juſt at the perpendicular edge of the fall. On both ſides of this iſland runs all the water that comes from the lakes of Canada; viz. Lake Superior, Lake Michigan, Lake Huron, and Lake Erie, which have ſome large rivers that open themſelves into them. Before the water comes to this iſland, it runs but ſlowly compared with its motion afterwards, when it grows the moſt rapid in the world, running with a ſurpriſing ſwiftneſs before it comes to the fall. It is perfectly white, and in many places is thrown high up into the air. The water that runs down on the weſt ſide is more rapid, in greater abundance, and whiter, than that on the eaſt ſide; and ſeems almoſt to outfly an arrow in ſwiftneſs. When you are at the fall, and look up the river, you may ſee that the water is everywhere exceedingly ſteep, almoſt like the ſide of a hill; but when you come to look at the fall itſelf, it is impoſſible to expreſs the amazement it occaſions. The height of it, as meaſured by mathematical inſtruments, is found to be exactly 137 feet; and when the water is come to the bottom, it jumps back to a very great height in the air. The noiſe may be heard at the diſtance of 45 miles, but ſeldom further; nor can it be heard even at Fort Niagara, which is only ſix leagues diſtant, unleſs Lake Ontario is calm. At that fort it is obſerved, that when they hear the noiſe of the fall more loud than ordinary, they are ſure that a north-eaſt wind will follow; which is the more ſurpriſing, as the fort lies ſouth-weſt from the fall. At ſome times the fall makes a much greater noiſe than at others; and this is held for an infallible ſign of approaching rain or other bad weather.

From the place where the water falls there ariſes abundance of vapour like very thick ſmoke, inſomuch that when viewed at a diſtance you would think that the Indians had ſet the foreſts on fire. Theſe vapours riſe high in the air when it is calm, but are diſperſed by the wind when it blows hard. If you go into this vapour or fog, or if the wind blows it on you, it is ſo penetrating, that in a few moments you will be as wet as if you had been under water. Some are of opinion that when birds come flying into this fog or ſmoke of the fall, they drop down and periſh in the water; either becauſe their wings are become wet, or that the noiſe of the fall aſtoniſhes them, and they know not where to go in the darkneſs: but others think that ſeldom or never any bird periſhes there in that manner; becauſe among the abundance of birds found dead below the fall, there are no other ſorts than ſuch as live and ſwim frequently in the water; as ſwans, geeſe, ducks, water hens, teal, and the like. And very often great flocks of them are ſeen going to deſtruction in this manner: they ſwim in the river above the fall, and ſo are carried down lower and lower by the water; and as water fowl commonly take great delight in being carried with the ſtream, they indulge themſelves in enjoying this pleaſure ſo long, till the ſwiftneſs of the water becomes ſo great, that it is no longer poſſible for them to riſe, but they are driven down the precipice and periſh. They are obſerved, when they draw nigh the fall, to endeavour with all their might to take wing and leave the water; but they cannot. In the months of September and October ſuch abundant quantities of dead water fowl are found every morning below the fall, on the ſhore, that the garriſon of the fort for a long time live chiefly upon them. Beſides the fowl, they find alſo ſeveral ſorts of dead fiſh, alſo deer, bears, and other animals which have tried to croſs the water above the fall: the larger animals are generally found broken to pieces. Juſt below, a little way from the fall, the water is not rapid, but goes all in circles, and whirls like a boiling pot; which however does not hinder the Indians going upon it in ſmall canoes a-fiſhing; but a little further, and lower, the other ſmaller falls begin. When you are above the fall, and look down, your head begins to turn; even ſuch as have been here numberleſs times, will ſeldom venture to look down, without at the ſame time keeping faſt hold of ſome tree with one hand.

It was formerly thought impoſſible for anybody living to come at the iſland that is in the middle of the fall: but an accident that happened about 50 years ago made it appear otherwiſe. The hiſtory is this: Two Indians of the Six Nations went out from Niagara fort to hunt upon an iſland that is in the middle of the river, or ſtrait, above the great fall, on which there uſed to be abundance of deer. They took ſome French brandy with them from the fort, which they taſted ſeveral times as they were going over the carrying place; and when they were in their canoe, they took now and then a dram, and ſo went along up the ſtrait towards the iſland where they propoſed to hunt; but growing ſleepy, they laid themſelves down in the canoe, which getting looſe drove back with the ſtream, farther and farther down, till it came nigh that iſland that is in the middle of the fall. Here one of them, awakened by the noiſe of the fall, cries out to the other that they were gone: Yet they tried if poſſible to ſave life. This iſland was nigheſt, and with much working they got on ſhore there. At firſt they were glad; but when they had conſidered every thing, they thought themſelves hardly in a better ſtate than if they had gone down the fall, ſince they had now no other choice, than either to throw themſelves down the ſame, or periſh with hunger. But hard neceſſity put them on invention. At the lower end of the iſland the rock is perpendicular, and no water is running there. The iſland has plenty of wood; they went to work then, and made a ladder or ſhrouds of the bark of the lind tree (which is very tough and ſtrong) ſo long till they could with it reach the water below; one end of this bark ladder they tied faſt to a great tree that grew at the ſide of the rock above the fall, and let the other end down to the water. So they went down along their new invented ſtairs, and when they came to the bottom in the middle of the fall they reſted a little; and as the water next below the fall is not rapid, as before mentioned, they threw themſelves out into it, thinking to ſwim on ſhore. We have ſaid before, that one part of the fall is on one ſide of the iſland, the other on the other ſide. Hence it is, that the waters of the two cataracts running againſt each other, turn back againſt the rock that is juſt under the iſland. Therefore, hardly had the Indians begun to ſwim, before the waves of the eddy threw them back with violence againſt the rock from whence they came. They tried it ſeveral times, but at laſt grew weary; and by being often thrown againſt the rock they were much bruiſed, and the ſkin torn off their bodies in many places. So they were obliged to climb up ſtairs again to the iſland, not knowing what to do. After ſome time they perceived Indians on the ſhore, to whom they cried out. Theſe ſaw and pitied them, but gave them little hope or help: yet they made haſte down to the fort, and told the commandant where two of their brothers were. He perſuaded them to try all poſſible means of relieving the two poor Indians; and it was done in the following manner:

The water that runs on the eaſt ſide of this iſland is ſhallow, eſpecially a little above the iſland towards the eaſtern ſhore. The commandant cauſed poles to be made and pointed with iron; two Indians took upon them to walk to this iſland by the help of theſe poles, to ſave the other poor creatures, or periſh themſelves. They took leave of all their friends, as if they were going to death. Each had two ſuch poles in his hands, to ſet to the bottom of the ſtream, to keep them ſteady; and in this manner reached the iſland: and having given poles to the two poor Indians there, they all returned ſafely to the main land. Theſe two Indians (who in the above-mentioned manner were firſt brought to this iſland) were nine days on the iſland, and almoſt ready to ſtarve to death. Now ſince the road to this iſland has been found, the Indians go there often to kill deer, which have tried to croſs the river above the fall, and are driven upon it by the ſtream. On the weſt ſide of this iſland are ſome ſmall iſlands or rocks, of no conſequence. The eaſt ſide of the river is almoſt perpendicular, the weſt ſide more ſloping. In former times, a part of the rock at the fall which is on the weſt ſide of the iſland, hung over in ſuch a manner, that the water which fell perpendicularly from it left a vacancy below, ſo that people could go under between the rock and the water; but the prominent part ſome years ſince broke off and fell down. The breadth of the fall, as it runs in a ſemicircle, is reckoned to be about 300 feet. The iſland is in the middle of the fall, and from it the water on each ſide is almoſt the ſame breadth; the breadth of the iſland at its lower end is about 100 feet. Below the fall, in the holes of the rocks, are great plenty of eels, which the Indians and French catch with their hands without any other means. Every day when the ſun ſhines, you ſee here from ten o'clock in the morning to two in the afternoon, below the fall, and under you, where you ſtand at the ſide of the fall, a glorious rainbow, and ſometimes two, one within the other. The more vapours, the brighter and clearer is the rainbow. When the wind carries the vapours from that place, the rainbow is gone, but appears again as ſoon as new vapours come. From the fall to the landing above it, where the canoes from Lake Erie put aſhore (or from the fall to the upper end of the carrying place), is half a mile. Lower the canoes dare not come, leſt they ſhould be obliged to try the fate of the two Indians, and perhaps with leſs ſucceſs. They have often found below the fall pieces of human bodies, perhaps drunken Indians, that have unhappily come down to the fall. The French ſay, that they have often thrown whole great trees into the water above, to ſee them tumble down the fall: they went down with ſurpriſing ſwiftneſs, but could never be ſeen afterwards; whence it was thought there was a bottomleſs deep or abyſs juſt under the fall. The rock of the fall conſiſts of a gray limeſtone. For an intereſting account of this celebrated fall, the reader is referred to Volney's Travels in America.

Having mentioned the *Six Nations* which live on the banks of the Niagara, we ſhall here add a few particulars relative to thoſe nations which, as they ſeem not to be well underſtood even in America, are probably ſtill leſs known in Europe. The information which we have to give was communicated to the Royal Society of London by Mr Richard M'Cauſland ſurgeon to the 8th regiment of foot, who, writing from the beſt authority, informs us, that each nation is divided into three tribes, of which the principal are called the *turtle tribe*, the *wolf tribe*, and the *bear tribe*.

Each tribe has two, three, or more chiefs, called *ſachems;* and this diſtinction is always hereditary in the family, but deſcends along the female line: for inſtance, if a chief dies, one of his ſiſter's ſons, or one of his own brothers, will be appointed to ſucceed him. Among theſe no preference is given to proximity or primogeniture; but the ſachem, during his lifetime, pitches upon one whom he ſuppoſes to have more abilities than the reſt; and in this choice he frequently, though not always, conſults the principal men of the tribe. If the ſucceſſor happens to be a child, the offices of the poſt are performed by ſome

of

of his friends until he is of ſufficient age to act himſelf.

Each of theſe poſts of ſachem has a name which is peculiar to it, and which never changes, as it is always adopted by the ſucceſſor: nor does the order of precedency of each of theſe names or titles ever vary. Nevertheleſs, any ſachem, by abilities and activity, may acquire greater power and influence in the nation than thoſe who rank before him in point of precedency; but this is merely temporary, and dies with him.

Each tribe has one or two chief warriors; which dignity is alſo hereditary, and has a peculiar name attached to it.

Theſe are the only titles of diſtinction which are fixed and permanent in the nation; for although any Indian may by ſuperior talents, either as a counſellor or as a warrior, acquire influence in the nation, yet it is not in his power to tranſmit this to his family.

The Indians have alſo their great women as well as their great men, to whoſe opinions they pay great deference: and this diſtinction is alſo hereditary in families. They do not ſit in council with the ſachems, but have ſeparate ones of their own.—When war is declared, the ſachems and great women generally give up the management of public affairs into the hands of the warriors. It may however ſo happen, that a ſachem may at the ſame time be alſo a chief warrior.

Friendſhips ſeem to have been inſtituted with a view towards ſtrengthening the union between the ſeveral nations of the confederacy; and hence friends are called the *ſinews of the Six Nations*. An Indian has therefore generally one or more friends in each nation. Beſides the attachment which ſubſiſts during the lifetime of the two friends, whenever one of them happens to be killed, it is incumbent on the ſurvivor to replace him, by preſenting to his family either a ſcalp, a priſoner, or a belt conſiſting of ſome thouſands of wampum; and this ceremony is performed by every friend of the deceaſed.

The purpoſe and foundation of war parties, therefore, is in general to procure a priſoner or ſcalp to replace the friend or relation of the Indian who is the head of the party. An Indian who wiſhes to replace a friend or relation preſents a belt to his acquaintance; and as many as chooſe to follow him accept this belt, and become his party. After this, it is of no conſequence whether he goes on the expedition or remains at home (as it often happens that he is a child;) he is ſtill conſidered as the head of the party. The belt he preſented to his party is returned fixed to the ſcalp or priſoner, and paſſes along with them to the friends of the perſon he replaces. Hence it happens, that a war party, returning with more ſcalps or priſoners than the original intention of the party required, will often give one of theſe ſupernumerary ſcalps or priſoners to another war party whom they meet going out; upon which this party, having fulfilled the purpoſe of their expedition, will ſometimes return without going to war.

NICÆA, in *Ancient Geography*, the metropolis of Bithynia; ſituated on the lake Aſcanius, in a large and fertile plain; in compaſs 16 ſtadia: firſt built by Antigonus, the ſon of Philip, and thence called *Antigonea;* afterwards completed by Lyſimachus, who called it *Nicæa*, after his conſort the daughter of Antipater. According to Stephanus, it was originally a colony of the Bottiæi, a people of Thrace, and called *Ancore;* and afterwards called *Nicæa*. Now *Nice* in Aſia the Leſs *. Famous for the firſt general council.—A ſecond *Nicæa*, (Diodorus Siculus), of Corſica.—A third, of the Hither India, (Arrian); ſituated on the weſt ſide of the Hydaſpes, oppoſite to Bucephale, on the eaſt ſide.—A fourth *Nicæa*, a town of Liguria, at the Maritime Alps, on the eaſt ſide of the river Paulon, near its mouth, which runs between the Varus and Nicæa, (Mela). A colony of the Maſſilians, (Stephanus); the laſt town of Italy to the weſt. Now *Nizza* or *Nice*, capital of the county of that name, on the Mediterranean.—A fifth, of Locris, (Strabo); a town near Thermopylæ; one of the keys of that paſs. It ſtood on the Sinus Maliacus.

END OF THE FOURTEENTH VOLUME.

---

* See *Nice*.

DIRECTIONS FOR PLACING THE PLATES OF VOL. XIV.

PART I.

Plate CCCXXXVII.—CCCXLV. to face	page 38
CCCXLVI.—CCCL.	76
CCCLI.—CCCLIII.	254

PART II.

CCCLIV.—CCCLXII.	552
CCCLXIII.—CCCLXVIII.	702
CCCLXIX.	734