
IN HOC SIGNO VINCES
Berry of Tayfield

ENCYCLOPÆDIA BRITANNICA.

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 a great value, as a particular mark of his esteem. He died in 1664.

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. Beside portraits, his general subjects were conversations, persons performing on musical instruments, patients attended by the apothecary or doctor, chymists 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 (John), son of the former, was born at Leyden in 1660, and learned the art of painting from his father. The young artist unhappily was severely afflicted with the gravel and stone; and by those complaints was much hindered in the progress of his studies. But, after the death of his father, he travelled to Germany, and from thence to Florence, where the fame of his father's merit procured him a most honourable reception from the grand duke, who, when he saw some of his paintings, endeavoured to retain him in his service. But Mieris politely declined it, and proceeded to Rome, where his great abilities were well known before his arrival, and his works were exceedingly coveted. In that city his malady increased; yet at the intervals of ease he continued to work with his usual application, till the violence of his distemper ended his days in 1690, when he was only thirty years old. He was allowed to have been as eminent for painting in a large size as his father had been for his works in small.

MIERIS (William), called the *Young Mieris*, was brother to 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, (anc. geog.), 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, (anc. geog.), 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), a very 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 are 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 appoint 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 Franckfort 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 most 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 removal of a thing out of one place into another.

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

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.

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 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 breed 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 ſiſkin, 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 probaby their winter-aſylum.

14. *Swallows and goat-ſucker.* Every ſpecies diſappears at the approach of winter.

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 ſcarce 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 diſturb-

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ance 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 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 forsake us in the spring, retire 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 continue 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 Fosdike 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 numbers, 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 Skie. 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. Barentz 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

also obferves, that the Dutch difcovered them on the rocks of that country and in Waygate Straits. They, as well as the other fpecies of wild-geefe, go very far north to breed, as appears from the hiftories of Greenland and Spitzbergen, by Egede and Crantz. Thefe birds feem to make Iceland a refting place, as Horrebow obferves: few continue there to breed, but only vifit that ifland in the fpring, and after a fhort ftay retire ftill further north.

30. *Corvorants.* The corvorant and fhag breed on moft of our high rocks: the gannet in fome of the Scotch ifles, and on the coaft of Kerry: the two firft continue on our fhores the whole year. The gannet difperfes itfelf all round the feas of Great Britain, in purfuit of the herring and pilchard, and even as far as the Tagus to prey on the fardina.

But of the numerous fpecies of fowl here enumerated, it may be obferved how very few intruft themfelves to us in the breeding feafon, and what a diftant flight they make to perform the firft great dictate of nature.

There feems to be fcarcely any but what we have traced to Lapland, a country of lakes, rivers, fwamps, and alps, covered with thick and gloomy forefts, that afford fhelter during fummer to thefe fowls, which in winter difperfe over the greateft part of Europe. In thofe arctic regions, by reafon of the thicknefs of the woods, the ground remains moift and penetrable to the woodcocks, and other flender-billed fowl: and for the web-footed birds, the waters afford larvæ innumerable of the tormenting knat. The days there are long; and the beautiful meteorous nights indulge them with every opportunity of collecting fo minute a food: whilft mankind is very fparingly fcattered over that vaft northern wafte.

Why then fhould Linnæus, the great explorer of thefe rude defarts, be amazed at the myriads of waterfowl that migrated with him out of Lapland? which exceeded in multitude the army of Xerxes; covering, for eight whole days and nights, the furface of the river Calix! His partial obfervation as a botanift, would confine their food to the vegetable kingdom, almoft denied to the Lapland waters; inattentive to a more plenteous table of infect food, which the all-bountiful Creator had fpread for them in the wildernefs. It may be remarked, that the lakes of mountainous rocky countries in general are deftitute of plants: few or none are feen on thofe of Switzerland; and Linnæus makes the fame obfervation in refpect to thofe of Lapland; having, during his whole tóur, difcovered only a fingle fpecimen of a *lemma trifulca*, or "ivy-leaved duck's meat," *Flora Lap.* n° 470.; a few of the *fcirpus lacuftris*, or "bullrufh," n° 18.; the *alopecurus geniculatus*, or "flote foxtail grafs," n° 38.; and the *ranunculus aquatilis*, n° 234.; which are all he enumerates in his *Prolegomena* to that excellent performance.

Under the article Swallow will be found the principal arguments for and againft the migration of fwallows. Here we fhall give a fhort abftract of the arguments ufed by the Hon. Daines Barrington againft the migration of birds in general, from a paper publifhed by him in the 62d volume of the Philofophical Tranfactions. This gentleman denies that any wellattefted inftances can be produced of this fuppofed migration; which, he thinks, if there were any fuch periodical flight, could not poffibly have efcaped the frequent obfervation of feamen. It has indeed been afferted that birds of paffage become invifible in their flight, becaufe they rife too high in the air to be perceived, and becaufe they choofe the night for their paffage. The author, however, expreffes his doubts "whether any bird was ever feen to rife to a greater height than perhaps twice that of St Paul's crofs;" and he further endeavours to fhow, that the extent of fome of thefe fuppofed migrations (from the northern parts of Europe, for inftance, to the line) is too great to be accounted for, by having recourfe to the argument founded on a nocturnal paffage.

The author next recites, in a chronological order, all the inftances that he has been able to collect, of birds having been actually feen by mariners when they were croffing a large extent of fea; and he endeavours to fhow that no ftrefs can be laid on the few cafual obfervations of this kind that have been produced in fupport of the doctrine of a regular and periodical migration.

Mr Barrington afterwards proceeds to invalidate M. Adanfon's celebrated obfervation with refpect to the migration of the fwallow in particular, and which has been confidered by many as perfectly decifive of the prefent queftion. He endeavours to fhow that the four fwallows which that naturalift caught, on their fettling upon his fhip, on the 6th of October at about the diftance of 50 leagues from the coaft of Senegal, and which he fuppofes to have been then proceeding from Europe to pafs the winter in Africa, could not be true European fwallows; or, if they were, could not have been on their return from Europe to Africa. His objections are founded principally on fome proofs which he produces of M. Adanfon's want of accuracy on this fubject, which has led him, in the prefent inftance, to miftake two African fpecies of the fwallow-tribe, defcribed and engraved by Briffon, for European fwallows, to which they bear a general refemblance; or granting even that they were European fwallows, he contends, that they were flitting from the Cape de Verd Iflands to the coaft of Africa; "to which fhort flight, however, they were unequal, and accordingly fell into the failor's hands." See the article Swallow.—We fhall here only add, in oppofition to the remarks of Mr Barrington, the following obfervations of the Rev. Mr White * in a letter to Mr Pennant on this fubject.

* *Natural Hiftory of Selborne*, Letter ix, p. 139.

"We muft not (fays he) deny migration in general; becaufe migration certainly does fubfift in fome places, as my brother in Andalufia has fully informed me. Of the motions of thefe birds he has ocular demonftration, for many weeks together, both fpring and fall: during which periods myriads of the fwallow kind traverfe the Straits from north to fouth, and from fouth to north, according to the feafon. And thefe vaft migrations confift not only of hirundines, but of bee-birds, hoopoes, oro pendolos, or golden thrufhes, &c. &c. and alfo of many of our foft-billed fummer birds of paffage; and moreover of birds which never leave us, fuch as all the various forts of hawks and kites. Old Belon, 200 years ago, gives a curious account of the incredible armies of hawks and kites which he faw in the fpring-time traverfing the Thracian

Migration.

cian Bofphorus from Afia to Europe. Befides the above mentioned, he remarks, that the proceffion is fwelled by whole troops of eagles and vultures.

"Now it is no wonder that birds refiding in Africa fhould retreat before the fun as it advances, and retire to milder regions, and efpecially birds of prey, whofe blood being heated with hot animal food, are more impatient of a fultry climate: but then I cannot help wondering why kites and hawks, and fuch hardy birds as are known to defy all the feverity of England, and even of Sweden and all north Europe, fhould want to migrate from the fouth of Europe, and be diffatisfied with the winters of Andalufia.

"It does not appear to me that much ftrefs may be laid on the difficulty and hazard that birds muft run in their migrations, by reafon of vaft oceans, crofs winds, &c.; becaufe, if we reflect, a bird may travel from England to the equator without launching out and expofing itfelf to boundlefs feas, and that by croffing the water at Dover and again at Gibraltar. And I with the more confidence advance this obvious remark, becaufe my brother has always found that fome of his birds, and particularly the fwallow kind, are very fparing of their pains in croffing the Mediterranean: for when arrived at Gibraltar, they do not,

—— "rang'd in figure, wedge their way,
—— "and fet forth
"Their airy caravan high over feas
"Flying, and over lands with mutual wing
"Eafing their flight." MILTON.

but fcout and hurry along in little detached parties of fix or feven in a company; and fweeping low, juft over the furface of the land and water, direct their courfe to the oppofite continent at the narroweft paffage they can find. They ufually flope acrofs the bay to the fouth-weft, and fo pafs over oppofite to Tangier, which it feems is the narroweft fpace.

"In former letters we have confidered whether it was probable that woodcocks in moon-fhiny nights crofs the German ocean from Scandinavia. As a proof that birds of lefs fpeed may pafs that fea, confiderable as it is, I fhall relate the following incident, which, though mentioned to have happened fo many years ago, was ftrictly matter of fact:—As fome people were fhooting in the parifh of Trotton, in the county of Suffex, they killed a duck in that dreadful winter 1708 9, with a filver collar about its neck (I have read a like anecdote of a fwan), 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 beft of my remembrance, the collar was in the poffeffion of the rector.

"At prefent I do not know any body near the feafide that will take the trouble to remark at what time of the moon woodcokes firft come. One thing I ufed to obferve when I was a fportfman, that there were times in which woodcocks were fo fluggifh and fleepy that they would drop again when flufhed juft before the fpaniels, nay juft at the muzzle of a gun that had been fired at them: whether this ftrange lazinefs was the effect of a recent fatiguing journey, I fhall not prefume to fay.

"Nightingales not only never reach Northumberland and Scotland, but alfo, as I have been always told, Devonfhire and Cornwall. In thofe two laft counties we cannot attribute the failure of them to the want of warmth: the defect in the weft is rather a prefumptive argument that thefe birds come over to us from the continent at the narroweft paffage, and do not ftroll fo far weftward."

MIGRATION of Fifhes. See CLUPEA.

St Miguel.

ST MIGUEL, one of the Azore iflands, fituated in W. Long. 22. 45. N. Lat. 38. 10. This ifland appears to be entirely volcanic. The beft account we have of it hath been publifhed in the 68th volume of the Philofophical Tranfactions by Mr Francis Maffon. According to him, the productions differ greatly from thofe of Madeira, infomuch 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 ever-green fhrub very like a phillyrea, which gives them a moft beautiful appearance.

It is one of the principal and moft fertile of the Azorian iflands, lying nearly eaft and weft. Its length is about 18 or 20 leagues; its breadth unequal, not exceeding five leagues, and in fome 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 fituated on the fouth fide of the ifland, on a fine fertile plain country, pretty regularly built; the ftreets ftraight, and of a good breadth. It is fupplied with good water, which is brought about the diftance of three leagues from the neighbouring mountains. The churches and other religious edifices are elegant and well built for fuch an ifland. There is a large convent of Fracifcan friars and one of the order of St Auguftin, four convents for profeffed nuns, and three Recolhimentos for young women and widows who are not profeffed. The veffels anchor in an open road; but it is not dangerous, as no wind can prevent their going to fea in cafe of ftormy weather.

The country round the city is plain for feveral miles, well cultivated, and laid out with good tafte into fpacious fields, which are fown with wheat, barley, Indian corn, pulfe, &c. and commonly produce annually two crops; for as foon as one is taken off, another is immediately fown in its place. The foil is remarkably gentle and eafy to work, being for the moft part compofed of pulverifed pumice-ftone. There are in the plains a number of pleafant country feats, with orchards of orange trees, which are efteemed the beft in Europe.

The fecond town is Ribeira Grande, fituated on the north fide of the ifland, containing about as many inhabitants as the city; a large convent of Francifcan friars, and one of nuns. It gives title to a count, called the *Conde Ribeira Grande*, who firft inftituted linen and woollen manufactories in the ifland.

The third town is Villa Franca, on the fouth fide of the ifland, about fix leagues eaft of Ponta del Guda. It has a convent of Francifcan friars, and one of nuns, which contains about 300. Here, about half a mile from the fhore, lies a fmall ifland (Ilhao), which is hollow in the middle, and contains a fine bafon with only one entrance into it, fit to hold 50 fail of veffels fecure from all weather; at prefent it wants cleaning out,

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.

Beside these towns are several smaller, *viz.* Alagoa, 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 ever-greens, *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 pulverised pumice-stone that the earth is composed of.

There are a number of 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 on 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, where the steam issues out, 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 Ann'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 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 number 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

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 another 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.

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 returned 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 Maggione, 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 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 Burri, 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 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 abovementioned; 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 *Doninia 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

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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, as being 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 Appenine 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 150 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*.

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The trade and manufactures of this duchy consist principally in silks, 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 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, is 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.

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, Milan.

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 Boromæo is depoſited. The other churches moſt worthy a ſtranger's notice are thoſe of St Alexander, St Jerom, 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 Boromæo, 16 profeſſors teach gratis. In the ſame college is alſo an academy of painting, with a muſeum, and a library containing a vaſt number of 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 rixdollars.

The number of the inhabitants of this city is ſaid to be about 200,000. 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 bed-fellow," who continues maſked till ſhe enters the bed-chamber. Milan is deſcribed as inferior to Turin both in beauty and conveniency; many of the ſtreets bing 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 Lambro 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 maſter-piece 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.

Milan, Milborn.

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 ſplendor and magnificence, not only in their entertainments, but in their uſual ſtyle of living, unknown in any other country in 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 ſplendor 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. 15. 35. N. Lat. 38. 32.

MILBORN-PORT, a town of Somerſetſhire in England, ſeated on a branch of the river Parret, 115 miles from London. Though it is repreſented in parliament, 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

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 are about 1100, the houses not much above 200. There are two fairs, June 6th and October 28th.

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.

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 two 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 deficcation 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 (anc. geog.), 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 (anc. geog.), 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 with much difficulty taken. It gave birth to 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 Anaximance, 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

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.

MILFORD, a town of Sussex-county in the Delaware state, is situated at the source of a small river, 15 miles 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 out-let 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 custom-house 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 Llanstadwell, 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 an 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, n° 229.

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 corona 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

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tend to the oppreffion of the people, that power was delegated to him by the vote of the people themfelves. So too, among the ancient Germans, the anceftors 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 ftate. The dukes were elective, the kings hereditary: for fo only can be confiftently underftood that paffage of Tacitus, *Reges ex nobilitate, duces ex virtute fumunt.* In conftituting their kings, the family or blood-royal was regarded; in choofing their dukes or leaders, warlike merit: juft as Cefar relates of their anceftors in his time, that whenever they went to war, by way either of attack or defence, they elected leaders to command them. This large fhare of power, thus conferred by the people, though intended to preferve the liberty of the fubject, was perhaps unreafonably detrimental to the prerogative of the crown: and accordingly we find a very ill ufe made of it by Edric duke of Mercia, in the reign of king Edmond Ironfide; who, by his office of duke or heretoch, was intitled to a large command in the king's army, and by his repeated treacheries at laft transferred the crown to Canute the Dane.

It feems univerfally agreed by all hiftorians, that king Alfred firft fettled a national militia in this kingdom, and by his prudent difcipline made all the fubjects of his dominions foldiers: but we are unfortunately left in the dark as to the particulars of this his fo celebrated regulation; though, from what was laft obferved, the dukes feem to have been left in poffeffion of too large and independent a power: which enabled duke Harold, on the death of Edward the Confeffor, though a ftranger to the royal blood, to mount for a fhort fpace the throne of this kingdom, in prejudice of Edgar Etheling the rightful heir.

Upon the Norman conqueft, the feodal law was introduced here in all its rigour, the whole of which is built on a military plan. In confequence 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 foldier, *miles*, was bound to attend the king in his wars, for 40 days in a year; in which fpace of time, before war was reduced to a fcience, the campaign was generally finifhed, 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 perfonal attendance of all knights and others; *quod habeant et teneant fe femper in armis et equis, ut decet et oportet: et quod femper fint prompti et parati ad fervitium fuum integrum nobis explendum et peragendum, cum opus adfuerit, fecundum quod debent de feodis et tenementis fuis de jure nobis facere.* This perfonal fervice in procefs of time degenerated into pecuniary commutations or aids; and at laft the military part of the feodal fyftem was abolifhed at the Reftoration, by ftatute 12 Car. II. c. 24. See FEODAL-*Syftem*.

In the meantime, we are not to imagine that the kingdom was left wholly without defence in cafe of domeftic infurrections, or the profpect of foreign invafions. Befides thofe who by their military tenures were bound to perform 40 days fervice in the field, firft the affize of arms, enacted 27 Hen. II. and afterwards the ftatute of Winchefter, under Edward I. obliged every man, according to his eftate and degree, to provide a determinate quantity of fuch arms as were then in ufe, in order to keep the peace; and conftables were appointed in all hundreds by the latter ftatute, to fee that fuch arms were provided. Thefe weapons were changed, by the ftatute 4 & 5 Ph. & M. c. 2. into others of more modern fervice; but both this and the former provifions were repealed in the reign of James I. While thefe continued in force, it was ufual from time to time for our princes to iffue commiffions of array, and fend into every county officers in whom they could confide, to mufter and array (or fet in military order) the inhabitants of every diftrict; and the form of the commiffion of array was fettled in parliament in the 5 Hen. IV. But at the fame time it was provided, that no man fhould be compelled to go out of the kingdom at any rate, nor out of his fhire, but in cafes of urgent neceffity; nor fhould provide foldiers unlefs by confent of parliament. About the reign of king Henry VIII. and his children, lord-lieutenants began to be introduced, as ftanding reprefentatives of the crown, to keep the counties in military order; for we find them mentioned as known officers in the ftatute 4 & 5 Ph. & M. c. 3. though they had not been then long in ufe; for Cambden fpeaks of them in the time of Queen Elizabeth as extraordinary magiftrates, conftituted only in times of difficulty and danger.

In this ftate things continued till the repeal of the ftatutes of armour in the reign of king James I.; after which, when king Charles I. had, during his northern expeditions, iffued commiffions of lieutenancy, and exerted fome military powers which, having been long exercifed, were thought to belong to the crown, it became a queftion in the long-parliament, how far the power of the militia did inherently refide in the king; being now unfupported by any ftatute, and founded only upon immemorial ufage. This queftion, long agitated with great heat and refentment on both fides, became at length the immediate caufe of the fatal rupture between the king and his parliament: the two houfes not only denying this prerogative of the crown, the legality of which claim perhaps might be fomewhat doubtful; but alfo feizing into their hands the entire power of the militia, the illegality of which ftep could never be any doubt at all.

Soon after the reftoration of king Char. II. when the military tenures were abolifhed, it was thought proper to afcertain the power of the militia, to recognife the fole right of the crown to govern and command them, and to put the whole into a more regular method of military fubordination: and the order in which the militia now ftands by law, is principally built upon the ftatutes which were then enacted. It is true, the two laft of them are apparently repealed; but many of their provifions are re-enacted, with the addition of fome new regulations, by the prefent militia-laws; the general fcheme of which is to difcipline a certain number of the inhabitants of every county, chofen by lot for three years, and officered by the lord-lieutenant, the deputy-lieutenants, and other principal landholders, under a commiffion from the crown. They are not compellable to march out of their counties, unlefs in

Military. in case of invasion or actual rebellion, nor in any case compellable to march out of the kingdom. They are to be exercised 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 is 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 Edw. II. by martial law, his attainder was reversed 1 Edw. 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 carta*. 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 Ch. 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 (tho' 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 W. 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 stat. 8. Geo. III. c. 13. to 16,235 men in time of peace. Military.

To prevent the executive power from being able to oppress, says baron Montesquieu, it is requisite that the armies with which it is entrusted 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 beforementioned, 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 abovementioned 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."

Military. Military || Milium.

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.

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 entrust 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.

Blackst. Comment.

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, in botany: A genus of the digynia order, belonging to the triandria class of plants; and in the natural method ranking under the 4th order, *Gramina*. The calyx is bivalved, and uniflorous; the corolla is very short; the stigmata pencil like.—There are five species; of which the most remarkable is the panicum, or common millet. This is a native of India, but is now commonly cultivated in many parts of Europe as an esculent grain. It rises, with a reed-like stalk, three or four feet high, and channelled: at every joint there is one reed-like leaf, which is joined on the top of the sheath, and embraces and covers that joint of the stalk below the leaf; this sheath is closely covered with soft hairs, but the leaf which is expanded has none. The top of the stalk is terminated by a large loose panicle, which hangs on one side, having a chaffy flower, which is succeeded by a small round seed. There are two varieties; one with white, and the other with black seeds; but they do not differ in any other particular. This plant is greatly cultivated in the oriental countries, and from whence we are annually furnished with it. It is seldom cultivated in Britain but in small gardens, for feeding of poultry, where the seeds generally ripen very well. It is used as an ingredient in puddings, and is by some people greatly esteemed. The seeds must be sown in the beginning of April, upon a warm dry soil, but not too thick, because the plants divide into several branches, and should have much room. When they come up they should be cleaned from weeds; after which they will

Milk.

will in a ſhort time get the better of them, and prevent the future growth. In Auguſt the ſeeds will ripen, when the plant muſt be cut down, and the ſeeds beaten out, as is practiſed for other grain; but if it is not protected from birds, they will devour it as ſoon as it begins to ripen.

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 lives 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 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.

* *Lect. on Mat. Med.*

Its contents are of three kinds: firſt, 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 flouriſhing 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 almoſt ſuited to 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 heart-burn, 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, one ſometimes as corroſive as the foſſil acid. When the acidity of milk is carried to a great degree, it may prove remarkably refrigerent, 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 to Dr Cullen the coagulation of milk ſeems to be owing to a weak acid in the ſtomach, the relicts 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

Milk. 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 residuum 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: therefore, 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 milk 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 véry 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 milk 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. Milk.

These qualities, in particular milks, are considerably diversified by different circumstances. First, Different animals, living on the same diet, give a considerably 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

Milk.

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 proportions:

Twelve ounces of	Left of dry matter	From which water extracted a ſweet ſaline ſubſtance amounting to
Cows milk	13 drams.	$1\frac{1}{4}$ drams.
Goats milk	$12\frac{1}{2}$	$1\frac{1}{4}$
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.

Milks 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 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 ſpirit of vitriol (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 acids 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. Iu the Breſlau 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 diſ-

Milk. posed 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 farinous; 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 on 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, woman's milk, in an 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 woman'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 woman'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 grey 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 woman'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

Milk. 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 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 by 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 on 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. Woman's milk in an 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 characteriſe 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. Tho' 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. 7. 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 effects 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 *mais* or Turkey wheat; ſome with cabbage; others with ſmall potatoes; and others with common graſs. The milk of thoſe fed with the *mais* 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 Reamur's thermometer. In the reſiduums of the diſtillations no difference whatever could be perceived. As the only difference therefore exiſting in cow's 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, an 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

Milk. were formed into a kind of half-made butter; of which that formed from the milk from mais was white, firm, and infipid; that from potatoes was fofter and more pinguedinous; but that from common grafs was the beft of all. Cabbage, as in other cafes, gave a ftrong tafte.

In the courfe 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 reafon abfolutely fatisfactory on either fide, but incline to the latter opinion; becaufe when cream is allowed to remain among the milk, and the whole curdled promifcuoufly, only fat cheefe, without any butter, is produced. The oily parts cannot be feparated into butter either by acids or any other means than churning: even the artificial mixture of oil with the cream is infufficient for the purpofe.

The ferum of milk was reduced by filtration to a clear and pellucid liquor; and, by mixture with fixed alkali, depofited a portion of cheefy matter which had been diffolved in the whey. The fugar of milk was alfo found in this liquor.

In their experiments upon the milk of various animals, it was found that the milk of affes yielded by diftillation an infipid liquor, and depofited a liquor fimilar to the lymph of cows milk. It is coagulated by all the acids, but not into an uniform mafs, exhibiting only the appearance of diftinct flocculi. It affords but little cream, which is converted with difficulty into a foft butter that foon becomes rancid. It has but a fmall quantity of faccharine particles, and thefe are often mixed with muriatic felenite and common falt. Goats milk has a thick cream, and agreeable to the tafte; and the milk itfelf may be preferved longer in a found ftate than any other fpecies, the fcum on its furface being naturally convertible into palatable cheefe. It is eafily made into firm butter, which does not foon become rancid, and has a good flavour. The butter-milk contains a large quantity of cheefy matter which readily coagulates; but has ftill lefs faccharine matter than that of affes. Sheeps milk can fcarce be diftinguifhed from that of a cow, and eafily parts with its cream by ftanding. It is of a yellow colour, an agreeable flavour, and yields a great proportion of butter; but this is not folid, and foon becomes rancid. Mare's milk is the moft infipid and leaft nutritious of any; notwithftanding which it has been much recommended for weak and confumptive patients: in which cafes it is probable that it proves efficacious by being more confonant than any other to the debilitated powers of digeftion. It boils with a fmaller fire than any other kind of milk, is eafily coagulated, and the diftilled water does not foon change its nature. It has but a fmall quantity of cheefy matter, and very few oily particles: the cream cannot be made into butter; and the whey contains about as much fugar 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 fhould be well fed, their ftalls kept clean, and their litter frequently renewed: they fhould be milked at ftated hours, but not drained: great attention fhould alfo be paid to the breed; becaufe inferior cattle are maintained at as great expence as the moft valuable kinds. No change ought to be made in the food; though if the milk be employed for medicinal purpofes, it may be improved by a proper mixture of herbs, &c.

In their experiments on woman's milk, Meffrs Parmentier and Deyeux differ fomewhat from Dr Clarke, They firft tried the milk of a woman who had been delivered four months; and obferved, that after the cream had been feparated 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 fuperabundance of ferum. But they found that in proportion to the age of the milk it was found to be more eafily coagulable; and this was confirmed by experiments made upon the milk of 20 nurfes. Its coagulability was not increafed by heat. The cream, by agitation, formed a vifcid 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 fubjects, but in the fame fubject at different times. In a nurfe aged about 32 years, who was extremely fubject to nervous affections, the milk was one day found almoft quite colourlefs and tranfparent. In two hours after, a fecond quantity drawn from the breaft was vifcid like the white of an egg. It became whiter in a fhort time, but did not recover its natural colour before the evening. It was afterwards found that thefe changes were occafioned by her having fome violent hyfteric fits in the mean time.

Sugar of Milk. Under the article Chemistry an account has been given of the fugar of milk, with fome of the different methods of making it: but of late we have an account of a method ufed by fome of the Tartar nations of preferving their milk by means of froft; in which operation great quantities of the fugar of milk are accidentally formed. The account was given by Mr Fahrig of Peterfburgh, who undertook a journey, by order of the academy of Peterfburgh, among the Mogul tribes who inhabit the country beyond the lake Baikal, on the banks of the river Salenga. Thefe 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 foften the edges of the cake, after which it may be taken out with a wooden fpatula. They commence thefe operations at the beginning of the cold, when they have milk in the greateft abundance; after which it may be preferved with great eafe throughout the whole winter. Mr Fahrig having frequent opportunities of feeing thefe cakes, foon obferved, that the furface of them was covered to a confiderable depth with a farinaceous powder; and having eftablifhed a dairy upon the fame plan with thofe of the Moguls, he found the fame thing take place with himfelf. This powder was extremely fweet, and he received platefuls of it from the natives, who ufed it in their food, and fweetened their other victuals with it. Having caufed a number of cakes of frozen milk to be conveyed to the top of his houfe, where they were directly expofed to the violent cold, he found that the feparation of the faccharine powder was greatly promoted by this means. He fcraped the cakes every week to the depth

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 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 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 to 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 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 moſt fluid and volatile parts.

Theſe natural milky juices have not been examined by any chemiſt. Such an examination would, however, procure much eſſential knowledge concerning vegetable œconomy. We ſhould probably find examples of all kinds of oils reduced into milky juices; and this knowledge cannot fail of throwing much light on the nature of reſins and gum-reſins.

Milk-Fever. See Midwifery, p. 806.

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 pretty ſolid, and the bark grey and cracked. This plant, he informs us, has acquired a great reputation in curing the venereal diſeaſe, on the following account. A poor Portugueſe woman, the oldeſt 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

Milky-way Mill.

tured 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, Sect. V.

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 mill-stones. 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 distinguishing them, as the Highlanders and we distinguish them at present, by the simple appellations of *querns*, *carnes*, 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 hand-mills 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 Castle-field 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 below. 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 every where 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 History of Manchester.

Mill.

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

pened in June 1707. Dr Mills was employed 30 years in preparing this edition.

MILL-STONE, the ftone by which corn is ground. —The mill-ftones which we find preferved from ancient times are all fmall, and very different from thofe in ufe at prefent. Thorefby mentions two or three fuch found in England, among other Roman antiquities, which were but 20 inches broad; and there is great reafon to believe that the Romans, as well as the Egyptians of old, and the ancient Jews, did not employ horfes, or wind, or water, as we do, to turn their mills, but made their flaves and captives of war do this laborious work: they were in this fervice placed behind thefe mill-ftones, and pufhed them on with all their force. Sampfon, when a prifoner to the Philiftines, was treated no better, but was condemned to the mill-ftone in his prifon. The runner or loofe mill-ftone, in this fort of grinding, was ufually very heavy for its fize, being as thick as broad. This is the mill-ftone which is exprefsly prohibited in fcripture to take in pledge, as lying loofe it was more eafily removed. The Talmudifts have a ftory, that the Chaldeans made the young men of the captivity carry mill-ftones with them to Babylon, where there feems to have been a fcarcity at that time; and hence, probably, their paraphrafe renders the text "have borne the mills, or mill-ftones;" which might thus be true in a literal fenfe. They have alfo a proverbial expreffion of a man with a mill-ftone about his neck; which they ufe to exprefs a man under the fevereft weight of affliction. This alfo plainly refers to this fmall fort of ftones.

Rhenifh MILL-*Stone*, is claffed by Cronftedt among the volcanic products, on account of its appearance, which is a blackifh grey, porous, and perfectly refembling a lava of Mount Vefuvius.

MILLENARIANS, or CHILIASTS, a name given to thofe, in the primitive ages, who believed that the faints will reign on earth with Chrift 1000 years. See MILLENIUM.

MILLENER, or MILLINER, one who fells ribbands and dreffes, particularly head-dreffes, for women; and who makes up thofe dreffes.

Of this word different etymologies have been given. It is not derived from the French; for, through fome ftrange fatality, the French cannot exprefs the notion of *millener*, otherwife 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 Englifh and Dutch, 1708, defcribes *millener* to be "en kraamer van lint en andere optonifelon, Franfche kraamer;" that is, "a pedlar who fells ribbons and other trimmings or ornaments; a French pedlar."

Littleton, in his Englifh and Latin dictionary, publifhed 1677, defines millener, "a jack of all trades;" q. d. *millenarius*, or *mille mercium venditor;* that is, "one who fells a thoufand different forts of things." This etymology feems fanciful: But, if he rightly underftood the vulgar meaning of the word *millener* in his time, we muft hold that it then implied what is now termed "a haberdafher of fmall wares," one who dealt in various articles of petty merchandife, and who did not *make up* the goods which he fold.

Before Littleton's time, however, a fomewhat nicer characteriftic than feems compatible with his notion, appears to have belonged to them; for Shakefpeare, in his Henry IV. makes Hotfpur, when complaining of the daintinefs of a courtier, fay,

"He was *perfumed* like a millener."

The fact feems to be, that there were milleners of feveral kinds: as, *horfe-milleners*, (for fo thofe perfons were called who make ornaments of coloured worfted for horfes); haberdafhers of fmall wares, the *milleners* of Littleton; and *milleners* fuch as thofe now peculiarly known by that name, whether male or female, and to whom Shakefpeare's allufion feems moft appropriate.

Laftly, Dr Johnfon, in his Dictionary, derives the word from *milaner*, an inhabitant of *Milan*, from whence people of this profeffion firft came, as a *Lombard* is a banker.

MILLE PASSUS, or *Millia Paffuum;* a very common expreffion among the ancient Romans for a meafure of diftance, commonly called a *mile. Milliarium*, rarely ufed. Which Hefychius made to confift of feven ftadia; Plutarch, little fhort of eight; but many others, as Strabo and Polybius, make it juft eight ftadia. The reafon of this difference feems to be, that the former had a regard to the Grecian foot, which is greater than the Roman or Italic. This diftance is oftentimes called *lapis*, which fee. Each paffus confifted of five feet, (Columella).

MILLENIUM, "a thoufand years;" generally employed to denote the thoufand years, during which, according to an ancient tradition in the church, grounded on fome doubtful texts in the Apocalypfe and other fcriptures, our bleffed Saviour fhall reign with the faithful upon earth after the firft refurrection, before the final completion of beatitude.

Though there has been no age of the church in which the millenium was not admitted by individual divines of the firft eminence, it is yet evident from the writings of Eufebius, Irenæus, Origen, and others among the ancients, as well as from the hiftories of Dupin, Mofheim, and all the moderns, that it was never adopted by the whole church, or made an article of the eftablifhed creed in any nation.

About the middle of the fourth century the millenians held the following tenets:

1ft, That the city of Jerufalem fhould be rebuilt, and that the land of Judea fhould be the habitation of thofe who were to reign on earth 1000 years.

2dly, That the firft refurrection was not to be confined to the martyrs; but that after the fall of Antichrift all the juft were to rife, and all that were on the earth were to continue for that fpace of time.

3dly, That Chrift fhall then come down from heaven, and be feen on earth, and reign there with his fervants.

4thly, That the faints during this period fhall enjoy all the delights of a terreftrial paradife.

Thefe opinions were founded upon feveral paffages of fcripture, which the millenarians among the fathers underftood in no other than a literal fenfe, but which the moderns, who hold that opinion, confider as partly literal and partly metaphorical. Of thefe paffages, that upon which the greateft ftrefs has been laid, we believe to be the following:—"And I faw an angel come down from heaven, having the

Millenium. key of the bottomlefs pit, and a great chain in his hand. And he laid hold on the dragon, that old ferpent, which is the devil and Satan, and bound him a *thoufand years*, and caft him into the bottomlefs pit, and fhut him up, and fet a feal upon him, that he fhould deceive the nations no more till *the thoufand years* fhould be fulfilled; and after that he muft be loofed a little feafon. And I faw thrones, and they fat upon them, and judgment was given unto them: and I faw the fouls of them that were beheaded for the witnefs of Jefus, and for the word of God, and which had not worfhipped the beaft, neither his image, neither had received his mark upon their foreheads, or in their hands; and they lived and reigned with Chrift a *thoufand years*. But the reft of the dead lived not again till *the thoufand years were finifhed*. This is the firft refurrection *." This paffage all the ancient millenarians took in a fenfe grofsly literal; and taught, that during the millenium the faints on earth were to enjoy every bodily delight. The moderns, on the other hand, confider the power and pleafure of this kingdom as wholly fpiritual; and they reprefent them as not to commence till after the conflagration of the prefent earth. But that this laft fuppofition is a miftake, the very next verfe except one affures us: for we are there told, that "when the thoufand years are expired, Satan fhall be loofed out of his prifon, and fhall go out to deceive the nations which are in the four quarters of *the earth*;" and we have no reafon to believe that he will have fuch power or fuch liberty in "the new heavens and the *new earth* wherein dwelleth righteoufnefs."

* Rom. xx. 1—6.

For this and other reafons, which our limits will not permit us to enumerate, the moft judicious critics contend, that the prophecies of the millenium point, not to a refurrection of martyrs and other juft men to reign with Chrift a thoufand years in a vifible kingdom upon earth, but to that ftate of the Chriftian church, which, for a thoufand years before the general judgement, will be fo pure and fo widely extended, that, when compared with the ftate of the world in the ages preceding, it may, in the language of fcripture, be called a refurrection from the dead. In fupport of this interpretation they quote two paffages from St Paul, in which a converfion from Paganifm to Chriftianity, and a reformation of life, is called a refurrection from the dead:—"Neither yield ye your members as inftruments of unrighteoufnefs unto fin; but yield yourfelves unto God as thofe that are *alive from the dead* §:" And again, "Wherefore he faith, Awake thou that fleepeft, and *arife from the dead*, and Chrift fhall give thee light ‡." It is likewife to be obferved, that in all the defcriptions of the refurrection and future judgement which are given us at fuch length in the gofpels and epiftles, there is no mention made of a *firft* and *fecond* refurrection at the diftance of a thoufand years from each other. There is indeed an order in the refurrection: for we are told †, that "every man fhall rife in his own order; Chrift the firft fruits, afterwards they that are Chrift's at his coming, &c." But were the millenarian hypothefis well founded, the words fhould rather have run thus: "Chrift the firft fruits, then the martyrs at his coming, and a thoufand years afterwards the refidue of mankind. Then cometh the end, &c."

§ Rom. vi. 13.

‡ Eph. v. 14.

† 1 Chron. xv. 23.

These arguments ftrongly incline us to believe, that by the reign of Chrift and the faints for a thoufand years upon earth, nothing more is meant, than that before the general judgment the Jews fhall be converted, genuine Chriftianity be diffufed through all nations, and mankind enjoy that peace and happinefs which the faith and precepts of the gofpel are calculated to confer on all by whom they are fincerely embraced.

Our Saviour's own account of his religion is, that from a fmall beginning it will increafe to the full harveft. The millenium therefore is to be confidered as the full effect of the Chriftian principles in the hearts of men, and over the whole world; and the divines who have treated of this fubject endeavour to prove, that this is to be expected from the facts which have already exifted, and from the importance of the Chriftian doctrine.

1. The gradual progrefs of Chriftianity is no objection to this fact. This is fimilar to the progrefs and advancement from lefs to greater perfection in every thing which poffeffes vegetable or animal life. The fame thing is obferved in the arts, in civilization, in focieties, and in individuals—and why fhould it not be admitted to have place in religion? There is indeed a general principle on which a gradual progreffion, both in the natural and moral world, is founded. The Almighty never employs fupernatural means where the thing can be accomplifhed by thofe which are natural. This idea is of the moft general extent through the whole of the prefent fyftem of nature. The poffibility of another plan could eafily be admitted; but in this cafe there would be a total alteration of every part of the works of God or of man that we are acquainted with. In the fame manner, if the religion of Chrift had been irrefiftible, it would have totally altered its natural confequences. It was neceffary, therefore, from the prefent condition of man, as an active, intelligent, and accountable being, that means fhould be employed; and wherever means are employed, the effects produced muft be gradual, and not inftantaneous.

2. Though the progrefs of a divine revelation be gradual, yet it is to be expected, from the wifdom and compaffion of God, that it will ftill be advancing in the hearts of men, and over the world. In the firft age of the church, the word of God, fupported by miracles, and by the animated zeal of men, who fpake what they faw and heard, grew and prevailed. In this cafe fupernatural means were neceffary, becaufe the prejudices of the world could not be fubdued without them. It was the firft watering of a plant which you afterwards leave to the dew of heaven. Miracles at the fame time were employed only as the means of conviction; and they were not continued, becaufe in this cafe they would have become a conftant and irrefiftible principle, incompatible with the condition of man as a reafonable agent. After this power was withdrawn, there were many ages of ignorance and fuperftition in the Chriftian church. But what is neceffary to be eftablifhed on this fubject is, not that the progrefs of Chriftianity 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 vifible;

Millenium. ſible: 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 havoc 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, 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.)

* Iſ. lxvi. 8.

† Ver. 12, 23.

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 millenium 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 millenium. 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 millenium 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

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 millenium 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, in zoology; a species of ONISCUS. These insects are found in cellars, under stones, and in cold moist places; in the warmer countries they are rarely met with. Millepedes have a faint disagreeable smell, and a somewhat pungent, sweetish, nauseous taste. They have been highly celebrated in suppressions of urine, in all kinds of obstructions of the bowels, in the jaundice, weakness of sight, and a variety of other disorders. Whether they have any just title to these virtues is greatly to be doubted; thus much is certain, that their real effects come far short of the character usually give them.

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 stellate 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 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, in botany. See MILIUM.

MILLIARE, or MILLIARIUM, a Roman mile, which consisted of 100 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 jusque a 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 abridgment 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 abridgment, 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'Hi-*

stoire

Millot, Milo. *ſtoire des Troubadours*, 3 vols. 12mo, compiled from the manuſcripts of M. de Sainte-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 Provencal 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 of 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 ſcape. 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 æra.

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 diſpatch 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. 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 Lacedemonian 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

Milo.

yoke of Turkiſh deſpotiſm, and has loſt its opulence and ſplendor. 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 cliffs 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 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 left; three-fourths of the town in ruins, and the inhabitants daily decreaſing. In ſhort, during the laſt 50 years, Milos has aſſumed a quite different appearance. The plague, which the Turks propagate every where, 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 Milos 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.

* Letters on Greece, Let. 42.

"Yet (continues our author) a judicious and enlightened government might expel thoſe evils which ravage Milos. 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 re-peopled. 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 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 Milos is therefore to be aſcribed to the deſpotiſm of the Porte, and its deteſtable police."

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 ſcarely 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 during the late war, 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

Sutherland's Tour up the Straits, p. 146

(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 Milos, in the days of Tournefort, contained at leaſt 20,000 ſouls.

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 Mill-stone.

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 takes for the *vesiculæ seminales*.

MILTHORP, a port-town of Westmoreland, at the mouth of the Can, five miles 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, he departed for the Chersonesus, and was invested by the inhabitants with sovereign power. The first measures he took was 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

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.

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 a 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 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 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 every where 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 Holburn, 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 reigns of government into his own hands 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 over, he married a third wife, Elizabeth, daughter of Mr Minſhall a Cheſhrie gentleman; and not

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 any where; 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.—As to his perſon, it was remarkably handſome; 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 1500 l. in money, beſide 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 alms-houſe 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 Sittinbourn and the Iſle of Sheppey, 6 miles north-weſt of Feverſham, and 40 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 Godwin, &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 hereabouts 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 block-houſe here, for the defence both of this town and Graveſend, and the command of the river. It has a fair Jan. 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, in ornithology, a ſpecies of FALCO.

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 6th 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. 9. 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.

Epiſt. VI. Lib. i. v. 65.

Mimosa.

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 this Greek poet, which have been preſerved by Stobæus.

Τις δε βιος, τι δε τερπνον ατερ 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 the polygamia order, belonging to the monœcia claſs of plants; and in the natural method ranking under the 33d order, *Lomentaceæ*. The hermaphrodite calyx is quinquedentate; the corolla quinquefid; there are five or more ſtamina, one piſtil, and a legumen: The male calyx is quinquedentate; the corolla quinquefid; with five, ten, or more ſtamina.

The name *mimoſa* ſignifies "mimic;" and 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. See SENSITIVE *Plant*.

To this genus Linnæus joins many of the *acacias*; and it compriſes near 60 different ſpecies, all natives of warm climates. Of the ſorts cultivated here in our ſtoves, &c. ſome are of the ſhrub and tree kind, and two or three are herbaceous perennials and annuals. The ſenſitive kinds are exceedingly curious plants in the very ſingular circumſtance of their leaves receding rapidly from the touch, and running up cloſe together; and in ſome ſorts the footſtalks and all are affected, ſo as inſtantly to fall downward as if faſtened by hinges, which laſt are called *humble* ſenſitives. They have all winged leaves, each wing conſiſting of many ſmall pinnæ.

In the *Syſtema Vegetabilium*, this genus, including the *mimoſas* properly ſo called, and the *acacias*, is divided into ſeveral ſections, diſtinguiſhed by the figure, ſituation, and arrangement, of the leaves; as, ſimple, ſimply-pinnated, bigeminous and tergeminous, conjugate and pinnated, doubly pinnated. The following are the moſt remarkable

Species, with their properties. 1. The *Senſitiva*, or common ſenſitive humble plant, riſes with an undershrubby prickly ſtem, branching ſix or eight feet high, armed with crooked ſpines; conjugated, pinnated leaves, with bijugated patial lobes or wings, having the inner ones the leaſt, each leaf on a long footſtalk; and at the ſides and ends of the branches many purple flowers in roundiſh heads; ſucceeded by broad, flat, jointed pods, in radiated cluſters.—This is ſomewhat of the humble ſenſitive kind; the leaves, footſtalks and all, receding from the touch, though not with ſuch facility as in ſome of the following ſorts.

2. The *Pudica*, or baſhful humble plant, riſes with an underſhrubby, declinated, prickly ſtem, branching two or three feet around, armed with hairy ſpines; pinnated, digitated leaves, each leaf being of five or more long folioles, attached by their baſe to a long footſtalk, and ſpread out above like the fingers of a hand; and at the ſides and ends of the branches roundiſh heads of greeniſh white flowers, ſucceeded by ſmall jointed prickly pods.—This is truly of the humble ſenſitive kind; for by the leaſt touch the leaves inſtantly recede, contract, cloſe, and together with the footſtalk quickly decline downward, as if aſhamed at the approach of the hand.

3. The *Pernambucana*, or Pernambuca ſlothful mimoſa, has unſhrubby, procumbent, unarmed ſtems, branching two or three feet around; bipinnated leaves, of three or four pair of ſhort, winged ſoliola; and at the axillas drooping ſpikes of pentandrous flowers, the lower ones caſtrated.—This ſpecies recedes very ſlowly from the touch, only contracting its pinnæ a little when ſmartly touched; hence the name *ſlothful mimoſa*.

4. The *Aſperata*, or Panama ſenſitive plant. Of this curious ſpecies, which has been well deſcribed by Dr Browne (but not figured), there is a good figure in the *Reliquiæ Houſtonianæ* publiſhed by Sir Joſeph Banks. It grows in moiſt places, and by the ſides of rivulets, in the pariſhes of St James and Hanover, Jamaica. It ſeldom riſes above three feet in height; but its ſlender branches extend conſiderably on the neighbouring buſhes. It is armed with crooked, ſharp, ſpines; ſo thickly ſet on the trunk, branches, and leaves, that there is no touching it with ſafety. But the plant has a beautiful appearance; the flowers are yellow and globular, growing at the extremity of the branches. The pods are hairy, brown, and jointed; each containing a ſmall, flat, and brown ſeed. The leaves are numerous, ſmall, and winged: next to thoſe of the mimoſa pudica, they are the moſt irritabile; contracting with the leaſt touch, and remaining ſo for ſeveral minutes after. This ſpecies would form a good hedge or fence round a garden; and by being trimmed now and then by a cutlaſs or gardener's ſciſſars, may be eaſily kept from ſpreading.

5. The *Punctata*, or punctated ſenſitive mimoſa, riſes with a ſhrubby, upright, taper, ſpotted, unarmed ſtem, branching erectly five or ſix feet high; bipinnated leaves, of four or five pair of long winged folioles, having each about 20 pair of pinnæ; and at the axillas and termination of the branches oblong ſpikes of yellowiſh decandrous flowers, the inferior ones caſtrated; ſucceeded above by oblong ſeed-pods. This ſort, though naturally ſhrubby and perennial in its native ſoil, yet in this country it ſometimes decays in winter. It is only ſenſitive in the foliola, but quick in the motion.

6. The *Viva*, lively mimoſa, or ſmalleſt ſenſitive weed, has many creeping roots, and ſpreads itſelf ſo as to cover large ſpots of ground. It riſes at moſt to two inches, has winged leaves, with numerous ſmall pinnæ. The flower is globular, of a bluiſh colour, and grows in cluſters from the axillæ: theſe are followed by little, ſhort, hairy, pods, containing ſmooth ſhining ſeeds. This is the moſt ſenſible of all the mimoſas, the pudica not excepted. By running a ſtick over the plant, a perſon may write his name, and it will remain viſible for ten minutes.

7. The *Quadrivalvis*, perennial, or quadrivalve humble mi-

Mimosa. mimosa, has herbaceous, slender, quadrangular, prickly stems, branching and spreading all around, armed with recurved spines; bipinnated leaves of two or three pair of winged lobes, having each many pinnæ; and at the axillas globular heads of purple flowers, succeeded by quadrivalvular pods. This is of the humble sensitive kind, both leaves and footstalks receding from the touch.

8. The *Plena*, annual, or double-flowered sensitive mimosa, rises with an herbaceous, erect, round, unarmed stem, closely branching and spreading every way, three or four feet high; bipinnated leaves of four or five pair of winged lobes, of many pairs of pinnæ; and at the axillas and termination of the branches spikes of yellow pentandrous flowers, the lower ones double; succeeded by short broad pods. This annual is only sensitive in the foliola, but extremely sensible of the touch or air.

9. The *Cornigera*, or horned Mexican mimosa, commonly called *great horned acacia*, has a shrubby, upright, deformed stem, branching irregularly, armed with very large, horn-like white spines, by pairs, connated at the base; bipinnated leaves thinly placed; and flowers growing in spikes. This species is esteemed a curiosity for the oddity of its large spines, resembling the horns of animals, and which are often variously wreathed, twisted, and contorted.

10. The *Farnesiana*, or fragrant acacia, grows in woodlands and waste lands in most parts of Jamaica; rising to 25 or 30 feet, with suitable thickness. The bark of the trunk is brown and scaly, the branches are alternate. It is adorned with bipinnated leaves of a bright green colour; and yellow globular flowers from the axillæ, of a fragrant smell. The pods are about three inches long, and half an inch broad: they are of a light brown colour, smooth, compressed, and contain five or six smooth flat seeds. Formerly the flowers of this tree were used as an ingredient in the *theriaca andromachi* of the old dispensatories. The tree is sometimes planted for a hedge or fence round inclosures; and the timber, though small, is useful in rural economy.

11. The *Arborea*, or wild tamarind tree, is common in all the woodlands, and especially near where settlements have been made, in Jamaica. It rises to a considerable height, and is proportionably thick. The timber is excellent, and serves many purposes in rural economy: it is of the colour of cedar, pretty hard, and takes a good polish. The leaves are numerous; the flowers globular and white. The pods are about a foot in length, of a fine scarlet colour; when they are ripe they open and become twisted. The seeds then appear; they are oblong, smooth, of a shining black, and quite soft. On the whole, from the leaves, flowers, and pods, this tree exhibits a singular and beautiful contrast. With us this plant is raised in hot-houses; but it appears, that with a little pains it may be made to grow in the open air. A good sizeable tree of this sort grew in the garden of the late Dr William Pitcairn, at Islington, near London.

12. The *Latifolia*, shag-bark, or white wild tamarind. This excellent timber tree is very common in Jamaica, and rises to a moderate height and good thickness. The trunk is rough and scaly: The leaves are numerous, of a rhomboidal figure, and yellowish cast. Mimosa. The flower-spikes are from the axillæ; their colour is yellow. The seed-vessels are flat, jointed, and twisted. The seeds are of the bigness of a vetch, white, and finely streaked with blue.

Of this tree there is a variety which some botanists call *M. serpentina*. The chief difference is in the leaves, which are smaller, and of a shining dark green.

13. The *Lebeck*, or ebony tree. This is a native of the East Indies, but raised from seeds in Jamaica and St Vincent's. It is figured, though not accurately, by Plukenet, Tab. 331. fig. 1. To what height this tree grows, we cannot yet say; but it must be of a considerable thickness if it be the ebony we have in use here. Time will soon determine this, as the few plants in the islands are reared with great care by Dr Dancer in Jamaica, and Mr Alexander Anderson in St Vincent's.

Plate CCCXI. fig. 4.

14, 15. The *Cinerea* α; — β *Pinnata?* Cashaw bushes. These species are common about Kingston and Spanish town Jamaica, and rise by slender trunks to about 20 feet.

Dr Roxburgh of Madrass, amongst a number of useful discoveries, has found the lac insect on this species of mimosa *. We have seen the native gum-lac on one of the small twigs, and a specimen of the plant in the collection of a gentleman here. The plant is a variety of the cincrea, and appears rather to be the *M. pinnata*, Lin. It is to be hoped that in a short time the useful insect just mentioned may be transported from Asia to the West Indies, where this gum, or rather wax, may be also produced.

* See *Asiatic Researches*, Vol. I.

16. The *Scandens*, cacoons, or mafootoo wyth (*Gigalobium scandens*, Browne's Jam. p. 362. *Phaseolus maximus perennis*, Sloane's Cat. 68. *Perein Kaku-valli*, H. M. viii. T. 32, 3, 4.) This species of mimosa is frequent in all the upland valleys and woodlands on the north side of Jamaica. It climbs up the tallest trees, and spreads itself in every direction by means of its *cirrhi* or claspers, so as to form a complete arbour, and to cover the space of an English acre from one root. This circumstance has a bad effect on the trees or bushes so shaded. Light, air, and rain (so necessary for all plants), being shut out, the leaves drop off, the tree gradually rots, and the limbs fall down by the weight of this parasite.

Several authors have mentioned the cacoon; but their descriptions of the plant, and particularly the figures, are erroneous. On that account we have given a figure from the herbarium of a gentleman long resident in Jamaica; and the following are the characters, transcribed from his field notes. Fig. 3.

Folia conjugata. *Petioli* communis longi oppositi *cirrho* terminali. *Pinnæ* quadrijugæ vel duodecim jugæ, oblongæ apice obtusæ nitidæ utrinque glabræ. *Cirrhus* longus contortus apice bifidus. *Spicæ* axillares erectæ, longissimæ, multifloræ floribus parvis, colore viride flavo. *Calyx* quinquedentatus minimus. *Corolla* pentapetala, erecta, parva. *Filamenta* numerosa, è basi corollæ, et eodem longitudine. Antheræ globosæ erectæ. *Stylus* filiformis, tortus, longitudine staminum. *Stigma* simplex. Legumen maximum, lignosum durum, 5 vel 8 pedale longum et 4-5 unciarum latitudine, varie contortum, compressum, bivalve.

Mimosa.

Semina plura, circiter decem vel quindecim numero, orbiculata, subcompressa, cortice duro, nitido-fusco. *Hilo* nigro breve.

The roots of this plant run superficially under the ground or herbage. The trunk is seldom thicker than a man's thigh, and sends off many branches, with numerous shining green leaves, each of which terminates in a tendril or clasper, that serves to fasten it to trees or bushes. The flower-spikes are from the axillæ: they are slender, and the florets on them small and numerous. The pod is perhaps the largest and longest of any other in the world; being sometimes eight or nine feet in length, five inches broad, jointed, and containing 10 or 15 seeds. These seeds are brown, shining, flattened, and very hard, and called *cacoons*. They are the same mentioned in the Philosophical Transactions, n° 222. page 298. by Sir Hans Sloane, as being thrown ashore on the Hebrides and Orkneys. This happens in the following manner: The seeds or beans fall into the rivers, and are conveyed to the sea. The trade-winds carries them westward till they fall into the gulf stream, which forces them northward along the coast of America and Bahama islands. As the winds blow frequent and strong from America, these seeds are driven to the eastward, till at length they are thrown ashore and left with the tide as aforesaid.

This bean, after being long soaked in water, is boiled and eaten by some negroes; but, in general, there seems to be no other use made of it than as a sort of snuff-box.

† *Med. Obs. and Inquir.* Vol. V. p. 151, &c.

17. The *Catechu*, according to Mr Ker †, grows only to 12 feet in height, and to one foot in diameter; it is covered with a thick rough brown bark, and towards the top divides into many close branches: the leaves are bipinnated, or doubly winged, and are placed alternately upon the younger branches: the partial pinnæ are nearly two inches long, and are commonly from 15 to 30 pair, having small glands inserted between the pinnæ: each wing is usually furnished with about 40 pair of pinnulæ or linear lobes, beset with short hairs: the spines are short, recurved, and placed in pairs at the bases of each leaf: the flowers are hermaphrodite and male, and stand in close spikes, which arise from the axillæ of the leaves, and are four or five inches long: the calyx is tubular, hairy, and divides at the limb into five oval pointed segments: the corolla is monopetalous, whitish, and of the same form as the calyx, but twice its length: the filaments are numerous, capillary, double the length of the corolla, adhering at the base of the germen, and crowned with roundish antheræ: the germen is oval, and supports a slender style, which is of the length of the filaments, and terminated by a simple stigma: the fruit, or pod, is lance-shaped, brown, smooth, compressed, with an undulated thin margin; it contains six or eight roundish flattened seeds which produce a nauseous odour when chewed. From this tree, which grows plentifully on the mountainous parts of Indostan, where it flowers in June, is produced the officinal drug long known in Europe by the name of *terra japonica*; for the history and preparation of which, see the article TERRA *Japonica*.

Plate CCCXI. fig. 2.

18. The *Nilotica*, or true Egyptian acacia, rises to a greater height than the preceding: the bark of the trunk is smooth, and of a grey colour; that of the branches has commonly a purplish tinge: the leaves are bipinnated, and placed alternately: the partial pinnæ are opposite, furnished with a small gland between the outermost pair, and beset with numerous pairs of narrow elliptical pinnulæ, or leafits: the spines are long, white, spreading, and proceed from each side of the base of the leaves: the flowers are hermaphrodite and male; they assume a globular shape, and stand four or five together upon slender peduncles, which arise from the axillæ of the leaves: the calyx is small, bell-shaped, and divided at the mouth into five minute teeth: the corolla consists of five narrow yellowish segments: the filaments are numerous, capillary, and furnished with roundish yellow antheræ: the germen is conical, and supports a slender style, crowned with a simple stigma: the fruit is a long pod, resembling that of the lupin, and contains many flattish brown seeds. It is a native of Arabia and Egypt, and flowers in July.

Mimosa. Plate CCCXI. fig. 1.

Although the mimosa nilotica grows in great abundance over the vast extent of Africa, yet gum arabic is produced chiefly by those trees, which are situated near the equatorial regions; and we are told that in Lower Egypt the solar heat is never sufficiently intense for this purpose. The gum exsudes in a liquid state from the bark of the trunk and branches of the tree, in a similar manner to the gum which is often produced upon the cherry-trees &c. in this country; and by exposure to the air it soon acquires solidity and hardness. In Senegal the gum begins to flow when the tree first opens its flowers; and continues during the rainy season till the month of December, when it is collected for the first time. Another collection of the gum is made in the month of March, from incisions in the bark, which the extreme dryness of the air at that time is said to render necessary. Gum arabic is now usually imported into England from Barbary; not packed up in skins, which was the practice in Egypt and Arabia, but in large casks or hogsheads. The common appearance of this gum is well known; and the various figures which it assumes seem to depend upon a variety of accidental circumstances attending its transudation and concretion. Gum Arabic of a pale yellowish colour is most esteemed; on the contrary, those pieces which are large, rough, of a roundish figure, and of a brownish or reddish hue, are found to be less pure, and are said to be produced from a different species of mimosa *(M. Senegal)*; but the Arabian and Egyptian gum is commonly intermixed with pieces of this kind, similar to that which comes from the coast of Africa near the river Senegal.

Gum-arabic does not admit of solution by spirit or oil, but in twice its quantity of water it dissolves into a mucilaginous fluid, of the consistence of a thick syrup; and in this state answers many useful pharmaceutical purposes, by rendering oily, resinous, and pinguious substances, miscible with water. The glutinous quality of gum Arabic is preferred to most other gums and mucilaginous substances, as a demulcent in coughs, hoarsenesses, and other catarrhal affections, in order to obtund irritating acrimonious humours, and to supply the loss of abraded mucus. " It has been very generally employed in cases of ardor urinæ and strangury;

Mimosa.

Mimosa nilotica.

Mimosa Catechu

Mimosa Cinerea.

Mimosa Scandens.

A. Bell Prin. Wal. Sct. fec.

Mimosa, Mina. ary: but it is the opinion of Dr Cullen, "that even this mucilage, as an internal demulcent, can be of no service bey-·d the alimentary canal." See farther the article *Gu... Arabic*.

19. The *Senegal* is a native of Guinea, and was some time ago introduced into Jamaica. Dr Wright tells us, he saw both this and the mimosa nilotica, of the size of a cherry tree, growing at Dr Paterson's in the parish of Hanover, Jamaica. The flowers are globular, yellow, and fragrant. The pods are brown, and of the size of a goose-quill. The tree, on being wounded, exsudes gum arabic, though in less quantity, and less transparent, than that of the shops, which is obtained from the *nilotica* above described.

There are above 40 other species characterised in the *Systema Vegetabilium*.

On Plate CCCXII. is figured a new species, of an uncommon size, mentioned by Mr Paterson in his Travels among the Hottentots, but not particularly described. Like several of the other mimosas, it produces gum, which is considered by the natives as a peculiarly delicate species of food: the leaves and lower points of the branches seem to constitute the principal aliment of the camelopardalis; and, from the extent of its boughs, and the smoothness of the trunk, it affords a sufficient defence to a species of gregarious bird against the tribe of serpents and other reptiles which would otherwise destroy its eggs. See the article Loxia.

† *Travels*, Vol. V. p. 34, 35. Mr Bruce † describes two plants which seem referable to this genus; the one named *ergett el dimmo*, the other *ergett el krone*.

The former, in our author's opinion, should be named *mimosa sanguinea*; its name in the Abyssinian language signifying *the bloody ergett*, and derived, as he supposes, from its being partly composed of beautiful pink filaments. When the blossoms are fully spread, the upper part of them consists of yellow curled filaments, and the under part of pink filaments of a similar shape. In its unripe state, that part which afterwards becomes pink is of a green colour, and composed of tubercles of a larger size, and more detached than those which afterwards produce the yellow filaments; the latter being smaller, and closer set together: the leaves are of the double-pinnated kind.

The name of the other species, in the Abyssinian language, signifies *the horned ergett*; which our author supposes to be given it on account of the figure of the pods. The flower very much resembles that of the acacia vera in size and shape, excepting that it is attatched to the branch by a strong woody stalk of considerable length, which grows out at the bottom of the branch bearing the leaves, and is sheltered as in a case by the lower part of it. The branches are all covered with short, strong, and sharp-pointed thorns, having their points inclined backwards towards the root. The pods are covered with a prickly kind of hair, which easily rubs off with the fingers, sticks to them, and gives a very uneasy sensation. They have thirteen divisions; in each of which are three hard, round, and shining seeds, of a dusky brown colour.

Both of these shrubs shut their leaves on the coming on of the violent rains in the wet season, and never fully expand them till the dry season returns.

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 2 l. 17 s. sterling. There was also a lesser mina, which was valued at 75 drachmæ.

Minagnghinim ‖ Mindanoa.

MINAGNGHINIM, a pulsatile 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 thro' balls of wood or brass, which struck against the table, when the instrument was shook, and occasioned a clear sound, which might be heard at a great distance. See Kircher's figure of it in Plate CCCXIV.

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, and worth 200 l. a-year. Near it are very large camps, with deep trenches; and near Dunkirk in this parish are fulling mills.

MINCIUS, a river of the Transpadana; 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.

MINDANOA, or Magindanao, a large island of Asia in the East Indies, and one of the Philippines; *Meares's Voyages.* 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 acknow-

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 are 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 are 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 Rastat. 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 bishopric of Augsburgh 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 belongs to the king of Prussia, who has secularized the bishopric. 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 Ravensberg, 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 secularised; and was ceded to the elector of Brandenburg by the treaty 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. Neither 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

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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, ſome-

times

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times 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 wall makes 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 proportionably. 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 once only 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 neighbourhood 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 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 an 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 their 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 to be rather improbable. Aristotle, however, is of the same opinion with Lucretius, and tells us, that some shepherds in 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

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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 tides 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 coruscations; 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 inchantment. 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 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 having 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 *ſhodeing*; that is, tracing them by looſe ſtones, fragments, or *ſhodes*, which may have been ſeparated and 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 tract of them up the hill as long as they can find any of them," &c.

"Another way (ſays Mr Price) of diſcovering lodes 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 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 gang-ways 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

Mine.

The places abounding with mines are generally healthy, as ftanding high, and every where expofed to the air; yet fome places where mines are found prove poifonous, and can upon no account be dug, though ever fo rich: the way of examining a fufpected place of this kind, is to make experiments upon brutes, by expofing them to the effluvia or exhalations to find the effects.

Devonfhire 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 fubterraneous drains to fome valley at a diftance, by which to carry off the water from the mine, which otherwife would drown them out from getting the ore. Thefe adits are fometimes carried a mile or two, and dug at a vaft expence, as from 2000l. to 4000l. efpecially 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 raifed, thereby faving half the expence.

The late Mr Coftar, confidering that fometimes from fmall ftreams, and fometimes from little fprings or collections of rain-water, one might have a good deal of water above ground, though not a fufficient quantity to turn an overfhot-wheel, thought, that if a fufficient fall might be had, this collection of water might be made ufeful in raifing the water in a mine to the adit, where it may be carrried off.

But now the moft general method of draining mines is by the fteam-engine. See *Steam-Engine.*

Mine, in the military art, denotes a fubterraneous canal or paffage, dug under the wall or rampart of a fortification, intended to be blown up by gunpowder.

The alley or paffage of a mine is commonly about four feet fquare; 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 fix feet in height; and here the gunpowder is ftowed. The fauciffe 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 raifing two cubic feet of earth; confequently 200 ounces, that is, 12 pound 8 ounces, will raife 200 cubic feet, which is only 16 feet fhort of a cubic toife, becaufe 200 ounces joined together have proportionably a greater force than 2 ounces, as being an united force.

All the turnings a miner ufes to carry on his mines, and through which he conducts the fauciffe, fhould be well filled with earth and dung; and the mafonry 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 fhut with thick planks, in the form of a St Andrew's crofs, fo that the inclofure be fecure, and the void fpaces fhut up with dung or tempered earth. If a gallery be made below or on the fide of the chamber, it muft abfolutely be filled up with the ftrongeft mafonry, half as long again as the height of the earth; for this gallery will not only burft, but likewife obftruct the effect of the mine. The powder fhould always be kept in facks, which are opened when the mine is charged, and fome of the powder ftrewed about: the greater the quantity of earth to be raifed is, the greater is the effect of the mine, fuppofing it to have the due proportion of powder. Powder has the fame effect upon mafonry as upon earth, that is, it will proportionably raife either with the fame velocity.

The branches which are carried into the folidity of walls do not exceed three feet in depth, and two feet fix inches in width nearly: this fort of mine is moft excellent to blow up the ftrongeft walls.

The weight of a cubic foot of powder fhould be 80 lb. 1 foot 1 inch cube will weigh 100 lb. and 1 foot 2 inches and $\frac{1}{12}$, 150 lb. and 200 lb. of powder will be 1 foot 5 inches cube; however, there is a diverfity in this, according to the quantity of faltpetre 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 facks or barrels of 100 lb. each. The fauciffe muft have a clear paffage 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 acrofs thefe; then one is placed over the top of the chamber, which is fhaped for that purpofe: between that and thofe which cover the powder, props are placed, which fhore it up; fome inclining towards the outfide, others to the infide of the wall; all the void fpaces being filled with earth, dung, brick, and rough ftones. Afterwards planks are placed at the entrance of the chamber, with one acrofs the top, whereon they buttrefs three ftrong props, whofe other ends are likewife propped againft another plank fituated on the fide of the earth in the branch; which props being well fixed between the planks with wedges, the branch fhould then be filled up to its entrance with the forementioned materials. The fauciffes which pafs through the fide branches muft be exactly the fame 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 fauciffes being of equal length, will fpring together.

From a great number of experiments, it appears, 1. That the force of a mine is always towards the weakeft fide; fo that the difpofition of the chamber of a mine does not at all contribute to determine this effect. 2. That the quantity of powder muft be greater or lefs, in proportion to the greater or lefs weight of the bodies to be raifed, and to their greater or lefs cohefion; fo that you are to allow for each cubic fathom

Of loofe earth,	- -	9 or 10 lb.
Firm earth and ftrong fand,		11 or 12
Flat clayey earth,	-	15 or 16
New mafonry, not ftrongly bound,		15 or 20
Old mafonry, well bound,		25 or 30

3. That the aperture, or entonnoir of a mine, if rightly charged, is a cone, the diameter of whofe bafe 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 parabaloid, 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.

MINERAL, in natural history, is used in general for all fossile bodies, whether simple or compound, dug out of a mine; from whence it takes its denomination.

Mineral Waters. All waters naturally impregnated with any heterogeneous matter which they have dissolved within the earth may be ealled *mineral waters*, 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 earth or selenites. But waters containing only earth or selenites are not generally called *mineral*, but *hard* or *crude waters*.

Hard waters, which are simply selenetic, when tried by the chemical proofs, show no marks of an acid or of an alkali, nor of any volatile, sulphureous, or metallic matters. Waters which contain a disengaged calcareous earth, change the colour of syrup of violets to a green; and those that contain selenites, being mixed with a solution of mercury in nitrous acid, form a turbith mineral; and when a fixed alkali is added, they are rendered turbid, and a white sediment is precipitated. These waters also do not dissolve soap well. From these circumstances we may know, that any water which produces these effects is a hard, earthy, or selenetic water. The waters impregnated with gas are also hard.

Although the waters of the sea and saline springs be not generally enumerated amongst mineral waters, they might nevertheless be justly considered as such: for besides earthy and selenetic matters, they also contain a large quantity of mineral salts. We shall therefore consider them as such in this article.

Mineral waters, properly so called, are those in which gas, or sulphureous, saline, or metallic substances, are discovered by chemical trials. As many of these waters are employed successfully in medicine, they are also called *medicinal waters*.

Mineral waters receive their peculiar principles by passing through earths containing salts, or pyritous substances that are in a state of decomposition. Some of these waters are valuable from the quantity of useful salts which they contain, particularly of common salt, great quantities of which are obtained from these waters; and others are chiefly valued for their medicinal qualities. The former kind of mineral waters is an object of manufacture, and from them is chiefly extracted that salt only which is most valuable in commerce. See Salt.

Many of those waters have been accurately analysed by able chemists and physicians. But notwithstanding these attempts, we are far from having all the certainty and knowledge that might be desired on this important subject; for this kind of analysis is perhaps the most difficult of any in chemistry.—Almost all mineral waters contain several different substances, which being united with water may form with each other numberless compounds. Frequently some of the principles of mineral waters are in so small quantity, that they can scarcely be perceived; although they may have some influence on the virtues of the water, and also on the other principles contained in the water.—The chemical operations used in the analysis of mineral waters, may sometimes occasion essential changes in the substances that are to be discovered. And also, these waters are capable of suffering very considerable changes by motion, by rest, and by exposure to air.

Probably also the variations of the atmosphere, subterranean changes, some secret junction of a new spring of mineral or of pure water, lastly the exhaustion of the minerals whence waters receive their peculiar principles, are causes which may occasionally change the quality of mineral waters.

We need not therefore wonder that the results of analyses of the same mineral waters made by different chemists, whose skill and accuracy are not questioned, should be very different.

The consequences of what we have said on this subject are, That the examination of mineral waters is a very difficult task; that it ought not to be attempted but by profound and experienced chemists; that it requires frequent repetitions, and at different times; and lastly, that no fixed general rules can be given concerning these analyses.

As this matter cannot be thoroughly explained without entering into details connected with all the parts of chemistry, we shall here mention only the principal results, and the most essential rules, that have been indicated by the attempts hitherto made on this subject.

We may admit the division or arrangement of mineral waters into certain classes, proposed by some of the best chemists and naturalists.

Some of these waters are called *cold*, because they are not naturally hotter than the atmosphere. Some of them are even colder, especially in summer.

Those are called *hot* mineral waters, which in all seasons are hotter than the air. These are of various degrees of heat, and some of them are almost as hot as as boiling water, In some mineral waters certain volatile, spirituous, and elastic principles may be perceived, by a very sensible piquant taste: this principle is called the *gas* or *spirit* of the waters.

The waters which contain this principle are generally lighter than pure water. They sparkle and emit bubbles, at their spring, but especially when they are shaken, and poured from one vessel into another. They sometimes break the bottles containing them, when these are well corked, as fermenting wines sometimes do. When mixed with ordinary wine, they give to it the piquancy and sparkling quality of Champaigne wine.

This volatile principle, and all the properties of the water dependent upon it, are lost merely by exposure to air, or by agitation. The waters containing this principle are distinguished by the name of *spirituous mineral waters*, or *acidulous waters*.

Other divisions of mineral waters may be made relatively to some of their predominant principles. Hence some waters are called *acidulous*, *alkaline*, *martial*, *neutral*, &c.

When a mineral water is to be examined, we may observe the following rules:

Experiments ought to be made near the spring, if possible.

The situation of the spring, the nature of the soil, and the neighbouring rising grounds, ought to be examined.

Its sensible qualities, as its smell, taste, colour, are to be observed.

Its specific gravity and heat are to be ascertained by the hydrostatical balance and the thermometer.

From the properties above-mentioned of spirituous mineral waters, we may discover whether it be one of this class. For greater certainty we may make the following trial. Let the neck of a wet bladder be tied to the neck of a bottle containing some of this water. By shaking the water, any gas that it may contain will be disengaged, and will swell the bladder. If the neck of the bladder be then tied with a string above the bottle, and be cut below this string, so as to separate the bladder from the bottle, the quantity and nature of the contained gas may be further examined.

Lastly, we must observe the changes that are spontaneously produced upon the water in close and in open vessels, and with different degrees of heat. If by these means any matter be crystallized or deposited, it must be set apart for further examination.

These preliminary experiments and observations will almost certainly indicate, more or less sensibly, something concerning the nature of the water, and will point out the method to be followed in our further inquiry.

We must then proceed to the decomposition of the water, either without addition, and merely by evaporation and distillation, or with the addition of other substances, by means of which the matters contained in the water may be precipitated and discovered. It is not material which of these two methods be first practised, but it is quite necessary that the one should succeed the other. If we begin by evaporating and distilling, these operations must be sometimes interrupted, that the several principles which rise at different times of the distillation may be obtained and examined separately, and also to allow the several salts that may be contained to crystallize by the evaporation and by cold.

The substances which have hitherto been met with in mineral waters are,

1. *Vitriolic acid.* This acid is sometimes found pure and unmixed with any other substance, though more frequently joined with iron or copper. In its pure state, it is most frequently found in the neighbourhood of volcanoes, where, in the opinion of Dr Donald Monro, it is most probably "distilled from mines of vitriol or of pyrites-stone, decomposed by subterraneous fire." It seems, however, more probably to proceed from the decomposition of sulphur; for neither vitriol nor pyrites will at all give a pure acid. This only can be obtained from the fumes of sulphur, which we know abound in all such places. Dr Vandellius, in a book intitled *De Thermis Agri Patavini*, published in 1761, mentions a cave near to the town of Latera, about 30 miles from Viterbo, in Italy, where a clear acid water drops from the crevices of the rocks, and is collected by the country people in glazed earthen vessels. This has a mild agreeable taste, and is found to be a pure vitriolic acid much diluted. The cavern, however, is so filled with noxious vapours, that it cannot be entered without danger of suffocation except in winter, or when it blows a north wind. A similar native vitriolic water is mentioned by Theophilus Griffonius, near the town of Salvena. Varenius also mentions a spring in the province of Nota in Sicily, the waters of which are so sour, that the neighbouring people use it instead of vinegar. In some waste coal pits, the water tastes sour, and effervesces with alkalies; but in all these the acid is mixed with much vitriol, or other matter. Dr Monro mentions acid dews collected in the East Indies: this acid he supposes to be the vitriolic, and that it probably imparts some acidity to waters upon which the dews fall.

2. *Nitrous* and *marine* acids are never found in waters pure, though the former is frequently found combined with calcareous earth, and the latter with fossile alkali, calcareous earth, or magnesia.

3. *Fixed air* enters into the composition of all waters; but abounds particularly in those of the mineral kind, at least such as are cold. It imparts an agreeable acidulous taste to such water as it is mixed with, and is found by undoubted experiments to be that which gives the power and efficacy to the cold kind. It is known to be a solvent of iron, and that by its means this metal is very often suspended in waters; and Dr Dejean of Leyden, in a letter to Dr Monro in the year 1777, supposes it to be the medium by which sulphur also is dissolved. "Having been lately at Aix La Chapelle (says he), I mixed a solution of arsenic in the marine acid with some of the water of the emperor's bath, and immediately a true and genuine sulphur was precipitated to the bottom of the vessel in which the water was contained; which convinced me that the sulphur was dissolved by means of fixed air, though Sir Torbern Bergman thinks otherwise, and that the sulphur is suspended by means of phlogiston, and the matter of heat united in the waters; and he says, that if the concentrated nitrous acid be added to these waters, it seizes the phlogiston, precipitates the sulphur, and takes away the hepatic smell." If sulphur is by this medium suspended in

water, however, it muſt be by a natural proceſs, with which we are entirely unacquainted; for we cannot unite ſulphur and fixed air artificially. We are not informed whether there is any native mineral water impregnated only with fixed air; probably, indeed, there is not, for water thus impregnated becomes a very active ſolvent of calcareous and other earths, and muſt undoubtedly meet with ſomething or other of this kind in paſſing through the ground. Many waters in Germany, particularly in the neighbourhood of the Rhine, are very much impregnated with this acid, and are eſteemed otherwiſe pretty pure; but they have never been examined chemically to diſcover whether they are not impregnated alſo with ſome proportion of metallic or earthy ſubſtances.

4. *Vegetable alkali* was long ſuppoſed to be a production entirely artificial; but ſome late authors ſeem to think that it is a native ſalt as well as the vegetable alkali. M. Margraaf mentions his having got a true nitre, the baſis of which is the vegetable alkali, from ſome waters at Berlin. M. Monnet ſays, that from the Pohoun ſpaw water he obtained eight grains of a grey-coloured alkaline ſalt from a reſiduum of twelve Paris pints of the water, which he ſaturated with the vitriolic acid; and on diluting, evaporating, and cryſtallizing, he obtained a tartarus vitriolatus, and not a Glauber's ſalt as he expected. Dr Hoffman affirms, that he obtained a vitriolated tartar from the Seltzer water by mere evaporation: but as this ſalt has neither been found in Seltzer nor any other water by other chemiſts, it is probable that he has been miſtaken.

5. The *foſſil alkali* is found in many waters in Hungary, Tripoli, Egypt, and other countries where that ſalt is found native. It is combined in Seltzer water, and other acidulous waters, with fixed air, and may be obtained from them pretty pure by ſimple evaporation. M. Monnet informs us, that he has obtained it in tolerable purity from the waters of Auvergne: but in moſt of the alkaline waters this ſalt was in an imperfect ſtate, and may be called rather an embryo than a perfect ſalt; for it would not cryſtallize, and made a very imperfect neutral ſalt with acids. It was incapable alſo of decompoſing the ſelenites, which was frequently found along with it in the ſame water.—Bergman makes mention of an imperfect alkaline ſalt; but obſerves, that all of that kind which he had an opportunity of examining, appeared to him to be no other than a genuine mineral alkali mixed with deliqueſcent ſalts.

In ſome of the mineral waters near volcanoes, this kind of alkali has been found ſo intimately united with phlogiſton as to be capable of producing a true Pruſſian blue, on adding a ſolution of ſilver or of green vitriol to the water; of which an example is given by Dr Nichola Andrea, in the thermal waters of a ſpring in the iſland of Iſchia.

6. *Volatile alkali* has formerly been accounted an ingredient in mineral waters; but Dr Hoffman, and moſt of the later chemiſts, have denied this, as the volatile alkali is not a mineral ſubſtance. It is poſſible, indeed, that ſome waters in the neighbourhood of great quantities of putrid matter may give ſome tokens of volatile alkali, as was the caſe with Rathbone-place water, analyſed by the Hon. Henry Cavendiſh.

7. *Glauber's ſalt.* Many mineral waters contain a portion of this ſalt, though the quantity is commonly very ſmall. However, M. Boulduc, in the memoirs of the academy of ſciences at Paris for 1724, makes mention of the waters of a ſpring in the neighbourhood of a village about three leagues from Madrid, which, by evaporation, yields a true Glauber's ſalt.—This ſalt, he ſays, is found in a concreted ſtate about the ſides of the ſpring, reſembling the icicles which in winter hang from the roofs of houſes. From this circumſtance, it would ſeem that the water of the ſpring was very richly impregnated with the ſalt; and Dr Nichola Andrea ſpeaks of a water at Sællia, in Calabria, which is ſo ſtrongly impregnated with this kind of ſalt, that he thinks it would be worth while to prepare it from thence in the way of trade. It is very probable that ſuch waters are frequently to be met with in countries where the ſoil is impregnated with mineral alkali.

8. *Common nitre.* In ſome of the barren provinces of Bengal, the earth is ſo ſtrongly impregnated with this ſalt, that the ſurface is covered with a nitrous cruſt reſembling hoar-froſt; and in ſuch places the waters are ſtrongly impregnated with it, as may naturally be ſuppoſed. In colder countries, however, this impregnation is more rare, though inſtances of perfect nitre being found in ſprings are not wanting in Europe; but no natural combination of nitrous acid with foſſil alkali, or cubic nitre, has yet been met with in any part of the world.

9. *Sea ſalt.* This abounds not only in the waters of the ocean, but in great numbers of ſalt ſprings; and there are but few waters ſo pure as not to contain ſome portion of it.

10. *Aerated foſſile alkali.* This is found in Seltzer, and other waters of that kind, but combined with ſuch a quantity of fixed air, that the acrid taſte of the alkali is entirely covered, and the water has a briſk acidulous one. By evaporating the water, however, this ſuperfluous quantity of air is diſſipated, and the alkali then appears in its more acrid ſtate.

11. *Gypſum,* or *ſelenites.* This compoſition of the vitriolic acid and lime is extremely common in mineral waters. For a long time it was ſuppoſed to be a ſimple earth or ſtone, on account of its difficult ſolubility in water, requiring 700 or 800 times its own weight of water to diſſolve it artificially, though Dr Rutty informs us, that the water in which it is originally diſſolved will contain four or five times that proportion. There are to appearance ſeveral kinds of this ſubſtance; but whether they ariſe from foreign mixture, or from any difference in the calcareous earths among themſelves, we know not. It is not, however, conſidered as a medicinal ingredient, nor indeed is the internal uſe of it thought to be very ſafe.

12. *Epſom ſalt.* Bergman and ſome other chemiſts have reduced all the calcareous purging ſalts in which the vitriolic acid is concerned; but Dr Monro obſerves, that theſe ſalts not only cryſtallize in various modes, but have different degrees of ſolubility in water.—Thus the Epſom ſalt, properly ſo called, diſſolves in an equal quantity of water; while the calcareous nitres, or purging ſalts from mineral waters, require from 10 to 80 times their weight to diſſolve them.—This matter would require the analyſis of a great num-

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Mineral. ber of salts obtained from mineral waters in large quantity, and has not yet been thoroughly explained. These salts, however, are seldom met with by themselves in mineral waters, but usually mixed with sea-salt, iron, earth, sulphureous matter, &c. Dr Rutty tells us, that a mineral water begins to be laxative when it contains ten grains of this salt to a pint, or 80 to a gallon.

13. *Alum.* This was formerly supposed to be a very common ingredient in mineral waters; but more accurate observations have shown it to be very rare, insomuch that Dr Hoffman thinks it is not to be met with in any. Dr Layard, however, in the 56th volume of the Philosophical Transactions, gives an account of a chalybeate water at Somersham, from which he got five grains of alum out of two pounds of the water. Dr Rutty supposes that the mineral water at Ballycastle, in Ireland, contains also a portion of this salt.

14. *Calcareous nitre.* This is rarely found in mineral waters, though common enough in such as are simply called *hard* waters. Dr Monro says, that the only one containing this ingredient which he ever heard of is one mentioned by Dr Home, in his treatise on bleaching.

15. 16. *Muriated calcareous earth, and muriated magnesia.* Muriated calcareous earth is likewise a rare ingredient in mineral waters, though frequently mentioned by writers on this subject. Bergman informs us, that he obtained a small quantity from a spring in Ostro-Gothland; and Dr Monro got some from the water of a salt spring at Pitkeathly, near Perth, in Scotland. It is found, as well as muriated magnesia, in sea water, though the latter is much more abundant, and probably to be met with in all salt waters whatever, but is very difficult to be obtained in a crystalline form; though its presence and nature may always be ascertained, by dropping vitriolic acid into the concentrated liquor supposed to contain it, which will both precipitate the calcareous earth, and raise the marine acid in vapours. Muriated magnesia is likewise found in salt waters, and abounds in those of the ocean. It is the principal ingredient in the bitter ley remaining after the salt is extracted from sea-water, and is much more capable of being crystallized than the former.

17. *Aerated calcareous earth,* and *aerated magnesia.* Both these earths may be dissolved by means of fixed air, and frequently are so in mineral waters, as well as iron. They are likewise often found in great quantity in hard waters; nor is there probably any kind of water, unless that which is distilled, entirely void of them.—When such waters are boiled, the air evaporates, and the earth falls to the bottom, which will also be the case upon long exposure to the air. Hence originates the crust upon tea-kettles, the petrefactions upon different substances immersed in some kinds of water, &c. Hence also hard waters become soft, by running in channels for a considerable way; and to this cause we may with probability ascribe the growth of stones in rivulets.

18. *Vitriolated copper.* This salt is seldom found, except in waters which flow from copper mines. The water impregnated with it is emetic and purgative, and may justly be accounted poisonous rather than medicinal. On dipping clean iron into such water, the copper is instantly precipitated in its metallic state, and the iron dissolved in its stead. Sometimes the quantity Mineral. of copper is so great, that it is found advantageous to extract it in this way, as is the case in a certain stream in Ireland.

19. *Vitriolated iron* is found in considerable quantity in several waters both of England, Scotland, and Ireland, as well as in many countries on the continent. Some authors have imagined, that there is a kind of volatile vitriol with which waters are sometimes impregnated. An anonymous author, in a work intitled *delle Terme Porretane*, published at Rome in 1768, informs us, that having fixed a glass receiver to a hole through which the vapour of the water rises from the aqueduct below, he found in it a month afterwards, as well as in the mouth of the hole, a concrete and incrustated substance, like stalactite, which by experiment proved to be a true salt of iron, with a superabundant quantity of acid. Hence he concludes, that this water, as it rises from the spring, is impregnated with a fine volatile martial vitriol, in such small proportion that it cannot be discovered in any quantity that may be analysed in retorts or stills, though it may be discovered by confining for a long time the vapour, which is naturally and constantly sublimed from the whole body of the thermal water discharged from the spring, as it passes through the aqueducts. The water of this spring is strongly sulphureous, and its heat 92 degrees of Fahrenheit.

Another kind of supposed volatile vitriol is that composed of iron, dissolved by fixed air. The notion of this being a volatile substance arose from observing that there are some waters which taste strongly chalybeate at the fountain, but, after running for a little way, loses it entirely. This, however, is founded on a mistake; for it is only one of the ingredients, viz. the fixed air, which flies off when it is combined with earth; after which the iron precipitates in a similar manner.

20. *Vitriolated zinc.* This has been found native in the bowels of the earth; and thence has been supposed, not without reason, to be an ingredient in mineral waters: but none have yet brought any decisive experiments on this subject, except Dr Rutty and Dr Gmelin, who both say that they have obtained a white vitriol from mineral waters which were at the same time impregnated with iron and some other ingredients.

21. *Muriated manganese.* Waters impregnated with this salt are mentioned both by Bergman and Scheele; but the particular properties of them are not known.

22. *Arsenic* has been supposed sometimes to be an ingredient in mineral waters, though no certain proofs of its existence have been brought. Poisonous springs, supposed to be impregnated with it, are mentioned by Varenius; and Dr Baldassari tells us of a small spring (near to the Aqua Sancta, in the country of Siena), the waters of which kill any animal that drinks them. He suspects this to be owing to arsenic, but was afraid to analyse the water.

23. *Fossil oils.* Almost all waters, even those which are accounted the most pure, contain some portion of an oily matter, though generally so small hat it cannot be perceived without evaporating a large quantity of the liquid. Some contain it in great quantity; insomuch that, besides impregnating the water as strongly as possible, a great quantity falls to the bot-

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tom, or swims on the top. The other ingredients of these bituminous waters have not been examined; but in whatever manner the oil is united with the water, a portion of it adheres very obstinately, so that it cannot be fully separated even by filtration through paper. A fine bituminous vapour rises from the bottom of some wells, and pervades the water, taking fire on the application of any flaming substance, though no oil is observed in the water itself. Of this kind are the burning wells at Brosely and Wigan in Lancashire in England, and others in different countries.— The cause of the inflammation of these waters was first discoveeed in 1759 by Mr Thomas Shirley, who caused the waters of the well at Wigan to be drained away; and found that the inflammable vapour rose from the ground at the bottom, where it would take fire, as it did at the surface of the water. On applying his hand to the place whence the vapour issued, he found the impulse of it like a strong breath; or wind; and the same sensation was felt on applying his hand to the surface of the water. See *Phil. Transf.* vol. 26.

24. *Sulphur*. This is a common ingredient in mineral waters; and its presence is known by the strong hepatic smell they emit, as well as by their blackening silver, &c. Sulphureous waters are frequently very clear and transparent when taken up at the fountain; but when kept in open vessels, or bottles not well stopped, they soon deposit the sulphur they contain in the form of a dirty white powder, and lose their sulphureous smell. The bottom of the wells containing such waters, or of the channels in which they run, assume a black colour, and a raggy kind of matter is deposited on such substances as they run over for some time; and when these are taken up and dried, they appear covered with a true sulphur. Some waters contain this ingredient in very considerable quantity. From that of Harrowgate it may be separated by filtration; and Father de Tertre, in the second volume of his *Histoire Naturelle des Antilles*, tells us, that when he was in the island of Guadaloupe, and amusing himself one day with evaporating in a tin plate some sulphureous water which he found near the burning mountain, there remained on the plate a layer of sulphur about the thickness of a leaf of paper. Dr Monro mentions his having obtained a true sulphur, by evaporation, from a mineral water at Castle-Leod, in the county of Ross, in Scotland. Dr Brown, in his Travels, informs us, that having caused some of the pipes which carry off the water from the duke's bath at Baden, in Austria, to be opened, he took from thence a quantity of fine sulphur in powder, something like flour of brimstone, which had been sublimed from the waters. A similar kind of sulphur is obtained from the upper part of the pipes and conduits which convey the waters of Aix-la-Chapelle from their sources.

From these, and other facts of a similar nature, Dr Monro concludes, that sulphur is dissolved by some means or other in the water. Great differences, however, have taken place among chemists concerning the mode in which sulphur is thus dissolved. Sulphur, we know, may be dissolved by means of an alkali, as well as by calcareous earth; and there are some instances of alkaline waters containing sulphur, though we are not absolutely certain that the alkaline salt is the bond of union betwixt the sulphur and them. Dr Vandellius, in his treatise *de Thermis agri Patavini*, already quoted, mentions a substance found in the conduits of the waters of the baths at Aponum, which he calls crystallized sulphur, and says that it dissolves in the waters by boiling, recovering afterwards its solid form. This substance has not been examined; but we know of no other mineral with which sulphur readily assumes a crystalline form than terra ponderosa.— This compound is easily dissolved in water, and communicates to it a most powerful taste and smell of hepar sulphuris. Great part of the terra ponderosa, though not the whole, may be separated by fixed air, so that it is probably this permanent compound which Vandellius observed. Dr Lucas supposed that the sulphureous waters contain both an acid and phlogiston; and Sir Torbern Bergman, that they are impregnated only with the hepatic gas; and that this gas consists of sulphur united with phlogiston, from which the sulphur may be precipitated by the nitrous acid.

For an account of the cause of heat in mineral waters, see the article SPRINGS.

Having now mentioned the principal substances that form almost all these waters, we shall next show the proofs by means of which they may be discovered in water, without decomposing the water by evaporation or by distillation.

If any portion of disengaged acid or alkali be contained in water, it may be known by the taste, by changing the colour of violets or of turnsol, and by adding the precise quantity of acid or of alkali that is necessary for the saturation of the contained disengaged saline matter.

Sulphur, and liver of sulphur, may be discovered in waters by their singular smell, and by the black colour which these substances give to white metals or to their precipitates, but especially to silver.

Vitriolic salts with earthy basis may be discovered in water by two proofs: 1. By adding some fixed alkali, which decomposes all these salts, and precipitates their earthy basis; and, 2. By adding a solution of mercury in nitrous acid, which also decomposes these salts, and forms a *turbith mineral* with their acid. But for this purpose the solution of mercury ought to have a superabundant quantity of acid: for this solution, when perfectly saturated, forms a precipitate with any kind of water, as M. Rouelle has very justly remarked: and indeed, all metallic solutions in any acids are strictly capable of decomposition by water alone, and so much more easily as the acid is more perfectly saturated with the metal.

Martial vitriol or iron combined with any acid, or even with gas, shows itself in waters by blackening an infusion of galls, or by forming a Prussian blue with the phlogisticated alkaline lixivium.

The vitriol of copper, or copper dissolved by any acid, may be discovered by adding some of the volatile spirit of sal ammoniac, which produces a fine blue colour; or by the addition of clean iron, upon the surface of which the copper is precipitated in its natural or metallic state.

Glauber's salt is discovered by adding a solution of mercury in nitrous acid, and forming with it a turbith mineral; or by crystallization.

Common salt contained in waters forms with a solution

lution of ſilver in nitrous acid a white precipitate, or luna cornea. It may alſo be known by its cryſtallization. Marine ſalt with earthy baſis produces the ſame effect upon ſolution of ſilver. It alſo forms a precipitate when fixed alkali is added. The acrimony, bitterneſs, and deliqueſcency of this ſalt, ſerve to diſtinguiſh it.

The proofs related for the examination of mineral waters, are only thoſe which are moſt eſſential. Many others may be made to confirm the former proofs: but the details of theſe are too extenſive to be inſerted here. We ſhall add only two of them, becauſe they are very general, and may be very uſeful.

The firſt is the production of artificial ſulphur, or of the volatile ſulphureous acid; by which means the vitriolic acid may be diſcovered in any combination whatever. For this purpoſe, the matter to be examined muſt be mixed with any inflammable ſubſtance, and expoſed to a red heat. If this matter contained but a particle of vitriolic acid, it would be rendered ſenſible by the ſulphur, or by the volatile ſulphureous acid thence produced.

The ſecond general proof for mineral waters which we ſhall mention here, ſerves to diſcover any metallic ſubſtance whatever, diſſolved in water by any acid. This proof conſiſts in adding ſome of the liquor ſaturated by the colouring matter of Pruſſian blue. This liquor produces no effects upon any neutral ſalts with earthy or alkaline baſes, but decompoſes all metallic ſalts: ſo that if no precipitate be formed upon adding ſome of this liquor, we may be certain that the water does not contain any metallic ſalt; and on the contrary, if a precipitate be formed, we may certainly infer that the water does contain ſome metallic ſalt.

Two kinds only of gas, or the ſpirituous volatile part of ſome waters, are hitherto known; of which one is the volatile ſulphureous acid, and the other is fixed air. See Aerology, Fixed *Air*, and Gas, *paſſim*. Air united ſuperabundantly with ſpirituous waters is the chief cauſe of their lightneſs, piquancy, and ſparkling.

When the nature and quantities of the principles contained in a mineral water are aſcertained by ſuitable experiments, we may imitate artificially this water, by adding to pure water the ſame proportions of the ſame ſubſtances, as Mr Venel has done in examining ſeveral waters, eſpecially that of Selters.

We may eaſily perceive the neceſſity of uſing no veſſels in theſe experiments, but ſuch as are perfectly clean and rinſed with diſtilled water; of weighing the products of the experiments very exactly; of making the experiments upon as large quantities of water as is poſſible, eſpecially the evaporations, cryſtallizations, and diſtillations; and of repeating all experiments ſeveral times. We may further obſerve, that the mixtures from which any precipitates might be expected ought to be kept two or three days, becauſe many of theſe precipitates require that time, or more, to appear, or to be entirely depoſited.

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 Germain's 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, foſſile 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, foſſile 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 drank in leproſy, ſcabs, and other cutaneous diſeaſes.
Antrim,	Ireland,		Similar to Barrowdale 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.

Names of Springs.	Countries in which they are found.	Contents and Quality of the Water.	Medicinal Virtues.
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 fossile 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 an 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 Balemore 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 fossile alkali.	Similar in virtue to that of Balemore.
Bagniers,	Biggore 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,	Biggore in France.	Sea-salt, fossile 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.
Barrowdale,	Cumberland in England.	A great quantity of sea-salt, aerated calcareous earth, and some bittern. Cold.	Strongly emetic and cathartic. 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 drams and an half of sea-salt; so that a great part of the virtue must reside in the aerated calcareous earth.
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, fossile alkali, and a little sulphur.—Cold.	Gently laxative, diuretic, and diaphoretic.
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 Harrogwate.
Buxton,	Derbyshire in England.	A small quantity of sea-salt, fossile 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.

Names of Springs.	*Countries in which they are found.*	*Contents and Quality of the Water.*	*Medicinal Virtues.*
Caroline baths,	Bohemia.	Iron, fixed air, aerated earth, ſea-ſalt, foſſile-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,	Nottingham ſhire 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.	Foſſile 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.
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 foſſile alkali. Cold.	Purgative, and corrects acidities.
Chadlington,	Oxfordſhire in England.	Foſſile alkali, ſea-ſalt, and ſulphur. Cold.	Purgative.
Chaude Fontaine,	Liege in Germany.	Aerated earth, foſſile 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. 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.	Foſſile 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.
Corſtorphin,	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.

Names of Springs.	Countries in which they are found.	Contents and Quality of the Water.	Medicinal Virtues.
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.
Cross-town,	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 Thouloufe in France.	Similar to Aix-la-Chapelle. Hot.	Used as a bath, and also drank, like the Aix-la-Chapelle waters.
Dedding ton,	Oxford in England.	Iron, sulphur, aerated earth, sea-salt, or fossile 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 fossile alkali.	Diuretic and diaphoretic.
Derrindaff,	Cavan in Ireland.	Sulphur and purging salt.	Similar to the *Askeron* water.
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.
Drig-well,	Cumberland in England.	Similar to Deddington.	
Dropping-well,	Yorkshire in England.	Aerated earth.	Astringent and corroborant.
Drumas-nave,	Leitrim in Ireland.	Sulphur, fossile 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 salt.	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.

Names of Springs.	*Countries in which they are found.*	*Contents and Quality of the Water.*	*Medicinal Virtues.*
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.
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.	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 foſſile 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 foſſile alkali.	Similar to Swadlinghar water.
Killingſhanvally,	Fermanagh, Ireland.	Smilar to Hanly's chalybeate water.	

Kilroot,

Names of Springs.	*Countries in which they are found.*	*Contents and Quality of the Water.*	*Medicinal Virtues.*
Kilroot,	Antrim in Ireland.	Nature of Barrowdale 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 foſſile alkali.	Laxative, and uſeful in correcting acidities.
Knareſborough	See *Dropping-well.*		
Knowſley,	Lancaſhire in England.	Similar to Scarborough wa-	
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,	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, foſſile alkali, and a little Epſom ſalt.	Similar to Swadlinghar water.
Liſbeak,	Fermanagh in Ireland.	Sulphur, &c.	Emetic, cathartic, and diuretic.
Lis-done-Vurna,	Clare in Ireland.	Foſſile alkali, with much iron.	
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.	
Mahereberg,	Kerry in Ireland.	Similar to Barrowdale 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,

Names of Springs.	*Countries in which they are found.*	*Contents and Quality of the Water.*	*Medicinal Virtues.*
Maudſley,	Lancaſhire in England.	Sulphur and ſea-ſalt.	Similar to Harrowgate.
Mechan,	Fermanagh in Ireland.	Sulphur and foſſile alkali.	Similar to the waters of Drumgoon.
Miller's Spaw,	Lancaſhire in England.	Similar to Tunbridge.	
Moffat,	Annandale in Scotland.	Sulphur, ſea-ſalt, and earth.	Alterant, diuretic, and ſometimes purgative. Is uſed as a bath, and the ſteam of the hot water has been found ſervicable 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.	
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, foſſile 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, foſſile 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 foſſile 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.	Foſſile alkali and calcareous earth.	Diuretic and laxative
Pougues,	Nivernois, France.	Calcareous earth, magneſia, foſſile alkali, ſea-ſalt, earth of alum, and ſiliceous earth.	Diuretic and laxative.

Names of Springs.	*Countries in which they are found.*	*Contents and Quality of the Water.*	*Medical Virtues.*
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, foſſile alkali, calcareous earth, and bituminous oil.	Uſed in ſcrofulous and cutateous diſorders.
Richmond,	Surry in England.	Similar to Acton water.	
Rippon,	Yorkſhire, England,	Sulphur; ſea-ſalt, and aerated earth.	Diaphoretic and alterant.
Road,	Wiltſhire, England.	Sulphur, iron, foſſile alkali, and fixed air.	Uſeful in ſcrofula, ſcurvy, and cutaneous diſorders.—Acts as a laxative.
St Bartholomew's well,	Cork in Ireland.	Foſſile alkali, iron, and fixed air.	Similar to Tilbury water.
St Bernard's well,	Near Edinburgh.	Sulphureous volatile acid and phlogiſton.	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 Barrowdale water.
Scarborough,	Yorkſhire, England.	Aerated calcareous earth, Epſom ſalt, ſea-ſalt, and iron.	Diuretic and purgative.
Scollienſis,	Switzerland.	Iron, foſſile alkali, and a great quantity of fixed air.	Excellent in colic pains, both as a cure and preventative.
Sedlitz,	Bohemia.	Epſom ſalt.	Strongly purgative.
Seltzer,	Germany.	Calcareous earth, magneſia, foſſile alkali, and fixed air.	Diuretic. Uſeful in the gravel, rheumatiſm, ſcurvy, ſcrophula, &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.	Foſſile 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, foſſile alkali, and ſea-ſalt.	Alterative and laxative.
Swadlingbar,	Cavan in Ireland	Sulphur, earth, ſea-ſalt, and foſſile alkali.	Alterative and diaphoretic.
Swanſey,	Glamorganſhire in North Wales.	Green vitriol.	Similar to Shadwell.
Sydenham,	Kent in England.	Similar to Epſom, but weaker.	

Names of Springs.	*Countries in which they are found.*	*Contents and Quality of the Water.*	*Medical Virtues.*
Tarleton,	Lancashire in England.	Similar to Scarborough water.	
Tewksbury,	Gloucestershire in England.	Similar to Acton.	
Thetford,	Norfolk in England.	Fossile 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.
Tilbury,	Essex in England.	Fossile alkali.	Diuretic and diaphoretic.
Tober Bony,	Near Dublin in Ireland.	Fossile alkali, earth, and bituminous oil.	Similar to Tilbury.
Tonstein,	Cologne in Germany.	Fossile 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, fossile 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.
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.

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 Elisabeth, 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 200 l. 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 portreve, 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 4000 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.

 MINERALOGY,

MINERALOGY,

IS that ſcience which teaches us the properties of mineral bodies, and by which we learn how to characteriſe, diſtinguiſh, and claſs them into a proper order.

INTRODUCTION.

MINERALOGY ſeems to have been in a manner coeval with the world. Precious ſtones of various kinds appear to have been well known among the Jews and Egyptians in the time of Moſes; and even the moſt rude and barbarous nations appear to have had ſome knowledge of the ores of different metals. As the ſcience is nearly allied to chemiſtry, it is probable that the improvements both in chemiſtry and mineralogy have nearly kept pace with each other; and indeed it is but of late, ſince the principles of chemiſtry were well underſtood, that mineralogy has been advanced to any degree of perfection. The beſt way of ſtudying mineralogy, therefore, is by applying chemiſtry to it; and not contenting ourſelves merely with inſpecting the outſides of bodies, but decompounding them according to the rules of chemiſtry. This method has been brought to the greateſt perfection by Mr Pott of Berlin, and after him by Mr Cronſtedt of Sweden. To obtain this end, chemical experiments in the large way are without doubt neceſſary: but as a great deal of the mineral kingdom has already been examined in this manner, we do not need to repeat all thoſe experiments in their whole extent, unleſs ſome new and particular phenomena ſhould diſcover themſelves in thoſe things we are examining; elſe the tedioufneſſes of thoſe proceſſes might diſcourage ſome from going farther, and take up much of the time of others that might be better employed. An eaſier way may therefore be adopted, which even for the moſt part is ſufficient, and which, though made in miniature, is as ſcientifical as the common manner of proceeding in the laboratories, ſince it imitates that, and is founded upon the ſame principles. This conſiſts in making the experiments upon a piece of charcoal with the concentrated flame of a candle directed through a blow-pipe. The heat occaſioned by this is very intenſe; and the mineral bodies may here be burnt, calcined, melted, and ſcorified, &c. as well as in any great works.

For a deſcription of the blow-pipe, the method of uſing it, the proper fluxes to be employed, and the different ſubjects of examination to which that inſtrument is adapted, ſee the article *Blow-Pipe*, where all thoſe particulars are conciſely detailed. It may not be improper here, however, to reſume thoſe details at greater length; avoiding, at the ſame time, all unneceſſary repetitions. After which we ſhall exhibit a ſcientific arrangement of the mineral kingdom, according to the moſt approved ſyſtem.

PART. I. EXPERIMENTAL MINERALOGY; with a DESCRIPTION of the NECESSARY APPARATUS (A).

SECT. I. *Of Experiments upon Earths and Stones.*

WHEN any of theſe ſubſtances are to be tried, we muſt not begin immediately with the blow-pipe; but ſome preliminary experiments ought to go before, by which thoſe in the fire may afterwards be directed. For inſtance, a ſtone is not always homogeneous, or of the ſame kind throughout, although it may appear to the eye to be ſo. A magnifying glaſs is therefore neceſſary to diſcover the heterogeneous particles, if there be any; and theſe ought to be ſeparated, and every part tried by itſelf, that the effects of two different things, examined together, may not be attributed to one alone. This might happen with ſome of the finer micæ, which are now and then found mixed with ſmall particles of quartz, ſcarcely to be perceived by the eye. The trapp (in German *ſchwartzſtein*) is alſo ſometimes mixed with very fine particles of feltſpar *(ſpatum ſcintillans)* or of calcareous ſpar, &c. After this experiment, the hardneſs of the ſtone in queſtion muſt be tried with ſteel. The flint and garnets are commonly known to ſtrike fire with ſteel; but there are alſo other ſtones, which, though very ſeldom, are found ſo hard as likewiſe to ſtrike fire. There is a kind of trapp of that hardneſs, in which no particles of feltſpar are to be ſeen. Coloured glaſſes reſemble true gems; but as they are very ſoft in proportion to theſe, they are eaſily diſcovered by means of the file. The common quartz-cryſtals are harder than coloured glaſſes, but ſofter than the gems. The loadſtone diſcovers the preſence of iron, when it is not mixed in too ſmall a quantity in the ſtone, and often before the ſtone is roaſted. Some kinds of hæmatites, and particularly the cœruleſcens, greatly reſemble ſome other iron ores; but this diſtinguiſhes itſelf from them by a red colour when pounded, the others giving a blackiſh powder, and ſo forth.

The management of the *Blow-pipe* has been deſcribed under that article; but a few particulars may be here recapitulated, or added.

The candle ought to be ſnuffed often, but ſo that the top of the wick may retain ſome fat in it, becauſe the flame is not hot enough when the wick is almoſt burnt to aſhes; but only the top muſt be ſnuffed off, becauſe a low wick gives too ſmall a flame. The blue flame is the hotteſt; this ought, therefore, to be forced

(A) From Engeſtrom's *Treatiſe on the Blow-Pipe*, and Magellan's *Deſcription of Pocket-Laboratories*, &c. ſubjoined to the Engliſh Tranſlation of *Cronſtedt's Mineralogy*, 2d edit. in 2 vols. Dilly.

forced out when a great heat is required, and only the point of the flame muſt be directed upon the ſubject which is to be eſſayed. M. Magellan recommends, as being moſt cleanly and convenient, that the candle be made of wax, and the wick ſhould be thicker than ordinary. Its upper end muſt be bended towards the matter intended to be heated, and the ſtream of air muſt be directed along the ſurface of the bended part, ſo as not abſolutely to touch it.

The piece of charcoal made uſe of in theſe experiments muſt not be of a diſpoſition to crack. If this ſhould happen, it muſt gradually be heated until it does not crack any more, before any aſſay is made upon it. If this be not attended to, but the aſſay made immediately with a ſtrong flame, ſmall pieces of it will ſplit off in the face and eyes of the aſſayer, and often throw along with them the matter that was to be aſſayed. Charcoal which is too much burnt conſumes too quick during the experiment, leaving ſmall holes in it, wherein the matter to be tried may be loſt; and charcoal that is burnt too little, catches flame from the candle, burning by itſelf like a piece of wood, which likewiſe hinders the proceſs.

Of thoſe things that are to be aſſayed, only a ſmall piece muſt be broken off for that purpoſe, not bigger than that the flame of the candle may be able to act upon it at once, if required; which is ſometimes neceſſary, as, when the matter requires to be made red hot throughout, the piece ought to be broken as thin as poſſible, at leaſt the edges; the advantage of which is obvious, the fire having then more influence upon the ſubject, and the experiment being more quickly made.

Some of the mineral bodies are very difficult to be kept ſteady upon the charcoal during the experiment, before they are made red hot; becauſe, as ſoon as the flame begins to act upon them, they ſplit aſunder with violence, and are diſperſed. Such often are thoſe which are of a ſoft conſiſtence or a particular figure, and which preſerve the ſame figure in however minute particles they are broken; for inſtance, the calcareous ſpar, the ſparry gypſum, ſparry fluor, white ſparry lead-ore, the potters ore, the teſſellated mock-lead or blende, &c. even all the common fluors which have no determinate figure. Theſe not being ſo compact as common hard ſtones, when the flame is immediately urged upon them, the heat forces itſelf through and into their clefts or pores, and cauſes this violent expanſion and diſperſion. Many of the clays are likewiſe apt to crack in the fire, which may be for the moſt part aſcribed to the humidity, of which they always retain a portion.

The only way of preventing this inconvenience is to heat the body as ſlowly as poſſible. It is beſt, firſt of all, to heat that place of the charcoal where the piece is intended to be put on; and afterwards lay it thereon: a little crackling will then enſue, but commonly of no great conſequence. After that, the flame is to be blown very ſlowly towards it, in the beginning not directly upon, but ſomewhat above it, and ſo approaching nearer and nearer with the flame until it become red hot. This will do for the moſt part; but there are nevertheleſs ſome, which, notwithſtanding all theſe precautions, it is almoſt impoſſible to keep on the charcoal. Thus the fluors are generally the moſt difficult; and as one of their principal characters is diſcovered by their effects in the fire *per ſe*, they ought neceſſarily to be tried that way. To this purpoſe, it is beſt to make a little hole in the charcoal to put the fluor in, and then to put another piece of charcoal as a covering upon this, leaving only a ſmall opening for the flame to enter. As this ſtone will nevertheleſs ſplit and fly about, a larger piece thereof than is before-mentioned muſt be taken, in order to have at leaſt ſomething of it left.

But if the experiment is to be made upon a ſtone whoſe effects one does not want to ſee in the fire *per ſe*, but rather with fluxes, then a piece of it ought to be forced down into melted borax, when always ſome part of it will remain in the borax, notwithſtanding the greateſt part may ſometimes fly away by cracking.

1. *Of ſubſtances to be tried in the fire* per ſe. As the ſtones undergo great alterations when expoſed to the fire by themſelves, whereby ſome of their characteriſticks, and often the moſt principal, are diſcovered, they ought firſt to be tried that way, obſerving what has been ſaid before concerning the quantity of matter, direction of the fire, &c. The following are generally the reſults of this experiment.

Calcareous earth or *ſtone*, when it is pure, does not melt by itſelf, but becomes white and friable, ſo as to break freely between the fingers; and, if ſuffered to cool, and then mixed with water, it becomes hot, juſt like common quick-lime. As in theſe experiments only very ſmall pieces are uſed, this laſt effect is beſt diſcovered by putting the proof on the outſide of the hand, with a drop of water to it, when inſtantly a very quick heat is felt on the ſkin. When the calcareous ſubſtance is mixed with the vitriolic acid, as in gypſum, or with a clay, as in marle, it commonly melts by itſelf, yet more or leſs difficultly in proportion to the differences of the mixtures. Gypſum produces generally a white, and marle a grey, glaſs or ſlag. When there is any iron in it, as a white iron ore, it becomes dark, and ſometimes quite black, &c.

The *ſiliceæ* never melt alone, but become generally more brittle after being burnt. Such of them as are coloured become colourleſs, and the ſooner when it does not ariſe from any contained metal; for inſtance, the topazes, amethiſts, &c. ſome of the precious ſtones, however, excepted: And ſuch as are mixed with a quantity of iron grow dark in the fire, as ſome of the jaſpers, &c.

Garnets melt always into a black ſlag, and ſometimes ſo eaſily that they may be brought into a round globule upon the charcoal.

The *argillaceæ*, when pure, never melt, but become white and hard. The ſame effects follow when they are mixed with phlogiſton. Thus the ſoap-rock is eaſily cut with the knife; but being burnt it cuts glaſs, and would ſtrike fire with the ſteel, if as large a piece as is neceſſary for that purpoſe could be tried in this way. The ſoap-rocks are ſometimes found of a dark brown and nearly black colour, but nevertheleſs become quite white in the fire like a piece of China ware. However, care muſt be taken not to urge the flame from the top of the wick, there being for the moſt part a ſooty ſmoke, which commonly will darken all that it touches; and, if this is not obſerved, a miſtake in the experiment might eaſily happen. But if

 it

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it is mixed with iron, as it is sometimes found, it does not so easily part with its dark colour. The argillaceæ when mixed with lime melt by themselves, as above-mentioned. When mixed with iron, as in the boles, they grow dark or black; and if the iron is not in too great a quantity, they melt alone into a dark slag; the same happens when they are mixed with iron and a little of the vitriolic acid, as in the common clay, &c.

Mica and *asbestos* become somewhat hard and brittle in the fire, and are more or less refractory, though they give some marks of fusibility.

The *fluors* discover one of their chief characteristics by giving a light like phosphorus in the dark, when they are slowly heated; but lose this property, as well as their colour, as soon as they are made red hot.—They commonly melt in the fire into a white opaque slag, though some of them not very easily.

Some sorts of the *zeolites* melt easily, and foam in the fire, sometimes nearly as much as borax, and become a frothy slag, &c.

A great many of those mineral bodies which are impregnated with iron, as the *boles*, and some of the white iron ores, &c. as well as some of the other iron ores, viz. the bloodstone, are not attracted by the loadstone before they have been thoroughly roasted, &c.

2. *Of substances heated with fluxes.* After the mineral bodies have been tried in the fire by themselves, they ought to be heated with fluxes to discover if they can be melted or not, and some other phenomena attending this operation. For this purpose, three different kinds of salts are used as fluxes, viz. sal sodæ, borax, and sal fusible microsmicum; (see the article *Blow-Pipe*).

The *sal sodæ* is, however, not much used in these small experiments, its effects upon the charcoal rendering it for the most part unfit for it; because, as soon as the flame begins to act upon it, it melts instantly, and is almost wholly absorbed by the charcoal. When this salt is employed to make any experiment, a very little quantity is wanted at once, viz. about the cubical contents of an eighth part of an inch, more or less. This is laid upon the charcoal, and the flame blown on it with the blow-pipe; but as this salt commonly is in form of a powder, it is necessary to go on very gently, that the force of the flame may not disperse the minute particles of the salt. As soon as it begins to melt, it runs along on the charcoal, almost like melted tallow; and when cold, it is a glassy matter of an opaque dull colour spread on the coal. The moment it is melted, the matter which is to be tried ought to be put into it, because otherwise the greatest part of the salt will be soaked into the charcoal, and too little of it left for the intended purpose. The flame ought then to be directed on the matter itself; and if the salt spreads too much about, leaving the proof almost alone, it may be brought to it again by blowing the flame on its extremities, and directing it towards the subject of the experiment. In the assays made with this salt, it is true, we may find whether the mineral bodies which are melted with it have been dissolved by it or not: but we cannot tell with any certitude whether this is done hastily and with force, or gently and slow; nor whether a less or a greater part of the matter has been dissolved: neither can it be well distinguished if the matter has imparted any weak tincture to the slag; because this salt always bubbles upon the charcoal during the experiment, nor is it clear when cool; so that scarcely any colour, except it be a vey deep one, can be discovered, although it may sometimes be coloured by the matter that has been tried.

The following earths are entirely *soluble* in this flux with effervescence: Agate; chalcedony; carnelian; Turkey stone †, (*cos Turcica*); fluor mineralis †; onyx; opal; quartz; common flint; ponderous spar. The following are *divisible* in it with or without effervescence, but not entirely soluble: Amianthus; asbestus; basaltes; chrysolite ‡; granate ‡; hornblende; jasper; marlstone; mica; the mineral of alum from Tolfa; petrosilex; aluminous slate and roof slate from Helsingia; emeralds; steatites; common flint; schoerl; talc; trapp; tripoli; tourmalin. And the following are neither fusible nor divisible in it: Diamond; hyacinth; ruby; sapphire; topaz.

The other two salts, viz. *borax* and the *sal microcosmicum*, are very well adapted to these experiments, because they may by the flame be brought to a clear uncoloured and transparent glass; and as they have no attraction to the charcoal, they keep themselves always upon it in a round globular form. The sal fusible microsmicum § is very scarce, and perhaps not to be met with in the shops; it is made of urine. § See *Chemistry*, n° 905, 906.

The following earths are soluble in borax, with more or less *effervescence*: Fluor mineralis †; marle; mica†; the mineral of alum from Tolfa; aluminous slate, and roof-slate from Helsingia†; ponderous spar; schoerl; talc †; tourmalin. And the following *without* effervescence; Agate; diamond; amianthus; asbestus; basaltes; chalcedony; cornelian; chrysolite; cos turcica; granate; hyacinth *; jasper; lapis ponderosus; onyx; opal; petro-silex; quartz *; ruby; sapphire; common flint *; steatite; trapp; trippel, or tripoli; topaz; zeolite; hydrophanes.

In the microcosmic salt, the following are soluble with more or less effervescence: Basaltes †; turkey stone ‡; fluor mineralis †; marle; mica; the mineral of alum from Tolfa; schistus aluminaris, schistus tegularis from Helsingia †; schoerl; spathum ponderosum; tourmalin †; lapis ponderosus. And the following without visible effervescence: Agate; diamond; amianthus; asbestus; chalcedony; carnelian; chrysolite; granate; hyacinth; jasper; onyx ‖; opal; petrosilex; quartz ‖; ruby; sapphire; common flint ‖; emerald; talc; topaz; trapp; trippel; zeolite; hornblend; hydrophanes; lithomarga; steatites.

Calcareous earth, ponderous spar, gypsum, and other additaments, often assist the solution, as well in the microcosmic salt as in borax. To which it is necessary to add, that in order to observe the effervescence properly, the matter added to the flux should be in the form of a small particle rather than in fine powder; because in this last there is always air between the particles, which being afterwards driven off by the heat afford the appearance of a kind of effervescence (A).

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(A) In the above lists, the articles marked † effervesce very little; those marked ‡ not at all; those marked * require a larger quantity of the flux and a longer continuance of heat than the rest; those marked ‖ are more difficultly dissolved than the others.

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The quantity of thofe two falts required for an experiment is almoft the fame as the *fal fodæ;* but as the former are cryftallifed, and confequently include a great deal of water, particularly the borax, their bulk is confiderably reduced when melted, and therefore a little more of them may be taken than the before-mentioned quantity.

Both thofe falts, efpecially the borax, when expofed to the flame of the blow-pipe, bubble very much and foam before they melt to a clear glafs, which for the moft part depends on the water they contain. And as this would hinder the affayer from making due obfervations on the phenomena of the experiment, the falt which is to be ufed muft firft be brought to a clear glafs before it can ferve as a flux; it muft therefore be kept in the fire until it become fo tranfparent that the cracks in the charcoal may be feen through it. This done, whatfoever is to be tried is put to it, and the fire continued.

Here it is to be obferved, that for the affays made with any of thefe two fluxes on mineral bodies, no larger pieces muft be taken than that altogether they may keep a globular form upon the charcoal; becaufe it may then be better diftinguifhed in what manner the flux acts upon the matter during the experiment. If this be not obferved, the flux, communicating itfelf with every point of the furface of the mineral body, fpreads all over it, and keeps the form of this laft, which commonly is flat, and by that means hinders the operator obferving all the phenomena which may happen. Befides, the flux being in too fmall a quantity in proportion to the body to be tried, will be too weak to act with all its force upon it. The beft proportion therefore is about a third part of the mineral body to the flux; and as the quantity of the flux above mentioned makes a globe of a due fize in regard to the greateft heat that is poffible to procure in thefe experiments, fo the fize of the mineral body muft be a third part lefs here than when it is to be tried in the fire by itfelf.

The *fal fodæ*, as has been already obferved, is not of much ufe in thefe experiments; nor has it any particular qualities in preference to the two laft mentioned falts, except that it diffolves the zeolites eafier than they do.

The microcofmic falt fhows almoft the fame effects in the fire as the borax, only differing from it in a very few circumftances; of which one of the principal is, that, when melted with manganefe, it becomes of a crimfon hue inftead of a jacinth colour, which borax takes. This falt is, however, for its fcarcity ftill very little in ufe, borax alone being that which is commonly employed. Whenever a mineral body is melted with any of thefe two laft mentioned falts, in the manner already defcribed, it is eafily feen, Whether it quickly diffolves; in which cafe an effervefcence arifes, that lafts till the whole be diffolved: Whether the folution be flowly performed; in which cafe few and fmall bubbles only rife from the matter: or, Whether it can be diffolved at all; becaufe, if not, it is obferved only to turn round in the flux, without the leaft bubble, and the edges look as fharp as they were before.

In order farther to illuftrate what has been faid about thefe experiments, we fhall give a few examples of the effects of borax upon the mineral bodies.—The *calcareous* fubftances, and all thofe ftones which contain any thing of lime in their compofition, diffolve readily and with effervefcence in the borax. The effervefcence is the more violent the greater the portion of lime contained in the ftone. This caufe, however, is not the only one in the gypfum, becaufe both the conftituents of this do readily mix with the borax, and therefore a greater effervefcence arifes in melting gypfum with the borax than lime alone.—The *filiceæ* do not diffolve; fome few excepted which contain a quantity of iron.—The *argillaceæ*, when pure, are not acted upon by the borax: but when they are mixed with fome heterogeneous bodies, they are diffolved, though very flowly; fuch are, for inftance, the ftone-marrow, the common clay, &c.

The *granates*, *zeolites*, and *trapp*, diffolve but flowly. The *fluors*, *afbeftinæ*, and *micaceæ*, diffolve for the moft part very eafily; and fo forth.—Some of thefe bodies melt to a colourlefs tranfparent glafs with the borax; for inftance, the calcareous fubftances when pure, the fluors, fome of the zeolites, &c. Others tinge the borax with a green tranfparent colour, *viz.* the granates, trapp, fome of the argillaceæ, and fome of the micaceæ and afbeftinæ. This green has its origin partly from a fmall portion of iron which the granates particularly contain, and partly from phlogifton.

Borax can only diffolve a certain quantity of the mineral body proportional to its own. Of the calcareous kind it diffolves a vaft quantity; but turns at laft, when too much has been added, from a clear tranfparent to a white opaque flag. When the quantity of the calcareous matter exceeds but little in proportion, the glafs looks very clear as long as it remains hot: but as foon as it begins to cool, a white half opaque cloud is feen to arife from the bottom, which fpreads over the third, half, or more of the glafs globe, in proportion to the quantity of calcareous matter; but the glafs or flag is neverthelefs fhining, and of a glaffy texture when broken. If more of this matter be added, the cloud rifes quicker and is more opaque, and fo by degrees till the flag becomes quite milk white. It is then no more of a fhining, but rather dry appearance, on the furface; is very brittle, and of a grained texture when broken.

Sect. II. *Of Experiments upon Metals and Ores.*

What has been hitherto faid relates only to the *ftones* and *earths*: We fhall now proceed to defcribe the manner of examining *metals* and *ores*. An exact knowledge and nicety of procedure are fo much the more neceffary here, as the metals are often fo difguifed in their ores, as to be very difficultly known by their external appearance, and liable fometimes to be miftaken one for the other: Some of the cobalt ores, for inftance, refemble much the *pyrites arfenicalis*; there are alfo fome iron and lead ores, which are nearly like one another, &c.

As the ores generally confift of metals mineralifed with fulphur or arfenic, or fometimes both together, they ought firft to be expofed to the fire by themfelves, in order not only to determine with which of thefe they are mineralifed, but alfo to fet them free from thofe volatile mineralifing bodies: This ferves inftead of calcination, by which they are prepared for further affays.

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Here it must be repeated, that whenever any metal or fusible ore is to be tried, a little concavity must be made in that place of the charcoal where the matter is to be put; because, as soon as it is melted, it forms itself into a globular figure, and might then roll from the charcoal, if its surface was plain; but when borax is put to it, this inconvenience is not so much to be feared.

Whenever an ore is to be tried, a small bit being broke off for the purpose, it is laid upon the charcoal, and the flame blown on it slowly. Then the sulphur or arsenic begins to part from it in form of smoke: these are easily distinguished from one another by their smell; that of sulphur being sufficiently known, and the arsenic smelling like garlick. The flame ought to be blown very gently as long as any smoke is seen to part from the ore; but after that, the heat must be augmented by degrees, in order to make the calcination as perfect as possible. If the heat be applied very strongly from the beginning upon an ore that contains much sulphur or arsenic, the ore will presently melt, and yet lose very little of its mineralising bodies, by that means rendering the calcination very imperfect. It is, however, impossible to calcine the ores in this manner to the utmost perfection, which is easily seen in the following instance, *viz.* in melting down a calcined potter's ore with borax, it will be found to bubble upon the coal, which depends on the sulphur which is still left, the vitriolic acid of this uniting with the borax, and causing this motion. However, lead in its metallic form, melted in this manner, bubbles upon the charcoal, if any sulphur remains in it. But as the lead, as well as some of the other metals, may raise bubbles upon the charcoal, although they are quite free from the sulphur, only by the flames being forced too violently on it, these phenomena ought not to be confounded with each other.

The ores being thus calcined, the metals contained in them may be discovered, either by being melted alone or with fluxes; when they show themselves either in their pure metallic state, or by tinging the slag with a colour peculiar to each of them. In these experiments it is not to be expected that the quantity of metal contained in the ore should be exactly determined; this must be done in larger laboratories. This cannot, however, be looked upon as any defect, since it is sufficient for a mineralogist only to find out what sort of metal is contained in the ore. There is another circumstance, which is a more real defect in the miniature laboratories, which is, that some ores are not at all capable of being tried by so small an apparatus; for instance, the gold ore called *pyrites aureus*, which consists of gold, iron, and sulphur. The greatest quantity of gold which this ore contains is about one ounce, or one ounce and an half, out of 100 pounds of the ore, the rest being iron and sulphur: and as only a very small bit is allowed for these experiments, the gold contained therein can hardly be discerned by the eye, even if it could be extracted; but it goes along with the iron in the slag, this last metal being in so large a quantity in proportion to the other, and both of them having an attraction for each other.

The blendes and black-jacks, which are mineral zinc ores, containing zinc, sulphur, and iron, cannot be tried this way, because they cannot be perfectly calcined, and besides the zinc flies off when the iron scorifies. Neither can those blendes, which contain silver or gold mineralised with them, be tried in this manner, which is particularly owing to the imperfect calcination. Nor are the quicksilver ores fit for these experiments; the volatility of that semimetal making it impossible to bring it out of the poorer sort of ores; and the rich ores, which sweat out the quicksilver when kept close in the hand, not wanting any of these assays, &c. Those ores ought to be assayed in larger quantities, and even with such other methods as cannot be applied upon a piece of charcoal.

Some of the rich silver ores are easily tried: for instance, *minera argenti vitrea*, commonly called *silver-glass*, which consists only of silver and sulphur. When this ore is exposed to the flame, it melts instantly, and the sulphur goes away in fume, leaving the silver pure upon the charcoal in a globular form. If this silver should happen to be of a dirty appearance, which often is the case, then it must be melted anew with a very little borax; and after it has been kept in fusion for a minute or two, so as to be perfectly melted and red-hot, the proof is suffered to cool: it may then be taken off the coal; and being laid upon the steel-plate†, the silver is separated from the slag by one or two strokes of the hammer†. Here the use of the brass ring† is manifest; for this ought first to be placed upon the plate, to hinder the proof from flying off by the violence of the stroke, which otherwise would happen. The silver is then found inclosed in the slag of a globular form, and quite shining, as if it was polished. When a large quantity of silver is contained in a lead ore, *viz.* in a potter's ore, it can likewise be discovered through the use of the blow-pipe, of which more will be mentioned hereafter.

† See the article Blow-Pipe, and Plate XCIX.

Tin may be melted out of the pure tin ores in its metallic state. Some of these ores melt very easily, and yield their metal in quantity, if only exposed to the fire by themselves: but others are more refractory; and as these melt very slowly, the tin, which sweats out in form of very small globules, is instantly burnt to ashes before these globules have time to unite in order to compose a larger globe, which, might be seen by the eye, and not so soon destroyed by the fire; it is therefore necessary to add a little borax to these from the beginning, and then to blow the flame violently at the proof. The borax does here preserve the metal from being too soon calcined, and even contributes to the readier collecting of the small metallic particles, which soon are seen to form themselves into a globule of metallic tin at the bottom of the whole mass, nearest to the charcoal. As soon as so much of the metallic tin is produced as is sufficient to convince the operator of its presence, the fire ought to be discontinued, though the whole of the ore be not yet melted; because the whole of this kind of ore can be seldom or never reduced into metal by means of these experiments, a great proportion being always calcined: and if the fire is continued too long, perhaps even the metal already reduced may likewise be burnt to ashes; for the tin is very soon deprived of its metallic state by the fire.

Most part of the lead ores may be reduced to a metallic state upon the charcoal. The *mineræ plumbi calciformes*, which are pure, are easily melted into lead; but

but ſuch of them as are mixed with an *ochra ferri*, or any kind of earth, as clay, lime, &c. yield very little of lead, and even nothing at all, if the heterogenea are combined in any large quantity: this happens even with the *minera plumbi calciformis arſenico mixta.* Theſe therefore are not to be tried but in larger laboratories. However, every mineral body ſuſpected to contain any metallic ſubſtance may be tried by the blow-pipe, ſo as to give ſufficient proofs whether it contain any or not, by its effects being different from thoſe of the ſtones or earths, &c.

The *mineræ plumbi mineraliſatæ* leave the lead in a metallic form, if not too large a quantity of iron is mixed with it. For example, when a teſſellated or ſteel-grained lead ore is expoſed to the flame, its ſulphur, and even the arſenic if there be any, begins to fume, and the ore itſelf immediately to melt into a globular form; the reſt of the ſulphur continues then to fly off, if the flame be blown ſlowly upon the maſs; but, on the contrary, very little of the ſulphur will go off, if the flame be forced violently on it: in this caſe, it rather happens that the lead itſelf crackles and diſſipates, throwing about very minute metallic particles. The ſulphur being driven out as much as poſſible, which is known by finding no ſulphureous vapour in ſmelling at the proof, the whole is ſuffered to cool, and then a globule of metallic lead will be left upon the coal. If any iron is contained in the lead-ore, the lead, which is melted out of it, is not of a metallic ſhining, but rather of a black and uneven, ſurface: a little borax muſt in this caſe be melted with it, and as ſoon as no bubble is ſeen to riſe any longer from the metal into the borax, the fire muſt be diſcontinued: when the maſs is grown cold, the iron will be found ſcorified with the borax, and the lead left pure and of a ſhining colour.

Borax does not ſcorify the lead in theſe ſmall experiments when it is pure: if the flame is forced with a violence on it, a bubbling will enſue, reſembling that which is obſerved when borax diſſolves a body melted with it; but when the fire ceaſes, the ſlag will be perfectly clear and tranſparent, and a quantity of very minute particles of lead will be ſeen ſpread about the borax, which have been torn off from the maſs during the bubbling.

If ſuch a lead ore is rich in ſilver, this laſt metal may likewiſe be diſcovered by this experiment; becauſe as the lead is volatile, it may be forced off, and the ſilver remain. To effect this, the lead, which is melted out of the ore, muſt be kept in conſtant fuſion with a ſlow heat, that it may be conſumed. This end will be ſooner obtained, and the lead part quicker, if during the fuſion the wind through the blow-pipe be directed immediately, though not forcibly, upon the melted maſs itſelf, until it begin to cool; at which time the fire muſt be directed on it again. The lead, which is already in a volatiliſing ſtate, will by this artifice be driven out in form of a ſubtil ſmoke; and by thus continuing by turns to melt the maſs, and then to blow off the lead, as has been ſaid, until no ſmoke is any longer perceived, the ſilver will at laſt be obtained pure. The ſame obſervation holds good here alſo, which was made about the gold, that, as none but very little bits of ores can be employed in theſe experiments, it will be difficult to extract the ſilver out of a poor ore; for ſome part of it will fly off with the lead, and what might be left is too ſmall to be diſcerned by the eye. The ſilver, which by this means is obtained, is eaſily diſtinguiſhed from lead by the following external marks, *viz.* that it muſt be red-hot before it can be melted: it cools ſooner than lead: it has a ſilver colour; that is to ſay, brighter and whiter than lead: and is harder under the hammer.

The *mineræ cupri calciformes* (at leaſt ſome of them), when not mixed with too much ſtone or earth, are eaſily reduced to copper with any flux; if the copper is found not to have its natural bright colour, it muſt be melted with a little borax, which purifies it. Some of theſe ores do not all diſcover their metal if not immediately melted with borax; the heterogenea contained in them hindering the fuſion before theſe are ſcorified by the flux.

The grey copper ores, which only conſiſt of copper and ſulphur, are tried almoſt in the ſame manner as above mentioned. Being expoſed to the flame by themſelves, they will be found inſtantly to melt, and part of their ſulphur to go off. The copper may afterwards be obtained in two ways: the one, by keeping the proof in fuſion for about a minute, and afterwards ſuffering it to cool; when it will be found to have a dark and uneven appearance externally, but which after being broken diſcovers the metallic copper of a globular form in its centre, ſurrounded with a regulus, which ſtill contains ſome ſulphur and a portion of the metal: the other, by being melted with borax, which laſt way ſometimes makes the metal appear ſooner.

The *mineræ cupri pyritaceæ*, containing copper, ſulphur, and iron, may be tried with the blow-pipe if they are not too poor. In theſe experiments the ore ought to be calcined, and after that the iron ſcorified. For this purpoſe a bit of the ore muſt be expoſed to a ſlow flame, that as much of the ſulphur as poſſible may part from it before it is melted, becauſe the ore commonly melts very ſoon, and then the ſulphur is more difficultly driven off. After being melted, it muſt be kept in fuſion with a ſtrong fire for about a minute, that a great part of the iron may be calcined; and after that, ſome borax muſt be added, which ſcorifies the iron, and turns with it to a black ſlag. If the ore is very rich, metallic copper will be had in the ſlag after the ſcorification. If the ore be of a moderate richneſs, the copper will ſtill retain a little ſulphur, and ſometimes iron: the product will therefore be brittle, and muſt with great caution be ſeparated from the ſlag, that it may not break into pieces; and if this product is afterwards treated in the ſame manner as before ſaid, in ſpeaking of the grey copper-ores, the metal will ſoon be produced. But if the ore is poor, the product after the firſt ſcorification muſt be brought into fuſion, and afterwards melted with ſome freſh borax, in order to calcine and ſcorify the remaining portion of iron; after which it may be treated as mentioned in the preceding paragraph. The copper will in this laſt caſe be found in a very ſmall globule.

The copper is not very eaſily ſcorified with this apparatus, when it is melted together with borax, unleſs it has firſt been expoſed to the fire by itſelf for a while in order to be calcined. When only a little of this metal is diſſolved, it inſtantly tinges the ſlag of a red-

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diſh brown colour, and moſtly opaque; but as ſoon as this ſlag is kept in fuſion for a little while, it becomes quite green and tranſparent: and thus the preſence of the copper may be diſcovered by the colour, when it is concealed in heterogeneous bodies, ſo as not to be diſcovered by any other experiment.

If metallic copper is melted with borax by a ſlow fire, and only for a very little time, the glaſs or ſlag becomes of a fine tranſparent blue or violet colour, inclining more or leſs to the green: but this colour is not properly owing to the copper, but it may rather be to its phlogiſton; becauſe the ſame colour is to be had in the ſame manner from iron; and theſe glaſſes, which are coloured with either of thoſe two metals, ſoon loſe their colour if expoſed to a ſtrong fire, in which they become quite clear and colourleſs. Beſides, if this glaſs, tinged blue with the copper, is again melted with more of this metal, it becomes of a good green colour, which for a long time keeps unchanged in the fire.

The iron ores, when pure, can never be melted *per ſe*, by the means of the blow-pipe alone; nor do they yield their metal when melted with fluxes; becauſe they require too ſtrong a heat to be brought into fuſion; and as both the ore and the metal itſelf very ſoon loſe their phlogiſton in the fire, and cannot be ſupplied with a ſufficient quantity from the charcoal, ſo likewiſe they are very ſoon calcined in the fire. This eaſy calcination is alſo the reaſon why the fluxes, for inſtance borax, readily ſcorify this ore, and even the metal itſelf. The iron loſes its phlogiſton in the fire ſooner than the copper, and is therefore more eaſily ſcorified.

The iron is, however, diſcovered without much difficulty, although it were mixed but in a very ſmall quantity with heterogeneous bodies. The ore, or thoſe bodies which contain any large quantity of the metal, are all attracted by the loadſtone, ſome without any previous calcination, and others without having being roaſted. When a clay is mixed with a little iron, it commonly melts by itſelf in the fire; but if this metal is contained in a limeſtone, it does not promote the fuſion, but gives the ſtone a dark and ſometimes a deep black colour, which always is the character of iron. A *minera ferri calciformis pura cryſtalliſata*, is commonly of a red colour: This being expoſed to the flame, becomes quite black; and is then readily attracted by the loadſtone, which it was not before. Beſides theſe ſigns, the iron diſcovers itſelf, by tinging the ſlag of a green tranſparent colour, inclining to brown, when only a little of the metal is ſcorified; but as ſoon as any larger quantity thereof is diſſolved in the ſlag, this becomes firſt a blackiſh brown, and afterwards quite black and opaque.

Biſmuth is known by its communicating a yellowiſh brown colour to borax; and arſenic by its volatility and garlick ſmell. Antimony, both in form of regulus and ore, is wholly volatile in the fire when it is not mixed with any other metal except arſenic; and is known by its particular ſmell, eaſier to be diſtinguiſhed when once known than deſcribed. When the ore of antimony is melted upon the charcoal, it bubbles conſtantly during its volatiliſing.

Zinc ores are not eaſily tried upon the coal; but the regulus of zinc expoſed to the fire upon the charcoal burns with a beautiful blue flame, and forms itſelf almoſt inſtantly into white flowers, which are the common flowers of zinc.

Cobalt is particularly remarkable for giving to the glaſs a blue colour, which is the zaffre or ſmalt. To produce this, a piece of cobalt ore muſt be calcined in the fire, and afterwards melted with borax. As ſoon as the glaſs, during the fuſion, from being clear, ſeems to grow opaque, it is a ſign that it is already tinged a little; the fire is then to be diſcontinued, and the operator muſt take hold, with the nippers, of a little of the glaſs, whilſt yet hot, and draw it out ſlowly in the beginning, but afterwards very quick, before it cools, whereby a thread of the coloured glaſs is procured, more or leſs thick, wherein the colour may eaſier be ſeen than in a globular form. This thread melts eaſily, if only put in the flame of the candle without the help of the blow-pipe.—If this glaſs be melted again with more of the cobalt, and kept in fuſion for a while, the colour becomes very deep; and thus the colour may be altered at pleaſure.

When the cobalt ore is pure, or at leaſt contains but little iron, a cobalt regulus is almoſt inſtantly produced in the borax during the fuſion; but when it is mixed with a quantity of iron, this laſt metal ought firſt to be ſeparated, which is eaſily performed ſince it ſcorifies ſooner than the cobalt; therefore, as long as the ſlag retains any brown or black colour, it muſt be ſeparated, and melted again with freſh borax, until it ſhows the blue colour.

Nickel is very ſeldom to be had; and as its ores are ſeldom free from mixtures of other metals, it is very difficultly tried with the blow-pipe. However, when this ſemimetal is mixed with iron and cobalt, it is eaſily freed from theſe heterogeneous metals, and reduced to a pure nickel regulus by means of ſcorification with borax, becauſe both the iron and cobalt ſooner ſcorify than the nickel. The regulus of nickel itſelf is of a green colour when calcined: it requires a pretty ſtrong fire before it melts, and tinges the borax with a hyacinth colour. Manganeſe gives the ſame colour to borax; but its other qualities are quite different, ſo as not be confounded with the nickel.

By means of the foregoing explanations, and thoſe given under the article *Blow-Pipe*, any gentleman, who is a lover of this ſcience, will be able, in an eaſy manner, to amuſe himſelf in diſcovering the properties of thoſe works of nature, with which the mineral kingdom furniſhes us; or more uſefully to employ himſelf by finding out what ſorts of ſtones, earths, ores, &c. there are on his eſtate, and to what economical purpoſes they may be employed. The ſcientific mineraliſt may, by examining into the properties and effects of the mineral bodies, diſcover the natural relation theſe bodies ſtand in to each other, and thereby furniſh himſelf with materials for eſtabliſhing a mineral ſyſtem, founded on ſuch principles as Nature herſelf has laid down in them; and this in his own ſtudy, without being forced to have recourſe to great laboratories, crucibles, furnaces. &c. which is attended with much trouble, and is the reaſon why ſo few can have an opportunity of gratifying their deſire of knowledge in this

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this part of natural hiftory. Farther improvements of this apparatus may ftill be made by thofe who choofe to beftow their attention upon it.

A great number of fluxes might, perhaps, be found out, whofe effects might be different from thofe already in ufe, whereby more diftinct characters of thofe mineral bodies might be difcovered, which now either fhow ambiguous ones, or which it is almoft impoffible to try exactly with the blow-pipe. Inftead of the *fal fodæ*, fome other falt might be difcovered better adapted to thefe experiments. But it is very neceffary not to make ufe of any other fluxes on the charcoal than fuch as have no attraction to it: if they, at the fame time, be clear and tranfparent, when melted, as the borax and the *fal fufibile microcofmicum*, it is ftill better: however, the tranfparency and opacity are of no great confequence, if a fubftance be effayed only in order to difcover its fufibility, without any attention to its colour; in which cafe, fome metallic flag, perhaps, might be ufeful.

When fuch ores are to be reduced whofe metals are very eafily calcined, as tin, zinc, &c. it might perhaps be of fervice to add fome phlogiftic body, fuch as hard refin, fince the charcoal cannot afford enough of it in the open fire of thefe effays. The manner of melting the volatile metals out of their ores *per defcenfum* might alfo, perhaps, be imitated: for inftance, a hole might be made in the charcoal, wide above and very narrow at the bottom; a little piece of the ore being then laid at the upper end of the hole, and covered with fome very fmall pieces of the charcoal, the flame muft be directed on the top: the metal might, perhaps, by this method, run into the hole below, concealed from the violence of the fire, particularly if the ore is very fufible, &c.

The ufe of the apparatus above referred to, and which may be called a *pocket laboratory* (as the whole admits of being eafily packed into a fmall cafe), is chiefly calculated for a travelling mineralift. But a perfon who always refides at one and the fame place, may by fome alteration make it more commodious to himfelf, and avoid the trouble of blowing with the mouth. For this purpofe he may have the blow-pipe go through a hole in a table, and fixed underneath to a fmall pair of bellows with double bottoms, fuch as fome of the glafs-blowers ufe, and then nothing more is required than to move the bellows with the feet during the experiment; but in this cafe a lamp may be ufed inftead of a candle. This method would be attended with a ftill greater advantage, if there were many fuch parts as *c*, fig. 13. the openings of which were of different dimenfions: thofe parts might by means of a fcrew be faftened to the main body of the blow-pipe, and taken away at pleafure. The advantage of having thefe nozzles of different capacities at their ends, would be that of exciting a ftronger or weaker heat as occafion might require. It would only be neceffary to obferve, that in proportion as the opening or nozzle of the pipe is enlarged, the quantity of the flame muft be augmented by a thicker wick in the lamp, and the force of blowing encreafed by means of weights laid on the bellows; a much intenfer heat would thus be produced by a pipe of a confiderable opening at the end, by which the experiments muft undoubtedly be carried farther than the common blow-pipe.

Plate CCCXIII.

A traveller, who has feldom an opportunity of carrying many things along with him, may very well be contented with this laboratory and its apparatus, which are fufficient for moft part of fuch experiments as can be made on a journey. There are, however, other things very ufeful to have at hand on a journey, which ought to make a feparate part of a portable laboratory, if the manner of travelling does not oppofe it: this confifts of a little box including the different acids, and one or two matraffes, in order to try the mineral bodies in liquid menftrua if required.

Thefe acids are, the acid of nitre, of vitriol, and of common falt. Moft of the ftones and earths are attacked, at leaft in fome degree, by the acids; but the calcareous are the eafieft of all to be diffolved by them, which is accounted for by their calcareous properties. The acid of nitre is that which is moft ufed in thefe experiments; it diffolves the limeftone, when pure, perfectly, with a violent effervefcence, and the folution becomes clear: when the limeftone enters into fome other body, it is neverthelefs difcovered by this acid, through a greater or lefs effervefcence in proportion to the quantity of the calcareous particles, unlefs there are fo few as to be almoft concealed from the acid by the heterogeneous ones. In this manner a calcareous body, which fometimes nearly refembles a filiceous or argillaceous one, may be known from thefe latter, without the help of the blow-pipe, only by pouring one or two drops of this acid upon the fubject; which is very convenient when there is no opportunity nor time of ufing this inftrument.

The gypfa, which confift of lime and the vitriolic acid, are not in the leaft attacked by the acid of nitre, if they contain a fufficient quantity of their own acid; becaufe the vitriolic acid has a ftronger attraction to the lime than the acid of nitre: but if the calcareous fubftance is not perfectly faturated with the acid of vitriol, then an effervefcence arifes with the acid of nitre, more or lefs in proportion to the want of the vitriolic acid. Thefe circumftances are often very effential in diftinguifhing the *calcarea* and *gypfa* from one another.

The acid of nitre is likewife neceffary in trying the zeolites, of which fome fpecies have the fingular effect to diffolve with effervefcence in the above mentioned acid; and within a quarter of an hour, or even fometimes not until feveral hours after, to change the whole folution into a clear jelly, of fo firm a confiftence, that the glafs wherein it is contained may be reverfed without its falling out.

If any mineral body is tried in this menftruum, and only a fmall quantity is fufpected to be diffolved, though it was impoffible to diftinguifh it with the eye during the folution, it can be eafily difcovered by adding to it *ad faturitatem* a clear folution of the alkali, when the diffolved part will be precipitated, and fall to the bottom. For this purpofe the *fal fodæ* may be very ufeful.

The acid of nitre will fuffice for making experiments upon ftones and earths; but if the experiments are to be extended to the metals, the other two acids are alfo neceffary.

Another inftrument is likewife neceffary to a complete

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complete Pocket-Laboratory, viz. a washing-trough (fig. 21.), in which the mineral bodies, and particularly the ores, may be separated from each other, and from the adherent rock, by means of water. This trough is very common in laboratories, and is used of different sizes; but here only one is required of a moderate size, such as 12 inches and a half long, three inches broad at the one end and one inch and a half at the other end, sloping down from the sides and the broad end to the bottom, where it is three quarters of an inch deep. It may, however, be made of much smaller dimensions. It is commonly made of wood, which ought to be chosen smooth, hard, and compact, wherein are no pores in which the minute grains of the pounded matter may conceal themselves. It is to be observed, that if any such matter is to be washed as is suspected to contain some native metal, such as silver or gold, a trough should be procured for this purpose of a very shallow slope; because the minute particles of the native metal have then more power to assemble together at the broad end, and separate from the other matter.

The management of this trough, or the manner of washing, consists in this: That when the matter is mixed with about three or four times its quantity of water in the trough, this is kept very loose between two fingers of the left hand, and some light strokes given on its broad end with the right, that it may move backwards and forwards; by which means the heaviest particles assemble at the broad and lower end, from which the lighter ones are to be separated by inclining the trough and pouring a little water on them. By repeating this process, all such particles as are of the same gravity may be collected together, and separated from those of different gravity, provided they were before equally pounded: though such as are of a clayey nature, are often very difficult to separate from the rest, which, however, is of no great consequence to a skilful and experienced washer. The washing process is very necessary, as there are often rich ores, and even native metals, found concealed in earths and sand in such minute particles as not to be discovered by any other means.

Sect. III. *Description of an Improved Portable Laboratory for assaying Minerals.*

The chief pieces and implements of the portable laboratories are represented in Plate XCIX. at *Blow-Pipe*, and in Plate CCCXIII. annexed to the present article.

I. The first contains those belonging to the *Dry* Laboratory, so called on account of its containing whatever is required to try all kinds of fossils in the dry way by fire, without any of the humid menstruums. They are made to pack in a box of the size of an octavo book, lined with green velvet, and covered with black fish-skin; the inside divided into different compartments, suited to the size, form, and number of the implements it is to contain. Of these the principal are described under *Blow-Pipe*. We must here, however, add the following remarks and alterations of that instrument by Mr Magellan.

Plate CCCXIII.

D and Q (fig. 13.) are the two pieces that form the blow-pipe, which is here represented entire. This very useful instrument has been considerably improved of late in England. The mouth-piece *aa* is made of ivory, to avoid the disagreeable sensation of having a piece of metal a long time between the teeth and lips, which, if not of silver or gold, may be very noxious to the operator; a circumstance that has been hardly noticed before.

Portable Apparatus.

1. If the mouth-piece *aa* be made of a round form, it cannot be held for any length of time between the teeth and lips, to blow through it, without straining the muscles of the mouth, which produces a painful sensation. It must, therefore, have such an external figure, as to adapt itself accurately to the lateral angles of the lips, having a flattish oval form externally, with two opposite corners to fit those internal angles of the mouth, when it is held between the lips, as may be seen in that represented in the figure.

2. The small globe *bb* is hollow, for receiving the moisture of the breath; and must be composed of two hemispheres, exactly screwing into one another in *bb*; the male-screw is to be in the lower part, and soldered on the crooked part Q of the tube Q D, at such a distance, that the inside end of the crooked tube be even with the edge of the hemisphere, as represented by the pointed lines in the figure. But the upper hemisphere is to be soldered at the end of the straight tube D. By these means, the moisture arising from the breath falls into the hollow of the lower hemisphere, where it is collected round the upper inside end of the crooked part Q of the blow-pipe, without being apt to fall into it.

3. The small nozzles, or hollow conical tubes, advised by Messrs Engestrom, Bergman, and others, are wrong in the principle; because the wind that passes from the mouth through such long cones loses its velocity by the lateral friction, as happens in hydraulic spouts; which, when formed in this manner, do never throw the fluid so far as when the fluid passes through a hole of the same diameter, made in a thin plate of a little metallic cap that screws at the end of the large pipe. It is on this account that the little cap *c* is employed, having a small hole in the thin plate, which serves as a cover to it; and there are several of these little caps, with holes of smaller and larger sizes, to be changed and applied whenever a flame is required to be more or less strong.

4. Another convenience of these little caps is, that even in case any moisture should escape falling into the hemisphere *bb*, and pass along with the wind through the crooked pipe Q, it never can arrive at nor obstruct the little hole of the cap *c*, there being room enough under the hole in the inside, where this moisture must be stopped till it is cleaned and wiped out.

The stream of air that is impelled by the blow-pipe (as seen in fig 3.) upon the flame, must be constant and even, and must last as long as the experiment continues to require it. This labour will fatigue the lungs, unless an equable and uninterrupted inspiration can at the same time be continued. To succeed in this operation without inconvenience, some labour and practice are necessary, as already explained under the detached article.

Every assay ought always to begin by the exterior flame, which must be first directed upon the mass under examination; and, when its efficacy is well known, then the interior blue flame is to be employed.

Portable Apparatus.

After the ore is roasted, it is to be rounded upon the steel plate by the hammer; the particles being prevented from being dissipated by the ring H (fig. 9. Plate XCIX.), within which the pieces to be broken are to be put.

Among the apparatus, beside the particulars already mentioned, three phials are necessary, containing the required fluxes, viz. the *borax*, the *sal sodæ*, and *sal fusibile microcosmicum*. Other useful particulars are, A small link of hard steel, to try the hardness or softness of mineral substances, and also to strike fire for lighting the candle when required: A piece of black flint, to serve as a touch-stone; (for being rubbed with any metal, if it be gold the marks will not be corroded by aqua fortis); and also to strike fire, when necessary, with the link of steel: An artificial loadstone, properly armed with iron, for the better preservation of its attractive power; (it serves to discover the ferrugineous particles of any ore after it has been roasted and powdered:) A triple magnifier, which, differently combined, produces seven magnifying powers, the better to distinguish the structure and metallic parts of ores, and the minute particles of native gold, whenever they contain that metal: A file, to try the hardness of stones and crystals, &c.: Some pieces of dry agaric or tinder, and small bits or splinters of wood tipped with brimstone, to serve as matches for lighting the candle; and various other little articles of use in these experiments.

II. For performing experiments in the *Humid Way*, the chief additional articles (and which must be kep in a separare case) consist of a collection of phials, containing the principal acids, tests, precipitants, and re-agents, both for examining mineral bodies by the humid way, and for analysing the various kinds of mineral waters. Those with acids and corrosive solutions have not only ground stoples, but also an external cap to each, ground over the stople, and secured downward by a bit of wax between both, in order to confine the corrosive and volatile fluids within. But those which contain mild fluid liquors have not such external caps; and those with dry inoffensive substances are only stopped with cork. Besides these phials, there are two smaller cylindrical ones, which serve to exhibit the changes of colour produced by some of the re-agents in those analytical assays. There are also two or three small matrasses, to hold the substances with their solvents over the fire; a small glass funnel for pouring the fluids; a small porcelain mortar, with its pestle; one or two crucibles of the same substance; a small wooden trough to wash the ground ores; some glass sticks to stir up the fluid mixtures; and, finally, pieces of paper tinged red, yellow, and blue, by the tinctures of Fernambuc wood (commonly called Brasil wood), turmeric, and litmus, thickened with a little starch.

The following list contains the names of the various fluid tests and re-agents that are necessary for these assays. But the whole number being too large to be all contained in a portable case, every one may give the preference to those he likes best.

1. Concentrated vitriolic acid, whose specific gravity may be expressed in the outside.
2. Nitrous acid, purified by the nitrous solution of silver.
3. Concentrated marine acid, with its specific gravity.
4. Marine acid dephlogisticated.
5. Aqua regia for gold, viz. 2 nit. and 1 marine.
6. Aqua regia for platina, viz. half marine and half nitrous acid.
7. Nitrous solution of silver.
8. Nitrous solution of mercury, made in the cold.
9. Muriatic solution of barytes.
10. Nitrous solution of lime.
11. Muriatic solution of lime.
12. Mercury in its metallic state.
13. Corrosive sublimate of mercury.
14. White arsenic.
15. Nitrous solution of silver.
16. Nitrous solution of copper.
17. Acid of sugar.
18. Liquor probatorius vini.
19. Hepar sulphuris.
20. Oil of tartar *per deliquium*.
21. Salt of tartar.
22. Caustic vegetable alkali.
23. Pearl-ashes.
24. Soap-makers ley.
25. Common salt.
26. Vitriolated argilla (alum.)
27. Vitriol of iron (copperas.)
28. Nitrous solution of silver.
29. Acetous solution of lead.
30. Acetous solution of barytes.
31. Phlogisticated alkali by the Prussian blue.
32. Lime-water.
33. Lime-water phlogisticated by the Prussian blue.
34. Caustic volatil alkali.
35. Mild volatile alkali (dry)
36. Rectified spirit (alcohol)
37. Æther.
38. Spirituous tincture of galls.

The following tests are very fit also for these assays, viz. 39. Spirituous solutions of soap; 40. Syrup of violets; 41. Tincture of litmus; 42. Tincture of Brasil wood; 43. Tincture of turmeric; 44. Oil of olives; 45. Oil of linseed; 46. Oil of turpentine; 47. Essential salt of wild-sorrel; 48. Hepar sulphuris; 49. Sugar of lead; 50. Solution of alum.

The method of applying the above tests of acids and re-agents may be seen in Bergman's treatises of the Analysis of Waters, and of Assaying by the Humid Way; in Kirwan's Elements of Mineralogy; in the Elements of Chemistry of Dijon; in the Memoirs of the same Academy; in Fourcroy's Lectures of Chemistry, &c.

III. The *Lamp-furnace* Laboratory, for experiments both by the *humid* and the *dry* way, is a very curious and useful, though small apparatus. It is an improvement of that which was contrived by M. de Morveau, in consequence of the information he received from his friend the president de Virly, who saw at Upsal how advantageously the late eminent professor Bergman availed himself of this convenience for many analytical processes in miniature, by the use of very small glass vessels about one inch diameter, and other implements of proportional size, for performing various chemical operations. (See the Dijon Memoirs for 1783, Part 1. p. 171.)

Portable Apparatus.

There can be no doubt but that whenever these processes are properly conducted, though in miniature, the lamp-furnace will prove amply sufficient to perform in a few minutes, and with very little expence, the various solutions, digestions, and distillations, which otherwise would require large vessels, stills, retorts, reverberatory furnaces, &c. to ascertain the component parts of natural bodies; though it is not always sufficient to ascertain their respective quantities. In this last case, operations must be performed in great laboratories, and on a large scale, at a considerable expence. But the substances are sometimes too valuable; as, for instance, when precious stones are examined; and of course the last way never can be attempted in such cases.

These small processes have likewise another advantage before noticed, which cannot be obtained in works at large. It consists in one's being able to observe the gradual progress of each operation; of easily retarding or urging it, as it may require; and of ascertaining at pleasure each step of every experiment, together with the phenomena attending the same.

The lamp-furnace is mounted in a small parallelogram of mahogany, about six inches long and four wide, marked fig. 5. This is kept steady over the edge of a common table, by means of the metallic clamp *ww*, which is fastened by the screw *x*. The pillar *rs* is screwed in a vertical position on the plate *s*, being about ten inches high; the other is screwed to the opposite corner, marked *pk*, and is only 7½ inches long; both are composed of two halves, that screw at *tt*, to be easily packed up with all the implements in a case covered with black fish-skin, and lined with green velvet, like the other laboratory already described.

Plate CCCXIII.

The lamp *k*, fig. 3. is supported on the plate *f*, which has a ring *l* that runs in the column *pk*, and may be fixed by its screw *l* at the required height.—This lamp has three small pipes of different sizes, to receive as many wicks of different thickness, and to be filled with spirit of wine. By a similar method, a piece of charcoal is mounted and supported by the pliers or little forceps screwed to the arm *ac*, fig. 1. which has all the motions requisite for being fixed by means of proper screws, at a proper distance from the flame of the wick *h*. The blow-pipe, fig. 4. is, by a similar mechanism, mounted on the smaller column *pq*, at such a distance as to blow the flame *hi* to the piece of ore *m*, which is upon the charcoal *gf*.

Every thing being disposed in this manner, the operator blows through the mouth-piece of the blow-pipe, fig. 4. and remains with his hands free to make the changes and alterations he may think proper.—

[*N. B.* The large round cavity *e* in the middle of the parallelogram, fig. 5. is to receive the lamp *k*, fig. 3. when all the implements are packed up in their case of black fish-skin; and the cover of the lamp is represented by fig. 12.]

But if the operator has the double bellows, fig. 14. and 15. he fixes them, at a due distance, to the same table by the brass clamp *y*. He then unscrews the blow-pipe at *zz*: joins the mouth *m* of the flexible tube to the hemisphere *zz*, passing each orifice, thro' the leather tube fig. 11. and tying both ends with a waxed thin pack-thread. If he works with his foot on the pedal, the string of which is seen hanging from the end of the bellows, fig. 15. (and is always up, on account of the weight *e*), then the air is absorbed by the bellows fig. 15. from whence it is propelled by the motion of the foot on the pedal to the bellows, fig. 14. whose constant weight *r* drives it out through the flexible pipe, fig. 10. it of course enters the curbed part *zzi* of the blow-pipe, and drives the flame on the piece *m* of the ore, that is to be examined upon the charcoal.

Portable Apparatus.

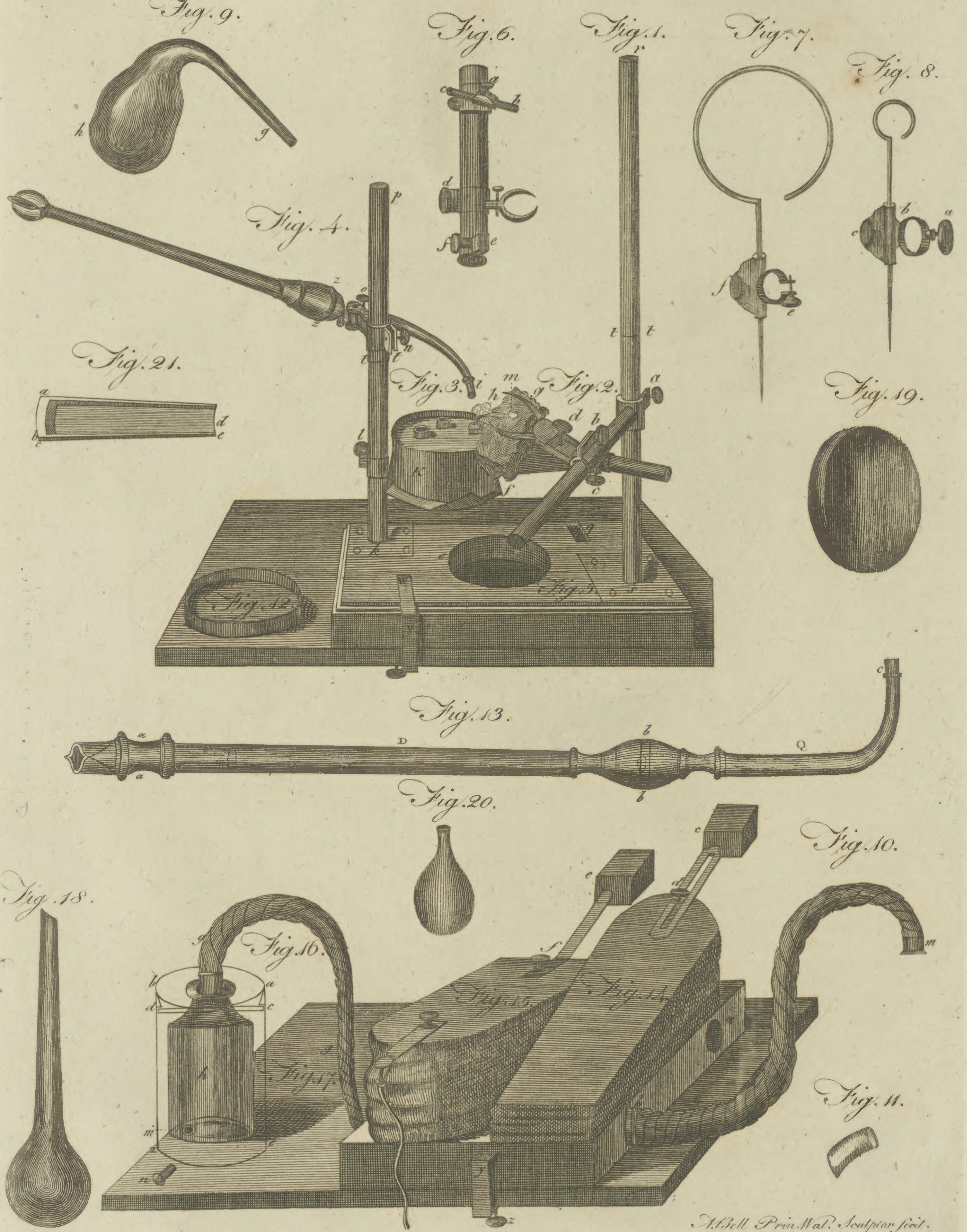
[*N. B.* 1. This double bellows is packed up by itself in a mahogany case, about 9 inches long, 6½ wide, and about 3¼ deep, outside measure. 2. The last blowing bellows, fig. 14. has an inside valve, which opens when the upper surface of it is at its greatest height; in order to let the superfluous air escape out, as it would otherwise issue with great velocity out of the tube, fig. 11. and spoil the operation.]

If the operator chooses to apply the vital or dephlogisticated air in his process, let him fill the glass-jar *b*, fig. 17. with this air; and put it within the tub marked by *abze*, filled with water, fastening the neck of the jar within by a cross board *ed*, which has a hole in it for that purpose; then introducing the two ends of the flexible hollow tube, fig. 16. both to the mouth of the jar and to the hole of the bellows fig. 15. he opens the hole *m* of the jar, that was stopped with the stople *n*; the column of the water passes in through *m*, and forces up the vital air, which enters the bellows, and of course, by the alternate motion of the pedal, passes through the end of the blow-pipe, to urge the flame upon the piece of ore *m*, fig. 2. on the charcoal *g*. But the dephlogisticated air may be also received at the same time that it is produced, by tying the pipe, fig. 16. to the mouth of an earthen retort, or even of a glass retort well-coated, according to the method of Mr Willis, described in the Transactions of the Society of Arts, Vol. V. p. 96. This last consists in dissolving two ounces of borax in a pint of boiling water, and adding to the solution as much slacked lime as is necessary to form a thin paste. this glass retort is to be covered all over with it, by means of a painter's brush, and then suffered to dry. It must then be covered with a thin paste made of linseed oil and slacked lime, except the neck that enters into the receiver. In two or three days it will dry of itself; and the retort will then bear the greatest fire without cracking. Two ounces of good nitre, being urged in the retort, by a good fire on a chafingdish, will afford about 700 or 800 ounce-measures of dephlogisticated air.

To make any other kind of chemical assays, the forceps of fig. 2. which supports the charcoal, is taken off, by unscrewing the screw *b*; the blow-pipe is also taken off, by loosening the screw *n*; the hoop fig. 7. is put in its place, where the metallic basin of fig. 19. is put filled with sand: the piece of fig. 8. is set on the other pillar *rs*, fig. 1. to hold the matrass, fig. 18. upright, or the receiver fig. 20. &c.

In the same manner, the retort, fig. 9. may be put in the sand-bath instead of the matrass, with its receiver fig. 20. which may be supported on a bit of cork or wood, hollowed to its figure, and held by the pliers, instead of the charcoal fig. 2.

But if the operation is to be made in the naked fire,



A. Bell Prin. Wal. Sculptor fecit.

Of Arrangement.

fire, the neck of the retort, fig. 9. being luted to the receiver, or balloon, fig. 20. may be hanged by a little chain with its ring over the flame, being suspended from the piece of fig. 7. or 8. screwed to either of the pillars as may be most convenient. Otherwise the receiver, fig. 20. may be supported by the round hoop of brass, fig. 8. or 7. screwed at a proper height to the pillar, fig. 1. tying round it some packthread to defend the glass from the contact with the metallic support.

The piece of fig. 6. may be screwed by its collar and screw *ef* to any of the pillars; carrying with it the retort and its receiver, at proper distances, higher or nearer to the lamp according as the flame is more or less violent.

It easily may be conceived, that these implements afford all sorts of conveniences for making any kind of small operations and assays in miniature, provided the operator pays a proper attention to the disposition requisite for each process or operation.

Every glass retort, receiver, matrass, bason, small funnels, &c. are made by the lamp-workers, that blow beads, thermometers, and other small glass instruments.

It is directed that the lamp *k*, fig. 3. be filled with spirit of wine, because it gives no disagreeable smell, and does not produce any fuliginous and disagreeable crust on the vessels as oil does: moreover, the spirit gives a dry flame, without smoke, and stronger than oil; besides the spots and disagreeable consequences this last causes, if split, &c. M. de Morveau adds, that the expence of spirit is quite inconsiderable; and that he performed in eight or ten minutes, with this apparatus, various dissolutions, evaporations, and other processes, which otherwise would have taken more than three hours, with the expence only of two or three halfpence for the spirit of wine, whilst the fuel of charcoal would have cost near ten or eleven pence.

Of Arrangement.

But a very important circumstance is, as Morveau observes likewise, that many philosophers do not apply themselves to chemical operations, for want of opportunity of having a laboratory to perform them: it requiring a proper room, and suitable expences of many large furnaces, retorts, crucibles, and numerous other implements, &c. whilst these miniature laboratories may in great measure afford the same advantages; at least to that degree of satisfaction sufficient to ascertain the contents and products of any substance that is subjected to trial: for with this simple apparatus a man of some abilities may, without any embarassment, in a very short time, and with little expence, perform such distillations as require a reverbatory furnace; all sorts of processes, digestions, and evaporations, which require a regular sand heat; he may vary his experiments or trials, and multiply them to a great number of various performances, draw up his conclusions, and reason upon them, without loss of time, without the hinderance of long preparations to work at large. And even when such large works are to be performed, he may observe beforehand various phenomena of some substances, which being known in time, would otherwise impede the processes at large, or make them fail absolutely; and all this without the risk of a considerable loss, and without exposing himself to a great fire, &c.

PART II. ARRANGEMENT (A) of MINERAL BODIES (B).

THE bodies belonging to the mineral kingdom are divided into four different classes, viz.

1. *Earths* (C), or those substances which are not ductile, are mostly indissoluble in water or oil, and preserve their constitution in a strong heat.
2. *Salts:* these dissolve in water, and give it a taste; and when the quantity of water required to keep them in dissolution is evaporated, they concrete again into solid and angular bodies.
3. *Inflammables*, which can be dissolved in oils, but not in water, and are inflammable.
4. *Metals*, the heaviest of all bodies; some of which are malleable, and some can be decompounded.

Here, however, it must be observed, that these classes are unavoidably blended one with another; and therefore some exceptions must be allowed in every one of them: for instance, in the first class, the calcareous earth is in some measure dissoluble in water, and pipe-clay with some others diminish somewhat in their bulk when kept for a long time in a calcining heat. In the third class, the calx of arsenic has nearly the same properties as salts; and there is no possible definition of salt that can exclude the arsenic, though at the same time it is impossible to arrange it elsewhere than among the semimetals. In the fourth class it is to be observed, that the metals and semimetals, perfect or imperfect, have not the same qualities common to them all; because some of them may be calcined, or deprived of their phlogiston, in the same degree of fire in which others are not in the least changed, unless particular artifices or processes are made use of: some of them also may be made malleable, while others are by no means to be rendered so. That the convex surface metals take after being melted, is a quality not particularly belonging to them, because every thing that is perfectly fluid in the fire, and has no attraction to the vessel in which it is kept, or to any added matter, takes the same figure; as we find borax, *sal fusibile microcosmicum*, and others do, when melted upon a piece of charcoal: therefore, with regard to all that has

(A) According to the system of *Cronstedt* †; altered, augmented, and improved from the Observations of other Mineralogists.

† *Cronstedt's Mineralogy*, 2d edition, in 2 vols, by Magellan.

(B) Of the different bodies enumerated in the following classification, full explanations are given under their respective names as they occur in the course of this Work. See also METALLURGY, and CHEMISTRY-*Index*.

(C) By *earths*, the author (Mr Cronstedt) does not mean (strictly speaking) only earths, but includes under that title all the kinds of stones or fossils not inflammable, saline, or metallic.

Earths. has been said, it is hardly worth while to invent such definitions as shall include several species at once; we ought rather to be content with perfectly knowing them separately.

Class I. EARTHS.

Earths, are those mineral bodies, not ductile, for the most part not dissoluble in water or oils, and which preserve their constitution in a strong heat.

Calcareous Earths. These bodies are here arranged according to their constituent parts, so far as hitherto discovered; and are divided into five orders. See the article Earth.

Order I. Calcareous Earths (d).

The properties of these are as follow:

1. Friability and falling into a fine white powder after calcination.

2 Partial solution in water, with which they contract

(d) Calcareous earth is most commonly found in the form of lime-stone; hard, compact, and of various colours; under which general name may be comprehended all the different kinds of marbles. Near Bath in England is found a kind of grey stone, rather soft than hard. This contains calcareous earth in a mild state, and likewise some in a state of causticity: hence, when newly dug out of the earth, it will dissolve sulphur, or make lime-water without any calcination. By attraction of fixed air from the atmosphere, it soon hardens after it has been dug up.

Mr Williams * divides the lime-stones of Scotland into the following species:

* Nat. Hist. of the Mineral Kingdom, 2 vols.

1. Grey, whitish, and pure white; regularly stratified; of a granulated texture; and much used in the Highlands for building bridges. Some of it is composed of fine glittering spangles like the scales of fishes; and some is as pure white as the best refined sugar, which kind he thinks may be called *Parian marble.*

2. Coarse-looking grey mountain limestone, hard and strong, of a granulated texture, difficult to work in some places rough and unequal, in others smooth and even. Sometimes regularly stratified, at other times appearing like one vast irregular bed or rock, of various thicknesses.

3. Ash-coloured mountain-limestones, consisting of small grains of a fine smooth texture; when broken resembling flint. In the Highlands there are hills of this kind of stone, which our author informs us he has seen; some of which have regular strata, while others appear in one vast mass like a rock of granite.

4. Regularly-stratified lime-stone, found in the low countries, exhibiting a vast variety of colours; as black, blue, grey, brown, purple, red, and ash-coloured, with various mixtures, of all degrees of hardness and purity.

5. Limestone accompanying coal, and frequently the immediate roof of the vein. This likewise shows a great variety of colour, texture, and quality; some being so much adulterated with clay and other heterogeneous mixtures as to be good for nothing, while others are very pure and fine. These limestones are always found in regular strata. "They are found (says our author) as regular as the coals they accompany; and the coal-strata are more regular in continuation upon the bearing, as far as the class of strata belonging to the coal reaches, than any other that I have investigated; and I look upon it, that this observation may be of use in practice."

For discovering limestone at some distance, Mr Williams gives the following directions:—"Let them keep the line of stretch, or bearing of the strata; and, in the coal country, they will be sure to discover it at nearly the same parallel distance from a seam of coal or other given stratum, as the place where it was last seen. But many of the mountain-limestones are not much to be depended on. Though you may have a good and plentiful quarry in one place, yet, perhaps, half a mile, or half a quarter of a mile farther forward, you cannot discover it: it is dwindled away to nothing, and yet will appear again farther forward; which makes the mountain-limestones uncertain to be discovered where you do not see them; as these rocks very frequently grow thicker or thinner, and sometimes squeezes out to nothing: and I comprehend under this denomination all the limestones not accompanying the coals and coal-metals.—The limestones of the coal-fields are often distinguishable by containing a great variety of shells, coral, and other marine bodies, which are found blended in the heart and composition of the stone."

6. The Scotch marbles are of great variety and beauty; and the parts of the kingdom most unfit for cultivation are found to abound most in them. Assint in Sutherland has a kind of white statuary marble, which Mr Williams says is the purest and best he ever saw. "I am persuaded (says he) there is none better, if any so good, in all Europe, and there is enough of it to serve all Britain; perfectly solid and pure, free of any blemishes, flaws, or stains, and blocks or slabs of any size may be cut out: but there is bad access to it; nor would it be easily quarried, there being a little cover above it, of a soft, loose, whitish limestone. This marble accompanies a prodigious rock of grey limestone, of a granulated texture, appearing in regular strata at Assint; but it is one of those which varies in thickness as you advance along the bearing of the strata. The good white marble of Assint is only to be seen in the bed of the river, near a considerable house a mile or two south of the church; but I cannot remember the name of the particular place."

Near Blairgourie in Perthshire, not far from the side of the high road, is an excellent, granulated, broad-bedded limestone, of a sugar-loaf texture, and as white as the finest statuary marble, which Mr Williams supposes to be a good species of the true Parian marble, and that it requires only to be known and brought into use to become of great value. In the duke of Gordon's lands, in the forest of Glenavon, there is also a kind of marble composed of broad glittering grains like spangles, as large as the scales of fishes; but the situation is remote, and difficult of access.

In

Calcareous Earths.

tract great heat, and by sprinkling with water they fall more readily into powder.

3. Infusibility without addition.

4. They attract the fixed air from the vegetable and mineral alkalies, and thus rendering them much more caustic, becoming at the same time mild themselves.

5. Solubility in all acids except the vitriolic, tartarous, and some anomalous vegetable acids.

6. Fusibility with borax and microcosmic salts.—The fusion is attended with effervescence, and the result is a transparent and colourless glass.

7. With metalline calces they melt into a currosive slag.

8. They imperfectly reduce the calces of lead and bismuth, and have even some effect upon those of copper and iron.

The calcareous earth is found,

I. Pure.

1. In form of powder. *Agaricus mineralis*, or *lac lunæ*.
   - *a.* White, in moors, and at the bottom of lakes.
   - *b.* Red.
   - *c.* Yellow.
2. Friable and compact. Chalk, *creta*.
   - *a* White, *creta alba*. Chalk is a nam aelso applied to other earths; whence we hear of chalks of various colours: but there are none which are known to be of a calcareous nature, except this kind here described, and of which there are no other varieties, otherwise than in regard to the looseness of the texture, or the fineness of the particles.
3. Indurated, or hard; Limestone; *Lapis calcareous*.
   - *A.* Solid, or not granulated.
     - *a.* White.
     - *b.* Whitish yellow.
     - *c.* Flesh-coloured, found in loose masses.
     - *d.* Reddish brown.
     - *e.* Grey.
     - *f.* Variegated with many colours, and particularly called *marble*.
     - *g.* Black.
   - *B.* Grained or granulated limestone.
     1. Coarse-grained, and of a loose texture, called *salt-slag* in Swedish, from its resemblance to lumps of salt.
        - *a* Reddish yellow. *b.* White.
     2. Fine-grained.
        - *a.* White. *b.* Semi-transparent, from Solfatara in Italy, in which native brimstone is found.
     3. Very fine grained.
        - *a.* White and green. *b.* White and black.
   - *C.* Scaly limestone.
     1. With coarse or large scales.
        - *a.* White. *b.* Reddish yellow.
     2. With small scales.
        - *a.* White.
     3. Fine glittering or sparkling.
        - *a.* White. *b.* Of many colours.
   - *D.* Lime or calcareous spars.
     - (1.) Of a rhomboidal figure.
       - A. Transparent or diaphanous.
         1. Refracting spar; *Spatum islandicum;* Iceland spar, or Iceland crystal.—This represents the objects seen through it double,
         2. Common spar, which shows the object single.
            - *a.* White, or colourless.
            - *b.* Yellowish and phosphorescent.
       - B. Opaque.
         1. White. 2. Black. 3. Brownish yellow.
     - (2.) Foliated or plated spar.
       - *a.* Opaque white.
   - *E.* Crystallized calcareous spars. *Spar. Drusen* (E.)
     - (1.) Transparent.
       - *a.* Hexagonal truncated.
       - *b.* Pyramidal.
         1. Dog's teeth; *Pyramidales distinctæ*.
         2. Balls of crystallized spar, *Pyramidales concretæ*.
   - *F.* Stalactitical spar; *Stalactites calcareus*. Stalactites, Stone-icicle, or Drop-stone.
     - (1.) Scaled stalactites of very fine particles.
       - *a.* Of a globular form.
         1. White, the pea-stone.
         2. Grey, *pisolithus*, *oolithus*. Also the hammites, from its resemblance to the roes or spawn of fish. It has been exhibited by authors as petrified roes. The Ketton free-stone, of Rutlandshire, is a remarkable stone of this sort.
       - *b.* Hollow, in the form of a cone.
         1. White.
       - *c.* Of an indeterminate figure.
       - *d.* Of coherent hollow cones.
     - (2.) Solid stalactites of a sparry texture.
       - *a.* Hollow, and in form of a cone.
         1. White, and semitransparent.

II. Sa-

In Lochaber, near the farm-houses on the north side of the ferry of Ballachylish, is a limestone or marble rock, of a beautiful ashen-grey colour, and a fine regular uniform grain or texture; capable of being raised in blocks or slabs of any size, and of receiving a fine polish. It is beautifully sprinkled with fine bright grains of mundick or pyrites, and likewise with grains or specks of beautiful lead ore of a fine texture.

About three miles south of Fort-William, in the bed of a river, is a curious kind of marble with a black ground, flowered with white, like fine needle-work, or rather resembling the frost flowering upon glass windows in winter; and this flowering is not only on the outside, but quite through all parts of the body of the stone.

Scotland has also chalk in abundace; some of which is regularly stratified, and much appears in thick irregular masses like sediment.

(E) The translator of Mr Cronstedt's Treatise has adopted this German term *drusen* into the English language, for a cluster of regular figured bodies, as a groupe conveys the idea of a cluster only, whether regular or of indeterminate figures.

Calcareous Earths.

II. Saturated or combined with the acid of vitriol. Gypsum, Plaster stone, or Parget.

1. Looser and more friable than a pure calcareou earth.
2. Either crude or burnt, it does not excite any effervescence with acids; or, at most, it effervesces but in a very slight degree, and then only in proportion as it wants some of the vitriolic acid to complete the saturation.
3. It readily falls into a powder in the fire.
4. If burnt, without being red-hot, its powder readily concretes with water into a mass, which soon hardens; and then,
5. No heat is perceived in the operation.
6. It is nearly as difficult to be melted by itself as the limestone, and shows mostly the same effects with other bodies as the lime-stone: the acid of vitriol seems, however, to promote its vitrification.
7. When melted in the fire with borax, it puffs and bubbles very much, and for a long while, during the fusion, owing to the nature of both the salts.
8. When a small quantity of any gypsum is melted together with borax, the glass becomes colourless and transparent; but some sorts of alabaster and sparry gypsa, when melted in some quantity with borax, yield a fine transparent yellow coloured glass, resembling that of the best topazes. This phenomenon might probably happen with every one of the gypseous kind. But it is to be observed, that if too much of such gypsum is used in proportion to the borax, the glass becomes opaque, just as it happens with the pure limestone.
9. Burnt with any inflammable matter, it emits a sulphureous smell; and may as well by that means, as by both the alkaline salts, be decompounded; but for this purpose there ought to be five or six times as much weight of salt as of gypsum.
10. Being thus decompounded, the calx or earth which is left shows commonly some marks of iron.

The gypseous earth is found,

(1.) Loose and friable. Gypseous earth, properly so called; *Gubr*.

A. White.

(2.) Indurated.

A. Solid, or of no visible particles, Alabaster.

a. White, alabaster.

1. Clear and transparent.
2. Opaque.

b. Yellow.

1. Transparent, from the Eastern countries.
2. Opaque.

B. Gypsum of a scaled or granulated structure. This is the common plaster-stone.

1. With coarse scales. *a.* White.
2. With small scales. *a.* Yellowish. *b.* Greyish.

C. Fibrous gypsum, or plaster-stone, improperly (though commonly) called *English talc* by our druggists.

1. With the fibres coarse. *a.* White, from Livonia.
2. With fine fibres. *a.* White.

D. Spar-like gypsum. Selenites, by some also called *glacies mariæ;* and confounded with the clear and transparent mica.

1. Pure selenites.

A. Transparent.

a. Colourless. *b.* Yellowish.

2. Liverstone, so called by the Swedes and Germans.

E. Crystallised gypsum. Gypseous drusen.

(1.) Drusen of crystals of pure sparry gypsum.

A. Wedge-formed, composed of a pure spar-like gypsum.

a. Clear and colourless. *b.* Whitish yellow.

B. Capillary.

a. Opaque, whitish yellow. *b.* Hexagonal, prismatic. *c.* Globular, consisting of cuneated rays proceeding from the centre.

F. Stalactitical gypsum. *Gipsum sinter.*

1. Of no visible particles; in French, *grignard.*

A. Of an irregular figure.

a. Yellow. *b.* White.

2. Of a spar-like texture.

A. In form of a cone.

a. White and yellow.

B. Of an irregular figure.

a. White.

III. Calcareous earth saturated with the acid of common salt. *Sal ammoniacum fixum naturale.*

This is found, 1. In sea-water. 2. In salt-pits.

IV. Calcareous earth combined or saturated with sparry acid, known by the name of *sparry fluor* and *blue john.*

These are commonly called *fluxing, vitrescent,* or *glass*-spars; because most part of them have a sparry form and appearance: they are, however, often met in an indeterminate figure.

They are only known in an indurated state, and distinguish themselves from the other earths by the following characters.

1. They are scarce harder than common calcareous spars, and consequently do not strike fire with steel.
2. They do not ferment with acids neither before nor after calcination.
3. They do not melt by themselves; but crack and split to pieces when exposed to a strong fire. But,
4. In mixtures with all other earths they are (generally) very fusible, and especially with calcareous earth, with which they melt into a corroding glass that dissolves the strongest crucibles, unless some quartz or apyrous clay be added thereto.
5. When heated slowly, and by degrees, they give a phosphorescent light: but as soon as they are made red-hot, they loose this quality. The coloured ones, especially the green, give the strongest light, but none of them any longer than whilst they are well warm.
6. They melt and dissolve very easily by the addition of borax; and, next to that, by the microcosmic salt, without ebullition.

A. Indurated fluor.

Calcareous Earths.

(1.) Solid, of an indeterminate figure; of a dull texture, semitransparent, and full of cracks in the rock.

a. White.

(2.) Sparry fluor. This has nearly the figure of spar; though on close observation it is found not to be so regular, nothing but the glossy surfaces of this stone giving it the resemblance of spar.

a. White. *b.* Blue. *c.* Violet. *d.* Deep green. *e.* Pale green. *f.* Yellow.

(3.) Crystallised fluor.

1. Of an irregular figure. *a.* White. *b.* Blue. *c.* Red.
2. Of a cubical figure. *a.* Yellow. *b.* Violet.
3. Of a polygonal spherical figure. *a.* White. *b.* Blue.
4. Of an octoedral figure. *a.* Clear, colourless.

V. Calcareous earth saturated with a particular acid, perhaps of the metallic kind, *viz.* the tungstenic acid. The *tungstein* of the Swedes.

This resembles the garnet-stone and the tin-grains; is nearly as heavy as pure tin; very refractory in the are, and excessively difficult to reduce to metal. Iron has, however, been melted out of it to more than 30 *per cent.* It is very difficultly dissolved by borax and alkaline salts, but melts very easily with the microcosmic salt, giving a black slag; and for this reason the last mentioned salt must be employed in the assays of this stone. It is found,

1. Solid and fine-grained.
   a. Reddish or flesh-coloured. *b.* Yellow.
2. Spathose, and with an unctuous surface.
   a. White. *b.* Pearl-coloured.

VI. Calcareous earth united with the inflammable substance.

These have a very offensive smell, at least when rubbed. They receive their colour from the phlogiston, being dark or black in proportion as it predominates.

(1.) Calcareous earth mixed with phlogiston alone; *Lapis suillus*, fetid stone and spar, or swine-stone and spar.

A. Solid, or of no visible or distinct particles.
a. Black.

B. Grained.
a. Blackish brown.

C. Scaly, *particulis micaceis.*
1. With coarse scales, *a.* Black.
2. With fine sparkling scales. *a.* Brown.

D. Sparry.
a. Black. *b.* Light brown. *c.* Whitish yellow.

E. Crystallised.
1. In a globular form.

VII. Calcareous earths blended with an argillaceous earth. Marle, *Marga*.

1. When crude, it makes an effervescence with acids: but,
2. Not after having been burnt; by which operation it is observed to harden, in proportion as the clay exceeds the calcareous substance.
3. It easily melts by itself into a glass, and even when it is mixed with the most refractory clay.
4. It is of great use in promoting the growth of vegetables, since the clay tempers the drying quality of the calcareous earth.
5. When burnt in a calcining heat, it readily attracts water: and, exposed to the air, in time it falls into a powder.

The varieties of this kind worthy to be taken notice of, depend on the different quantities of each of their component parts, and on the quality of the clay. The following are specified as examples.

A. Loose and compact, *Marga friabilis.*
a. Reddish brown.
b. Pale red. This, when burnt, is of a yellowish colour, and used for making earthen ware in some places.

B. Semi-indurated; which is nearly as hard as stone when first dug up, but moulders in the open air.
a. Grey. *b.* Red.

C. Indurated, or stone marle.
A. in loose pieces, *Marga indurata amorpha;* by the Germans called *duckstein* or *tophstein.*
a. White. *b.* Grey, formed from a sediment which the water carries along with it.
B. In continued strata. Hard slaty marle.

VIII. Calcareous earth united with a metallic calx.

Here, as well as in the others, such a mixture or combination is to be understood, as cannot be discovered by the eye alone without the help of some other means.

The subjects belonging to this division lose the property of raising an effervescence with acids, when they are rich in metal, or contain any vitriolic acid. However, there have been found some that contained 20 or 30 *per cent.* of metal, and yet have shown their calcareous nature by the nitrous acid.

There are no more than three metals hitherto known to be united in this manner with the calcareous earth, *viz.*

(1.) With iron. White spar like iron ore, *Minera ferri alba.* The *stahlstein* or *weises eisenerz* of the Germans.

1. This ore, however, is not always white, but commonly gives a white powder when rubbed.
2. It becomes black in the open air, as likewise in a calcining heat.
3. In this last circumstance it loses 30 or 40 *per cent.* of its weight, which by distillation has been found owing to the water that evaporates; and it is possible that some small quantity of vitriolic acid may, at the same time, evaporate with the water.
4. It is of all the iron ores the most easy to melt, and is very corrosive when melted.

This kind is found,

A. Loose; the mouldered part of the indurated sort.
a. Black, like soot.
b. Dark brown, somewhat resembling umbre.

B. Indurated.
1. Solid, of no distinct particles.
   a. Red. Looks like red ochre, or the red hæmatites, but dissolves in the acid of nitre with a great effervescence.
2. Scaly, *particulis micaceis.*
   a. White.
   b. Blackish grey.
3. Spar-like.
   a. Light brown.

4. Drusen.
a. Blackish brown.
b. White.
1. Porous. This is often called *eisenblute*, or *flos ferri.*
2. Cellular.

(2.) With copper.
A. Loose and friable. Mountain blue; Germanicè, *Bergblau.* This dissolves in aquafortis with effervescence.
B. Indurated.
1. Pure calcareous earth mixed with calx of copper. Armenian stone, *lapis Armenus.*
2. Gypseous earth united with calx of copper. Is of a green colour; and might perhaps be called *turquoise ore*, or *malachites;* though we do not know if all sorts of turquoise ore are of this nature.
a. Semi-transparent, is found at Ardal in Norway.

(3.) With the calx of lead.
This is a lead ochre, or a spar-like lead-ore, which, in its formation, has been mixed with a calcareous earth, and for that reason effervesces with acids.
A Loose and friable.
1. White.
B. Indurated.
1. Scaly.
a. Yellowish.
Both these varieties contain a considerable quantity of lead, *viz.* 40 *per cent.* more or less; and the calcareous earth is as equally and intimately mixed with it, as in the white iron ore.

IX. The following compounds of calcareous earth with different mineral substances are added from Mr Kirwan's Elements of Mineralogy.
1. A compound of calcareous and barotical earths: of this species are some yellowish stones found in Derbyshire, consisting of lumps of limestone interspersed with nodules of baroselenite. Many more may occur as compounds of gypsum and baroselenite, fluor and baroselenite, &c. &c.
2. Compounds of calcareous and magnesian earths; such as,
a. The white marble, interspersed with spots of steatites or soap-rock, either green or black, called by Cronstedt *kolmord marble.* This marble is of a scaly texture.
b. The *pietra talchina* of the Italians, which consists of white spar with veins of talc.
c. The *verde antico* of the Italians, which is a light green marble, with deep green, black, white, and purple spots. According to Mr Bayen, it contains 62 parts of mild calcareous earth, 30 of green talc, 1 of magnesia, and 1 of semiphlogisticated iron.
3. Compounds of calcareous and argillaceous earths; such as,
a. The green Campan marble from the Pyrenées. It is slaty and somewhat magnetic. According to Mr Bayen, it contains 65 of mild calcareous earth, 32 of the argillaceous, and 3 of semiphlogisticated iron.
b. The red Campan marble: this is not magnetic; it contains 82 parts of mild calcareous earth, 11 of argillaceous shistus, and 7 of dephlogisticated iron.
c. Yellow figured marble from Florence; according to Mr Bayen, it contains 75 parts of mild calcareous earth, 13 or 14 of shistus, and 4 or 5 of dephlogisticated iron.
d. Griotte marble from Autun of Burgundy in France: it contains 67 parts of mild calcareous earth, 26 of reddish schistus, 2 of iron, and 1 of magnesian earth.
e. The Amandola, which is a green marble, honey-comb like, with white spots. It contains 76 parts of mild calcareous earth, 20 of schistus, and 2 of semiphlogisticated iron. The cellular appearance proceeds from the schistus.
4. Compounds of calcareous earth and mica; such as,
a. The cipolin from Autun in France: it is of a green colour, and consists of 83 parts of chalk, 12 of green mica, and 1 of iron.
b. The micaceous limestone, is of a glittering appearance, of various degrees of hardness, and effervesces with acids. Such as the macigno of the Italians; their yellow pietra bigia; and their blue pietra columbina or turkina.
5. Compounds of calcareous and siliceous earths; such as,
a. The calcareous quartz and pudding-stone: this consists of lumps of quartz, and sometimes of felt-spar in a calcareous cement.
b. The limestone with veins of quarts; such as the *saxum sahlbergense*, and several marbles of Sweden and Siberia, which strike fire with steel.
6. Calcareous volcanic pudding-stone; such as,
a. The cierchina, which consists of lumps of spar and lava in a calcareous cement, mentioned by Mr Ferber.
b. The marble mixed with veins of black or green lava, mentioned by the same anthor.
7. Compounds of calcareous earth, mixed with two or more kinds of earth; such as,
a. The cipolin from Rome, which is a green marble with white zones: it strikes, though difficultly, fire with steel: it contains 67,8 parts of mild chalk, 25 of quartz, 8 of shistus, and 0,2 of iron, besides the iron contained in the argillaceous shistus.
b. The calcareous porphyry, which consists of quartz, felt-spar, and mica in separate grains united by a calcareous cement.
c. The limestone interspersed with shoerl and mica.
d. To these compounds belongs the pyritaceous limestone called by the French *Pierre de St Ambroix.* It is of an iron grey colour, interspersed with shining particles. Its texture is compact, and scarcely gives fire with steel. Its specific gravity is 2,7034. It is soluble in acids, and mostly with effervescence; calcines in a strong fire; makes nitre slightly detonate; and if distilled affords a small portion of vitriolic acid, and some sulphur sublimes. Its component

Ponderous Earth.

ponent parts are 75 of mild calcareous earth and 25 of pyrites; in which are contained 14 of argill, 7 of quartz and sulphur, and 4 of iron.

Order II. Ponderous Earth.

Ponderous earth, (*Terra Ponderosa*): Cauk, or calk. See Earth, Art. I. This is a particular kind of earth (like chalk in appearance, but with some very different properties), discovered in Sweden about 1774, which by its results with other bodies has some similarity to the known alkalis. It has not yet been found pure, but mixed with other substances: however, its great specific weight easily distinguishes it from the others, it being the heaviest of all earths.

1. Its specific gravity when considerably purified by art is 3,773.
2. This earth combines with aerial acid: and in this case effervesces with stronger acids.
3. With vitriolic acid it forms the ponderous spar, which is insoluble in water.
4. Its crystallization, after being combined with the nitrous, or with the muriatic acids, is hardly soluble;
5. But with acetous acid, it becomes deliquescent.
6. When pure; viz. without any mixture of acid or alkali, it does not vitrify in the fire.
7. If deprived of the aerial acid (fixed air) by calcination, is then soluble in 900 times its weight of boiling water. This solution exposed to air, forms a cremor, like that of lime-water in the same circumstances, and like it changes also the vegetable colours.
8. Whilst combined with aerial acid, it is only soluble in about 1550 times its weight of water, chiefly if the water has been impregnated also with the same aerial acid.
9. It expels the caustic volatile alkali from ammoniacal salt.
10. Mixed with brimstone it produces a hepar sulphuris, whose solution in water is but incompletely decomposed either by the nitrous or the muriatic acid, on account of the great attraction between this earth and the acid of sulphur, which is so strong that it
11. Separates this acid (the vitriolic) from the vegetable alkali.

I. Combined with aerial acid; *Terra ponderosa aërata.* See Chemistry-*Index.*

It resembles alum, but is hard and striated, as if composed of radiating fibres coming from a centre. It is found in Alston-moor in England.

A. Spar-like gypsum.

1. Semitransparent, *spatum Bononiense.* The Bononian stone, or native phosphorus.
2. Opaque. *a.* White. *b.* Reddish.

B. Ponderous Drusen spar.

1. Jagged, *cristatum.* These resemble cock's combs, and are found in clefts and fissures accreted on the surfaces of balls of the same substance.
2. White.
3. Reddish.

II. United with phlogiston and the vitriolic acid. *Leberstein* of the Germans and Swedes. *Lapis hepaticus.*

Magnesian Earths.

This stone in some specimens constantly, but in others only when rubbed, smells like the *hepar sulphuris*, or gun-powder.

It is found.

A. Scaly.

1. With coarse scales. *a.* Whitish yellow.
2. With fine sparkling scales. *a.* Black.

Order III. Magnesian, Micaceous, and Asbestine Earths.

§ 1. *Magnesian Earth.*

Magnesia is a white, loose, and light earth, only known since the beginning of this century. It is generally found combined or mixed with other heterogeneous substances, as other simple earths are.

1. When pure its specific gravity is 2,330, and then
2. It neither hardens, contracts, nor melts by the application of heat, even by the solar rays.
3. But it melts easily with borax, or microcosmic salt; though it is scarcely affected by fixed alkalis or calces of lead.
4. Mixed with other earths, it produces by fire different hard masses.
5. It gives no causticity except to the volatile alkali: and
6. Does not effervesce with any acid.
7. When mixed with water it shows a very small degree of heat, but without any effervescence. And when the water exceeds the weight of magnesia about 7,692 times, it is totally dissolved.

8 and 9. Being put in water and afterwards dried, it contains $\frac{18}{100}$ parts of its weight; though when saturated with aerial acid, it will absorb and retain after being dried $\frac{66}{100}$ parts of water.

10. This earth combined with aerial acid is more soluble in cold than in hot water.
11. Combined with vitriolic acid it crystallizes into a bitter salt, known by the name of *Epsom* and *Seydlitz* or *Seidschulitz* salt, which is soluble in little more than its own weight of water.
12. With nitrous acid it forms a deliquescent salt.
13. With the muriatic or the acetous acids it does not crystallize: and the mass being dried, attracts humidity from the air.
14. It has a stronger attraction to the fluor acid than to any other (Berg.): and crystallizes with it into hexangular prisms whose ends are formed of two low pyramids, of three rhombs (*Romé de l'Isle*).
15. It is not precipitated from other acids by the vitriolic, as calcareous earth is.
16. According to Lavoisier and Macquer, when magnesia is calcined, it becomes phosphorescent.

I. Magnesia combined with vitriolic and other acids.

A. When saturated with the vitriolic acid, it forms a bitter salt, called *English* or *Epsom*, *Seydshutz* or *Sedlitz* salt. The salts known under these dif-

ferent

Magnesian Earths.

ferent names only differ from one another on account of some heterogeneous substance, which is combined in them, the vitriolated magnesia being the characteristic and principal ingredient in them all.

B. Magnesia is found not only combined with the vitriolic acid in the waters of Epsom, Sedlitz, &c. but also with the marine acid to a considerable quantity in sea-water and other salt springs.

C. It is contained frequently in fresh waters, where it is dissolved by means of a quantity of aerial acid.

II. Combined with other earths.

A. Magnesia, when combined with siliceous earth, is commonly unctuous to the touch, and more or less difficult to be cut or turned in proportion to its different degrees of hardness.

It is not diffusible in water: grows hard, and is very refractory in the fire.

When pounded and mixed with water, it will not easily cohere into a paste: however, if it is managed with care, it may be baked in the fire to a mass, which being broken, shows a dull and porous texture.

It takes for the most part, and without much labour, a fine polish. It is found,

(1.) Compact and soft; *Smectis*, *Briançon* or French chalk.
a. White, from the Lands-End, in Cornwall.
b. Yellow.
c. Red and white, from the Lands-End: the soap-earth, from Switzerland: it looks like Castile-soap.

(2.) Solid and compact; of impalpable particles: Steatites or soap-rock.
a. White, or light green. *b.* Deep green — *c.* Yellow.

(3.) Solid, and of visible particles; serpentine stone.
A. Of fibrous and coherent particles.
This is composed, as it were, of fibres, and might therefore be confounded with the asbestus, if its fibres did not cohere so closely with one another, as not to be seen when the stone is cut and polished. The fibres themselves are large, and seem as if they were twisted.
a. Deep green. It is sold for the *lapis nephriticus*, and is dug at some unknown place in Germany. *b.* Light green, from Skienshyttan, in Westmanland; is used by the plate-smiths instead of French chalk.
B. Of granulated particles; fine grained sepentine stone, the Zoeblitz serpentine.
a. Black. *b.* Deep green. *c.* Light green. *d.* Red. *e.* Bluish grey. *f.* White. These colours are all mixed together in the serpentine stone from Zoeblitz, but the green is the most predominant colour.

B. Porcelain earth mixed with iron; *terra porcellanea* This is,
A. Diffusible in water.
a. Red, from Montmartre, and China. The water-clinkers which are imported from certain places in Germany seem to be made of this kind.
B. Indurated.
1. Martial soap earth.
a. Red.
2. Martial soap rock.
a. Black.
b. Red.

C. The telgsten of the Swedes; *lapis ollaris.*
a. Light grey. *b.* Whitish yellow. *c.* Dark grey. *d.* Dark green.

The serpentine stone has many varieties; being found, (1.) Veined or spotted with green steatites. (2.) Red, with veins of asbestos. (3.) Red, green, yellow, or black with veins or spots of white calcareous spar, is called *potzevera*. The black is called *nero di prato*; the green *verde di Suza*; but these names are not restrained to this species. (4.) Veined or spotted with gypsum. (5.) Veined or spotted with baroselenite. (6.) Veined or spotted with shistus — And, (7.) With veins of quartz, feltspar, or shoerl. (*Kirwan's Mineralogy.*)

What is commonly called *serpentine* is a true *lapis ollaris*; but being variegated with green, yellowish, and brown spots, like the skin of some common serpents, it is called by that name. Great quantities of this stone are found in Italy and Switzerland, where it is often worked into the shape of dishes and other vases (*Fabroni.*) And the *gabro* of the Italians is nothing else but a kind of serpentine, (*Kirwan.*)

§ 2. *Micaceous Earths.*

These are known by the following characters:

1. Their texture and composition consist of thin flexible particles, divisible into plates or leaves, having a shining surface.
2. These leaves or scales exposed to the fire lose their flexibility and become brittle, and then separate into inner leaves: but in a quick and strong fire, they curl or crumple, which is a step towards fusion; though it is very difficult to reduce them into pure glass by themselves or without addition.
3. They melt pretty easily with borax, the microcosmic salt, and the alkaline salt: and may by means of the blow-pipe be brought to a clear glass with the two former salts. The martial mica is, however, more fusible than the uncoloured ones: its specific gravity is 3,000.

A. Colourless or pure mica; daze, glimmer, or glist.
1. Of large parallel plates; Muscovy glass. This is transparent as glass; found in Siberia and Elfdalen in the province of Wermeland.
2. Of small plates, from Silfverberget, at Runneby, in the province of Blekinge.
3. Of fine particles like chaff; chaffy mica.
4. Of twisted plates; crumpled mica.

B. Coloured and martial glimmer.
1. Brown, semi-transparent.
2. Of fine and minute scales.
a. Brown. *b.* Deep green. *c.* Light green. *d.* Black.
3. Twisted or crumpled glimmer.
a. Light green.
4. Chaffy glimmer.
a. Black.

5. Chryftallized glimmer.
   a. Of concentrated and erect fcales.
   b. Of hexagonal horizontal plates.

The tranfparent Mufcovy glafs is ufed for windows, and upon all occafions where panes of glafs are wanted. Perhaps it might alfo be advantageoufly employed to cover houfes.

The twifted or crumpled mica, which is found at Hardol in Jemtland, is there manufactured into kettles and other veffels, as alfo for hearths of chimnies: and the powder which falls in the working may be mixed with the common falt for the diftillation of the muriatic acid.

§ 3. *Afbeftine Earths.*

Thefe are only yet difcovered in an indurated ftate; and their characters are as follows:

1. When pure, they are very refractory in the fire.
2. In large pieces they are flexible.
3. They have dull or uneven furfaces.
4. In the fire they become more brittle.
5. They do not ftrike fire with the fteel.
6. They are not attacked by acids.
7. They are eafily brought into fufion by borax or alkali.

In this fection are included both thofe varieties which by foffilogifts have been mentioned under the names of *amiantus* and *afbeftus*, and have often been confounded together.

I. Afbeftus, which is compounded of foft and thin membranes; *amiantus Wallerii.*
   A. Of parallel membranes: *Corium, five caro montana;* Mountain-leather.
      1. Pure. *a.* White.
      2. Martial. *a.* Yellowifh brown.
   B. Of twifted foft membranes; mountain-cork.
      1. Pure. *a.* White.
      2. Martial. *a.* Yellowifh brown.

II. Of fine and flexible fibres: Earth-flax; *afbeftus Wallerii.*
   A. With parallel fibres: *Byffus.*
      1. Pure and foft. *a.* Light green. *b.* White.
      2. A little martial, and more brittle.
         a. Greenifh, from Baftnas Grufva, at Ryddarhyttan in Weftmanland. There it forms the greateft part of the vein out of which the copper ore is dug; a great part of it is confequently melted together with the ore, and is then brought to a pure femi-tranfparent martial flag or glafs.
   B. Of broken and recombined fibres.
      1. Martial. *a.* Light green.

Order IV. Siliceous Earths.

Siliceous earth is, of all others, the moft difficult to defcribe and to diftinguifh perfectly; however, it may be known by the following characters, which are common to all bodies belonging to this order.

1. In its indurated ftate it is hard, if not in regard to the whole, yet at leaft in regard to each particle of it, in a degree fufficient to ftrike fire with fteel, and to fcratch it, when rubbed againft it, though the fteel be ever fo well tempered.
2. When pure, and free from heterogeneous particles, it does not melt by itfelf, neither in a reverbatory nor in a blaft furnace.

3. After being burnt, it does not fall to a powder, neither in the open air nor in water, as the calcareous earth does, but becomes only a little loofer and more cracked by the fire, unlefs it has been very flowly, and by degrees, heated.
4. It excites no effervefcence with acids.
5. In the fire it melts eafieft of all to a glafs with the fixed alkaline falt; and hence it has got the name of vitrefcent, though this name is, properly fpeaking, lefs applicable to this order than to a great many other earths.

To the above we may add the following properties, from Bergman.

6. It is not foluble in any of the known acids, the fluor-acid only excepted. But,
7. It may be diffolved by the fixed alkali, both in the dry and wet way.
8. If the fixed alkali is only half the weight of the filiceous earth, it produces a diaphonous and hard glafs: but when it is in a double or triple proportion, then the glafs deliquefces of itfelf by attracting the humidity of the atmofphere.
9. It melts eafily with borax; but
10. With microfcomic falt it is more difficult, and requires a longer time to melt.
11. This earth has a great analogy to acids, as it is perfectly diffolved in that wonderful natural hot-water-fpout above ninety feet high at Geyfer, in Iceland, where by cooling it forms a filiceous mafs.

§ 1. *Gems, or precious ftones.*

I. Diamond. *Adamas gemma.* See Diamond.
   1. Of all ftones, it is the hardeft.
   2. Is commonly clear, or tranfparent; which quality, however, may, perhaps, only belong to its cryftals, but not to the rock itfelf from which they have their origin.
   3. Its fpecific gravity is neareft 3,500. When brought to Europe in its rough ftate, it is in the form either of round pebbles with fhining furfaces, or of cryftals of an octoedral form.
   a. Colourlefs, or diaphonous, or the *diamond* properly fo called.
      But it alfo retains this name when it is tinged fomewhat red or yellow. Being rubbed, it difcovers fome electrical qualities, and attracts the maftic.
   b. Red; Ruby. *Adamas ruber; Rubinus.*—Which, by lapidaries and jewellers, is, in regard to the colour, divided into,
      1. The ruby of a deep red colour inclining a little to purple.
      2. Spinell, of a dark colour.
      3. The balafs, pale red, inclining to violet. This is fuppofed to be the mother of the rubies.
      4 The rubicell, reddifh yellow.
      However, all authors do not agree in the characters of thefe ftones.

II Sapphire. *Sapphyrus gemma.*
   It is tranfparent, of a blue colour; and is faid to be in hardnefs next to the ruby, or diamond.

III. To-

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III. Topaz. *Topazius gemma.*

a. The pale yellow topaz; which is nearly uncoloured.

b. The yellow topaz.

c. Deep yellow, or gold coloured topaz, or oriental topaz.

d. Orange-coloured topaz.

e. The yellowish green topaz, or *chrysolite.*

f. The yellowish green, and cloudy topaz, the *chrysoprase* (A).

g. Bluish green topaz, or the beryl.

This varies in its colours; and is called, when

1. Of a sea-green colour, the *aqua-marine.*
2. When more green, the *beryl.*

IV. Emerald. *Smaragdus gemma.*

Its chief colour is green and transparent. It is the softest of precious stones, and when heated it is phosphorescent like the fluors.

V. To the precious stones belong also the jacinths, or hyacinths; which are crystals harder than quartz crystals, transparent, of a fine reddish-yellow colour when in their full lustre, and formed in prisms pointed at both ends: these points are always regular, in regard to the number of the facets, being four on each point; but the facets seldom tally: the sides also which form the main body, or column, are very uncertain in regard both to their number and shape; for they are found of four, five, six, seven, and sometimes of eight, sides: further, the column or prism is in some also so compressed, as almost to resemble the face of a spherical facetted garnet.

Mr Cronstedt says, he got some jacinths of a quadrangular figure, which did not melt in the fire, but only became colourless.

VI. The amethyst is a gem of a violet colour, with great brilliancy, and as hard as the best kind of rubies or sapphires, from which it only differs by its colour. This is called the *oriental amethyst;* and is very rare: when it inclines to the purple, or rosy colour, it is more esteemed than when it is nearer to the blue.

These amethysts have the same figure, hardness, specific gravity, and other qualities, as the best sapphires or rubies; and come from the same places, particularly from Persia, Arabia, Armenia, and the West Indies.

The amethysts called *occidental,* are of the same nature as rock crystals, and have the same gradations. viz. of a violet inclining to the purple

(A) In the *Annals of Chemistry,* Vol. I. we have the following account of the method of digging for the chrysoprasus, and of the earths and stones with which it is accompanied.

This precious stone is found in certain mountains in Silesia, which seem to begin those of Tradas, extending to within half a league of Glatz. These mountains appear, in general, to consist of a number of strata, horizontal or inclined, composed chiefly of substances containing magnesia, but likewise mixed with calcareous, argillaceous, and siliceous earths. The greatest part of these consist of serpentine, mixed with asbestos and amianthus, grey argillaceous earths, boles, and red or green ochres, stone marrow, steatites, or soap-stone, and talc. In those mountains also we meet with quartz, petrosilex, opal, and chalcedony, in detached fragments, and sometimes in continued veins. We also discover in them veins of sand, of the nature of granite. Sometimes the serpentine is met with at the surface; sometimes at the depth of 20 or 30 feet. The stone marrow seems here to be produced by the decomposition of a very milky species of opal agate named *cacholong;* for at the depth of 50 feet and upwards the veins of this soapy earth assume a degree of solidity, and we find nothing but hard and semitransparent cacholongs.

The above-mentioned strata are crossed by a great number of cracks filled with green-coloured earths and stones; but these frequently do not contain a single true chrysoprasus. They are sometimes found immediately under the vegetable mould, or at the depth of some feet, in shapeless masses, covered with a heavy clay, and sometimes enveloped by an unctuous earth of a beautiful green colour, which it derives from the calx of nickel. In other places, the chrysoprasus has been found in uneven laminæ of several yards in length and breadth, either immediately under the mould, or in the upper strata of serpentine, which have little solidity; and very beautiful ones have been found at the depth of seven or eight fathoms; and some have been met with in grey clay at the depth of four fathoms. In some places also they are met with in a kind of red ochre, which is attracted by the magnet; in others they are found in the clefts of rocks. The beautiful green chrysoprasus is found most plentifully in the mountain of Glassendorf. In another mountain named Kosmutz, where it is also found, the pieces are so porous, and so much spotted with white, &c. that sometimes upwards of 1000 of them have not afforded one large enough for the use of the jewellers. The defects are frequently only discoverable on polishing, as the green opal, while rough, perfectly resembles the chrysoprasus; but, on polishing the stones in which it is contained, it is detected by its want of lustre.

The quantity in which these stones are found is not sufficient to afford the expences of regular mining; the most profitable way, therefore, of obtaining them is by making trenches in the earth from four to six feet deep. Almost all the mountain of Kosemutz, however, has already been examined in this manner; so that they now dig for the chrysoprasus in quarries by uncovering a bank of earth or stone, and descending to other banks by steps in the open air, so as to throw the rubbish back from bank to bank. This method, however, cannot be continued farther than 24 or 30 feet, otherwise the produce would not defray the expence. The only tools employed in digging for the chrysoprasus are a spade and pick-ax; the former to remove the earth, the latter to detach the chrysoprasus itself from the stones which surround it.

Various accounts have been given of the component parts of this precious stone. Lehmann thinks, that the purple or rosy colour, or inclining to the blue; very often they are semi-transparent, without any colour in one end, and violet towards the other. The best are found in the Vic mountains of Catalonia in Spain, and at Wiesenthal in Saxony, as well as in Bohemia in Germany, in Italy, and in the province of Auvergne in France.

Crystals within the geodes, or hollow agathe-balls, are very often found of an amethyst colour, and some are very fine.

What we call *amethyst root*, or *mother of amethyst*, is but a sparry fluor, of which we have plenty in Derbyshire: many fine ornamental pieces are made of this substance in different forms and shapes. These spars are found in insulated masses, sometimes pretty large; but never in the form of large rocks.

VII. The garnet, (*Granatus.*) This stone, when transparent and of a fine colour, is reckoned among the gems: but it varies more than any, both in the form of its crystals and in its colour, some being of a deep and dark red, some yellowish and purplish, and some brown, blackish, and quite opaque. In general, their lustre is less than that of other gems, as well as their hardness, which yields to the file, although they may strike fire with steel. But as to their form, these crystals take almost all sorts of figures, as the rhomboidal, tetradecaedral, &c. and some are of an irregular form.

Their colour proceeds from the iron which enters into their composition; and, according to M. de Saussure, even the finest oriental garnets attract the magnetic needle at a small distance.

The Syrian garnet is the finest and best esteemed. It is of a fine red, inclining to the purple colour, very diaphanous, but less brilliant than the oriental amethyst. It seems to be the *amethystizontas* of Pliny: the Italians call it *rubino di rocca*,

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the colour of it is owing to some ferruginous particles modified in a particular manner: but the experiments he adduces for this opinion are not satisfactory. Mr Sage attributes the colour to cobalt from the blue colour it imparts to glass. Mr Achard thinks the stone contains calx of copper as well as calx of iron; because a part of the metal separable from it may be dissolved in volatile alkali. The following are the experiments of M. Klaproth upon the subject.

1. On heating several pieces of very pure chrysoprasus red hot, and quenching them in water, the colour was changed from green to bluish grey; and, on repeating the operation, it became a white grey. They were found to have lost in weight one and an half per cent. and were easily pulverable in a glass mortar.

2. Three hundred grains of chrysoprasus were mixed with double its weight of mild mineral alkali, and the mixture heated for some hours red hot, in a porcelain crucible. The mass was then powdered, and digested in distilled water. By filtration, a yellowish grey residuum was obtained, weighing 44 grains; the filtered liquor was limpid and colourless, a copious precipitate being formed with muriatic acid, which being washed and dried was found to be siliceous earth.

3. The 44 grains of yellowish grey residuum were digested in a retort, with 352 grains of aqua regia; a great part of which was evaporated. The acid which came over was returned into the retort, and filtered after a second digestion. The residuum was a very fine white siliceous earth, which, after being washed, dried, and heated red hot, weighed 20 grains.

4. The filtrated solution was of a pale green, but on supersaturation with volatile alkali immediately turned of a bluish colour, precipitating a small quantity of brownish gelatinous matter; which, when collected, twice distilled with nitrous acid, and afterwards strongly heated, yielded a brown calx of iron, weighing no more than a quarter of a grain: whence our author concludes, that iron does not contribute to the colour of the chrysoprasus, as we know many colourless stones which contain as great a quantity of that metal. This small quantity of calx was left after digesting the gelatinous residuum. On precipitating the soluble parts, they appeared to consist of aluminous earth, in an excessively divided state; which being washed and dried, weighed half a grain.

5. To find whether the solution contained calcareous earth or not, he mixed with that, supersaturated with volatile alkali, a saturated solution of mild mineral alkali, which precipitated four grains and an half of white and very pure calcareous earth.

6. Nothing more was precipitated from the solution, either by acids or alkalies, after the separation of the calcareous earth, though it still retained a bluish colour. It was poured into a retort, and evaporated to dryness; the residuum was of a yellowish colour, which became green on being dissolved in distilled water. Mild mineral alkali threw down only a little earth of a greenish white colour; which being re-dissolved in dephlogisticated nitrous acid, and precipitated with Prussian alkali, the liquor yielded 17 grains of a sea-green powder. This precipitate, in our author's opinion, is the colouring principle of the chrysoprasus; and this principle he afterwards found to be calx of nickel.

7. Our author likewise attempted to analyse the chrysoprasus in the moist way by concentrated vitriolic acid; in which process his chief view was to discover whether or not the stone contained any volatile particles or not. On an ounce of crude chrysoprasus, therefore, when put into a retort, he poured an equal quantity of rectified vitriolic acid, and two parts of distilled water. After the latter had passed over into the receiver, the fire was increased to force over the superabundant acid; a part arose in white vapours, and some fell into the receiver with an hissing noise. Boiling water, which had been distilled, was then poured upon the residuum, and the solution filtered. The powdered chrysoprasus left on the filter had not been perfectly dissolved, and, in

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rocca, and is found in Syria, Calcutta, Cananor, Camboya, and Ethiopia.

The fine garnet of a red inclining to a yellow colour, is the *soranus* of the ancients, the *vermeille* of the French, and the *giacinto guarnacino* of the Italians. Its name is taken from *Sorian*, or *Surian*, a capital town of Pegu, from whence these gems are brought: when they have a brownish taint, they are then called *hyacinths*.

The occidental garnet is of a deep and dark red, and its hardness is lesser. However, some very fine hard garnets are found in Bohemia.—Garnets are also found in Hungary, at Pyrna in Silesia, at S. Sapho in the canton of Berne, in Spain, and in Norway.

The garnet melts in the focus of a good burning glass into a brown mass, which is attracted by the loadstone; and this shows that iron enters considerably into its composition.

Some garnets are found, which contain a little gold. Those called *zingraupen* by the Germans contain tin.

VIII. Tourmalin; *Lapis electricus*.

This is a kind of hard stone, lately brought into notice by its electrical properties. See Tourmalin.

1. Its form is a prism of nine sides of different breadths, mostly truncated, and seldom terminating in a pyramid at each end, which is either composed of three pentagons, or of nine triangles.
2. When heated in the fire, it gives signs of contrary electricity on the two opposite ends of their prismatic form. But many of these stones are not in the least electric. However, on being rubbed, they become electric in their sides, like other diaphanous gems.
3. It is as hard almost as the topaz, and strikes fire with steel.
4. It melts by itself in a strong fire, though with difficulty.
5. With the microcosmic salt it melts perfectly; but only in part with borax.
6. With mineral alkali it is divided into a kind of powder.
7. The three mineral acids dissolve it when first reduced to a powder.
8. It bears a greater similarity to schoerl than to any other stone: but its component parts show

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in general, had undergone but little alteration, so that he could not by this method determine the component parts. M. Achard, however, was more successful, and by a similar method determined the component parts of this gem to be five grains of an earth, which, distilled with vitriolic acid, became volatile; eight grains of calcareous earth, six grains of magnesia, two grains of calx of iron, three grains of calx of copper, and 456 of siliceous earth.

M. Klaproth never met with any volatile earth or magnesia in his experiments on this gem; and therefore concludes, that the chrysoprasus used by him had been essentially different from that made use of by M. Achard; and he seems not to give credit to the account of any copper being found in it.

8. One part of crude chrysoprasus, well powdered and washed with two parts of mild vegetable alkali, yielded a violet-coloured glass, which in the atmosphere ran into a brownish coloured liquor.

9. Five parts of the gem, with four of mild alkali, gave a beautiful violet-coloured glass after being two hours in fusion.

10. Equal parts of crude chrysoprasus and mild mineral alkali, yielded a transparent glass in thin laminæ, of a brown colour, resembling that of the tourmalin, the surface being marked with fine reticulated veins; which veins arose from small grains of very fine reduced nickel placed in lines against one another.

11. Equal parts of crude chrysoprasus and calcined borax, gave a clear, transparent, and brown glass, resembling the smoky topaz.

12. Equal parts of chrysoprasus, extracted by vitriolic acid and calcined borax, yielded a similar glass of a clear brown colour; "which proves (says our author), that the vitriolic acid was incapable of perfectly analysing the chrysoprasus, though I had used a double portion of the earth."

13. Eighty grains of prepared siliceous earth, sixty grains of mild fixed alkali, with three grains of calx of nickel procured from the chrysoprasus, yielded a beautiful, clear, and violet-coloured glass.

14. On substituting three grains of calx produced from an ore of nickel, a glass was produced exactly like the former.

15. Sixty grains of prepared siliceous earth and calcined borax, with three grains of calx of nickel from the chrysoprasus, yielded a transparent glass of a clear brown colour.

16. Sixty grains of prepared siliceous earth and vitrified phosphoric acid, with three grains of calx of nickel from the chrysoprasus, gave a glass of the colour of honey.

17. Thus the attempts of M. Klaproth to recompose the chrysoprasus proved abortive. From his experiments, however, he deduces the following conclusions: 1. The blue colour observable in the glass produced by fusing the chrysoprasus with vegetable alkali, arises entirely from the nickel contained in the gem; and the experiment shows that the calx of nickel, when purified as much as possible, has the surprising property of tinging glass frits prepared with vegetable alkali of a blue colour. "But (says he) why was not this colour also obtained with soda? and what is the cause of a difference so little to be expected?" 2. By these experiments the supposition of M. Sage is refuted, that the metallic matter which colours the chrysoprasus is cobalt: "many metallic substances besides cobalt, it is well known, give by certain processes a blue glass; thus cobalt,

show that it may be ranged with propriety in this place, along with other precious stones: as the argillaceous earth is also the most prevalent in its composition.

a. The oriental tourmalines are found in the island of Ceylon. They are transparent, of a dark brown yellow; and their specific gravity is from 3062 to 3295.

b. From Brasil. Transparent. These are green for the most part; but there are also some red, blue, and yellow: their specific gravity is from 3075 to 3180.

c. From Tyrol. Of so dark a green as to appear opaque. Their specific gravity is about 3050. These are found in beds of steatites and lapis-ollaris, among the micaceous veins, talcs, and hornblende of Schneeberg, Jurzagl, and Zillerthal, in the mountains of Tyrol.

d. From the mountains of Old Castile in Spain. These are transparent, and have the same properties as the preceding ones.

IX. The opal, *Opalus;* the *girasole* of the Italians.—This is the most beautiful of all the flint kind, owing to the changeable appearance of its colours by reflection and refraction, and must therefore be described under both these circumstances.

1. The opal of Nonnius, the *Sangenon* of the Indians. This appears olive-coloured by reflection, and seems then to be opaque; but when held against the light, is found transparent and of a fine ruby red colour.

There is, however, another of the same kind in Sweden, which by reflection appears rather brown; but by refraction it is red, with violet veins.

2. The white opal. Its ground is white, of a glass-like complexion, from whence are thrown out green, yellow, purple, and bluish rays; but it is of a reddish or rather flame-colour when held against the light.

a. Of many colours; the oriental opal.

b. Of a milky colour.

c. Bluish, and semi-transparent. This is not so much valued as those which are more opaque, because it is easier to be imitated by art.

§ 2. *Of Quartz.*

This stone is very common in Europe, and easier to be known than described. It is distinguished from the other kinds of the siliceous order by the following qualities.

1. That it is most generally cracked throughout, even in the rock itself; whereby,
2. As well as by its nature, it breaks irregularly, and into sharp fragments.
3. That it cannot easily be made red-hot without cracking still more.
4. It never decays in the air.
5. Melted with pot-ashes, it gives a more solid and fixed glass than any other of the siliceous order.
6. When there has been no interruption in its natural accretion, its substance always crystallises into hexagonal prisms pointed at one or both ends.
7. It occurs in clefts, fissures, and small veins in rocks. It very seldom forms large veins, and still seldomer whole mountains, without being mixed with heterogeneous substances.

According to Mr Kirwan, quartz neither loses its hardness nor its weight by calcination. Its texture is lamellar. These stones are in general the purest of the siliceous kind, though most contain a slight mixture of other earths; the most obvious distinction among them arises from their transparency or opacity.

Quartz is found,

(1.) Pure.

A. Solid, of no visible particles, with a glossy surface. Fat quartz.

a. Uncoloured and clear. This has no crystallised form, but is nevertheless as clear as quartz crystals of the best water.

b. White, the common fat quartz.

c. Blue

cobalt gives a blue colour to combinations of the mineral alkali with phosphoric acid, to mineral alkali itself, to potash, and to borax. The acid of tungsten (falsely so called) also gives a blue colour to frits made with phosphoric salts, but not to those made with borax; the calx of nickel gives a blue colour only to frits made with potash, brown to those with mineral alkali and borax, and yellow, like honey, to combinations of phosphoric acid with mineral alkali." 3. As the chrysoprasus gives a brown colour with borax, and the solution of this stone in muriatic acid gives no signs of cobalt dissolved in the same acid; this shows that there is no cobalt in the stone. Mr Sage, indeed, pretends, that he has obtained a blue glass from the chrysoprasus and borax; but this is contradicted by experience. 4. The mineralogical character of the chrysoprasus, therefore, is a quartz coloured green by nickel. Three hundred grains of it contain $288\frac{1}{2}$ of siliceous earth calcined to redness, one quarter of a grain of pure aluminous earth, two grains and an half of calcareous earth calcined to redness, three grains of calx of nickel, and one quarter of a grain of calx of iron. All these were extracted in the experiments; and there were besides five grains and an half of waste.

Our author mentions, that in the collections of chrysoprasus which have been brought to him, he has constantly observed green opal, in bits of vein from half an inch to an inch, and fixed in its borders: the reddish, yellow, and white opals, on the contrary, are generally met with on a green or brownish petrosilex. But the white opal, which, as well as the green, is found in pieces of the nature of matrix, differs from the true opal, approaching the chalcedony and the opaque milky quartzes. This kind of transparent opal, radiated with a whitish blue, contains the following ingredients in its composition: Siliceous earth, 237 grains; aluminous earth, a quarter of a grain; calx of iron, a quarter of a grain—in all, $237\frac{1}{2}$ grains. In 240 grains were two and an half of waste. The colour of this stone, as well as the chrysoprasus, in our author's opinion, is derived from nickel.

c. Blue.
d. Violet.
B. Grained.
a. White. *b*. Pale green.
C. Sparry quartz.
This is the fcarceft; and ought not to be confounded with the white felt-fpat, being of a fmoother appearance, and breaking into larger and more irregular planes.
a. Whitifh yellow. *b*. White.
D. Cryftallifed quartz. Rock cryftal. Quartz cryftal.
1. Opaque, or femi-tranfparent.
a. White, or of a milk colour.
b. Red, or of a carnelian colour.
c. Black.
2. Clear.
a. Blackifh brown, fmoky topaz, or *raunch topaz* of the Germans.
b. Yellow; found in Bohemia, and fold inftead of topazes.
c. Violet; the amethyft from Saxony, Bohemia, and Dammemore in Upland (B.)
d. Uncoloured; rock cryftal, properly fo called. When thefe coloured cryftals are not clear, they are called *flufs;* for inftance, *topaz-flufs*, *amethyft-flufs*, &c. (C.)
(2.) Impure quartz.
A. Mixed with iron, in form of a black calx.—This is of a gloffy texture, and contains a great quantity of iron.
B. Mixed with copper in form of a red calx.
a. Red.

§ 3. *Of Flints.*

The flint (*Silex pyromachus*, *Lapis corneus*, or the *hornftein* of the Germans) forms a kind of intermediate fubftance between quartz and jafper; both which, however, it fo nearly refembles, that it is not eafy to point out fuch characters as fhall readily diftinguifh it from them. We can only, therefore, fpeak of its properties comparatively.

1. It is more uniformly folid, and not fo much cracked in the mafs as the quartz; and,
2. It is more pellucid than the jafper.
3. It bears being expofed to the air without decaying better than the jafper, but not fo well as the quartz.
4. It is better for making of glafs than the jafper, but is not quite fo good as quartz for that purpofe.
5. Whenever there has been an opportunity in this matter of its fhooting into cryftals, quartz cryftals are always found in it; juft as if the quartz made one of its conftituent parts, and had in certain circumftances been fqueezed out of it: this is to be feen in every hollow flint, and its clefts, which are always filled up with quartz.
6. It often fhows moft evident marks of having been originally in a foft and flimy tough ftate like glue or jelly.

The feveral varieties of this fpecies have obtained more diftinct names with refpect to their colours than from any real difference in their fubftance; but thefe are ftill neceffary to be retained, as the only names ufed by jewellers and others, who know how to value them accordingly.

I. Jade. *Lapis nephriticus. Jafpachates.*
The true lapis nephriticus feems to belong to this filiceous order, as it gives fire with fteel, and is femi-pellucid like flint; it does not harden

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(B) The moft tranfparent are called *falfe diamonds*, *Briftol*, *Kerry ftones*, and *Alençon diamonds*, &c. The coloured tranfparent cryftals derive their tinge generally from metallic calces, though in exceeding fmall portions: they all lofe their colours when ftrongly heated. Thefe are what we call falfe gems, viz.

The *red*, from Oran in Barbary, *falfe rubies*.
The *yellow*, from Saxony, *falfe topazes*.
The *green*, from Dauphiny, (very rare) *falfe emeralds*, or *prafes*.
The *violet*, from Vil in Catalonia, *falfe amethyfts*.
The *blue*, from Puy in Valay, France, *falfe fapphires*.

There are alfo *opal*, or *rainbow cryftals*, fome of which make a very fine appearance; the various colours of which are thrown out in zones acrofs the furface, though they never fhine like the oriental opal.

(C) M. Fourcroy makes a remarkable difference between the cryftals and the quartz, by affirming that the former are unalterable in the fire, in which they neither lofe their hardnefs, tranfparency, nor colour; whilft the quartz lofes the fame qualities, and is reduced by it to a white and opaque earth. He claffes the rock cryftals,

1ft, According to their *form*, viz. 1. Infulated-hexagonal-cryftals, ending in two pyramids of fix faces, which have a double refraction, or fhow two images of the fame object when looked through. 2. Hexagonal cryftals united, having one or two points. 3. Tetrædral, dodecædral, flated cryftals; and which, though hexagonal, have neverthelefs their planes irregular. 4. Cryftals in large maffes, from the ifland of Madagafcar, which have a fimple refraction.

2dly, As to the colour, they are either diaphonous, reddifh, fmokey, or blackifh.

3dly, As to accidental changes, fome are *hollow:* fome contain *water* within one or more cavities: fome are cafed, viz. one within the other: fome are of a round form, as the pebbles of the Rhine: fome have a cruft of metallic calces, or of a pyrites: fome are of a geodical form, viz. cryftallifed in the infide of a cavity: fome feem to contain amianthe, or afbeftus, and others contain fhirls.

The fame author reckons among cryftals, the oriental topaz, the hyacinth, the oriental fapphire, and the amethyft. Mr Daubenton has always looked on this laft as a quartzous cryftal.

den in fire, but melts by the solar heat in the focus of a burning lens into a transparent green glass with some bubbles. That called by the name of *circoncision stone*, which comes from the Amazon river, melts easier, in the same solar fire, into a brown opaque glass, which is far less hard than the stone itself. (*Macquer*.)

This stone is superior in hardness to quartz, though from its unctuosity to the touch, one would suspect it to contain a large portion of argillaceous earth, or rather of magnesian earth, as Mr Kirwan seems to suspect.

Its specific gravity is from 2,970 to 3,389.—It is of a granular texture, of a greasy look, and exceedingly hard: is scarcely soluble in acids, at least without particular management, and is infusible in the fire. M. Saussure seems to have extracted iron from it.

a. It is sometimes of a whitish milky colour, from China; but mostly

b. Of a greenish, or

c. Deep-green colour, from America.

d. Grey, yellowish, and olive colour: these are the vulgar *lapis nephriticus*, they being supposed to cure the nephritic pains by their external application to the loins.

The semi-pellucidity, hardness, and specific gravity, are the characters by which the lapis nephriticus may be distinguished from other stones.

II. Cat's eye; *Pseudopalus*. The sun-stone of the Turks, called *guneche*.

This stone is opaque, and reflects green and yellowish rays from its surface: it is found in Siberia. It is very hard and semi-transparent, and has different points, from which light is reflected with a kind of yellow-brown radiation, somewhat similar to the eyes of cats, from whence it had its name. Jewellers do not fail to cut them round to the greatest advantage. The best of these stones are very scarce. One of these of one inch diameter was in the cabinet of the grand duke of Tuscany.

III. *Hydrophanes*, or *Oculus Mundi*; also called *Lapis mutabilis*.

The principal property which distinguishes this from all other stones, is that it becomes transparent by mere infusion in any aqueous fluid; but it gradually resumes its opacity when dry.

IV. The onyx. *Onyx camehuja*. Memphites. It is found of two sorts.

a. Nail-coloured onyx, having pale flesh-coloured and white lines.

b. With black and white lines. The oriental onyx.

V. The chalcedony, or white agate, is a flint of a white colour, like milk diluted with water, more or less opaque: it has veins, circles, and round spots. It is said to be softer than the onyx, but much harder than those agates which are sometimes found of the same colour.

a. The white opaque chalcedony, or *caholong*, from the Buckharish Calmucks. This was first made known by one Renez, a Swedish officer, who for several years had been in that country. The inhabitants find this flint on the banks of their rivers, and work idols and domestic vessels out of it.

b. Of white and semi-transparent strata; from Ceylon.

c. Bluish grey; from Ceylon and Siberia.

VI. The carnelian. *Carniolus*.

Is of a brownish red colour, and often entirely brown. Its name is originally derived from its resemblance to flesh, or to water mixed with blood.

a. Red.

b. Yellowish brown, looks like yellow amber. It is said not to be so hard as the chalcedony.

VII. The sardonyx.

This is a mixture of the chalcedony and carnelian, sometimes stratumwise, and sometimes confusedly blended and mixed together.

a. Striped with white and red strata: this serves as well cut in cameo as the onyx.

b. White, with red dendritical figures. This very much resembles that agate which is called the *mocha stone*; but with this difference, that the figures are of a red colour in this, instead of black, as in that agate.

Between the onyx, carnelian, chalcedony, sardonyx, and agate, there seems to be no real difference, except some inexplicable degrees of hardness.

VIII. The agate; *Achates*.

This name is given to flints that are variegated with different colours, promiscuously blended together; and they are esteemed in proportion to their mixture of colours, their beauty, and elegance. Hence also they have obtained variety of names, mostly Greek, as if the business of the lapidary in cutting of them, and admiring their several beauties and figures, had been derived from that nation alone (D).

a. Brown opaque agate, with black veins, and dendritical figures; the Egyptian pebble.

b. Of a chalcedony colour; *achates chalcedonisans*.

c. Semi-transparent, with lines of a blackish brown colour, and dendritical figures; the mocha stone.

d. Semi-transparent, with red dots; *Gemma divi Stephani*. When the points are very minute, so as to give the stone a red appearance, it is by some called *Sardea*.

e. Semi-

(D) On the side of a hill near the church of Rothes in Moray, is a quantity of fine agate of elegant red and white colours. It is very hard, heavy, of a smooth uniform texture, and of a considerable brightness; in which the red are remarkably clear, and finely mixed and shaded through the stone. Mr Williams says that this is the largest and most beautiful agate rock he ever saw; and so fine and hard as to be capable of the highest lustre in polishing.

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e. Semi-tranſparent, with clouds of an orange colour.

f. Deep red or violet, and ſemi-tranſparent.

g. Of many colours, or variegated.

h. Black.

IX. Common Flint; *Pyromachus*.

This, in reality, is of the ſame ſubſtance as the agate; but as the colours are not ſo ſtriking or agreeable, it is commonly conſidered as a different ſubſtance.

a. Blackiſh grey, from the province of Skone.

b. Yellow ſemi-tranſparent, from France.

c. Whitiſh grey.

d. Yellowiſh brown.

When the flints are ſmall, they are in England called *pebbles*; and the Swediſh ſailors, who take them as ballaſt, call them *ſingel*.

X. Chert; *Petroſilex, Lapis Corneus*. The *hornſtein* of the Germans.

This is of a coarſer texture than the preceding, and alſo leſs hard, which makes it conſequently not ſo capable of a poliſh. It is ſemi-tranſparent at the edges, or when it is broke into very thin pieces.

a. Chert of a fleſh colour, from Carl-Schakt, at the ſilver-mine of Salberg, in the province of Weſtmanland.

b. Whitiſh yellow, from Salberg.

c. White, from Kriſtierſberg, at Nya Kopparberget in Weſtmanland.

d. Greeniſh, from Preſtgrufvan, at Hellefors in Weſtmanland.

Chert runs in veins through rocks, from whence its name is derived. Its ſpecific gravity is from 2590 to 2700. In the fire, it whitens and decrepitates like ſilex, but is generally ſo fuſible as to melt *per ſe*. It is not totally diſſolved in the dry way by the mineral alkali; but borax and microcoſmic ſalt diſſolve it without effervеſcence. Its appearance is duller and leſs tranſparent than common flint. The reddiſh Petro-ſilex uſed in the Count de Lauragar's porcelain manufacture, and called there *felt ſpat*, contained 72 *per cent.* of ſilex, 22 of argill, and 6 of calcareous earth.

There are not yet any certain characters known by which the cherts and jaſpers may be diſtinguiſhed from each other: by ſight, however, they can eaſily be diſcerned, viz. the former (the cherts) appearing tranſparent, and of a fine ſparkling texture, on being broken; whereas the jaſper is grained, dull, and opaque, having the appearance of a dry clay. The chert is alſo found forming larger or ſmaller veins, or in nodules like kernels in the rocks; whereas the jaſper, on the contrary, ſometimes conſtitutes the chief ſubſtance of the higheſt and moſt extended chain of mountains. The chert is likewiſe found plentifully in the neighbourhood of ſcaly limeſtone, as flints in the ſtrata of chalk. What connection there may be between theſe bodies, perhaps time will diſcover.

But flints and agates being generally found in looſe and ſingle irregular nodules, and hardly in rocks, as the chert, it is a circumſtance very inſufficient to eſtabliſh a difference between them; for there is the agate-ſtone, near Conſtantinople, running vein-like acroſs the rock with its country of the ſame hardneſs, and as fine and tranſparent as thoſe other agates which are found in round nodules at Deux-ponts. We muſt, therefore, content ourſelves with this remark concerning flints, viz. That they ſeem to be the only kind of ſtone hitherto known, of which a very large quantity has been formed in the ſhape of looſe or ſeparate nodules, each ſurrounded with its proper cruſt; and that the matter which conſtitutes this cruſt has been ſeparated from the reſt of the ſubſtance, in like manner as ſandiver or glaſs-gall ſeparates from, and ſwims upon, glaſs, during its vitrification; though ſometimes the formation of this cruſt may be prevented by the too ſudden hardening of the matter itſelf.

Other ſpecies of ſtones, which are found in looſe pieces or nodules, except ores and ſome ſorts of ſtalactites, ſhow evidently by their cracks, angles, and irregular figures, that they have been torn from rocks, rolled about, and rubbed againſt one another in torrents, or by ſome other violent motions of water.

That flints had originally been in a ſoft ſtate, M. Cronſtedt obſerves, is eaſy to be ſeen in the Egyptian pebbles, which have impreſſions of ſmall ſtones, ſand, and ſometimes, perhaps, graſs; which, however, have not had any ingreſs into the very flint, but ſeem only to have forced the above agate-gall or cruſt out of the way.

§ 4. *Of Jaſpers.*

Jasper, *jaſpis*, (the *diaſpro* of the Italians), is a name given to all the opaque flints whoſe texture reſembles dry clay, and which have no other known quality whereby they may be diſtinguiſhed from other flints, except that they may be more eaſily melted in the fire; and this quality perhaps may proceed from the heterogeneous mixture, probably of iron.

I. Pure jaſper; which by no means yet known can be decompounded.

a. Green with red ſpecks or dots; the *heliotrope*, or blood-ſtone. b. Green. c. Red. d. Yellow. e. Red with yellow ſpots and veins. f. Black.

II. Jaſper containing iron; *Jaſpis martialis Sinople*.

A. Coarſe-grained.

a. Red and reddiſh brown; *ſinople*.

B. Steel-grained, or fine-grained.

a. Reddiſh brown: looks like the red ochre or chalk uſed for drawing; and has partition veins, which are unctuous to the touch, like a fine clay, and other like kinds.

C. Of a ſolid and ſhining texture, like a ſlag.

a. Liver-coloured; and, b. Deep red. c. Yellow. This laſt mentioned, when calcined, is attracted by the loadſtone; and being aſſayed, yields from 12 to 15 *per cent.* of iron. (E.)

§ 5.

(E) Near Portſoy in Banff-ſhire is an extenſive rock of jaſper; ſome parts of which contain a beautiful mixture of green and red, which appear finely ſhaded and clouded through the body of the ſtone when poliſhed. Mr Williams is of opinion that it would be a very valuable quarry if worked.

§ 5. *Felt-spars.*

I. Rhombic quartz; *Spatum scintillans.*

This has its name from its figure, but seems to be of the same substance as the jasper. We have not, however, ranked them together, for want of true marks to distinguish the different sorts of the flinty tribe from one another.

This kind is found,

1. Sparry.
   a. White. *b.* Reddish brown. *c.* Pale yellow. *d.* Greenish.
2. Crystallised.
   a. In separate or distinct rhomboidal crystals.

II. Labradore stone; *Spatum rutilum versicolor.*

Its colour is commonly of a light or of a deep grey, and mostly of a blackish grey: but when held in certain positions to the light, discovers different varieties of beautiful shining colours, as lazuly-blue, grass-green, apple green, pea-green; and seldom a citron-yellow; some have an intermediate colour betwixt red-copper and tombac-grey; besides other colours between grey and violet. These colours are seen for most part in spots; but sometimes in stripes, on the same piece.

III. White feltspar; *Terra Silicea Magnesia & ferro intimè mixta.*

This stone has been described by Mr Bayen: and is found at St Marie aux mines in Lorrain. —It is of a white opaque colour, spotted with ochre on the outside.

§ 6. *Of the Garnet Kinds.*

The substances of this *genus* (which is considered by Cronstedt as an *order*) are analogous to gems; since all these are composed of the siliceous, calcareous, and argillaceous earths, with a greater or less proportion of iron. The opaque and black garnets contain about 20 hundredths of iron: but the diaphanous ones only two hundredths of their weight, according to Bergman. The garnets, properly so called, contain a greater quantity of siliceous earth than the shirls, and both are now justly ranked with the siliceous earths.

The species are,

I. Garnet; *Granatus.*

This is a heavy and hard kind of stone, crystallising in form of polygonal balls, and mostly of a red, or reddish brown colour.

A. Garnet mixed with iron; *Granatus martialis.*

1. Coarse-grained garnet-stones, without any particular figure; in Swedish called *Granatberg*; in German, *Granatstein.*
   a. Reddish-brown garnet. *b.* Whitish-yellow. *c.* Pale yellow.
2. Crystallised garnet.
   a. Black. *b.* Red: semi-transparent, and cracked; transparent. *c.* Reddish-yellow; transparent; the jacinth, or hyacinth. *d.* Reddish brown. *e.* Green. *f.* Yellowish-green. *g.* Black.

B. Garnet mixed with iron and tin.

1. Coarse-grained, without any particular figure.
   a. Blackish-brown.
2. Crystallised.
   a. Blackish-brown.
   b. Light-green or white.

C. Garnet mixed with iron and lead.

1. Crystallised.
   a. Reddish-brown.

II. Cockle, or shirl. *Corneous crystallisatus Wallerii; Stannum crystallis columnaribus nigris Linnæi.*

This is a heavy and hard kind of stone which shoots into crystals of a prismatical figure, and whose chief colours are black or green. Its specific gravity is the same as the garnets, viz. between 3000 and 3400, though always proportionable to their different solidity.

A. Cockle, or shirl, mixed with iron.

1. Coarse, without any determined figure.
   a. Green,
2. Sparry.
   a. Deep green, (the mother of the emeralds), from Egypt.
   b. Pale green.
   c. White. This occurs very frequently in the scaly limestones; and its colour changes from deep green to white, in proportion as it contains more or less of iron.
3. Fibrous, striated cockle, or shirl: it looks like fibres or threads made of glass.
   A. Of parallel fibres. *a.* Black. *b.* Green *c.* White.
   B. Of concentrated fibres: The starred cockle, or shirl, from its fibres being laid stellarwise.
   a. Blackish green. *b.* Light green. *c.* White.
4. Crystallised cockle, or shirl.
   a. Black. To this variety belong most of those substances called *imperfect asbesti*; and as the cockle perfectly resembles a slag from an iron furnace, both in regard to its metallic contents and its glassy texture, it is no wonder that it is not soft enough to be taken for an asbestus. It has, however, only for the sake of its structure, been ranked among the asbesti. The striated cockle, or shirl, compared to the asbesti, is of a shining and angular surface (though this sometimes requires the aid of the magnifying-glass to be discovered), always somewhat transparent, and is pretty easily brought to a glass with the blow-pipe, without being consumed as the pure asbesti seem to be.
   b. Deep green.
   c. Light green.
   d. Reddish brown. The *tauffstein* is of this colour, and consists of two hexagonal crystals of cockle grown together in form of a cross; this the Roman Catholics wear as an amulet, and is called in Latin *lapis crucifer*, or the cross stone.

The figure of the cockle crystals is uncertain, but always prismatical: the cockle from Yxsio at Nya Kopparberg, is quadrangular: the French kind has nine sides or planes; and the tauffstein is hexagonal.

The name *cockle* for these substances is an old Cornish mineral name; but is also given sometimes to other very different matters.

We

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We have not in England any great quantity of species of cockles; the chief are found in the tin mines of Cornwall, and some fine crystallised kinds have been brought from Scotland.

The English mineral name of *call*, has been used by some authors as synonymous with *cockles*, and they are confounded together at the mines; but the call, definitely speaking, is the substance called *wolfram* by the Germans, &c.

Garnets, though small, are often found in micaceous stones in England; but extreme good garnets are found in great plenty also in like stones in Scotland.

III. Rowley rag, (*Kirwan.*) This stone is of a dusky or dark grey colour, with numerous minute shining crystals. Its texture is granular: by exposure to the air it acquires an ochry crust. Its specific gravity is 2748. Heated in an open fire it becomes magnetic. In strong heat it melts *per se*, but with more difficulty than basaltes. According to Dr Withering's analysis, 100 parts of it contain 47,5 of siliceous earth, 32,5 of argil, and 20 of iron.

IV. Siliceous muriatic spar, (*Id.*) This stone is of a hard, solid, and sparry texture; of a grey, ochry, dull colour, but internally bright. It gives fire with steel: yet it effervesces with acids. In a strong heat it grows brown; but at last it melts *per se*. One hundred parts of this stone contain fifty parts of silex: the remainder is mild magnesia and iron; but in what proportion is not mentioned (See *Journal de Physique*, Supplement, vol. xiii. p. 216.)

V. Turky stone; *cos Turcica*, (*Id.*) This stone is of a dull white colour, and often of an uneven colour, some parts appearing more compact than others, so that it is in some measure shattery. It is used as a whetstone: and those of the finest grain are the best hones for the most delicate cutting tools, and even for razors, lancets, &c. Its specific gravity is 2598. It gives fire with steel; yet effervesces with acids. Mr Kirwan found that 100 parts of it contains 25 of mild calcareous earth, and no iron. There probably are two sorts of stones known by this name, as Mr Wallerius affirms, that which he describes neither to give fire with steel nor effervesce with acids.

VI. Ragg stone. The colour of this stone is grey. Its texture is obscurely laminar, or rather fibrous, but the laminæ or fibres consist of a congeries of grains of a quartzy appearance, coarse and rough. Its specific gravity is 2729. It effervesces with acids; and gives fire with steel. Mr Kirwan found it to contain a portion of mild calcareous earth, and a small proportion of iron. It is used as a whet-stone for coarse cutting tools.

[The siliceous grit, *cos arenarius*, and other compounds of the siliceous earth, &c. will be found in a subsequent division of this article.]

Observations on the œconomical Uses of the Siliceous Order.

The Europeans have no farther trouble with the precious stones than either to cut them from their natural or rough figure, or to alter them when they have been badly cut in the East Indies; in which latter circumstances they are called *labora*: and it may be observed, that for cutting the ruby, spinell, ballas, and chrysolite, the oil of olive is required, instead of any other liquid, to be mixed with the diamond powder, in the same manner as for cutting the diamond itself.

If the petty princes in those parts of the Indies, where precious stones are found, have no other power nor riches proportionable to the value of these gems, the reason of it is as obvious as of the general weakness of those countries where gold and silver abound, *viz.* because the inhabitants, placing a false confidence in the high value of their possessions, neglect useful manufactures and trade, which by degrees produces a general idleness and ignorance through the whole country.

On the other hand, perhaps, some countries might safely improve their revenues by such traffic. In Saxony, for example, there might probably be other gems found besides aqua marines and topazes; or even a greater trade carried on with these than at present, without danger of bad consequences, especially under the direction of a careful and prudent government.

The *half-precious* stones, so called, or gems of less value, as the common opal, the onyx, the chalcedony, the cornelian, and the coloured and colourless rock crystals, have been employed for ornaments and economical utensils, in which the price of the workmanship greatly exceeds the intrinsic value of the stones. The ancients used to engrave concave and convex figures on them, which now-a-days are very highly valued, but often with less reason than modern performances of the same kind. These stones are worked by means of emery on plates and tools of lead, copper, and tin, or with other instruments; but the common work on agates is performed at Oberstein with grind-stones at a very cheap rate. When once such a manufactory is established in a country, it is necessary to keep it up with much industry and prudence, if we would wish it to surmount the caprice of fashions; since, howmuchsoever the natural beauties of these stones seem to plead for their pre-eminence, they will at some periods unavoidably sink in the esteem of mankind; but they will likewise often recover, and be restored to their former value.

The grindstones at Oberstein are of a red colour, and of such particular texture, that they neither become smooth, nor are they of too loose a composition.

Most part of the flinty tribe is employed for making glass, as the quartz, the flints, the pebbles, and the quartzose sands. The quartz, however, is the best; and if used in due proportion with respect to the alkali, there is no danger of the glass being easily attacked by the acids, as has sometimes happened with glass made of other substances, of which we had an instance of bottles filled with Rhenish and Moselle wines during the time of a voyage to China.

In the smelting of copper ores, quartz is used, to render the slag glassy, or to vitrify the iron; quartz being more useful than any other stone to prevent the calcination of the metal.

The quartzose sand which constitutes part of many stones, and is also used in making crucibles and such vessels,

vessels, contributes most of all to their power of resisting fire.

It appears likewise probable that the quartzose matter makes the grind and whetstone fit for their intended purposes. (*Magellan.*)

Order V. *The* Argillaceous Earths.

The principal character whereby those may be distinguished from other earths is, that they harden in the fire, and are compounded of very minute particles, by which they acquire a dead or dull appearance when broken.

I. *Argilla aerata; lac lunæ.*

This fanciful name was heretofore thought to denote a very fine species of calcareous earth; but Mr Screber has lately shown, that the earth to which this name is given, is a very uncommon species of argill. It is generally found in small cakes of the hardness of chalk; and like that, it marks white. Its hardness is nearly as that of steatites, and it does not feel so fat as common clay does. Its specific gravity is 1669; its colour snow white. When examined with a microscope, it is found to consist of small transparent crystals; and by his experiments it appears plainly to be an argill saturated with fixed air. It effervesces with acids, and contains a very small proportion of calcareous earth and sometimes of gypsum, besides some feeble traces of iron. It is found near Halles.

II. Porcelain clay; *Terra porcellanea*, vulgo *Argylla apyra*, very refractory; the *kaolin* of the Chinese.

(1.) Pure.

A Diffusible in water.

1. Coherent and dry.

a White.

2. Friable and lean.

a. White.

(2.) Mixed with phlogiston

A. Diffusible in water.

a. White and fat pipe clay. *b.* Of a pearl colour. *c.* Bluish grey. *d.* Grey. *e.* Black. *f.* Violet.

These contain a phlogiston, which is discovered by exposing them to quick and strong fire, in which they become quite black interiorly, assuming the appearance of the common flints, not only in regard to colour, but also in regard to hardness: but if heated by degrees, they are first white, and afterwards of a pearl colour. The fatter they seem to be, which may be judged both by their feeling smooth and unctuous, and by their shining when scraped with the nail, they contain a larger quantity of the inflammable principle. It is difficult to determine, whether this strongly inherent phlogiston be the cause of the above-mentioned pearl-colour, or prevents them from being burnt white in a strong fire; yet no heterogeneous substance can be extracted from them, except sand, which may be separated from some by means of water; but which sand does not form any of the constituent parts of the clays. If they be boiled in aqua regis in order to extract any iron, they are found to lose their viscosity.

III. Stone-marrow; *Lithomarga. Keffekil* of the Tartars.

1. When dry, it is as fat and slippery as soap; but,

2. Is not wholly diffusible in water, in which it only falls to pieces, either in larger bits, or resembles a curd-like mass.

3. In the fire it easily melts to a white or reddish frothy slag, consequently is of a larger volume than the clay was before being fused.

4. It breaks into irregular scaly pieces.

A. Of coarse particles: Coarse stone-marrow.

a. Grey.

b. Whitish yellow, from the Crim Tartary, where it is called *keffekil*, and is said to be used for washing instead of soap.

B. Of very fine particles; fine stone-marrow.

a. Yellowish brown; *Terra Lemnia.*—Is of a shining texture, falls to pieces in the water with a crackling noise; it is more indurated than the preceding, but has otherwise the same qualities.

IV. Bole, (iron clay.)

This is a fine and dense clay of various colours, containing a great quantity of iron, which makes it impossible to know the natural and specifical qualities of the bole itself, by any easy method hitherto in use. It is not easily softened in water, contrary to what the porcelain and the common clays are, (I. & VI.); but either falls to pieces in form of small grains, or repels the water, and cannot be made ductile. In the fire it grows black, and is then attracted by the loadstone.

A. Loose and friable boles, or those which fall to a powder in water.

a. Flesh-coloured bole.

b. Red.

1. Fine; *Bolus Armenus.*

2. Coarse; *Bolus communis officinalis.*

3. Hard: *Terra rubrica.*

c. Green; *Terre verte.*

1. Fine.

2. Coarse.

d. Bluish-grey, is ductile as long as it is in the rock, but even then repels the water; it contains 40 per cent. of iron; which metal being melted out of it in a close vessel, the iron crystallises on its surface.

e. Grey.

1. Crystallised in a spherical polygonal figure.

2. Of an undeterminate figure.

B. Indurated bole.

A. Of no visible particles.

This occurs very often in form of slate, or layers, in the earth; and then is made use of as an iron ore. However, it has usually been considered more in regard to its texture than to its constituent parts; and has been called *slate*, in common with several other earths which are found to have the same texture.

a. Reddish-brown; in most collieries, between the seams of coal.

b. Grey.

B. Of scaly particles.—The *hornblende* of the Swedes.

Argillaceous Earths.

It is diſtinguiſhed from the martial glimmer, or mica, by the ſcales being leſs ſhining, thicker, and rectangular.

a. Black.—This, when rubbed fine, gives a green powder.

b. Greeniſh.

V. Zeolyte.

This is deſcribed in its indurated ſtate in the Tranſactions of the academy of ſciences at Stockholm for the year 1756, and there arranged as a ſtone *ſui generis* in regard to the following qualities.

1. It is a little harder than the fluors and the other calcareous ſpars; it receives, however, ſcratches from the ſteel, but does not ſtrike fire with it.
2. It melts eaſily by itſelf in the fire, with a like ebullition as borax does, into a white frothy ſlag, which cannot without great difficulty be brought to a ſolidity and tranſparency.
3. It is more eaſily diſſolved in the fire by the mineral alkali (*ſal ſodæ*), than by borax or the microcoſmic ſalt.
4. It does not ferment with this laſt ſalt, as lime does; nor with the borax, as thoſe of the gypſeous kind,
5. It diſſolves very ſlowly, and without any effervefcence, in acids, as in oil of vitriol and ſpirit of nitre. If concentrated oil of vitriol be poured on pounded zeolites, a heat ariſes, and the powder unites into a maſs.
6. In the very moment of fuſion it gives a phoſphoric light.

There have lately been diſcovered ſome of the zeolites, particularly at Adelfors's gold mines in Smoland, in Sweden; of which ſome ſorts do not melt by themſelves in the fire, but diſſolve readily in the acid of nitre, and are turned by it into a firm jelly.

The zeolyte is found in an indurated ſtate:

(1.) Solid, or of no viſible particles.

A. Pure.

a. White.

B. Mixed with ſilver and iron.

a. Blue, *Lapis lazuli.*

(2.) Sparry zeolite. This reſembles a calcareous ſpar, though it is of a more irregular figure, and is more brittle.

a. Light red, or orange-coloured.

(3.) Cryſtalliſed zeolite. This is more common than the two preceding kinds; and is found,

A. In groupes of cryſtals, in form of balls, and with concentrical points.

a. Yellow.

b White.

B. Priſmatical and truncated cryſtals.

a. White.

C. Capillary cryſtals, which are partly united in groupes, and partly ſeparate. In this latter accretion they reſemble the capillary or feathery ſilver ore; and are perhaps ſometimes called *flos ferri*, at places where the nature of that kind of ſtone is not yet fully known.

a. White.

VI. Tripoli.

This is known by its quality of rubbing or wearing hard bodies, and making their ſurfaces to ſhine; the particles of the tripoli being ſo fine as to leave even no ſcratches on the ſurface. This effect, which is called *poliſhing*, may likewiſe be effected by other fine clays when they have been burnt a little. The tripoli grows ſomewhat harder in the fire, and is very refractory: it is with difficulty diſſolved by borax, and ſtill with greater difficulty by the microcoſmic ſalt. It becomes white when it is heated: when crude, it imbibes water, but is not diffuſible in it: it taſtes like common chalk, and is rough or ſandy between the teeth, although no ſand can by any means be ſeparated from it. It has no quality common with any other kind of earth, by which it might be conſidered as a variety of any other. That which is here deſcribed is of a yellow colour, and is ſold by druggiſts. This kind of tripoli has been lately diſcovered in Scotland. But the *rotten-ſtone*, ſo called, is another ſort found in England, viz. in Derbyſhire. It is in common uſe in England among workmen for all ſorts of finer grinding and poliſhing, and is alſo ſometimes uſed by lapidaries for cutting of ſtones, &c.

The tripoli is found,

1. Solid: of a rough texture.

a. Brown.

b. Yellowiſh.

c. Spotted like marble.

2. Friable and compact.

a. Granulated.

b. Brown.

c. Yellowiſh.

VII. Common clay, or brick clay.

This kind may be diſtinguiſhed from the other clays by the following qualities:

1. In the fire it acquires a red colour, more or leſs deep.
2. It melts pretty eaſily into a greeniſh glaſs.
3. It contains a ſmall quantity of iron and of the vitriolic acid, by which the preceding effects are produced.

It is found,

A. Diffuſible in water.

1. Pure.

a. Red clay.

b. Fleſh-coloured, or pale-red.

c. Grey.

d. Blue.

e. White.

f. Fermenting clay.

2. Mixed with lime. See Marle, above.

B. Indurated.

1. Pure.

a. Grey ſlaty.

b. Red ſlaty.

2. Mixed with phlogiſton, and a great deal of the vitriolic acid. See *Alum Ores*, above.

3. Mixed with lime. See Lime, above.

VIII. Argillaceous fiſſile ſtones.

Theſe and many other different kinds of earth have been comprehended under the denomination

Argillaceous EARTHS.

of *schisti*; but to avoid ambiguity we will confine this name to stones of the argillaceous kind.

1. The bluish purple schistus, or common roof slate; *schistus tegularis*.
   Its colour varies to the pale, to the slightly purple, and to the bluish.
   a. The dark-blue slate, *schistus scriptorius*.
2. The pyritaceous schistus.
   This is of a grey colour, brown, blue, or black.
3. The bituminous schistus.
   This is generally black, of a lamellar texture, and of different degrees of hardness.
4. Flag stone.
   This is of a grey, yellowish, or reddish white colour.
5. The argillaceous grit.
   This is called also *sand stone* and *free stone*, because it may be cut easily in all directions.
6. *Killas*.
   This stone is of a pale grey or greenish colour; either lamellar, or coarsely granular. It is found chiefly in Cornwall.
7. *Toadstone*.
   Dr Withering, who has given an analysis of this stone, describes it as being of a dark brownish grey colour, of a granular texture, not giving fire with steel, nor effervescing with acids. It has cavities filled with crystallised spar, and is fusible *per se* in a strong heat. It is found in Derbyshire. See TOADSTONE.

For the œconomical uses of the argillaceous earths, see the article CLAY.

[The compounds of this and other earths will fall to be mentioned under a subsequent division.]

CLASS II. SALTS.

BY this name those mineral bodies are called which can be dissolved in water, and give it a taste; and which have the power, at least when they are mixed with one another, to form new bodies of a solid and angular shape, when the water in which they are dissolved is diminished to a less quantity than is required to keep them in solution; which quality is called *crystallisation*.

In regard to the principal known circumstances or qualities of the mineral salts, they are divided into

1. Acid salts, or mineral acids.
2. Alkaline salts, or mineral alkalies.

Acid SALTS.

Order I. ACID SALTS.

FOR the characters, properties, and phenomena of these, see the article ACID, and CHEMISTRY-*Index*.

Till of late no more mineral acids were known than the vitriolic and marine; the boracic or sedative salt being reckoned as produced artificially: but later discoveries have proved that we may reckon at least *eleven mineral acids*; out of which only two or three have been found in an uncombined state. Those hitherto known are the following, viz. the *vitriolic*, the *nitrous*, the *marine*, the *sparry*, the *arsenical*, the *molybdenic*, the *tungstenic*, the *phosphoric*, the *boracic*, the *succinous*, and the *aerial*. See the article ACID, and CHEMISTRY-*Index*.

I. The vitriolic acid. See CHEMISTRY-*Index*.

II. Nitrous acid.
This acid is by some excluded from the mineral kingdom, because they suppose it to be produced from putrefaction of organic bodies. But these bodies, when deprived of life, are again received amongst fossils, from whence their more fixed parts were originally derived. For the nature of this acid, see CHEMISTRY-*Index*.

III. Acid of common or sea-salt. See CHEMISTRY-*Index*, at *Acid* and *Marine*.

IV. The *fluor* acid, or sparry fluor acid. See CHEMISTRY-*Index*.
This acid is obtained by art, as it has never been found disengaged, but united, to calcareous earth, forming a sparry fluor *, called *Derbyshire fluor*, *Cornish fluor*, *blue John*, or *amethyst root*, when of a purple colour. See p. 72. col. 2. concerning the substances arising from the combination of this acid with calcareous earth.

* See *Fluor Spar*

V. The acid of *arsenic*. See CHEMISTRY-*Index*.

VI. The acid of *molybdena*. *Ibid*.

VII. The acid of *tungsten*. *Ibid*.

VIII. The *phosphoric* acid. *Ibid*.

IX. The *boracic* acid. *Ibid*.

X. The succinous or *amber* acid. *Ibid*.

XI. Aerial acid, or *fixed air*. *Ibid*.

Order II. ALKALINE MINERAL SALTS.

FOR the characters, properties, and phenomea of these, see the article ALKALI; also CHEMISTRY-*Index*, at *Alkali* and *Alkalies*.

New acids are daily detected; but no additions have been made to the three species of alkali long since known.

These alkaline salts are,

I. Vegetable fixed alkali (A.)

M Vegetable

(A) With regard to the origin of the vegetable fixed alkali, there are sufficient proofs that it exists already formed in plants, and also that a portion is formed by combustion: but in each case, the alkali is obtained in an impure state through the admixture of other matters, which must be separated before it can be used for chemical purposes.

The *cendres gravelées* are made by burning the husks of grapes and wine lees. They contain the purest alkali met with in common, and are used by the dyers.

Pot-ash is made by burning wood and other vegetables. This alkali is much phlogisticated, and contains many foreign and saline matters, which, however, may be separated.

That which is obtained from the ashes of wood burned in kitchens is the most pure of all. On the contrary, Alkaline Salts.

Vegetable fixed alkali, deprived of every acid, is not found any where by itfelf; but it is fometimes met with in combination with the vitriolic acid or the muriatic, generally with the nitrous, rarely with the aerial (B.)

The fixed vegetable alkali (or *potaffe* of Morveau), is of a powdery appearance, and of a dead white colour. When pure, it is much more cauftic than the neutral falt; it forms with the aerial acid, and even corrodes the fkin (C.)

1. It changes the blue colours of vegetables into a deep green.
2. It has no fmell when dry; but when wetted, it has a flight lixivious odour.
3. Its tafte is ftrongly acrid, burning, cauftic, and urinous (D). This laft fenfation arifes from the volatile alkali it difengages from animal fubftances.
4. When expofed to the air, it attracts humidity, and is reduced into a tranfparent colourlefs liquor. According to Gellert, it attracts three times its own weight of water.
5. It likewife attracts fometimes the aerial acid from the atmofphere, and is thereby deprived of its property of deliquefcing.
6. When it is diffolved in an equal weight of water, it has an oily feel, owing to its action on the fatty parts of the fkin, whence it is, though improperly, called *oil of tartar*.
7. In a moderate heat it melts; but in a more violent fire, it is difperfed or volatilized.
8. It is a moft powerful folvent by the dry way: in a proper heat, it diffolves calcareous, argillaceous, filiceous, and metallic earths: and when the alkali is nearly equal in quantity to the earth, it forms various kinds of hard, folid, and tranfparent glafs.
9. But if the alkali be in quantity three or four times that of the earth, the glafs is deliquefcent.
10. The mild vegetable alkali unites with the vitriolic acid with a violent effervefcence, and produces vitriolated tartar.
11. With the nitrous acid, it forms the cryftallifable falt, called *nitre*.
12. With the marine acid it forms a kind of falt lefs grateful than common falt, which is called the *febrifuge falt of Sylvius*.
13. With vinegar it forms a neutral deliquefcent falt of a fharp tafte, called *terra foliata tartari*.
14. With cream of tartar it forms tartarized tartar.
15. It diffolves fulphur, and forms the fubftance called *liver of fulphur*, which is a powerful folvent of metallic fubftances.
16. It attracts the metals, and diffolves fome of them with peculiar management. Silver, mercury, and lead, are more difficultly diffolved than gold, platina, tin, copper, and efpecially iron. The laft gives a fine reddifh faffron colour, firft obferved by Stahl, who called it the *martial alkaline tincture*.
17. It diffolves in the dry way all the dephlogifticated metallic calces
18. It unites with oils and other fat fubftances, with which it forms foap.
19. This alkali becomes opaque when expofed to the flame of the blow-pipe: it decrepitates a long time, and forms a glaffy button, which is permanent in the little fpoon; but is abforbed with fome noife on the charcoal when blown upon it.

II. Foffile fixed alkalis.

A. Alkali of the fea, or of common falt (E.)

1. Pure.

This has nearly the fame qualities with the lixivious falt, which is prepared from the afhes of burnt vegetables. It is the fame with the *fal fodæ*, or kelp: for the kelp is nothing elfe than the afhes remaining, after the burning of certain herbs that abound in common falt; but which common falt, during the burning of thofe vegetables, has loft its acid (F).

The properties of the foffile alkali are as follows:

1. It

trary, that which is got from tartar, properly burned, then diffolved in boiling water, and purified by filtration and cryftallifation, is called *falt of water*. It is the beft.

(B) The vegetable alkali is feldom found in the earth, except in wells of towns, as at Doway, or in the argillaceous alum-ore of la Tolfa: it is found alfo united to the nitrous acid, near the furface of the earth, in Spain and in the Eaft-Indies, probably from the putrefaction of vegetables.

(C) Common vegetable alkali, falt of tartar, and pot-afh, were formerly confidered by chemifts as fimple alkalis; but Dr Black has demonftrated them to be true neutral falts, arifing from the combination of the vegetable alkali with the aerial acid. From hence it follows, that the above common alkalies, even after any other extraneous fubftance has been extracted, muft be freed from this acid, by putting each in a crucible, and expofing it to a ftrong fire, which will diffipate this aerial acid. The alkali fo purified, is to be put in a glafs vial before it be entirely cold, and kept clofe with a proper ftopple; otherwife the aerial acid which floats in large quantities on the atmofphere will combine again with the pure alkali. (*Mongez.*)

(D) The alkali muft be largely diluted with water, in order to be tafted; otherwife it will act on the tongue, and corrode the parts where it touches. (*Macquer.*)

(E) This falt is not met with pure in Europe; but it is faid to be found in both the Indies, not only in great quantity, but likewife of a tolerable purity: it is there collected in form of an efflorefcence in the extenfive deferts, a profitable trade being carried on in it for the making of foap and glafs; and, therefore, it is very probable that the ancients meant this falt by their *natron* or *baurach*. (*Magellan.*)

(F) The mineral alkali is often combined with the vitriolic and marine acid, and alfo with the aerial acid;

Alkaline Salts.

1. It effervesces with acids, and unites with them.
2. Turns the syrup of violets to a green colour.
3. Precipitates sublimate mercury in an orange-coloured powder.
4. Unites with fat substances, and forms soap.
5. Dissolves the siliceous earth in the fire, and makes glass with it, &c. It distinguishes itself from the salt of the pot-ashes by the following properties (G).
6. It shoots easily into rhomboidal crystals; which
7. Fall to powder in the air, merely by the loss of their humidity (H).
8. Mixed with the vitriolic acid, it makes the *sal mirabile Glauberi*.
9. It melts more easily, and is fitter for producing the *sal commune regeneratum, nitrum cubicum*, &c. Perhaps it is also more conveniently applied in the preparation of several medicines.
10. It is somewhat volatile in the fire.

III. Volatile mineral alkali.

This perfectly resembles that salt which is extracted from animals and vegetables, under the name of *alkali volatile*, or *sal urinosum*, and is commonly considered as not belonging to the mineral kingdom; but since it is discovered, not only in most part of the clays, but likewise in the sublimations at Solfatara, near Naples, it cannot possibly be quite excluded from the mineral king-kingdom (I).

Its principal qualities are,

a. In the fire it rises in *forma sicca*, and volatilises in the air in form of corrosive vapours, which are offensive to the eyes and nose (K).

b. It precipitates the solution of the mercurial sublimate in a white powder.

c. It also precipitates gold out of aqua-regia, and detonates with it; because,

d. It has a re-action in regard to the acids, tho' not so strongly as other alkalies.

e. It

acid; with which last it retains not only the name but many of the properties of a pure alkali, because this last acid is easily expelled.

It is easily known by its crystallisation and its solubility in two times and an half of its weight of water, at the temperature of 60 degrees.

One hundred parts of this alkali, when pure and recently crystallised, contain 20 of mere alkali, 16 of aerial acid, and 64 of water. (*Macquer*.)

Mineral alkali is found in Hungary, in marshy grounds, of an argillaceous or marly nature, either mixed with water or crystallised and efflorescing. It is found also in Egypt at the bottom of lakes, and dried up by the summer's heat; and also in the province of Suchena, 28 days journey from Tripoli, where it has the name of *Trona*; in Syria, Persia, as well as in the East-Indies, and China, where it is called *kien*. It sometimes germinates on walls, and is called by many *aphronitron*. In its native state, is frequently mixed with magnesian earth, common salt, muriatic magnesia, and marine selenite. (*Kirwan*.)

(G) This mineral alkali likewise differs from the vegetable, 1. By its taste, which is less corrosive and burning. 2. By its not deliquescing. 3. By the small degree of heat it produces if calcined, and afterwards added to water. 4. By its property of crystallising, by evaporating the water from its solution, as is practised with neutral salts; whereas the vegetable alkali does not crystallise unless combined with a large portion of aerial acid.

(H) This alkali being a very useful commodity, and essentially necessary in a number of manufactories, many ingenious processes have been contrived and attempted to procure it at a cheap rate, by decomposing the sea-salt; but it is believed, that till lately none of these new manufactures have succeeded, except that of Mr Turner, mentioned by Mr Kirwan in the second part of the Philosophical Transactions for 1782.—The process is said to consist in mixing a quantity of litharge with half its weight of common salt, which, on being triturated with water till it assumes a white colour, is left to stand some hours; after which, a decomposition ensues, the alkali being left alone, whilst the acid unites to the metallic calx; and this last being urged by a proper degree of fire, produces a fine pigment of a greenish yellow colour, whose sale pays for the most part of the expences.

Mr Kirwan says, in the place already quoted, that if common salt perfectly dry be projected on lead heated to incandescence, the common salt will be decomposed, and a horn-lead formed, according to Margraaf. He adds also, that according to Scheele, if a solution of common salt be digested with litharge, the common salt will be decomposed, and a caustic alkali produced; and, finally, that Mr Scheele decomposed common salt, by letting its solution slowly pass through a funnel filled with litharge.

(I) It is easily known by its smell, though in a mild state, by its volatility, and by its action on copper; the solutions of which, in the mineral acids, are turned blue by an addition of this alkali. It is frequently found, though in small quantities, in mould, marl, clay, schistus, and in some mineral waters. It probably derives its origin, in the mineral kingdom, from the putrefaction or combustion of animal or vegetable substances. (*Kirwan*.)

The same is caustic when uncombined with any acid, not excepting even the aerial acid. It differs from the other two alkalies in many essential particulars. 1. By its aeriform or gaseous nature. For the volatile alkali, in a state of purity, is nothing more than an alkaline gas diffused in water, as Dr Priestley has demonstrated. 2. By its volatility. 3. By the nature of the salts it forms with acids, which are very different from those whose bases are formed either of the vegetable or mineral alkali. (*Mongez*.)

(K) Pure volatile alkali, in an aerial form, resembles atmospheric air, but is more heavy. Its smell is pene-

Neutral Salts.

e. It tinges the solution of copper blue, and dissolves this metal afresh if a great quantity is added (L).

f. It deflagrates with nitre, which proves that it contains a phlogiston.

It is never found pure.

Order III. Neutral Salts.

Acids united to alkalies form neutral salts. These dissolved in water are no ways disturbed by the addition of an alkali; and generally, by evaporation, concrete into crystals. If, by proper tests, they show neither acid nor alkaline properties, they are said to be *perfect* nautrals; but *imperfect*, when, from defect in quantity or strength of one ingredient, the peculiar properties of the other more or less prevail.

I. Vitriolated tartar, vitriolated vegetable alkali, or (as Morveau calls it) the *vitriol of pot-ash*.

This is a perfectly neutral salt, which results from the combination of the vitriolic acid with the vegetable fixed alkali. According to Bergman, it seldom occurs spontaneously in nature, unless where tracks of wood have been burnt down: and Mr Bowles, quoted by Mr Kirwan, says it is contained in some earths in Spain. See Chemistry-*Index*.

It is easily obtained, by pouring the vitriolic acid on a solution of fixed vegetable alkali till it is saturated. Crystals of this neutral salt are then formed. This crystallisation succeeds better by evaporation than by cooling, according to Mongez.

The taste of this salt is disagreeable, though somewhat resembling common salt.

II. Common nitre, (*Alkali vegetabile nitratum*).

This is known in commerce by the name of *saltpetre*, and is also called *prismatic nitre*, to distinguish it from the cubic nitre after-mentioned.—It is perfect neutral salt; resulting from the combination of the nitrous acid with the pure vegetable alkali.

According to Bergman, it is formed upon the surface of the earth, where vegetables, especially when mixed with animal-substances, putrify.—See Chemistry-*Index*, at *Nitre*.

III. Digestive salt, salt of Sylvius, (*Alkali vegetabile salitum*).

This neutral salt is sometimes, though rarely, met with on the earth, generated perhaps, as professor Bergman observes, by the destruction of animal and vegetable substances.

According to Macquer, this salt has been very wrongly called *regenerated marine salt*; and the epithet of *febrifuge* has also been given to it, without any good reason, to evince that it has such a property But M. de Morveau calls it *muriate de potasse* with great propriety.

This salt is produced by a perfect combination of the vegetable alkali with marine acid. It has been wrongly confounded with common salt.—It is found in some bogs in Picardy, and in some mineral waters at Normandy, according to Monet, quoted by Kirwan. Mongez adds also the sea-water, as containing this salt, and that it is never found in large quantities, although its components parts are abundantly produced by nature. See Chemistry-*Index*, at *Digestive*.

IV. Mild vegetable alkali, (*alkali vegetabile aeratum.*)

This salt was formerly considered as a pure alkali, known by the name of *potash* and *salt of tartar*: but since the discovery of the aerial acid, it is very properly classed among the neutral salts, and ought to be called *aerated potasse*.

It results from a combination of the vegetable alkali with the aerial acid, and is hardly ever found native, unless in the neighbourhood of woods destroyed by fire.

On being exposed on a piece of charcoal, urged by the blow-pipe, it melts, and is absorbed by the coal; but,

In the metallic spoon, it forms a glassy bead, which becomes opaque when cold.

V. Vitriolated acid saturated with mineral alkali; Glauber's salt. *Alkali minerale vitriolatum*.

This is a neutral salt, prepared by nature (as well as by art), containing more or less of iron, or of a calcareous earth; from which arises also some difference in its effects when internally used. It shoots easily into prismatical crystals, which become larger in proportion to the quantity of water evaporated before the chrystallisation. When laid on a piece of burning charcoal, or else burnt with a phlogiston, the vitriolic acid discovers itself by the smell resembling the hepar sulphuris.

It is found in a dissolved state in springs and wells. Some of the lakes in Siberia and Astracan,

penetrating, and suffocates animals. Its taste is acrid and caustic. It quickly converts blue vegetable colours to green, and produces heat during its combination with water. But if the water be frozen, it melts, producing at the same time an extreme degree of cold. It has a remarkable action on most metals, particularly copper.

This substance is obtained by the putrefactive fermentation from animal and some vegetable matters. It is this salt which causes that strong smell which is perceived in drains and privies on a change of weather. (*Mongez.*)

Its volatility arises from a very subtile and volatile (or phlogistic) oil, which enters as a principle into its composition. (*Macquer.*)

(L) The solution of copper by this alkali, which is of a fine blue, presents a remarkable phenomenon. For if it be kept in a well closed phial, the colour decays, and at length disappears, giving place to transparency. But on opening the phial, the surface or part in contact with the air becomes blue, and the colour is communicated through the whole mass. This experiment may be many times repeated with the same success.

can, and many springs in other places, contain this salt, according to Bergman. It is found in the sea-water; also in the earth, at several parts of Dauphiné in France, and in Lorraine; and sometimes it germinates on the surface of the earth, according to Monet, quoted by Kirwan. It is found, in a dry form, on walls, in such places where aphronitrum has effloresced through them, and the vitriolic acid has happened to be present; for instance, where marcasites are roasted in the open air. This salt is often confounded with the aphronitum or mild mineral alkali.

VI. Cubic or quadrangular nitre. *Alkali minerale nitratum.*

This is the neutral salt which results from the combination of mineral alkali with nitrous acid. It has almost all the characters of prismatic or common nitre, from which it only differs on account of its base; and takes its denomination from the figure of its crystals, which appear cubic.

This salt rarely occurs but where marine plants putrify. According to Bowles, quoted by Kirwan, it is found native in Spain. See Chemistry, n° 741, &c.

VII. Common salt, or sea-salt; *Alkali minerale salitum, sal commune.*

This salt shoots into cubical crystals during the very evaporation; crackles in the fire, and attracts the humidity of the air. It is a perfectly neutral salt, composed of marine acid, saturated with mineral alkali. It has a saline but agreeable flavour. See Chemistry-*Index*, at *Sea-salt.*

A. Rock salt, fossile salt; *Sal montanum.* Occurs in the form of solid strata in the earth.

1. With scaly and irregular particles.
   a. Grey, and
   b. White. These are the most common, but the following are scarcer:
   c. Red;
   d. Blue; and
   e. Yellow, from Cracow in Poland, England, Salzberg, and Tirol.
2. Crystallised rock salt; *sal gemmæ.*
   a. Transparent, from Cracow in Poland, and from Transylvania.

B. Sea-salt.

This is produced also from sea-water, or from the water of salt lakes by evaporation in the sun, or by boiling.

The seas contain this salt, though more or less in different parts. In Siberia and Tartary there are lakes that contain great quantities of it.

C. Spring sea-salt.

This is produced by boiling the water of the fountains near Halle in Germany, and other places.

Near the city of Lidkoping, in the province of Westergotland, and in the province of Dal, salt-springs are found, but they contain very little salt: and such weak water is called *solen* by the Swedes.

VIII. Borax.

This is a peculiar alkaline salt, which is supposed to belong to the mineral kingdom, and cannot be otherwise described, than that it is . . . . . . dissoluble in water, and vitrescible; . . . . . . that it is fixed in the fire; and melts to a glass; which glass is afterwards dissoluble in water. See the detached article Borax.

IX. Mild mineral alkali; *Alkali minerale aeratum.* Natron, the nitre of the ancients.

This neutral salt is a combination of the mineral alkali with the aerial acid or fixed air. It is found plentifully in many places, particularly in Africa and Asia, either concreted into crystallised strata, or fallen to a powder; or efflorescing on old brick walls; or lastly, dissolved in springs. It frequently originates from decomposed common salt.

This is an imperfect neutral salt, and was formerly considered as a pure alkali; but the discovery of the aerial acid has shown the mistake.

1. It has nearly all the properties of the *pure* mineral *alkali* N° II. *A.* 1. (p. 90.), but with less energy.
2. The vegetable blue colours are turned green by this salt; it effloresces with acids, and has an urinous taste.
3. It is soluble in twice its weight of cold wawater; but if the water is hot, an equal weight is sufficient for its solution.
4. It effloresces when exposed to the action of the atmosphere.
5. It fuses easily on the fire, but without being decomposed.
6. Facilitates the fusion of vitrifiable earths, and produces glass more or less fine according to their qualities.
7. It is decomposable by lime and ponderous earth, which attract the aerial acid.
8. And also by the mineral acids; but these expel the aerial acid of this salt, by seizing its alkaline basis, (*Mongez.*)

Wallerius confounds this salt with the *aphronitrum* after-mentioned, and calls it *halinitrum*, when it contains some phlogiston. Mr Kulbel, quoted by Wallerius, showed that it exists in some vegetable earths, and takes it to be the cause of their fertility; but this (M. Magellan observes) can only be on account of its combination with the oily parts of them, and forming a kind of soap, which is miscible with the watery juices.

X. Vitriolic ammoniac, (*Alkali volatile vitriolatum.*)

This neutral salt was called *secret salt of Glauber*, and is a combination of the volatile alkali with vitriolic acid. According to Bergman, it is scarcely found any where but in places where the phlogisticated fumes of vitriolic acid arise from burning sulphur, and are absorbed in putrid places by the volatile alkali. Thus at Fahlun the acid vapour from the roasted minerals produces this salt in the necessary-houses. Dr Withering, however, observes, that as volatile alkali may be obtained in large quantities from pit-coal, and produced by processes not dependent upon putrefaction, there is reason to believe that the vitriolic ammoniac may be formed in several ways not noticed by the above author.

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It is said to have been found in the neighbourhood of volcanoes, particularly of Mount Vesuvius, where, indeed, it might well be expected; yet its existence seems dubious, since Mr Bergman could scarce find any trace of it among the various specimens of salts from Vesuvius which he examined. The reason (according to M. Magellan) probably is, that the vitriolic acid disengaged by the combustion of sulphur is in a phlogisticated state; and all its combinations in this state are easily decomposed by the marine acid, which plentifully occurs in volcanoes. It is also said to be found in the mineral lakes of Tuscany, which is much more probable, as the vitriolic acid when united to water easily parts with phlogiston, and recovers its superiority over other acids. It is said likewise that this neutral salt is found on the surface of the earth in the neighbourhood of Turin.

1. This salt is of a friable texture, and has an acrid and urinous taste.
2. Attracts the moisture of the atmosphere.
3. Is very soluble in water, it requiring only twice its weight of cold water, or an equal weight of boiling water, to be dissolved.
4. It becomes liquid on a moderate fire; but if urged,
5. It becomes red hot, and volatilizes.
6. The nitrous and muriatic acid decompose this salt by seizing the volatile alkali. But
7. Lime, ponderous earth, and pure fixed alkali, set the volatile alkali free, and combine with the vitriolic acid.
8. According to Kirwan, 100 parts of this salt contain about 42 of real vitriolic acid, 40 of volatile alkali, and 18 of water.

This vitriolic ammoniac is easily known; for if quicklime or fixed alkali be thrown into its solution, the smell of the volatil alkali is perceived; and if this solution be poured into that of chalk or ponderous earth by the nitrous acid, a precipitate will appear.

XI. Nitrous ammoniac, (*Alkali volatile nitratum.*)

This is a neutral salt, which results from the combination of the nitrous acid with the volatile alkali. It is frequently found in the mother-liquor of nitre. When mixed with a fixed alkali, the volatile betrays itself by its smell.

1. It is of a friable texture, of a sharp bitter, and of a nitrous or cooling taste.
2. According to Mongez, it attracts the moisture of the atmosphere; but Romé de l'Isle asserts, that its crystals are not deliquescent: the experiment may be easily tried, and the truth ascertained.
3. It is soluble in cold water; but half the quantity of water, if boiling, is sufficient for dissolving it.
4. It liquefies on the fire, and afterwards it becomes dry.
5. It detonates with a yellow flame before it is red hot; and what is peculiar to this salt, it needs not, like common nitre, the contact of any combustible matter for its detonation; from whence it appears that the volatile alkali itself possess a great share of phlogiston.
6. Its component parts, viz. the nitrous acid and the volatile alkali, are not very intimately united; and of course,
7. It is easily decomposed by all the substances that have any affinity to either of them.
8. Mixed with the muriatic acid it makes aqua regia.
9. One hundred parts of this neutral salt contain 46 of nitrous acid, 40 of volatile alkali, and 14 of water, as Mr Kirwan thinks.

XII. Native sal ammoniac. The muriatic (or marine) acid saturated with a volatile alkali.

This is of a yellowish colour, and is sublimed from the flaming crevices, or fire-springs, at Solfatara, near Naples.

XIII. Aerated or mild volatile alkali.

This neutral salt results from the combination of volatile alkali united to the aerial acid. It was formerly considered as a pure alkali:—But the discovery of the aerial acid (or fixed air) has shown it to be a true neutral salt, though imperfect; as it retains still all the properties of an alkali, though in a weaker degree, on account of its combination with the aerial acid, which is itself the most weak of all acids, and of course other stronger acids easily dislodge it from its base, and from various ammonial salts.

1. This imperfect neutral salt has an urinous taste, and a particular smell, which is very penetrating, though less pungent, than the pure volatile alkali; and in the same manner it turns the blue vegetable juices green. But,
2. It effervesces with other acids stronger than the aerial one, which the pure or caustic volatil alkali does not.
3. It sublimes very easily with a small degree of heat;
4. And dissolves in twice its weight of cold water; but in a lesser quantity, when this last is boiling hot.
5. It acts on metallic substances, chiefly on copper, with which a blue colour is produced.

According to Bergman, this salt was found in a well in London (Phil. Transf. for 1767), at Frankfort on the Mein, and at Lauchstadt.—Messrs. Hierne, Henkel, and Brandt, have found also this salt in the vegetable earth, in various kinds of argil, and in some stony substances. Mr Vozel found it also in some of the incrustations at Gottingen; and Mr Malouin in some acidulous waters of France.

M. Magellan observes, that the borax and the three aerated alkalis are called *imperfect* neutrals; whilst the other neutral salts have acquired the name of *perfect*, because these last do not exhibit any of the distinguishing properties of their component parts. The three aerated alkalis have a very distinct alkaline character, as they turn blue vegetable juices green, though not of so vivid a colour as the caustic alkali

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alkali does; and the borax is capable of receiving almost an equal quantity of its sedative acid, without losing all its alkaline properties.

In general, those neutral salts, consisting of fixed alkalies combined with acids, are more saturated than those composed of volatile alkali called ammoniacal salts, or those called aerated; which last are only composed by the combination of the aerial acid, united to any alkaline or earthy base.

The aerated alkalis are called also by the name of *mild* alkalis, because they possess no longer that sharp corroding quality which they exhibit when deprived of the aerial acid or fixed air; in which case they are termed caustic alkalis.

These aerated alkalis differ also from the caustic ones, not only on account of the mildness of their taste, from which comes their epithet of mild alkalis, but also by their property of crystallising, and by their effervescing with other acids, which expel the aerial one, the weakest of all acids we know.

Order IV. Earthy *Neutral Salts*.

The compounds of earths and acids which possess solubility are decomposed and precipitated by mild, but not by phlogisticated alkalis.

I. Calcareous earth combined with vitriolic acid.—Vitriolated calx; Selenite; Gypsum. See p. 72. col. 1. *supra*.

The gypsum, or plaster, is not only found dissolved in various waters, but also in many places it forms immense strata. It is placed by all mineralogists among the earths, which it greatly resembles; but it rather belongs to the saline substances of the neutral kind, as appears by its constituent parts. When burnt, it generates heat with water, but in a less degree than lime does. Berg. Sciag. § 59.

This salt has a particular taste, neither bitter nor astringent, but earthy, when applied to the tongue; and it is owing to it that some waters, chiefly from pumps and wells, are called hard waters, because they lie heavy on the stomach.

It is unalterable whilst kept in a dry place; but on being exposed to a moist air, it is much altered, and suffers a kind of decomposition.

When exposed to fire so as to lose the water of its crystallisation, it assumes a dead white colour; and it is then what we call plaster of Paris; but if the fire is too strong, it melts and vitrifies, after losing the vitriolic acid with which it is saturated. See Gypsum.

The most famous quarries of gypsum in Europe, are those of Montmartre, near Paris. See *Journal de Physique*; 1780, vol. xvi p. 289 and 1782, vol. xix. p. 173.

It is found also in the vegetable kingdom.—Mr Model found that the white spots in the root of rhubarb are a selenitical or gypseous earth (*Journal de Phys.* vol. vi. p. 14.)

What is called fossil flour (*farine fossile* in French), generally found in the fissures of rock and gypseous mountains, is very different from the agaricus mineralis p. 71. col. 1. and from the lac lunæ p. 87. col. 1.; as it is a true gypseous earth, already described p. 72. col. 1. which, according to Mongez, is of a white and shining colour, though sometimes it assumes a reddish or blueish colour, on account of some martial mixture.

II. Nitre of lime, (*Calx nitrata.*)

This earthy salt is sometimes found in water, but very sparingly. It is said that the chalk hills in some parts of France become spontaneously impregnated with nitrous acid, which may be washed out, and after a certain time they will become impregnated with it again. It is a combination of the nitrous acid with calcareous earth. (*Berg. Sciagr.*)

1. It is deliquescent; and is soluble in twice its weight of cold water, or in an equal weight of boiling water.
2. Its taste is bitter.
3. Is decomposed by fixed alkalies, which form the cubic and the prismatic nitres.
4. But caustic volatile alkali cannot decompose it.
5. It does not deflagrate in the fire; yet paper moistened with a saturated solution of it crackles in burning.
6. In a strong heat it loses its acid.
7. Its solution does not trouble that of silver in nitrous acid.
8. The vitriolic acid precipitates its basis.
9. As does likewise the acid of sugar.
10. One hundred parts of it contain, when well dried, about 33 of nitrous acid, 32 of calcareous earth, and 35 of water.

It exists in old mortar, and in the mother liquor of nitre; and also in the chalk rocks near Roche Guyon, in France. (*Kirwan.*)

III. Muriatic chalk, or fixed salt ammoniac. *Acidum salis communis terra calcarea saturatum.*

This somewhat deliquesces, or attracts the humidity of the air. It is found in the sea water.

It is with great impropriety that this salt has obtained the name of ammoniac, on account only of its being formed in the chemical laboratories during the decomposition of the ammoniacal salt with lime, in the process for making the caustic volatile alkali. In this case, the muriatic acid unites to the calcareous basis, while this last gives its water to the volatile alkali; which, therefore, comes over in a fluid caustic state: but if chalk is employed instead of lime, the volatile alkali receives the aerial acid instead of water, and comes over in a concrete form. In neither case, the new combination of calcareous earth with muriatic salt has any volatile alkali to deserve the name of ammoniacal salt. (*Macquer.*)

1. This earthy salt has a saline and very disagreeable bitter taste. It is supposed to be the cause of that bitterness and nauseous taste of sea-water.
2. It fuses in the fire, and becomes phosphorescent, after undergoing a strong heat.
3. It becomes hard, so as to strike fire with steel.
4. It is then the phosphorus of Homberg.
5. It is decomposable by ponderous earth and fixed alkalis.

6. And also by the vitriolic or nitrous acid; which expel the muriatic acid, to unite with the calcareous basis. (*Mongez.*)
7. Its solution renders that of silver in the nitrous acid turbid, at the same time that
8. It makes no change in that of nitrous selenite.
9. It obstinately retains its acid in a red heat.
10. One hundred parts of this earthy salt contain, when well dried, about 42 of marine acid, 38 of calcareous earth, and 20 of water.
11. It is found in mineral waters, and in the salt works at Saltzburg. (*Kirwan.*)

IV. Aerated chalk, (*Calx aerata.*)

Whenever calcareous earth is over saturated with the aerial acid, it becomes a true earthy neutral salt; becomes soluble in water, and has a slight pungent bitter taste. It is commonly found dissolved in waters, in consequence of an excess of the aerial acid. When this greatly abounds, the water is said to be hard (*cruda*). By boiling or by evaporation, it deposits streaks or crusts of calcareous matter.

But when the calcareous earth is only saturated with the aerial acid without excess, it is not easily soluble; it is then the calcareous spar p. 71. col. 2. and is properly referred to the class of earths, p. 71. col. 1.

V. Vitriolated ponderous earth. *Terra ponderosa vitriolata; barytes vitriolata.*

This earthy salt, known by the name of ponderous spar, is a combination of the ponderous earth described in p. 75. col. 1. with the vitriolic acid; and has been already treated of.

The nitrous ponderous earth, according to Bergman, has not yet been found, although it may perhaps exist somewhere, and of course be discovered in nature.

VI. Muriatic barytes, marine baro-selenite. *Barytes salita.*

This earthy salt consists of marine acid united to the ponderous earth. It is said to have been found in some mineral waters in Sweden; and may be known by its easy precipitability with vitriolic acid, and by the great insolubility and weight of this resulting compound, which is the true ponderous spar of the preceding section.

VII. Aerated ponderous earth. *Barytes aerata.*

This earthy neutral salt was found by Dr Withering in a mine at Alstonmore in the county of Cumberland in England. He says that it is very pure, and in a large mass. This substance is a new acquisition to mineralogy, and may be turned to useful purposes in chemistry.

1. It effervesces with acids, and melts with the blow-pipe, though not very readily.
2. In a melting furnace, it gave some signs of fusion; but did not feel caustic when applied to the tongue, nor had it lost its property of effervescing with acids.
3. But the precipitated earth from a saturated solution of it in the marine acid, by the mild vegetable or mineral alkali being burned, and thrown into water, gave it the properties of lime-water, having an acrid taste in a high degree: and a single drop of it added to the solutions of vitriolated salts, as the Glauber's salt, vitriolated tartar, vitriolic ammoniac, alum, Epsom salt, selenite, occasioned immediately a precipitation; from whence it appears to be the nicest test to discover the vitriolic acid. By it the marine acid may also be easily freed from any mixture of vitriolic acid, by means of this calx of ponderous earth. See CHEMISTRY, n° 1049. *et seq.*

VIII. Vitriolated magnesia.

This earthy neutral salt is called by the English *Epsom salt; Sel d'Angleterre* by the French, and also *sel de Sedlitz, de Seydschutz, sel amer, sel cathartique amer*, &c. These various names are given to it, either on account of its properties, it being a very mild purgative; or from the places where it is found, besides many others, as in the waters of Egra, of Creutzbourg, Obernental, Umea, &c. It has also been found native, mixed with common salt and coaly matter, germinating on some free stones in coal mines. See *Kirwan's Mineralogy*, p. 183.

1. It has a very bitter taste.
2. It is soluble in one part and a half of its weight of cold water: but in hot water, a given weight of it dissolves the double of this salt.
3. It effloresces when exposed to a dry atmosphere, and is reduced to a white powder.
4. Exposed to the fire, it loses the water of its crystallisation, and is reduced into a friable mass.
5. This earthy salt is decomposed by fixed and volatile alkalies.
6. Lime-water precipitates the magnesia from its solution, the calcareous earth of lime-water combining itself with the vitriolic acid, and forming a selenite. *N. B.* By this test the vitriolated magnesia is easily distinguished from the vitriolated mineral alkali or Glauber's salt which it resembles.
7. But crude chalk, or aerated calcareous earth, has not such an effect in the same case; which shows how much the efficacy of this substance, viz. the calcareous earth, is diminished merely by its union with the aerial acid.
8. When urged by the flame with the blow-pipe, it froths; and may be melted by being repeatedly urged with that instrument.
9. With borax it effervesces, and also when burned with the microcosmic salt.
10. According to Bergman, 100 weight of this salt contains only 19 parts of pure magnesia, 33 of vitriolic acid: and 48 of water. But
11. According to Kirwan, 100 parts of it contain about 24 of real vitriolic acid, 19 of magnesian earth, and 57 of water.

IX. Nitrated magnesia; nitrous Epsom salt.

This earthy salt is usually found together with nitre. It is a combination of the nitrous acid with the magnesian earth.

1. It has an acrid taste, very bitter.
2. Attracts the moisture from the atmosphere, and deliquesces.
3. Is very soluble in water.

4. Is

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4. Is easily decomposable by fire.
5. The ponderous and calcareous earths decompose it, and also the alkalies.
6. On being urged by the blow-pipe, it swells up with some noise, but does not detonate.
7. If saturated solutions of nitrous selenite and of this salt be mixed, a precipitate will appear; but,
8. Neither vitriolic acid, nor mild magnesia, will occasion any turbidness in its solution.
9. One hundred parts of this salt contain about 36 of real nitrous acid, 27 of magnesian earth, and 37 of water.

It exists in old mortar, and is found also in the mother liquor of nitre. As lime-water decomposes it, M. de Morveau has indicated the use of this process, not only to complete its analysis; but also to separate, in large quantities, and at a very cheap rate, the magnesian from the calcareous earth, as M. Mongez relates upon this subject.

X. Muriatic magnesia. *Magnesia salita.*

This earthy salt is a combination of magnesian earth with the muriatic acid. According to Bergman, it is found in the sea in greater plenty than any other salt except the sea-salt.

1. It has a very bitter taste: and being always mixed in the sea-water, it is the principal cause of its bitterness.
2. It is very deliquescent, and soluble in a small quantity of water.
3. All the alkalies, even the caustic volatile alkali and lime, decompose it by precipitating its basis.
4. The vitriolic, nitrous, and boracic acids expel the muriatic acid from the base of this neutral salt.
5. Its solution does not trouble that of nitrous or marine selenite; but,
6. It causes a cloud in the nitrous solution of silver.
7. The vitriolic acid throws down no visible precipitate from the solution of this neutral salt.
8. It loses its acid in a red heat.

XI. Aerated magnesia.

Common magnesia, with an excess of aerial acid, is a true neutral salt, like the aerated selenite of p 96. col. 1. and becomes soluble in cold water. Otherwise it is scarce soluble at all; and is then classed among the earths.

This neutral salt is decomposable by fire, by which its water and its acid are expelled; and it may become phosphoric.

When urged by fire, it agglutinates a little: and some pretended that it melts. But it must be in an impure state to vitrify at all.

The three mineral acids, and the alkalies, dissolve this salt with effervescence, by expelling the aerial acid.

XII. Argillaceous earth combined with vitriolic acid. The *alum* kind. See Alum, and Chemistry-*Index*.

a. With a small quantity of clay; native or plumose alum.

It is found on decayed alum ores in very small

quantities; and therefore, through ignorance, the alabastrites and selenites, both of which are found among most of the alum slates, are often substituted in its stead, as is also sometimes the asbestus, notwithstanding the great difference there is between the alum and these both in regard to their uses and effects.

b. With a greater quantity of pure clay; white alum ore.

1. Indurated pale-red alum ore, (*Schistus aluminis Romanus.*) It is employed at Lumini, not far from Civita Vecchia in Italy, to make the pale-red alum called *roch alum.* This is, of all alum ores, the most free from iron; and the reddish earth which can be precipitated from it, does not show the least marks of any metallic substance.

c. With a very large quantity of martial clay, which likewise contains an inflammable substance: Common alum ore. This is commonly indurated and slaty, and is therefore generally called *alum-slate.*

It is found,

1. With parallel plates, having a dull surface; from Andrarum in the province of Skone, Hunneberg and Billingen in the province of Westergottland, Rodoen in the province of Jemtland, and the island of Oeland, &c. In England, the great alum works at Whitby in Yorkshire are of this kind.
2. Undulated and wedge-like, with a shining surface. This at the first sight resembles pit-coal; it is found in great abundance in the parish of Nas in Jemtland.

XIII. Argillaceous earth saturated with muriatic acid. *Argilla salita.*

Professor Bergman says, that the combinations of the argillaceous earth with the nitrous, muriatic, and aerial acids, had not yet been found naturally formed as far as he knew. But Dr Withering affirms, that he found the muriatic argil to exist in a considerable quantity, in the Nevil Holt water, when he analysed that mineral water about the year 1777: and he adds, that it is probably contained also in the Ballycastle water in Ireland.

XIV. Argillaceous earth mixed with volatile alkali.

[Although this mixture is by no means a neutral salt, this seems to be the place to treat of it according to the order of saline substances adopted in this article.]

The greatest part of the clays contain a volatile alkali, which discovers itself in the distillation of the spirit of sea-salt. &c.

Order V. Metallic Salts.

The native salts belonging to this division may be distinguished by the phlogisticated alkali, which precipitates them all. The few which have saline properties, according to the definition of salts formerly given, shall be mentioned here; referring the rest to the mineralised metals; as the *luna cornea*, the saline quicksilver or muriatic mercury, &c.

I. Vitriol of copper; blue vitriol. *Vitriolum veneris, seu cyprium.*

This neutral metallic salt is a combination of the vitriolic acid with copper, and is found in all *ziment waters*, as they are called. Its colour is a deep blue; and being long exposed to the air, it degenerates into a rusty yellow blue. Urged by the flame of the blow-pipe on a piece of charcoal, it froths at first with noise, giving a green flame, and the metallic particles are often reduced to a shining globule of copper, leaving an irregularly figured scoria. But with borax the scoria is dissolved, and forms a green glass.

This salt rarely occurs crystallised: but is often found naturally dissolved in water in Hungary, Sweden, and Ireland: from this water a blue vitriol is generally prepared. These natural waters are called *cementatory* or *cementing* ones. According to Monet, this concrete salt, when found naturally formed, only proceeds from the evaporation of such waters. It is also occasionally extracted from sulphurated copper ores after torrefaction. See CHEMISTRY-*Index*, at *Vitriol.*

II. Muriatic copper, or marine salt of copper. *Cuprum salitum.*

This salt has been found in Saxony, in the mine of Johngeorgenstadt. 1. It is of a greenish colour, and foliated texture. 2. It is moderately hard. 3. Sometimes it is transparent and crystallised.

It has been taken for a kind of mica: but Professor Bergman found it to consist of copper and marine acid, with a little argillaceous earth.

Another specimen of a purer sort was deposited in the museum of Upsal. This is of a bluish green colour, and friable. It effervesced with nitrous acid, to which it gave a green colour: and by adding a proper solution of silver, a *luna cornea* was formed, by which the presence of the muriatic acid was ascertained. (*Kirwan* and *Bergman*)

III. Martial vitriol; vitriol of iron. Common green vitriol or copperas.

This is the common green vitriol, which is naturally found dissolved in water, and is produced in abundance by decayed or calcined marcasites.

This metallic neutral salt results from the combination of the vitriolic acid with iron.

1. It is of a greenish colour when perfectly and recently crystallised; but,
2. Effloresces by being exposed to the air, becomes yellowish, and is covered with a kind of rust. Sometimes it becomes white by long standing.
3. It requires six times its weight of water, in the temperature of 60 degrees, to be dissolved.
4. It has an astringent, harsh, and acidulous taste.
5. Exposed to a moderate heat, even to that of the sunshine, it falls into a yellowish powder: but,
6. On being exposed to a sudden heat, it melts; and on cooling, assumes a whitish brown colour.
7. When strongly urged by fire, it loses its acid, becomes of a dark red colour, and is then called *colcothar*; a powder which is employed in polishing metals, and to which our artists have applied the improper name of *crocus martis*, though this name only belongs to the yellow preparations of the iron-calces, used in pharmacy and in enamelling, &c.
8. Pure fixed alkali precipitates the iron from its solution in deep green flakes; the mild alkali, in a greenish white colour; pure volatile alkali, in so deep a green, that it appears black; but the mild volatile alkali precipitates it in a greyish-green colour.
9. All vegetable astringents, as the tincture of tea, quinquina, gales, &c. precipitate the iron in a black colour: hence they are used as tests to discover its presence in chemical analyses; and it is from this black precipitate that the common writing ink is made, being diluted in water, and there suspended by the Arabic or Senegal gums.
10. One hundred parts of this salt, recently crystallised, contain 20 of real vitriolic acid, 25 of iron, and 55 of water.
11. Its acid is known by this, that its solution mixes without turbidity with the solutions of other salts that contain vitriolic acid; as Epsom, selenite, vitriolated tartar, &c.
12. And the basis of this metallic salt is known by the black colour produced by the solution of vegetable astringents.
13. On being urged by the flame thrown by the blow-pipe, it offers the same phenomena as the vitriol of copper, except that it does not colour the flame.

Green vitriol is frequently found native, either in coal mines or in the cavities of pyritaceous mines, or adhering to their scaffolds in a stalactitical form. It is found also in small round stones, called *ink-stones*, of a white, red, grey, yellow, or black colour, which are almost soluble in water, and contain a portion of copper and zinc. Also sometimes in form of schistus or slaty pyritaceous stones. But the greatest part of that in use is prepared by art, from the martial pyrites or mundic. See CHEMISTRY, n° 619.

IV. Aerated iron. *Ferrum aeratum.*

This metallic salt is a combination of the aerial acid with iron; and is found in the light chalybeate waters, where it is dissolved by an excess of this acid.

Mr Lane was the first who discovered in England the action of the aerial acid on iron, when the water is impregnated with that menstruum. The late M. Rouelle demonstrated the same phenomenon in France upon this and other metals. But Professor Bergman seems to have preceded them both nearly about the same time, though neither had any knowledge of each other's discoveries.

The great volatility of this acid is the cause why this neutral salt is not often found. For the mere evaporation of the ferruginous mineral waters, in order to analyse them, is sufficient to let loose the aerial acid; so that the iron which was there dissolved by its power falls down to the bottom in the form of a light ore, which amounts to nearly $\frac{1}{10000}$ of the weight of the water; and when

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when fresh retains so much phlogiston as to obey the magnet, as Bergman says.

V. Vitriol of cobalt, or vitriolated cobalt.

This metallic salt results from the combination of the vitriolic acid with cobalt.

1. When found native, it is always in an efflorescent state; whence it arises that, in this case,
2. Its colour is greenish, mixed with a grey tint: but,
3. It is of a rosy colour when artificially made;
4. Effloresces when exposed to the action of the atmosphere; and,
5. Takes then a greenish colour mixed with a pale purple, or a *Lilias colour*, as the French call it.
6. It is difficultly soluble in water; and,
7. Its solution is of a red colour.
8. The phlogisticated alkali precipitates the cobalt from the solution of this salt, which with borax gives an azure glass.

By the above qualities, chiefly the rosy colour of the solution of this neutral salt, its basis is sufficiently distinguished. As to its acid, it is easily known by the same tests as those of the preceding vitriols.

It is said to be found native in small pieces, mixed with a greenish efflorescence in cobalt mines. (*Kirvan* and *Mongez.*)

VI. Vitriol of zinc, vitriolated zinc, or white vitriol.

This neutral metallic salt results from the combination of vitriolic acid with zinc.

1. Its colour is white. It,
2. Requires little more than twice its weight of water to dissolve it in the temperature of 60 degrees of Fahrenheit's thermometer, and deposits a greyish yellow powder.
3. Its specific gravity is 2000.
4. Its taste is very styptic.
5. It mixes uniformly with vitriolic neutral salts.
6. Precipitates nitrous or marine selenites from their solutions, by which its acid is ascertained.
7. It is precipitable in a whitish powder by alkalies and earths; but,
8. Neither iron, copper, nor zinc, precipitate it: by which circumstance its basis is sufficiently indicated.
9. If it contains any other metallic principle, this may be precipitated by adding more zinc to the solution; excepting iron, which will of itself precipitate by exposure to the air or boiling in an open vessel.
10. One hundred parts of this metallic salt contain 22 of vitriolic acid, 20 of zinc, and 58 of water.
11. Urged by fire, it loses a good part of its acid.
12. Treated with the blow-pipe, it exhibits nearly the same phenomena as other metallic vitriols; except only that the flame is brilliant when the zinc is reduced, and gives out white flocs called *flowers of zinc*

This neutral metallic salt is sometimes found native, mixed with vitriol of iron, and in the form of white hairy crystals; or in a stalactitical form in the mines of Hungary, or as an efflorescence on ores of zinc. It is also found dissolved in mineral waters, and generally with some proportion of vitriols of iron and copper. Bergman says, it is sometimes produced by the decomposition of pseudogalæna, or black-jack; but this rarely happens, because this substance does not readily decompose spontaneously.

But that in common use is mostly prepared at Goslaar, from an ore which contains zinc, copper, and lead, mineralised by sulphur and a little iron. The copper is first separated as much as possible: the remainder after torrefaction and distillation is thrown red-hot into water and lixiviated. It is never free from iron. (*Kirwan, Mongez.*)

VII. Vitriolated nickel, or vitriol of nickel

This neutral metallic salt results from the combination of the vitriolic acid with nickel. It exists sometimes in consequence of the decomposition of the sulphureous ores of this semimetal. It is found native, efflorescing on Kupfer-nickel; and generally mixed with vitriol of iron.—It is of a green colour, as well as its solution. It is precipitated by zinc; but when joined with iron, this last is not precipitated by the same.

Its origin is perhaps owing to the decomposition of the pyritaceous and sulphureous ore of Kupfer-nickel, mentioned by Wallerius. This ore contains a great quantity of arsenic and sulphur, as well as cobalt, nickel, and iron. And if it comes to be decomposed in the bowels of the earth, it is natural to expect that the vitriolic acid of the sulphur will attack the nickel and the iron, with which it will form neutral metallic salts (*Mongez, Kirwan*).

VIII. Muriatic manganese. *Manganesium salitum.*

M. Hielm is the only person who has as yet found this middle salt in some mineral waters of Sweden. It is composed by the combination of the regulus of Manganese with muriatic acid.

1. It is precipitated of a whitish yellow colour, by the Prussian (phlogisticated) alkali; and of a brownish yellow, by the mineral alkali. 2. It does not crystallise in any distinct form. 3. It abstracts the moisture of the air. 4. To obtain its basis free from iron, it must be precipitated by the mineral alkali; redissolved in nitrous acid; then calcined until this acid is expelled; and the residuum is to be treated with distilled vinegar, which will then take up only the manganese. (*Kirwan.*)

Order VI. Triple Salts.

Triple Neutral Salts.

The neutral salts hitherto enumerated are such as are composed of two ingredients only; but sometimes three or more are so united as not to be separated by crystallization. The vitriols that we are acquainted with are hardly ever pure; and two or three of them sometimes are joined together.

Sometimes likewise it happens that neutral salts join earthy salts, and earthy salts metallic ones. Bergman generally distinguishes compound salts according to the

Triple Neutral Salts.

the number of their principles, whether the ſame acid be joined to ſeveral baſes, or the ſame baſe to different acids; or, laſtly, whether ſeveral menſtrua and ſeveral baſes are joined together. Hence ariſe ſalts triple, quadruple, &c. which the diligence of after-times muſt illuſtrate. The moſt remarkable examples of triple and quadruple native ſalts which have yet occurred are,

I. Mineral alkali, with a ſmall quantity of calcareous earth. *Alkali ſalis communis.* Aphronitrum.

This is ſo ſtrongly united with the calcareous earth, that the latter enters with it into the very cryſtals of the ſalt: though by repeated ſolutions the earth is by degrees ſeparated from it, and falls to the bottom after every ſolution.

It grows in form of white froſt on walls, and under vaults; and in places where it cannot be waſhed away by the rain.

Hence it would appear, that this is not only a *triple*, but a *multiple* ſalt; as theſe pieces of old mortar covered with this white froſt, on ancient walls, are the very ſame from which the ſaltpetre makers extract the mother-water of nitre, after mixing therewith the vegetable aſhes, to furniſh the alkaline baſe to it. M. Fourcroy ſays in his ſeventeenth Lecture, that this mother-water contains not only nitre, but five other kinds of ſalt, viz. the *marine ſalt*, *nitrous magneſia*, *calcareous nitre*, *magneſia nitrata*, and *calx ſalita*; to which the chemiſts of Dijon add the *digeſtive ſalt of Sylvius*, and in ſome caſes various *vitriols* with *alkaline* or *earthy baſes*.

When it contains any conſiderable quantity of the calcareous earth, its cryſtals become rhomboidal, a figure which the calcareous earth often aſſumes in ſhooting into cryſtals: but when it is purer, the cryſtals ſhoot into a priſmatic figure.

This is a circumſtance which neceſſarily muſt confuſe thoſe who know the ſalts only by their figure; and ſhows, at the ſame time, how little certainty ſuch external marks afford in a true diſtinction of things.

This ſalt is very often confounded with the *ſal mirabile Glauberi*.

II. Common ſalt with magneſia; or muriatic mineral alkali contaminated by muriatic magneſia.

This is a compound of the common ſalt with muriatic magneſia: and by the expreſſion *contaminated (inquinatum)* of profeſſor Bergman, we may ſuppoſe that the magneſian ſalt is not intimately united to the alkaline baſe.

This triple ſalt is very deliqueſcent; a quality it owes to its integrant part the muriatic magneſia, (p. 97. col. 1.) For the pure muriatic alkali does not deliqueſce: but this degree of purity is ſeldom found, even in the native foſſil or *ſal gem*, (p. 93. col. 2.) In general all the earthy marine ſalts are very deliqueſcent, as the muriatic chalk, the muriatic barytes, and the muriatic magneſia. *Bergman*, *Macquer*, and *Mongez*.

III. Mineral alkali with ſuccinous acid and phlogiſton.

This ſubſtance will be afterwards mentioned among the *inflammables*.

IV. Vitriolated magneſia with vitriol of iron. Epſom ſalt contaminated with copperas.

Found in ſome mineral waters, according to Mr Monet, (*Treatiſe on Mineral Waters*).

V. Native-alum contaminated by copperas. Vitriolated argil with vitriol of iron.

Found in the aluminous ſchiſtus. It ſometimes effloreſces in a feathery form. Perhaps this is the *plumoſe alum* of the ancients.

VI. Native alum, contaminated by ſulphur.

At the places about Wedneſbury and Bilſton, in Staffordſhire, where the coal pits are on fire, this ſubſtance ſublimes to the ſurface; and may be collected, in conſiderable quantity, during dry or froſty weather.

A ſimilar compound ſubſtance ſublimes at the Solfaterra near Naples.

VII. Native alum contaminated by vitriolated cobalt.

In the mines of Herregrund and Idria this ſalt may be ſeen ſhooting out into long ſlender filaments. Perhaps this is the *trichites* of the Greeks.

1. Diſſolved in water, it immediately betrays the preſence of vitriolic acid upon the addition of terra poderoſa ſalita (muriatic acid ſaturated with heavy earth).
2. By the addition of phlogiſticated alkali, a precipitate of cobalt is thrown down, which makes blue glaſs with borax or microcoſmic ſalt. (*Berg. Sciag.*)

VIII. Vitriol of copper with iron.

This ſalt is of a bluiſh green colour. It is the *vitriolum ferreo-cupreum cyaneum* of Linnæus. Its colour varies, being ſometimes more or leſs green, and ſometimes more or leſs blue. It is found at Saltzberg and at Falhun. This vitriol is called *vitriol of Hungary*, becauſe it is found in the Hungarian mines is of this kind. (*Mongez.*)

IX. Vitriol of copper, iron, and zinc.

This is the *vitriolum ferreo-zinceo cupreum cyaneum* of Linnæus. Its colour is of a blue inclining to green. If rubbed on a poliſhed ſurface of iron, the copper is not precipitated thereby, as it happens to the blue vitriol; which ſhows that the vitriolic acid is perfectly ſaturated in this ſalt by the three metallic baſes.

X. Vitriol of copper and zinc.

This is the blue vitriol from Goſlar. According to Mongez it is the *vitriolum zinceo-cupreum cæruleum* of Linnæus.

XI. Vitriol of iron and zinc.

This is the green vitriol from Goſlar in the Hartz. According to Mongez, this is the *vitriolum zinceo-ferreum viride* of Linnæus, 105. 6. Its colour is a pale-green caſt.

XII. Vitriol of iron and nickel.

This ſalt is of a deep-green colour, and is contained in the ochre, or decayed parts, of the nickel, at the cobalt-mines of Los, in the province of Helfingland.

Class III. Mineral INFLAMMABLE Substances.

To this claſs belong all thoſe ſubterraneous bodies that are diſſoluble in oils, but not in water, which they repel;

Inflammables.

repel; that catch flame in the fire; and that are electrical.

It is difficult to determine what constitutes the difference between the purer sorts of this class, since they all must be tried by fire, in which they all yield the same product; but those which in the fire show their differences by containing different substances, are here considered as being mixed with heterogeneous bodies: that small quantity of earthy substance, which all phlogista leave behind in the fire, is, however, not attended to.

I. Inflammable air; fire damp.

This aeriform substance is easily known by its property of inflaming when mixed with twice or thrice its bulk of common atmospheric air; and it is asserted to be the real phlogiston almost pure. See AEROLOGY-*Index*, and *INFLAMMABLE Air*.

It admits considerable varieties, acording to the nature of the substances from which it is produced, and often gives different residuums upon combustion, some of which are of the acid kind. If it is produced from charcoal, it yields aerial acid or fixed air: from solutions of metallic substances in the vitriolic, nitrous, or marine acids, it yields these respective acids, as M. Lavoisier asserts.

Æther, converted into vapour in a vacuum, gives a permanent elastic vapour, which is inflammable. The atmosphere, which floats round the fraxinella, is inflammable from the admixture of its vapours, which seem to be of the nature of an essential oil: so that on approaching the flame of a candle under this plant, in hot weather, it takes fire in an instant; although the essential oil, extracted from this plant by distillation, is not inflammable on account of the watery particles mixed with it, as M. Bomare asserts.

Mr Scheele is of opinion, that every inflammable air is composed of a very subtile oil. This coincides with the idea entertained by chemists of their phlogiston; and is confirmed by the fact, of its being naturally found in those springs from whence issues petrol, whose exhalations are very inflammable.

The residuum, which remains in the atmosphere after the combustion of inflammable air, is extremely noxious to animals. Doctor Priestley takes it to be a combination of phlogiston with pure air, and on this account calls it *phlogisticated air*. But M. Lavoisier, on the contrary, considers it to be a primitive substance of an unchangeable nature, and gives it the singular name of *atmospheric mephitis*.

II. Hepatic air.

This air seems to consist of sulphur, held in solution in vitriolic or marine air. It is inflammable when mixed with three quarters of its bulk of common air. Nitre will take up about half the bulk of this air; and when saturated with it, will turn silver black; but if strong dephlogisticated nitrous acid be dropped into this water, the sulphur will be precipitated.

One hundred cubic inches of this air may hold eight grains of sulphur in solution in the temperature of 60°; and more, if hotter.

Atmospheric air also decomposes hepatic air.

It is found in many mineral waters, and particularly in the hot baths of Aix-la-Chapelle. The cause and manner of their containing sulphur, which was long a problem, has at last been happily explained by Mr Bergman.

It plentifully occurs in the neighbourhood of volcanoes and in several mines.

Hepatic air is easily obtained by art, from all sorts of liver of sulphur, whether the base be an alkali, an earth, or a metal, if any acid is poured upon it; and the better, if use be made of the marine acid, because it contains phlogiston enough, and does not so strongly attract that of the *hepar sulphuris*. For this reason the nitrous acid is not fit for this process, as it combines itself with the phlogiston, and produces nitrous air. It may also be produced, by distilling a mixture of sulphur and powdered charcoal, or of sulphur and oil, &c. See the detatched article *HEPATIC Air*, and AEROLOGY-*Index*.

III. Phlogiston combined with aerial acid; black lead, or wadd. *Plumbago*. See the detached article *Black-LEAD*.

It is found,

a. Of a steel-grained and dull texture. It is naturally black, but when rubbed it gives a dark lead colour.

b. Of a fine scaly and coarse-grained texture; coarse black-lead.

IV. Mineral tallow. *Serum minerale*.

This was found in the sea on the coasts of Finland in the year 1736. Its specific gravity is 0.770; whereas that of tallow is 0.969. It burns with a blue flame, and a smell of grease, leaving a black viscid matter, which is with more difficulty consumed.

It is soluble in spirit of wine only when tartarised: and even then leaves an insoluble residuum; but expressed oils dissolve it when boiling.

It is also found in some rocky parts of Persia, but seems mixed with petrol, and is there called *schebennaad*, *tsienpen*, *kodreti*.

Dr Herman of Strasburg mentions a spring in the neighbourhood of that city, which contains a substance of this sort diffused through it, which separates on ebullition, and may then be collected. (*Kirwan*).

V. Ambergris. *Ambra grisea*.

It is commonly supposed to belong to the mineral kingdom, although it is said to have doubtful marks of its origin (A).

a. It

(A) Ambergris, according to the assertion of M. Aublet (in his *Histoire de la Guiane*), is nothing more than the juice of a tree inspissated by evaporation into a concrete form. This tree grows in Guyana, and is called

Inflammables.

a. It has an agreeable ſmell, chiefly when burnt:
b. Is conſumed in an open fire:
c. Softens in a ſlight degree of warmth, ſo as to ſtick to the teeth like pitch.
d. It is of a black or grey colour; and of a dull or fine grained texture (B).

The grey is reckoned the beſt, and is ſold very dear. This drug is brought to Europe from the Indies. It is employed in medicine; and alſo as a perfume (C).

VI. Amber. *Ambra flava, ſuccinum, electrum*, Lat. *Carabé*, French. *Agtſtein, Bernſtein*, Germ.

This ſubſtance is dug out of the earth, and found on the ſea-coaſts. According to the experiments of M. Bourdelin, it conſiſts of an inflammable ſubſtance, united with the acid of common ſalt, which ſeems to have given it its hardneſs.

It is ſuppoſed to be of vegetable origin, ſince it is ſaid to be found together with wood in the earth.

By diſtillation it yields water, oil, and a volatile acid ſalt, which the above mentioned author has thought to be the acid of common ſalt united with a ſmall portion of phlogiſton.

Inſects, fiſh, and vegetables, are often found included in it, which teſtify its having once been liquid.

It is more tranſparent than moſt of the other bitumens; and is doubtleſs the ſubſtance which firſt gave riſe to *electrical experiments* (on account of the power it poſſeſſes of attracting little bits of ſtraw, or of other light ſubſtances, when rubbed).

Its varieties are reckoned from its colour and tranſparency. It is found,

A.

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called *cuma*, but has not been inveſtigated by other botaniſts. When ſome branches are broken by high winds, a large quantity of the juice comes out; and if it chances to have time to dry, various maſſes (ſome of which had been ſo large as to weigh 1200 pounds and more) are carried into the rivers by heavy rains, and through them into the ſea: afterwards they are either thrown into the ſhore or eaten by ſome fiſh, chiefly the ſpermaceti whale, known by the name of *Phyſeter-macrocephalus* among ichthyologiſts. This kind of whale is very greedy of this gum-reſin, aud ſwallows ſuch large quantities when they meet with it, that they generally become ſick; ſo that thoſe employed in the fiſhery of theſe whales, always expect to find ſome amber mixed with the excrements and remains of other food in the bowels of thoſe whales who are lean. Various authors, among whom is Father Santos in his *Ethiopia Orientalis*, who travelled to various places of the African coaſt, and Bomare, ſay, that ſome ſpecies of birds are fond of eating this ſubſtance as well as the whales and other fiſhes. This accounts very well for the claws, beaks, bones, and feathers of birds, parts of vegetables, ſhells, and bones of fiſh, and particularly for the beaks of the cuttle fiſh or *ſepia octopedia*, that are ſometimes found in the maſs of this ſubſtance. Dr Swediar, however, attended only to theſe laſt, though he had mentioned alſo the other ſubſtances in his paper inſerted in the Philoſophical Tranſactions for 1783; wherein he attempts to eſtabliſh an opinion, that the amber is nothing elſe but a preternaturally hardened dung, or feces, of the phyſeter whale. Dr Withering and Mr Kirwan have embraced this notion; as did alſo, inadvertently, the editors of this Work. See AMBERGRIS.

(B) Mr Aublet brought ſpecimens of this gum-reſin, which he collected on the ſpot, from the cuma tree at Guiane. It is of a whitiſh-brown colour with a yellowiſh ſhade, and melts and burns like wax on the fire. The ſingularity of this gum-reſin is, that it imbibes very ſtrongly the ſmell of the aromatic ſubſtances which ſurround it; and it is well known that perfumers avail themſelves very conſiderably of this advantage. M. Rouelle examined very carefully this ſubſtance brought over by Mr Aublet, and found that it produced the very ſame reſults as in other good kind of amber. Beſides Mr Aublet's authority, which is deciſive, as being grounded upon direct proofs of fact, Rumphius, quoted by Bergman, long ſince mentioned a tree called *Nanarium*, whoſe inſpiſſated juice reſembles amber. It cannot therefore at preſent be doubted that the origin of this phlogiſtic ſubſtance is the vegetable kingdom, although it may be often found and reputed as a product of the foſſile kind.

This ſuſtance being analyſed by Meſſrs Geoffroy and Newman, quoted by M. Fourcroy, yielded them the ſame principles as the bitumens; viz. an acid ſpirit, a concrete acid ſalt, ſome oil, and a charry reſiduum; which evidently evinces, that all theſe fat and oily foſſile ſubſtances have their origin from the other two kingdoms of nature.

(C) Ambergris is not only brought from the Eaſt Indies, but from the coaſts of the Bahama Iſlands, Braſil, Madagaſcar, Africa, China, Japan, the Molucca iſlands, the coaſts of Coromandel, Sumatra, &c. Dr Lippert, in a treatiſe he publiſhed at Vienna in 1782, entitled *Phlogiſtologia Mineralis*, has copied chiefly from Wallerius what he aſſerts of this ſubſtance. He affirms that there are eight known ſpecies of amber; five of a ſingle colour, viz. the white and the black from the iſland of Nicobar, in the gulph of Bengal, the aſh-coloured, the yellow, and the blackiſh; and two variegated, viz. the grey coloured with black ſpecks, and the grey with yellow ſpecks. This laſt he aſſerts to be the moſt eſteemed on account of its very fragrant ſmell, and to come from the South coaſt of Africa and Madagaſcar, as well as from Sumatra; and that the black dark coloured amber is often found in the bowels of the cetaceous fiſhes. The ſame author adds alſo from Wallerius, that by diſtilling the oil of yellow amber (*ſuccinum*) with three parts and a half of fuming nitrous acid, a reſiduum remains like roſin, which emits a perfect ſmell of muſk; whence ſome conclude, that the ambergris belongs to the foſſile kind: the contrary, however, is evinced in the preceding note.

Inflammables.

A. Opaque.
a. Brown.
b. White.
c. Blackish.
B. Transparent.
a. Colourless.
b. Yellow.

The greatest quantity of European amber is found in Prussia; but it is, besides, collected on the sea-coast of the province of Skone, and at Biorko; in the lake Malaren in the province of Upland; as also in France and in Siberia. It is chiefly employed in medicine and for making varnishes (D).

VII. Rock-oil.

This is an inflammable mineral substance, or a thin bitumen, of a light brown colour, which cannot be decomposed; but is often rendered impure by heterogeneous admixtures. By length of time it hardens in the open air, and then resembles a vegetable resin; in this state it is of a black colour, whether pure or mixed with other bodies. It is found,

A. Liquid.

1. Naphtha.

This is of a very fragrant smell, transparent, extremely inflammable, and attracts gold. It is collected on the surface of the water in some wells in Persia. See NAPHTHA.

2. Petrol.

This smells like the oil of amber, though more agreeable; and likewise very readily takes fire. It is collected in the same manner as the Naphtha from some wells in Italy. See PETROLEUM.

B. Thick and pitchy; *Petroleum tenax*. Barbadoes-tar.

This resembles soft pitch.

It is found at the Dead Sea in the Holy Land; in Persia, in the chinks of rocks, and in strata of gypsum and limestone, or floating on water; also in Siberia, Germany, and Switzerland, in coal-pits; and in America: likewise in Colebrookdale in England.

C. Elastic petrol.

This is a very singular fossil, found of late in England.

By its colour and consistency, it exactly resembles the Indian-rubber, or the gum-resin, from the north part of Brasil, called *caoutchouc*. It is of a dark brown colour, almost black; and some is found of a yellowish brown cast, like the same gum-resin.

With respect to its elastic consistence, it hardly can be distinguished from it, except in the cohesion of its particles, which is weaker.

It has the same property of rubbing off from paper the traces of black-lead pencils.

It burns likewise with a smoky flame; and also melts into a thick oily fluid; but emits a disagreeable smell, like the fossile pitch, or Barbadoes tar.

It

(D) Amber, says M. Fourcroy, is found in small detached pieces, for the most part under coloured sands, dispersed in beds of pyritaceous earth; and above it is found wood, charged with a blackish bituminous matter. Hence it is strongly supposed that it is a resinous substance, which has been altered by the vitriolic acid of the pyrites, notwithstanding that we know that acids, when concentrated, always blacken and charry resinous substances. In fact, the chemical analysis of this substance rather confirms that supposition.

The singular opinion of Dr Girtanner, about the yellow amber being produced by a kind of ants, may be seen in *Journal de Physique* for March 1786, page 227. Or see the article AMBER in this Dictionary.

The colour, texture, transparency, and opacity of this substance, have shown some other varieties besides these mentioned in the text. The principal ones are the following:

6. The yellow succinum, 7. The coloured green or blue by foreign matter, 8. The veined succinum,	opaque.	9. The white, 10. The pale-yellow, 11. The citron-yellow, 12. The deep-red,	transparent.

The golden yellow transparent amber, mentioned in the text, is what the ancients called *chrysolectrum*, and the white opaque was called *leucolectrum*

But we must be cautious about the value of the specimens remarkable for their colour, size, transparency, and the well-preserved insects they contain internally; since there is a probability of deception, several persons possessing the art of rendering it transparent and coloured, and of softening it, so as to introduce foreign substances, &c. into it at pleasure.

M. Fourcroy says, that two pieces of this substance may be united, by applying them to one another, after being wet with oil of tartar and heated. And Wallerius mentions, that pieces of yellow amber may be softened, formed into one, and even dissolved by means of oil of turnip-seed, in a gentle heat; and that according to some authors, it may be rendered pure and transparent, by boiling it in rape-seed oil, linseed oil, salt-water, &c.

Mr Macquer says, that for the purpose of making varnish, this substance must undergo beforehand a previous decomposition by torrefaction, in order to be dissolved by linseed-oil or essential oils. See VARNISH.

Besides the making of varnishes, this substance was much employed formerly in making various pieces of ornament and jewellery. The best pieces were cut, turned, carved, or plained, to make vases, heads of canes, collars, bracelets, snuff-boxes, beads, and other toys, small fine chests, &c. But after diamonds and beautiful hard stones were brought into use, these trinkets are little considered in Europe: nevertheless, they are still sent to Persia, China, and to various other eastern nations, who esteem them still as great curiosities.

It is found in the ſame earthy and ſtony beds as petrol. Some ſpecimens are of a cylindrical form, like bits of thin branches or ſtalks of vegetables, though much more flexible, being perfectly elaſtic.

M. Magellan obſerves, that this foſſil ſeems to favour the opinion of thoſe mineralogiſts, "who believe that theſe oily combuſtibles derive their origin from the vegetable kingdom. It ſeems worth trying, whether pieces of aſphaltum, buried in damp beds of ſparry rubbiſh, or other kind of earths, would take the ſame elaſtic conſiſtence. But ſince many beds of ſhells and other foſſile ſubſtances, both of the vegetable and animal kind, as impreſſions of various plants, and the remains of various quadrupeds, &c. have been found in different parts of the globe, whoſe individual ſpecies undoubtedly exiſt no longer alive unleſs in far diſtant climates, and in the moſt remote countries from the ſpot where their exuvia are dug out; why ſhould we not allow that this new foſſil may be the ſame original elaſtic gum, now growing naturally in Braſil, China, and other hot climates, only altered in its ſmell, and in the tenacity of its particles, by its long depoſition during centuries in the bowels of the earth?"

This elaſtic petrol was found in 1785, near Caſſeltown, in the county of Derbyſhire in England, but in very inconſiderable quantities.

D. Hardened rock-oil; foſſile pitch. *Petroleum induratum, Pix montana.*

1. Pure aſphaltum.

This leaves no aſhes or earthy ſubſtance when it is burnt.

It is a ſmooth, hard, brittle, inodorous, black or brown ſubſtance. When looked through in ſmall pieces, appears of a deep red colour. It ſwims in water.

It breaks with a ſmooth ſhining ſurface.—Melts eaſily: and, when pure, burns without leaving any aſhes; but if impure, leaves aſhes or a ſlag.

According to M. Monet, it contains ſulphur, or at leaſt the vitriolic acid.

It is ſlightly and partially acted on by alcohol and æther.

From this, or the preceding ſubſtance, it is probable the aſphaltum was prepared that the Egyptians uſed in embalming their dead bodies, and which is now called *mummia*.

It is found alſo on the ſhores of the Red Sea, in the Dead Sea, in Germany, and France.—(*Kirwan.*)

And it comes likewiſe from Porto Principe, in the iſland of Cuba. (*Brun.*)

It is found alſo in many parts of China: and is employed as a covering to ſhips by the Arabs and Indians. (*Fourcroy.*)

2. Impure; *Pix montana impura.* Piſſaphaltum.

This contains a great quantity of earthy matter, which is left in the retort after diſtillation, or upon the piece of charcoal, if burnt in an open fire; it coheres like a ſlag, and is of the colour of black-lead: but in a calcining heat, this earth quickly volatiliſes, ſo that the nature of it is not yet known.

It is found in Moſſgrufvan in Norberg, and in Grengierberget, both in the province of Weſtmanland; and alſo in other places.

The piſſaphaltum is of a mean conſiſtence between the aſphaltum and the common petroleum. It is the very bitumen which is collected in Auvergne in France in the well called *de la Pege*, near Clermont Ferrand.

VIII. Jet. *Gagas, Succinum nigrum.*

This is a very compact bitumen, harder than aſphaltum, always black, and ſuſceptible of a good poliſh. It becomes electrical when rubbed; attracts light bodies like the yellow amber; and it ſwims on water.

It ſeems to be nothing elſe than a black amber, or ſuccinum; but ſpecifically lighter, on account of the greater portion of bitumen that enters into its compoſition. When burned, it emits a bituminous ſmell. See the article Jet.

IX. Mineral phlogiſton united with earths.

A. With calcareous earth.

1. With pure calcareous earth. This is the fetid or ſwine ſpar formerly deſcribed.

B. United with calcareous, argillaceous, ponderous, and ſiliceous earth and vitriolic acid. Liver-ſtone: *Lapis hepaticus.*

C. With an argillaceous earth; Pit or Stone Coal.

1. With a ſmall quantity of argillaceous earth and vitriolic acid. *Lithanthrax.* See the articles Coal and Pit-coal.

This is of a black colour, and of a ſhining texture: it burns with a flame, and is moſtly conſumed in the fire; but leaves, however, a ſmall quantity of aſhes.

a. Solid coal. *b.* Slaty coal.

2. Culm-coal, called *kolm* by the Swedes.

This has a greater quantity of argillaceous earth and vitriolic acid, and a moderate proportion of petrol.

It has the ſame appearance with the preceding one, though of a more dull texture: it burns with a flame; and yet is not conſumed, but leaves behind a ſlag of the ſame bulk or volume as the coal was.

From England, and among the alum rock at Moltorp and Billingen in the province of Weſtergottland.

3. Slate-coal.

This coal contains abundance of argillaceous earth. It burns with a flame by itſelf, otherwiſe it looks like other ſlates.

It is found at Gulleraſen in the pariſh of Rettwik, in the province of Dalarne, and alſo with the coals at Boſerup in Skone.

This ſeems to be the ſame with the bituminous ſchiſtus, already deſcribed among the argillaceous earths.

4. Cannel-coal.

Mr Kirwan has put together this variety of coal with that other called *Killkenny-coal*, tho' they have ſome different properties.

The cannel-coal is of a dull black colour; breaks eaſily in any direction; and, in its fracture, preſents a ſmooth conchoidal ſurface, if broken tranſverſely.

It contains a conſiderable quantity of petrol, in in a less denser state than other coals; and burns with a bright lively flame, but is very apt to fly in pieces in the fire. It is said, however, to be entirely deprived of this property, by being previously immersed in water for some hours.

Its specific gravity is about 1270; and being of an uniform hard texture may be easily turned in the lathe, and receive a good polish.

It is from this kind of coal that small vases, as ink-stands, various trinkets, and other curiosities, are made in England, which appear as if made of the finest jet.

5. Kilkenny-coal.

This contains the largest proportion of petrol or asphaltum; burns with less flame and smoke, and more slowly, though intensely, than the cannel-coal.

The quantity of earth in this coal does not exceed one twentieth of its weight. Its specific gravity is about 1400. It is frequently mixed with pyrites.

It is found in the county of Kilkenny, belonging to the province of Leinster in Ireland. The quality of this coal burning almost without smoke, is mentioned in a proverb by which the good qualities of this county are expressed.

6. Sulphureous coal.

This consists of the former kinds of coal, mixed with a notable proportion of pyrites: hence it is apt to moulder and break when exposed to the air. It contains yellow spots that look like metal; and burns with a sulphureous smell, leaving either red ashes, or a slag, or both. Water acts upon it, after it has mouldered. Its specific gravity is = 1500, or more.

Besides the above varieties, schistus, micaceous schistus, and gneiss, are frequently found in the neighbourhood of coal-mines, so penetrated with petrol bitumen as to constitute an inferior species of coal; but the bitumen being burnt, they preserve their form, and in some measure their hardness. Also some grey slates, that are so soft as to be scraped with the nail, and are greasy to the touch, burn like coal.

All the differences of coal arise from a mixture of the varieties already mentioned; and it is observable, that wherever coals exist, slates are generally found near them. Salt or mineral springs are also often found in their neighbourhood. (*Kirwan.*)

7. Bovey coal. *Xylanthrax.*

This is of a brown, or brownish black colour, and of a yellow laminar texture.

The laminæ are frequently flexible when first dug, though generally they harden when exposed to the air.

It consists of wood penetrated with petrol or bitumen; and frequently contains pyrites, alum, and vitriol.

Its ashes afford a small quantity of fixed alkali, according to the German chemists; but according to Mr Mills they contain none.

By distillation it yields an ill smelling liquor, mixed with a volatile alkali and oil, part of which is soluble in spirit of wine, and part infusible, being of a mineral nature.

It is found in England, France, Italy, Swisserland, Germany, Ireland, &c. (*Kirwan.*)

8. Peat. *Geanthrax.*

There are two sorts of inflammable substances known by this name, viz.

The first of a brown, yellowish brown, or black colour, found in moorish grounds; in Scotland, Holland, and Germany. When fresh, it is of a viscid consistence, but hardens by exposure to the air. It consists of clay mixed with calcareous earth and pyrites; and sometimes contains common salt. While soft, it is formed into oblong pieces for fuel, after the pyritaceous and stony matters are separated. When distilled, it affords water, acid, oil, and volatile alkali. Its ashes contain a small proportion of fixed alkali. They are either white or red, according as it contains more or less ochre or pyrites.

The second is found near Newbury in Berkshire. It contains but little earth; but consists chiefly of wood, branches, twigs, roots of trees, with leaves, grass, straw, and weeds. (*Kirwan.*)

9. Stone-turf.

Cronstedt has ranged the turf among the fossils of his Appendix; but as that called in England by the name of *stone-turf* contains a considerable proportion of peat, it may be mentioned with propriety in this class.

Soon after it is dug out from the ground, where it keeps a soft consistence, it at first hardens; but afterwards it crumbles by long exposure to the air.

As to the other common turf, it only consists of mould interwoven with the roots of vegetables; but when these roots are of the bulbous kind, or in a large proportion, they form the worst kind of turf.

Although it may appear incredible, it is nevertheless a real fact, that in England pit-turf is advantageously employed in Lancashire to smelt the iron-ore of that county. Mr Wilkinson, brother-in-law to Dr Priestley, and famous for his undertakings in the extensive iron-works, perhaps the greatest in Europe, makes use of pit-turf in his large smelting furnaces of that province.

Those fossil substances, which furnish fuel for the various purposes of human life, are distinguished by the name of *coals*, on account of their being a succedaneum for wood and other vegetable productions, which, when dry or of an oleaginous kind serve for the same uses. If these vegetable substances are deprived of the access of air, by covering them after ignition, the half-consumed remainder, which is of a black colour, is called by the name of *coal* or *charcoal;* and from hence the fossil which affords fuel has also

Inflammables.

also been called by the same name, though of a very different nature.

Pit-coal and earth-coal are synonymous, and mean coals dug out of a pit or from the earth. But the lithanthrax denotes stone-coal, and more properly indicates the cannel-coal, which has the greatest similarity to a stony substance, by the dull appearance of its fracture and by the uniform texture of its parts.

All these coals are in general a bituminous black or brown and dark substance: for the most part they have a lamellated texture, which breaks easily, and always with a shining surface.

The varieties of pit-coals above-mentioned are the most remarkable, by which they may be distinguished from one another. But they are far from being homogeneous in each kind; as the accidental qualities, and the various proportions of their component parts, produce a far greater number of properties, which renders them more or less fit for different purposes; though these are generally overlooked, and confounded with the common one of affording fuel for making fire to warm our rooms, or for culinary operations.

This fossile bitumen, as Fourcroy remarks, being heated in contact with a body in combustion, and a free access of air, kindles the more slowly, and with more difficulty, as it is more weighty and compact. When once kindled, it emits a brisk and very durable heat, and burns for a long time before it is consumed. If extinguished at a proper time, the remaining cinders may serve several times for a new firing with a small addition of fresh coals. The matter that is burned, and produces the flame, appears very dense, as if united to another substance which retards its destruction. Upon burning, it emits a particular strong smell, which is not at all sulphureous when the earth-coal is pure, and contains no pyrites.

When the combustible, oily, and most volatile parts, contained in the earth-coal, are dissipated and set on fire by the first application of heat; if the combustion is stopped, the bitumen retains only the most fixed and least inflammable part of its oil, and is reduced to a true charry state, in combination with the earthy and fixed base. Pit-coals in this charry state are called *coaks*, which are capable of exciting the most intense heat; and are employed all over Britain in the smelting of iron, copper, and other metallic ores, to the greatest advantage. See COAKS, COAL, COALERY, and PIT-COAL (E).

X. The

‡ *Nat. Hist. of the Mineral Kingdom.*

(E) The coal-metals, or stone strata inclosing coals, are very numerous. Mr Williams ‡ gives the following general account of those in Scotland.

The sand-stones. Of these there is a great variety, distinguishable by colour, texture, and degrees of hardness, generally disposed into thick, middling, and thin strata. The only species our author takes notice of is the regular broad-bedded free-stone of a laminated texture. This commonly rises in thin or middling strata; appearing at the edges of a section, when broken or cut, to be formed of thin lamina or layers of sand, equally laid on the whole breadth of the stone, and well cemented together. A great deal of both red and white free-stone rise in layers of five or six inches, and so upwards, with regular streaks of a fifth or sixth part of an inch appearing the whole length of the stone, when the edge of a slab is polished, as if so many gentle waves of water had formed the layer. The regularity of the structure of this stone corresponds exactly with the regularity of its layers; and our author is of opinion, that the flaggy grey-strata of free stone, with many of the black and grey-strata of coal metals, the grey slate, as well as many other thin strata of the coal metals, may be ranked with this free stone for perfect and regular stratification.

Along with these he classes some of the thin argillaceous strata. "Many of the grey regularly stratified mountain limestones (says he) are also streaked or striped; and the streaks in these appear more conspicuous when broken than the streaked free stones. Some of the hard regularly stratified mountain rocks are also stratified; and in all these three kinds of stones, the streaks are regularly and exactly parallel to the bed of the stone."

Another remarkable instance of regularity of strata is met with in the grey flaggy strata of Caithness.—Throughout all the low country of Caithness, a square of about 10 or 15 miles, there are bluish argillaceous strata, with generally a small quantity of lime in the composition of the stone, which is indurated to a greater degree than is common to such thin strata. The stone is strong and tough, every where disposed in thin broad-beded, regular strata; and in several parts of the country the flags are so thin and regular, and are raised so light and broad, that they are used for covering houses; and three or four of them will cover the side of a small one. Our author mentions a gentleman who has an estate on the south side of the Pentland frith, and who in a bay there raises flags of any size and thickness he pleases; "so truly flat and smooth, that he has only to square the edges to make of them good loft-floors, partitions, chests, mangers, roofs of houses; in short, he does every thing with them. The face of these flags are as smooth and true a plane, as if artificially finished by the best workman."

In most coal fields there are a great variety of strata of different kinds accompanying and lying between the seams of coal, of all sorts of colours, consistencies, and dimensions; all of them blended together without any certain order or regularity; so that if there be 20 seams of coal, it is possible that there may be as many different roofs; that is, the stratum which is the immediate roof of one seam of coal, shall differ from that of another seam in quality, thickness, and colour, so that perhaps no two of the twenty shall be in any respect alike.

The various kinds of coal-roofs (*a*) commonly met with are the following.

1. Ba-

(*a*) The stratum which is placed immediately above a seam of coal, is called the *roof* of the coal, and that which is placed immediately below the seam, is called the *pavement* of the coal: which three, viz. the stratum of coal, and its roof and pavement, with the other concomitant strata lying above and below them, always preserve their stations and parallelism; that is, are all stretched out and spread one above another upon the same inclining plane, and have the same line of bearing and of declivity.

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X. The mineral phlogiston or bitumen, united with the vitriolic acid: sulphur or brimstone. See the article SULPHUR.

This is very common in the earth, and discovers itself in many and various forms. It is found,

A. Native. *Sulphur nativum.*

In this the two constituent parts are mixed in due proportion in regard to each other, according to the rules of that atttraction which is between them. It is easily known,

1. By its inflammability, and by its flame.
2. By its smell when burnt; and,

O 2 3. By

1. *Basaltes.* This is very common in Scotland, where it is frequently called *whin* stone; and at Borrowstounness there are several thick beds of it between the seams of coal. One of them being the immediate roof of a seam of coal there at Hillhouse lime quarry, there is a thin seam of coal beneath a beautiful bed of columnar basaltes. In the Bathgate hills to the southward of Linlithgow, also, there are several strata of coal blended with those of basaltes. These basaltine strata are always very hard, frequently very thick, and generally of a black or blackish grey colour. "There are but few people (says Mr Williams) sufficiently versed in natural history, to know that they are basaltes, as this kind of rock, both in England and Scotland, goes by the name of *whin rock.* In the north of Scotland it is called *skurdy*; and among the miners in Cornwall it has the name of *cockle* (*b*)."—

2. Strata of *limestone* of various thicknesses are met with in different coal-fields. Sometimes the lime is the immediate roof; but sometimes there is an argillaceous stratum of about the thickness of a foot between the coal stratum and that of lime. In the coal-fields at Gilmerton, near Edinburgh, are several beds of limestone, some of them very good, and of considerable thickness. At Blackburn in West Lothian, also, there is a stratum of limestone six or seven feet thick, which is the immediate roof of a seam of coal about five or six feet thick. At Carlops and Spittlehaugh in Tweedale, they have a seam of coal immediately below their lime quarries, which they work for burning their lime.

3. *Post-stone*, a kind of thick and solid stratum of free stone, is one of the roofs of coal, generally without the intervention of any argillaceous stratum, though sometimes a stratum of this kind is interposed. Frequently this kind of stone is rendered very hard by a mixture of iron or pyrites. In most coal fields, thinner strata of free stone are met with as the roofs of coal seams.

4. *Dogger-band*, as it is called by the Scots colliers, is frequently met with as the roof of coal seams. This name is applied to various substances. Sometimes they call strata of iron-stone *dogger bands*; sometimes the name is restricted to the ball iron-stone; sometimes to pyrites; and sometimes the dogger band is a kind of imperfect stone, composed of several heterogeneous mixtures, among which pyrites bears a considerable proportion, and by which the whole is so strongly bound together, that it is frequently very difficult to break through it.

5. *Whin-stone*, properly so called, not of a basaltic nature. These roofs are always very hard, and of various colours, as black, blackish grey, brown, red, &c. sometimes not above two or three feet in thickness, but sometimes much more.

6. *Post-stone*, of a softer nature than that already mentioned. This has no mixture of ferruginous matter.

7. *Regular strata of free-stone*, of various colours, textures, and thicknesses, but not sufficiently thick to deserve the name of *post-stone*, which our author thinks they do not, unless they are above three or four feet. These thin strata of free stone are very numerous in coal fields, and very frequently form the roofs of coal-seams. Some of them are three or four feet thick, while others do not exceed three or four inches. They make good roofs, easily cut through, and may be readily quarried out for other purposes.

8. *Grey-bands*, or grey-coloured free-stone, frequently form the roofs of coal seams. A great number of them are generally arranged in one place, lying immediately above one another; and they are frequently found of all degrees of thickness from one to twenty inches, though the most common dimensions are from two to six. By the Scots colliers these are called *grey sekes* as well as grey bands. Frequently they are found of moderate hardness, and sufficiently strong to make good flags and covers for sewers. These roofs are strong and safe when the stone partakes of the nature of the coal, and has a black or blackish grey colour; but when they have a mixture of tilly or argillaceous matter, they are more friable.

9. *Blaes*, when hard, strong, and well stratified, are reckoned tolerably good coal-roofs. These are always of a bluish-black or black-grey colour, and are of great variety in respect to hardness and strength. Some of the strongest and hardest are either entirely black or greyish black; while some of the different shades of black are pretty thick, and others are but thin. The thickest, however, are not above 18 inches, and the thinnest two or three inches or less. The medium thickness is from one foot to three or four inches. Some of them are sufficiently hard to make a good and safe coal-roof; but they seldom acquire such a degree of hardness as to give any considerable obstruction in sucking. All of them seem to have a considerable quantity of black argillaceous matter in their composition; and the strong blaes have also a considerable quantity of sand; often also containing a large portion of empyreumatic oil, and sometimes have a considerable mixture of coaly matter. There is a great variety both in the thickness and quantity of these blaes found above seams of coal. In some places the thinnest strata make the immediate roof; in others, the thickest. Sometimes we find only five or six inches of blaes upon the coal; in others as many fathoms, or even much more; and it is common to find them of all the intermediate thicknesses.

10. *Whitish*

(*b*) We must observe, however, that according to Bergman and other eminent mineralogists, the *cockles* or *shirls* ought not to be confounded with *basaltes*; which last name does not at all fit those substances. See *Volcanic Products* in the Appendix to this article.

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3. By its producing a liver of ſulphur, when mixed with a fixed alkali, like that made from artificial ſulphur. It is found,

a. Pellucid, of a deep yellow colour.

b. Opaque, white, and greyiſh.

Theſe are found in Siberia, at Bevieux in Swiſſerland, and at Salfatara near Naples.

c. Cryſtalliſed in octoedral priſms, with blunted points.

d. Tranſparent. Mr Davila had been informed that this was brought from Normandy in France. (*Brun.*)

1. Native ſulphur is found in different forms, *viz.* either in ſolid pieces of indeterminate figure, running in veins through rocks; or in ſmall lumps, in gypſum and limeſtones; in conſiderable quantities at Solfatara, and in the neighbourhood of volcanoes; or cryſtalliſed in pale, tranſparent, or ſemitranſparent, octogonal, or rhomboidal cryſtals, in the cavities of quartz; and particularly in the matrices of ores; or in the form of ſmall needles over hot ſprings, or near volcanoes (*Kirwan*). Some-

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10. *Whitiſh and aſh-coloured argillaceous ſtrata*, of middling ſtrength, are frequently found to be the immediate roofs of coal. Some of theſe are of middling thickneſs, others thin. They are commonly found from two inches to two feet in thickneſs. A great many of theſe roofs are very dangerous on account of their fragility; while others are quite ſafe, owing to the more perfect formation of their ſtrata, or to ſome ingredient in their compoſition.

11. *Streaked roofs.* Theſe are of two ſorts: 1. Such as are compoſed chiefly of ſand, with a very ſmall mixture of clay and blaes; and, 2. Thoſe compoſed principally of clay or blaes with a ſmall quantity of ſand. Some of theſe have large, others ſmall, ſtreaks or ribs. Mr Williams ſays that he has ſeen them ſo beautifully ſtreaked as to reſemble the fineſt ſtriped cotton ſtuffs. Theſe ſtripes or ſtreaks always lie exactly parallel to one another, as well as to the bed of the ſtone, and are always ſpread out the whole breadth of the ſtratum. Their colours are various in different ſtrata, ſome of the ſtripes being nearly black and white, others white and red, and others yellow and red. In ſome the ſtripes appear of a lighter and darker grey colour. Some of the finely ſtriped ſtones have their ſtreaks about a quarter of an inch in diameter; ſometimes leſs: and it is common to ſee ſtripes from a quarter to three quarters of an inch broad; but in the finely ſtriped ſtones it is rare to find them a full inch thick without ſome different ſhade on one ſide or other of the ſtripe. The ſecond kind of theſe ſtreaked roofs, viz. ſuch as are compoſed of blaes, with a ſmaller mixture of ſand, differ but little from the former; only the colours are not always ſo bright, nor the ſtripes ſo fine; neither is the roof quite ſo hard.

12. *The ſoft blae roofs* ſometimes conſiſt of pretty thick ſtrata; others of ſuch as are thin or of middling thickneſs. There are likewiſe arrangements or claſſes of regularly ſtratified blaes, found immediately above ſeams of coal, from three or four inches to ſeveral fathoms in thickneſs, though ſome are even met with little exceeding one inch in thickneſs; though in the ſame place there might be a conſiderable thickneſs of blaes above the coal, taking in all the different ſtrata, thick and thin, which lay above it. Some of theſe roofs have an oily appearance on the outſide, and through all the fiſſures and joints of the ſtrata; that is, they appear ſmooth and gloſſy, and are very ſlippery to the touch. Others have no appearance of this kind; but all of them are tender, weak, and fragile, ſo that they make a very indifferent and dangerous roof.

13. Another kind of coal-roof conſiſts likewiſe of *blaes*, but ſuch as are *imperfectly ſtratified*. It is altogether the ſame in quality and colour as the laſt, the only difference that can be diſtinguiſhed being in the different degrees of ſtratification. The beds of this kind are not perfect, but unequal; whence it is a bad and dangerous roof, as great pieces of it are frequently apt to fall down by reaſon of the inequality and different joints of the ſtrata. Some of theſe blaes appear in thick, and others in thin or middling thick beds; while ſome have an oily ſmoothneſs, called by the Scots colliers *creeſhy* (greaſy) *blaes*. It is owing to this oilineſs particularly that theſe kinds of roofs are ſo dangerous; for the oil pervades the joints, and, rendering them ſlippery, makes the pieces more apt to fall out as ſoon as the coal is worked away from below them. Some of theſe have ſuch a quantity of natural oil, that they will flame a little in the fire; and in ſome places there are hard blaes which will burn when fire is ſet to them, though they will not conſume. At Pitfirran in Fifeſhire there is a ſpecies of this blaes ſo inflammable, that when fire is ſet to one corner of a hillock it will burn throughout the whole; nevertheleſs it is not reduced in bulk by this combuſtion, nor does it produce any aſhes. Inſtead of this it becomes conſiderably harder than before, and acquires a pale red colour. By reaſon of its hardneſs, it is proper for being laid upon horſe and foot paths, but is not ſo for roads over which heavy wheel-carriages paſs.

14. *Soft blaes not ſtratified at all.* Of theſe there is no more than one bed from two or three inches to ſeveral fathoms in thickneſs, without any others either above or below it. They are as common as any above the coal ſeams; but their ſubſtance is not always uniform throughout the whole ſtratum. Some of them are found divided into ſmall angular maſſes, and others into larger ones; but whether theſe are uniform or not, they always make a bad and dangerous roof. Theſe argillaceous ſtrata are ſometimes called *beds of till*; the uniform ſort are called *dauk*, and the glebous kind *lipey* blaes, by the Scots colliers. Both the uniform and glebous ſoft blaes frequently contain a quantity of ball iron-ſtone, though ſome of it contains none at all. The regular continuous ſtrata of iron-ſtone are commonly found in ſtratified ſoft blaes. There is a variety of ſoft coal-roofs of a grey colour, and of which ſome are regularly ſtratified, and ſome not.

15. *Re-*

Sometimes it is formed in old privies: of this Mr Magellan saw some lumps that were found in a very old one at Paris.

2. United with clay in the aluminous ore of La Tolfa, and also at Tarnowitz in Silesia. This last resembles a light grey earth: when dry, bursts or cracks in the water like marl; and possesses a strong peculiar smell like camphor. If distilled, the sulphur sublimes. One hundred parts of this earth afford eight of sulphur, besides gypsum and a quantity of iron.

3. Mixed with clay, iron, and selenite. This compound is of a grey, brown, or black colour, found near Rome, Auvergne, Spain, and Iceland.

4. With limestone in the form of a calcareous hepar. This is found at Tivoli, near Rome, and elsewhere in Italy. It is sometimes dissolved in mineral waters, three pounds of which contain as much as 25 grains of sulphur. It often forms incrustations on the brinks of these springs.

5. In the form of an alkaline hepar. This is said to be found in some waters in Russia; as will be hereafter noticed.

6. United to iron and clay of pyrites, &c. of which hereafter.

7. United to metallic substances, as hereafter specified.

B. Saturated with metals (F).

1. With iron. Pyrites, or copperas-stone; *Pyrites*.

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15. *Regularly soft grey coal-roofs*.—Of these there are several sorts. Some have a considerable quantity of sand in the composition of the strata; and many of these are as regularly stratified as any coal-metals whatever. Numbers are found very thin, and others of middling thickness; though in all cases they are so tender and friable, that they make very bad and dangerous roofs. Some of them indeed look pretty well at first but they soon crumble and come down, especially when they have been exposed to the air. This, in the opinion of Mr Williams, is owing partly to their having too much clay in their composition, and partly to the want of a sufficient quantity of natural cement to connect the several particles of the stone together.

16. *Soft grey regular strata*, or grey bands of an argillaceous kind; and of these there is likewise a considerable variety. Some are of a dark, others of a lighter grey; some thick, others thin: they are very numerous in coal-fields, and are frequently to be found as the immediate roofs of coal. These, as well as the black kinds, are found in all quantities or degrees of thickness above different coals, from a few inches up to several fathoms; but whether they be in great or small quantity, the roof they compose is generally very frail and tender.

17. *Soft grey argillaceous bands, imperfectly stratified*. These differ little or nothing in substance from the former; the only difference is in the stratification. Many of the strata of the former are of a middling thickness, or rather thin, finely and regularly spread out, and every part of each stratum of an equal thickness. But this sort, though it has the appearance of strata, is clumsy and irregular; that is, the several beds are unequal, and divided by many irregular joints into unequal misshapen masses, which makes this a very bad roof; the masses being apt to separate at the joints, and to fall down when the coal is worked out from below them.

18. *Soft grey argillaceous beds* of metal or coal roofs *not stratified at all*. These are of two kinds, *viz.* 1. such as are found broken or formed in the stratum into glebes or masses; and, 2. such as are found in one uniform mass throughout the whole bed, without any division into masses or strata. These grey soft roofs are of all degrees of thickness, from a few inches up to many fathoms, as well as the black; and there is but very little difference between them in any respect excepting the colour. But in this, as well as in the black unstratified blaes, and that both in the glebous and uniform beds, ball or glebous iron-stone is frequently found; and strata of iron-stone are also found in the stratified soft grey blaes.

19. *White and ash-coloured soft argillaceous coal-roofs*; and of these there is also a great variety. Some of this kind are regularly stratified, others imperfectly, and some not at all. Some of the whitish argillaceous roofs are compounded of gritty sand and clay; others appear to be chiefly composed of pure clay; and some of a loamy clay. Those which are regularly stratified and mixed with sand, either coarse or fine, are of great variety with regard to thickness and the arrangements of the strata; but all of them are tender and fragile, and thus make very troublesome and dangerous roofs.

20. *Whitish argillaceous roofs, stratified*, and of a homogeneous quality, or not mixed with sand. Some of these are finely and perfectly stratified, and are of different degrees of hardness; but in general, make but a weak roof. Some of them are found in irregular strata, with all the other varieties and imperfections already mentioned.

21. *White and ash-coloured argillaceous coal-roofs*, not *stratified at all*. Sometimes these are found in very thick beds in the coal-fields; and some of these, as well as of the black soft roofs, rise in glebes and masses of different sizes; while others are homogeneous throughout the whole bed, however thick, from two or three inches to several fathoms. Some of these beds of white argillaceous marle-like matter are found to be a sandy or loamy clay; others a pure homogeneous clay, which does not feel gritty between the fingers nor in the mouth. The shades and varieties of this kind are as numerous as those of any of the foregoing; and all of them, by the Scots colliers, are called *dauk*, whatever be their coour. Mr Williams informs us, that he has frequently taken some of these fine white clays to wash his hands, and has found them answer almost as well as soap.

(F) Sulphur is the most common mineraliser of metals; and therefore most of its combinations with those substances fall to be ranked hereafter among the metallic ores.

Inflammables.

rites. This is the ſubſtance from which moſt ſulphur is prepared, and is therefore ranked here with all its varieties. It is hard, and of a metallic ſhining colour.

A. Pale yellow pyrites; *Pyrites ſubflavus.* Marcaſite. This is very common, and contains a proportionable quantity of ſulphur with reſpect to the iron; when once thoroughly inflamed, it burns by itſelf.

a. Of a compact texture; *Polita piedra del ynca, Hiſpanorum.*

b. Steel-grained.

c. Coarſe-grained.

d. Cryſtalliſed. It ſhoots moſtly into cubical and octoedral figures, though it alſo cryſtalliſes into innumerable other forms.

B. Liver-coloured marcaſite. Its colour cannot be deſcribed, being betwixt that of the preceding marcaſite and the azure copper ore. The iron prevails in this kind; it is therefore leſs fit to have ſulphur extracted from it, and alſo for the ſmelting of copper ores. It is found,

a. Of a compact texture.

b. Steel-grained.

c. Coarſe-grained.

C. Variouſly combined with iron and other metallic ſubſtances.

1. With iron and copper; forming yellow or marcaſitical copper ore.
2. With iron, ſilver, and lead; potters lead ore.
3. With iron and zinc; mock lead, black jack or blende.
4. With iron and arſenic; arſenical pyrites.
5. With iron and cobalt.
6. With iron and biſmuth.
7. With iron and nickel.
8. With iron and gold; pyritical gold ore.
9. With ſilver; glaſs ſilver ore.
10. With copper; grey or vitreous copper ore.
11. With lead; potters lead ore.
12. With biſmuth.
13. With quickſilver; cinnabar.
14. With arſenic; orpiment, realgar.

XI. Mineral phlogiſton mixed with metallic earths.

This is not found in any great quantity: in regard to its external appearance, it reſembles pit-coal; and the fat ſubſtance contained in it, at times, partly burns to coal, and partly volatiliſes in a calcining heat.

The only known varieties of this kind are,

A. Minera cupri phlogiſtica.

When it has been inflamed, it retains the fire, and at laſt burns to aſhes, out of which pure copper can be ſmelted.

B. Minera ferri phlogiſtica.

This is not very different in its appearance from the pit-coal or foſſile pitch, but it is ſomewhat harder to the touch. There are two varieties of this ſpecies:

Metals.

1. Fixt in the fire; *Minera ferri phlogiſtica fixa.*

Expoſed to a calcining heat, it burns with a very languid though quick flame; it preſerves its bulk, and loſes only a little of its weight. It yields above 30 per cent. of iron.

a. Solid, which reſembles black ſealing-wax.

b. Cracked, and friable.

2. Volatile in the fire.

This is unalterable in an open fire, either of charcoal, or even upon a piece of charcoal before the flame of the blow-pipe; but under a muffle the greateſt part of it volataliſes, ſo that only a ſmall quantity of calx of iron remains. It is found,

a. Solid.

b. Cracked.

This laſt kind leaves more aſhes: theſe aſhes, when farther expoſed to the fire, become firſt yellowiſh-green, and afterwards reddiſh-brown; when, beſides iron, they then alſo diſcover ſome marks of copper: it has, however, not been poſſible to extract any metallic ſubſtance from them, the effects of the loadſtone, and the colour communicated to the glaſs of borax, having only given occaſion to this ſuſpicion.

Class IV. METALLIC SUBSTANCES.

Metals are thoſe minerals which, with reſpect to their volume, are the heavieſt of all known bodies. Some of them are malleable; and ſome may be decompounded; and, in a melting heat (G), be brought back again to their former ſtate by the addition of the phlogiſton they had loſt in their decompoſition. See Metallurgy, Part I. Sect. i. and Chemistry-Index at *Metallic Calces* and *Metals.*

All the metallic ſubſtances contain phlogiſton; and when, to a certain degree, deprived of it, fall into a powder like an earth; but their attractions for phlogiſton are different.

Moſt of them, when melted in a common way, and expoſed to the air, have an earthy cruſt formed upon the ſurface, which cannot again be reduced to metal without the addition of ſome inflammable matter. The baſe metals have this property.

But the noble metals, *viz.* platina, gold, and ſilver, are ſo firmly united to the phlogiſton, that they never calcine under fuſion, however long continued; and, after being changed into a calx in the liquid way, when melted in the fire, they reaſſume their metallic form without any other phlogiſton than what is contained in the matter of heat.

Quick-

(G) The various degrees of heat required to reduce metals to a fluid ſtate, are ſeen in the following table, which was extracted, for the moſt part, by Dr Withering, from the printed treatiſes of the late celebrated Profeſſor Bergman. It exhibits, in a ſimple view, 1. The ſpecific gravity of each metal; 2. The degree of heat by Fahrenheit's ſcale, in which it melts; 3. The quantity of phlogiſton it requires for its ſaturation; and, 4. Its

Quickfilver holds a kind of middle place: for, like the bafe metals, it may be calcined, though not readily; and, like the noble ones, it may be reduced by heat alone.

We may therefore reckon four noble or perfect metals; *viz.* gold, platina, filver, and mercury; becaufe, when calcined, they recover their phlogifton without the addition of any phlogiftic fubftance.

But as tin, lead, copper, and iron, cannot be reduced without fuch addition, thefe are called *ignoble* and *imperfect* or *bafe metals*. *Kirwan's Mineralogy.*

However, all thofe eight metals (even mercury, when folid) are malleable to a confiderable degree, and are called *entire metals*. But

Bifmuth, zinc, antimony, arfenic, cobalt, nickel, manganefe, molybdena, and wolfram, are fcarce at all malleable, and hence they are called *femimetals*. Neverthelefs, zinc and purified nickel are more malleable than any of the other femimetals; fo that we have four perfect or noble metals, four imperfect or bafe, eight entire, and nine femimetals (H).

Order

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4. Its attraction to the fame faturating phlogifton. We muft, however, obferve, that if the fecond column be compared with that of Wedgwood's thermometer, their great difagreements betray fome fundamental error in the affumed data: for the degrees of heat affigned by Mr Wedgwood for melting gold, filver, and copper, are more than quadruple of thofe affigned by Bergman, and that for melting iron is more than eleven times greater; although they both nearly agree in the red heat of iron, which Bergman fays to be 1050 degrees, and Wedgwood 1077. Mr Magellan is of opinion, that the fault lies in Mortimer's thermometer, which Bergman quotes with fome diffidence (Sect. 197. of his *Sciagraphia*); and thinks it probable, that the changes caufed by heat, on this metallic thermometer, are in a much lefs increafing proportion by intenfe fire, than thofe indicated by the contraction of the pure clay, happily employed by Wedgwood in his thermometer. He therefore added another column to this table, marked *Wedgw.* with the degrees of the melting heats already afcertained by this laft thermometer, as being the neareft to truth.

Metals.	Specific Gravity.	Melting Heat. *Berg.*	Melting Heat. *Wedgw.*	Saturating Phlogifton.	Attraction to faturating Phlogifton.
Gold	19,640	1301	5237	394	1 or 2
Platina	21,000			756	1 or 2
Silver	10,552	1000	4717	100	3
Quickfilver	14,110	—40	—40	74	4
Lead	11,352	595		43	10
Copper	8,876	1450	4587	312	8
Iron	7,800	1601	17977	342	11
Tin	7,264	415		114	9
Bifmuth	9,670	494		57	7
Nickel, common	7,000	1301		156	11
Nickel, pure	9,000	1601		109	5
Arfenic	8,308				
Cobalt, common	7,700	1450			
Cobalt, pure		1601			
Zinc	6,862	699		182	11
Antimony	6,860	809		120	6
Manganefe	6,850	Very great		227	11

N. B. By faturating phlogifton, Profeffor Bergman means to exprefs the proportionate quantities taken away from each metallic fubftance, when diffolved by means of acids, and of courfe reduced to a calciform ftate. The laft column only expreffes their attraction to this part of their phlogifton, not to that which ftill remains united to them in a calciform ftate. *Withering.*

(H) Mr Mongez remarks, that the following are the general properties of metals, when confidered as phyfical bodies; *viz.* their opacity, great fpecific gravity, ductility, tenacity, cryftallization, flavour, and even fmell, at leaft in fome of them.

It is from their denfity that their gravity and opacity proceed; this laft being fuch, that, even reduced to the thinneft plates, no rays of light can pafs through their particles, unlefs there remains an interftice or pore quite free from the metallic fubftance. Gold leaf muft, however, be excepted, which exhibits a fine green by tranfmitted light.

As to their cryftallization, it has been found to take place whenever they are pure, and left to cool very flowly by themfelves, after having been perfectly fufed. (See *Journal de Phyfique* for July 1781, p. 74.) The flavour and fmell above mentioned are very perceptible in the reguline fubftances of arfenic and antimony, as well as in lead, copper, and iron.

All metals are conductors of electricity; and more perfectly fo than any other bodies during their union with phlogifton.

They

Metals. Gold.

Order I. Noble or Perfect Metals.

I. Gold; *Aurum sol chymicorum.* See the articles Gold; also Chemistry-*Index*; and Metallurgy, Part II. sect. 1.

This is esteemed the principal and first among the metals; and that partly for its scarcity, but chiefly for the following qualities:

1. It is of a yellow shining colour.
2. It is the heaviest of all known bodies, its specific gravity to water being as 19,640 to 1000.
3. It is the most tough and ductile of all metals; because one grain of it may be stretched out so as to cover a silver wire of the length of 98 yards, by which means $\frac{1}{3000000}$ of a grain becomes visible to the naked eye.
4. Its softness comes nearest to that of lead, and consequently it is but very little elastic.
5. It is fixed and unalterable in air and water, and is indestructible by the common action of fire.

6. When melted, it reflects a bluish-green colour from its surface.
7. It dissolves in aqua-regia, in the dephlogisticated marine acid, and also (according to Crell ‡) in an acid obtained by distilling vitriolic acid from off manganese.
8. When mixed with a volatile alkali and a little of the acid of nitre, by means of precipitation out of aqua-regia, it burns off quickly, in the least degree of heat, with a strong fulmination.
9. It is dissolved, *in forma sicca*, by the liver of sulphur, and also somewhat by the glass of bismuth (i).
10. It is not carried away by the antimony during the volatilisation of that semi-metal, and is therefore conveniently separated from other metals by the help of crude antimony; in which process the other metals are partly made volatile, and fly off with the antimony, and partly unite with the sulphur, to which the gold has no attraction, unless by means of some uniting body, or by a long digestion (k).

11. The

Metals. Gold.

‡ *Journal de Physique*, Oct. 1785. p. 297.

They are soluble either in nitrous acid and in dephlogisticated marine acid, or in aqua regia; and are precipitable in some degree by caustic alkalies; and except platina by the Prussian alkali.

When dephlogisticated, they communicate a tinge to borax and to microcosmic salt, or at least render them opaque.

They assume a convex surface when melted, and even a globular form, if in a small quantity; and though they mix for the most part with one another whilst fused, yet they refuse to unite with unmetallic substances, even their own calces, iron only excepted, which does to its own calx slightly dephlogisticated and to plumbago. Nickel also, and some others, may contain sulphur in their reguline state.

Metals, when calcined, are capable of uniting with other calces and salts.

Three of the metallic calces have been found to be of an acid nature; *viz.* the arsenical, molybdenic, and tungstenic; from which, by analogy, the nature of other calces may be conjectured.

The phlogiston contained in metals is in a pure state; *viz.* without water and aerial acid, with which it is invariably accompanied in all other compounds except acid airs and sulphur.

When metallic substances are naturally found in the earth united to their full share of phlogiston, and consequently possessing their peculiar properties, they are called *native.*

But when they are found more or less deprived of their phlogiston and of their properties, combined with other substances, they are then called *mineralised.* This is the most common state of the mineral kingdom. The substance so combined with them is called the *mineraliser*, and the whole is called *ore*; by which name are also distinguished these earths and stones in which metallic substances are contained.

But if both metallic substances are mixed together in their metallic or reguline form, without the loss of phlogiston, they are then said to be alloyed.

When the mineraliser is of a saline nature, and renders the metallic combination soluble in less than 20 times its weight of water, the compound is ranged among salts. Thus the vitriols of iron, copper, and zinc, are rather classed with salts than with ores.

The most common mineralisers are, sulphur, arsenic, and fixed air or aerial acid. The least common are the vitriolic and the marine acids. The phosphoric has been found only in two instances; *viz.* united to lead, discovered by Gahn; and to iron, in the siderite, as Mr Meyer believes.

Those metallic substances, mineralised by aerial acid, are called *calciform ores.*

M. Magellan observes, that if the new doctrine of the French chemists, who assert, that calces of metals are a compound of dephlogisticated or vital air with the metallic substance, were just, all calciform ores should produce this vital air instead of aerial acid, when they are reduced to their metallic form; which is not the case: neither should all the base metals and semimetals absolutely require the mixture of some phlogistic substance in order to their being reduced from the state of calces to their metallic form, which otherwise would be quite useless, if their reduction simply consisted in their separation from the vital or dephlogisticated air.

(i) Neither sulphur nor fixed alkali has any action on gold; but the liver of sulphur, which is a compound of both, can dissolve it in the dry way; so that if a proper quantity of gold-leaves be put in a crucible together with liver of sulphur, and it be melted in a brisk fire, the gold is thoroughly dissolved; and if the whole be diluted in water, the gold will be kept in the solution, and even pass through the filtre along with it.

(k) Antimony is used also to refine gold from its alloy, as it attenuates and carries off all other metallic substances

I

Perfect METALS. Gold.

11. The phosphorus is said to have ingress into gold (L).

12. If mixed with a less portion of silver, platina, copper, iron, and zinc, it preserves tolerably well its ductility. But,

13. When mixed with tin, it becomes very brittle; and it attracts likewise the smoke of that metal, so as to be spoiled if melted in an hearth where tin has been lately melted (M).

14. It requires a strong heat before it melts, nearly as much or a little more than copper.

15. It mixes or amalgamates readily with quicksilver. See METALLURGY, Part II. sect. i. (N).

16. It is not dissolved by the glass of lead, and therefore remains on the cupel.

A. Native gold. With respect to the figure or the quantity in which gold is found in one place, it is by miners divided into,

1. Thin superficial plated or leaved gold; which consists of very thin plates or leaves, like paper.
2. Solid or massive, is found in form of thick pieces.
3. Crystallised, consists of an angular figure.
4. Wash gold, or gold dust, is washed out of sands, wherein it lies in form of loose grains and lumps (O). See other distinctions of form under the article GOLD.

B. Mineralised gold. This is an ore in which the gold is so far mineralised, or so entangled in other bodies, as not to be dissolved by the aqua-regia.

1. Mineralised with sulphur by means of iron. Marcasitical gold-ore; *Pyrites aureus.*
2. By means of quicksilver. It is found in Hungary.
3. By means of zinc and iron, or silver. The Schemnitz blende.

See other varieties of mineralised gold ores under the detached article GOLD, already referred to.

Perfect METALS. Silver.

II. Silver: *Argentum, Luna.* See the article SILVER. See also CHEMISTRY-*Index;* and METALLURGY, Part II. sect. iii. and Part III. sect. iii.

This metal is,

a. Of a white shining colour.

b. Its specific gravity to water is, according to Cronstedt, as 11,091 to 1000; according to Bergman, = 10,552; and according to Kirwan, 11,095.

c. It is very tough or ductile, so that a grain of it may be stretched out to three yards in length and two inches in breadth.

d. It is unalterable in air, water, and fire.

e. It dissolves in the acid of nitre, and also by boiling in the acid of vitriol.

f. If precipitated out of the acid nitre with the common salt, or with its acid, it unites so strongly with this last acid, that it does not part from it, even in the fire itself, but melts with it into a mass like glass, which is called *luna cornea* (P).

3. It

substances mixed with it, without excepting the silver; whilst lead leaves this last behind, and even adds some of its own to the gold. *Paucton*, p. 659.

(L) Gold, reduced into thin leaves, is not acted upon by the phosphoric acid in the humid way, though the fire be urged till luminous decrepitations take place; but when it passes that point which separates the humid from the dry way, Mr Margraaf observed that some purple scoria were formed, which is an indication that this concrete acid had partly calcined the gold during its fusion. *Elements de Chymie de Dijon*, Vol. III. p. 131.

Besides this, a drop of the phosphoric acid on the solution of gold by aqua-regia precipitates the metal in its revived state, as asserted by the academicians of Dijon. *Magellan.*

(M) The fumes of a single grain of tin are capable of rendering hard eight ounces of gold; but it easily recovers its malleability by being melted on the fire. (*Wallerius* and *Bomare's* Mineralogy.) But when gold is mixed with arsenic, cobalt, nickle, bismuth, or with the regulus of antimony, it only loses great part of its malleability; and when in a certain proportion, it may be calcined and vitrified with them.— (*Fabroni.*)

(N) Bergman doubts if ever gold has been found perfectly pure; and Mr Kirwan says that it is very seldom found so, being generally alloyed with silver, copper, or iron, or all three. As to the gold commonly used in toys and other objects of luxury, every one knows that it is purposely debased by the artists with copper or other metals; and of late it has been employed in various pieces of jewellery, to form ornaments of various colours: thus a great alloy of silver (viz. one-third part), gives it a shade of a green colour; a similar quantity of copper, a reddish one; a mixture of arsenic, or filings of steel, in the proportion of one-fourth part, gives it a bluish cast; so that having the yellow naturally in the pure gold, and the white in pure silver, the jewellers have almost all the colours to diversify their work. Even in the currency of money, there is none coined out of pure gold, which, by common agreement, is called *gold of 24 carats.* The gold coin of England, France, and Portugal, only contains 22 parts of pure gold, and two of alloy, viz. it is only 22 carats, in the common saying: that of Spain is but of $21\frac{10}{12}$ carats: but the ducat of Holland is of $23\frac{24}{32}$ carats; and the zecchino of Venice, of $23\frac{28}{32}$ carats: which last therefore, it would seem, is the purest gold coin of Europe. (*Pauston's Metrologie.*)

(O) M. Daubenton, in his Methodical Tables of Minerals, enumerates eight sorts of native gold, viz. 1. In powder; 2. In grains; 3. In small spangles; 4. In masses of lumps; 5. In filaments; 6. In branches like vegetables; 7. In lamella; and 8. In octoedral crystals.—He observes also, that gold, in its reguline state, is formed, either, 1. Into angular crystals, composed of yellow octoedres; or, 2. Into irregular yellow masses, which, being broken, show a granular substance.

(P) The marine acid attracts the calx of silver, but cannot remove its phlogiston; and therefore cannot dissolve

Perfect Metals. *Silver.*

g. It does not unite with the semi-metal nickel during the fusion.

h. It amalgamates easily with quicksilver.

i. It is in the dry way dissolved by the liver of sulphur.

k. It has a strong attraction to sulphur, so as readily to take a reddish yellow or black colour when it is exposed to liver vapours.

l. It has no attraction to arsenic; whence, when the red arsenical silver ore, or *rothgulden ertz* of the Germans, is put into the fire, the arsenic flies off, and leaves the sulphur (which in this compound was the *medium uniens*, behind, united with the silver in form of the glass silver ore, or glass ertz.

m. It is not dissolved by the glass of lead, and consequently it remains on the cupel.

n. It is exhaled or carried off by volatile metals and acids; as by the vapours of antimony, zinc, and the acid of common salt.

o. According to Cronstedt, it melts more easily than copper; and this was a general opinion. But the contrary, as Mr Magellan remarks, has been proved by means of the nice thermometer lately invented by Wedgewood.—See Thermometer.

Silver is found,

A. Native or pure; which most generally is nearly of 16 carats standard (Q.)

1. Thin, superficial, plated or leaved.
2. In form,
   a. Of snaggs, and coarse fibres.
   b. Of fine fibres. Capillary silver.
   c. Arborescent.
   d. Crystalline or figured. This is very rare: it has distinct fibres, with shining surfaces.

B. Mixed or alloyed with other metals.

The following are the known instances of these mixtures:

1. United to gold, (*Bergman's Sciagraphia*, § 154.)
2. Mixed with copper; (*Berg. Sc.* § 155.)
3. United to gold and copper; (*Berg. Sc.* § 156.)
4. Amalgamated with mercury, found in the mines of Salberg; (*Foster's notes to Brunnich.*)
5. United to iron; (*Berg. Sc.* § 157.)
6. United to lead, sometimes in such quantities as to be worth the expences attending the separation.
7. United to arsenic; (*Journal de physique*, 1778, p. 50.)
8. United to antimony; (*Berg. Sc.* § 159.)
9. Joined to the regulus of arsenic and iron; (*Berg. Sc.* § 160.)
10. Mixed with the alkaline limestone from Annaberg, described by Mr Justi; (*Brunnich.*)
11. Sandy silver-ore, without any metallic shining.
12. Silver-ore in a red-brown schistus, described by Lehman: it is composed of argillaceous earth, micaceous hematites, sulphur, calcareous spar, fluor mineralis, lead, and silver.—It contains about seven or eight ounces of silver on the hundred weight.
13. Soft silver-ore. It is found among the marles and argillaceous earths; and is of various colours, either singly or mixed.

C. Dissolved and mineralised.

(1.) With sulphur alone. Glass silver-ore.

This is ductile, and of the same colour as lead; but, however, becomes blacker in the air. It has therefore, though very impoperly, got the name of *glass-ore;* for that name rather belongs to the *minera argenti cornea*, or horn silver ore, if indeed any silver ore can be considered as glassy.

It is found,

1. In crusts, plates, or leaves.
2. Grown into
   a. Snaggs, and
   b. Crystalline figures.
   It is generally either of a lamellar or a grained texture.

The glass silver ore is the richest of all silver ores; since the sulphur, which is united with the silver in this ore, makes but a very small quantity of its weight.

(2.) Arsenico-martial silver ore, (*Weill ertz*, Germ.)

This ore contains silver and iron mineralised by arsenic; the arsenic in a larger proportion than the iron. This is the *Pyrites argenteus* of Henckel.

1. It is a hard substance, of a white shining appearance, and of a compact, lamellar, or fibrous texture. (*Kirwan*, sp. 7.)
2. Of a yellowish white colour, and of a striated structure, resembling bismuth, but much harder. (*Kirwan*, sp. 3.)—It is found near Guadanal canal in Spain.
3. Near the same place is found also another ore of the same kind, which is very soft and easily cut; and when cut, has a brilliant metallic appearance. It consists of conchoidal laminæ. The quintal contains only from four to six ounces of silver; but it is easily reduced by evaporating the arsenic, which then leaves the silver slightly contaminated with iron. (*Kirwan*, sp. 4.)

(3.) With

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dissolve it in its metallic state, (*Bergman.*) However, the marine acid, if well concentrated, or rather reduced into an aerial form, dissolves silver in its metallic state, (*Fabroni.*)

Mr Scheele, and after him Mr Bertholet, assert positively, that the marine acid, being dephlogisticated by its distillation over maganese in the form of a yellow air or gas, dissolves all the metals, without excepting gold, silver, or mercury. See Scheele's Essay 5. § 25. H.

The vitriolic acid being distilled also over the maganese, dissolves silver, gold, and mercury, as Dr Crell asserts, (*Journal de Physique*, Oct. 1785, p. 297.)

Silver is precipitated from the vitriolic and nitrous acids by the marine; and from the nitrous, in great measure, by the vitriolic, (*Kirwan.*)

(Q) Wallerius distinguishes seven species of silver: (see the article Silver). Daubenton reckons eight varieties of *native white silver*, arising from their peculiar forms.

Perfect METALS, *Silver.*

(3.) With sulphur and arsenic. The red or ruby-like silver ore. The *rothgulden* of the Germans.

The colour of this ore varies as the proportion of the ingredients varies in the mixture, viz. from dark grey to deep red; but when it is rubbed or pounded, it always gives a red colour.

a. Grey arsenical silver ore.

1. Plated, crusted, or leaved.
2. Solid.

b. The red arsenical silver ore:

1. Plated, crusted, or leaved;
2. Solid or scaly.
3. Crystallised (R.)

In this last form it shows the most beautiful red colour, and is often semi-transparent. It contains about 60 *per cent.* in silver.

(4.) With sulphur, little arsenic, and iron.—(*Schwartz ertz, Schwartz gulden, Silber mulm.* Germ.)

This is a friable, weathered, decayed ore.

a. Of a black or sooty colour; and is therefore called by the Germans *silberschwartz*, or *russigtes-ertz.*

(5.) With sulphurated arsenic and copper. The *weissgulden* of the Germans.

This, in its solid form, is of a light grey colour, and of a dull and steel-grained texture. Its proportion of silver is from 10 to 30 *per cent.*

(6.) With sulphurated arsenic and iron. The *weisertz*, or white silver ore of the Germans.

This is an arsenical pyrites, which contains silver; it occurs in the Saxon mines, and so exactly resembles the common arsenical pyrites, as not to be distinguished from it by sight alone, or without other means.

(7.) With sulphurated antimony.

a. Of a dark grey and somewhat brownish colour; the *laberetz* of the Germans.

b. Of a blackish blue colour.

1. In form of capillary crystals. *Federertz*, or plumose silver ore.

(8.) With iron, arsenic, and cobalt, mineralised by sulphur.

This ore looks like the *weissgulden* described above; but is distinguished by the rose coloured particles of cobalt, dispersed through dark brown, blackish, or grey, and sometimes shining solid mass. It is to this species of ores that the silver goose dung ore belongs.

(9.) With sulphurated copper and antimony.—The Dal *fah-lertz.*

This resembles both in colour and texture the dark-coloured weissgulden. When rubbed, it gives a red powder.

a. Solid.

b. Crystallised.

Perfect METALS, *Platina.*

(10.) With sulphurated zinc. The *pechblende* of the Germans.

This is a zinc ore, mock lead, or blende, which contains silver, and is found among rich silver and gold ores.

a. Of a metallic changeable colour.

1. Solid, and with fine scales.
2. In form of balls. The *kugel-ertz*, or ball ore.

b. Black mock lead, or blende, found in Saxony. This is also found,

1. Solid, and with fine scales;
2. And in form of balls.

(11.) With sulphurated lead; potters ore. *Galena; bleyglanz.*

(12.) With sulphurated lead and antimony, called *striperz.*

(13.) With sulphurated iron. *Silberhalitgier kies;* marcasite holding silver.

(14.) With sulphurated and arsenical cobalt; dendrites being sometimes found in the stone.

These kinds keep well in water; but generally wither in the air, and lose the silver they contain.

(15.) Mineralized by sulphur, with regulus of antimony and barytes. The butter-milk ore.

This is found in the form of thin particles, on granular spar, (*Kirwan*, sp. 13.)

(16.) Combustible silver ore.

This is a black and brittle substance, and leave about 6 per cent. of silver in its ashes. It is in fact a coal in which silver is found. (*Kirwan*, sp. 14.)

(17.) With the acid of common salt. *Minera argenti cornea. Hornetz*, or horn-silver ore.

This is the scarcest silver ore; it is of a white or pearl colour, changeable or varying on the surface, semi-transparent, and somewhat ductile both when crude and when melted. It cannot be decomposed without some admixture of such substances as attract the acid of sea-salt.

III. Platina del Pinto; *Juan blanca.*

This metal is a recent discovery of our times; and is described with great accuracy by Scheffer, in the Acts of the Royal Academy of Sciences at Stockholm for the year 1752; as also by Dr Lewis, in the Philosophical Transactions for the year 1754, vol. xlviii. and by many other writers. By these descriptions we are convinced of the resemblance this metal bears to gold; and therefore we must allow it to be called *white gold.* It has, however, a variety of distinguishing qualities

(R) Wallerius mentions the six following varieties of this notable ore in his *Species* 388, viz. 1. The red opaque, like cinnabar, from Andreasberg in the Hartz, and from Salberg in Westmannia: 2. The bluish, from Freiberg and Annaberg: 3. The grey, from Freiberg and Andreasberg: 4. The red transparent amorphous, of the garnet colour, from Potosi and Ioachimstal: 5. The red transparent, crystallised into prismatic decaedres, or dodecaedres, from Hungary, Alsace, and the Duchy of Deuxponts: 6. The only superficially red ore, from Salberg and Ehrenfriederichsdorf.

lities befides its colour, which afcertain its peculiar nature: All which, with its hiftory, ufes, &c. are particularly defcribed under the detached article Platina. See alfo Chemistry-*Index;* and Metallurgy, Part II. fect. ii.

1. It is of a white colour.
2. It is fo refractory in the fire, that there is no degree of heat yet found by which it can be brought into fufion by itfelf, the burning-glafs excepted. But, when mixed with other metals and femimetals, it melts very eafily, and efpecially with arfenic, both in its metallic form and in form of a calx or glafs.

IV. Quickfilver, mercury. *Hydrargyrum, Argentum vivum, Mercurius.* See the article Quicksilver; Chemistry-*Index*, at *Mercury;* and Metallurgy, Part II. fect. viii.

Mercury diftinguifhes itfelf from all metals by the following qualities (s.)

a. Its colour is white and fhining, a little darker than that of filver.

b. It is fluid in the cold, and divifible by the leaft force; but, as it only fticks to a few bodies to which it has an attraction, it is faid that it does not wet.

c. It is volatile in the fire.

d. It attracts the other femimetals and metals; and unites with them all except cobalt and nickel, with which it cannot by any means yet known be made to mix. This union is called *amalgamation.* This amalgamation, or mixtion of metallic bodies, according to the readinefs with which they unite or mix, is in the following progreffion, viz. gold, filver, lead, tin, zink, bifmuth, copper, iron, and the regulus of antimony; the three latter, however, do not very readily amalgamate. The iron requires a folution of the vitriol of iron, as a medium to promote the union.

e. It diffolves in fpirit of nitre, out of which it is precipitated by a volatile alkali, and common falt, in form of a white powder; but if a fixed alkali is ufed, a yellow powder or calx is obtained (T).

f. But

(s) It were almoft fuperfluous, fays Mr Kirwan, to mention any other character of quickfilver than its liquidity, to diftinguifh it from other metals. In regard to this property, Bergman obferves, that mercury conftitutes one extreme among the metals, and platina the other; fince it requires to be melted only fuch a degree of heat as is rarely wanting in our atmofphere, and boils at the 6000 degrees nearly after lead melts. See the table at p. 111. *Note.* But when the cold is increafed to the temperature denoted by 40 degrees below o both of Fahrenheit's and of the Swedifh thermometer, which both coincide in that point (fince 212—32, or 180 : 100 : : 32+40, or 72 : 40), this metal concretes like any other metal, and becomes quite folid; (fee Philofophical Tranfactions for 1783, p. 303.) Mercury in its common ftate, therefore, according to Bergman (Treatife of *Elect. Attract.*), is to be confidered as a metal in fufion: and fince in its folid ftate it is nearly as malleable as lead, it by no means ought to be placed among the femimetals, otherwife every other entire metal fhould be confidered as brittle, for none is malleable when in fufion.

(T) 1. Mercury is diffolved with great rapidity by nitrous acid: the liquor is of a greenifh-blue colour, but lofes it afterwards and becomes limpid. This folution, when made without heat, is ufed as a teft for the analyfis of mineral waters, and has different properties from that made with the help of heat. In the firft cafe, fays Bergman, very little phlogifton is loft, and the falt eafily cryftallifes, being white, and fcarcely acrid. It is not precipitated by diftilled water; but by cauftic vegetable alkali, it is precipitated of a yellowifh colour; by mild alkali, the precipitation is white; by mineral alkali, it is yellow, but it foon grows alfo white; by volatile alkali, it turns to a greyifh-black colour; by Glauber's falt, or by pure vitriolic acid, the precipitation is white, granulated, and in a fmall quantity; nor, if this precipitant has been fparingly ufed, does this colour appear in lefs than an hour: by muriatic acid, or common falt, the precipitation is alfo white, but in a large quantity, and in curdles.

2. But if the mercurial folution be put over a fand-heat, it may be charged with a quantity of mercury equal almoft to its weight. According to the chemifts of Dijon, 10 ounces of nitrous acid may diffolve eight of mercury. The action of the folvent becomes ftronger with the heat; emits great quantity of vapours; and if not taken from the fire, will be too far evaporated. Diftilled water will precipitate from this folution a white calx, becaufe it is more dephlogifticated, and the folvent is overcharged with it; and the water changing the denfity of the liquor, diminifhes the adhefion of the calx, as Fourcroy remarks. This white calx will turn yellow, if boiling water be poured on it. The vegetable alkali precipitates it of a brownifh yellow, which by degrees affumes a pale-yellow tinge: the mild vegetable, and the mineral alkalies, produce nearly the fame colour; though when this laft is employed, the colour turns afterwards to white. The precipitation by volatile alkali is quite white alfo; that by the vitriolic acid is yellow; and, finally, a copious white mucilaginous matter is the precipitate by the marine acid.

3. This folution by nitrous acid is very cauftic; corrodes and deftroys animal fubftances; when it falls on the fkin, ftains it it of a deep purple brown colour, which appears black: the ftains do not go off before the feparation of the epidermis, which falls away in fcales or kind of fcars. It is ufed in furgery as a powerful efcharotic, and is called *mercurial water.*

4. The fame folution, by cooling, is fufceptible of forming cryftals, which vary from one another according to circumftances; for the moft part they are like needles; are very cauftic; redden the fkin; and detonate when put on burning coals, provided they be dry. They are called *mercurial nitre*, which fufes when heated in a crucible; exhales reddifh fumes; affumes a deep yellow colour, which afterwards turns to orange, and

f. But it requires a boiling heat to diffolve it in oil of vitriol (U).

g. It is not affected by the acid of common falt, unlefs it be previoufly diffolved by other acids (V); in which cafe only they both unite with one another, and may be fublimed together: this fublimate is a ftrong poifon.

h. It unites with fulphur by grinding; and then produces a black powder called *æthiops mineralis* (W), which fublimes into a red ftriated body called *factitious cinnabar*.

i. The fulphur is again feparated from the quickfilver, by adding iron or lime, to which the fulphur attaches itfelf, leaving the quickfilver to be diftilled over in a metallic form; but if a fixed alkali be ufed, fome part of the quickfilver will remain diffolved in the refiduum, which is a liver of fulphur.

Quickfilver is found,

A. Native, or in a metallic ftate. *Mercurius nativus*, or *virgineous*.

This found in the quickfilver mines at Idra in Friuli, or the Lower Auftria, in clay, or in a black flaty *lapis ollaris*, out of which it runs, either fpontaneoufly, or by being warmed even in the hands.

B. United to gold or filver. *Hydrargyrum argento vel auro adunatum*.

Mr Kirwan afferts, on the authorities of Monet and Lin. Von Gmelin, that in Sweden and Germany mercury has been found united to filver in the form of a fomewhat hard and brittle amalgam.

Romé de l'Ifle had a fpecimen of this natural amalgam from Germany, which is imbedded in a quartzofe mafs, and mixed with cinnabar, as Mr Mongez afferts; and he adds, that in the royal cabinet, at the king's garden at Paris, is depofited another fine fpecimen of this mercurial ore, which was found cryftallifed in the mine called *Carolina* at Muchel-lanfberg in the duchy of Deux Ponts. M. de l'Ifle fpeaks alfo very pofitively of a fpecimen of native gold from Hungary, which feems to be a natural amalgam of gold and mercury. It is compofed of quadrangular prifms, of a greyifh yellow colour, and of a brittle texture. This fpecimen is alfo in the king's cabinet at the royal garden at Paris.

Mr Kirwan, fpeaking of the method of examining the purity of gold by the moift way, fuppofes, with Sir Torbern Bergman, that there are natural amalgamations of mercury with gold and filver: and Neumann obferves, that fometimes a mineral, containing gold or filver, is met with among mercurial ores, although this is a great rarity.

It is evident, therefore, that there naturally exift

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and at laft to a brilliant red: in this ftate it is called *red precipitate*, or *arcanum corallinum*. It muft be made in a matrafs with a gentle heat if it is defigned to be corrofive for chirurgical purpofes.

(U) 1. The vitriolic acid, concentrated and boiling hot, feizes on mercury, and prefently reduces it if urged by heat to a kind of white powder, which turns yellow by the affufion of hot water, but does not diffolve in it; this is called *turbith mineral*: but if cold water, inftead of hot, was poured in the white mafs, the powder would not change its white colour into yellow as was faid above about the nitrous folution.

2. If Mercury be rarefied by heat into vapours, and thefe meet with thofe of marine acid in the fame ftate, a corrofive fublimate will be formed. This metallic falt fhoots into cryftals pointed like daggers, which are the ftrongeft of all poifons. But there are various other proceffes found in chemical authors to make this falt with more or lefs trouble. See Chemistry, n° 814—818.

3. If corrofive fublimate be mixed with tin and diftilled, a very fmoking liquor is produced, called by the name of its inventor the *fmoking liquor of Libavius*. See Chemistry, n° 810.

The muriatic acid in the fublimate is not faturated, and from hence proceeds its great corrofive power; for if a frefh quantity of mercury be added to it, and fublimed a fecond or third time, a fweet, or mixed fublimate, called *mercurius dulcis*, is produced, which is not poifonous, and is given internally as a purgative, or an emetic, according to the dofe. See Chemistry, n° 819.

(V) Muriatic acid does not act upon quickfilver unlefs this laft be previoufly deprived of as much phlogifton, as $\frac{74}{100}$ of the quantity contained in the hundred of filver, or of $\frac{80}{82}$ in the hundred of zinc. (See Bergman's *Sciagraphia*, and his treatife *De Phlogifti quantitate*.)

(W) The academicians of Dijon fay, that the true proportion to make this æthiops, is that of one part of brimftone with four of mercury. Fourcroy directs only one of mercury, with three of flowers of fulphur, to be triturated, till the mercury is extinguifhed. A black powder is then produced, which is the æthiops mineral. The combination is better effected when the mercury is mixed with the fufed fulphur: by agitating this mixture, it becomes black, and eafily takes fire; it fhould be then taken from the fire, and the flame fhould be extinguifhed a little after, ftirring the mafs till it becomes into folid clots. If this fubftance be expofed to a great degree of heat, it takes fire, the fulphur is confumed, and a fubftance remains which is of a violet colour when pulverifed. This powder being put into matraffes, till their bottom become red by the force of fire, is fublimed after fome hours, and artificial cinnabar is found in the top of the veffels cryftallifed into brown red needles.

Mercury, divided by means of a rapid and continual motion, as that of a mill-wheel, gradually changes itfelf into a very fine black powder, which is called *æthiops per fe*, on account of its colour, in order to diftinguifh it from this *æthiops mineralis* mentioned in the text.

ift various ores of quickfilver, amalgamated with filver, gold, and other minerals, although they be but feldom met with.

C. Mineralifed,

[1.] With fulphur.

A. Pure cinnabar, *Cinnabaris nativa.*

a. Loofe or friable cinnabar like red ochre.

b. Indurated or folid cinnabar. It is of a deep red colour; and, with refpect to its texture, is either,

1. Steel-grained;
2. Radiated;
3. Compofed of fmall cubes, or fcaly; or
4. Cryftallifed, in a cubical form; it is tranfparent, and deep red like a ruby.

B. Impure cinnabars.

1.) A mercurial ore is found in Idria, fays Gellert, where the mercury lies in an earth or ftone, as if it were in a dead form; and has the appearance of a red-brown iron-ftone; but it is much heavier than that. It contains from three quarters to feven eighths of the pureft mercury; leaves, after diftillation, a very black ftrong earth behind; and gives fome marks of cinnabar.

2.) Liver ore, which is moft common in Idria, and has its name from its colour.—Outwardly it refembles an indurated iron-clay; but its weight difcovers that its contents are metallic. It yields fometimes 80 pounds of quickfilver per hundred weight.

3.) Burning ore; *brand-erz* in German. This ore may be lighted at the candle; and yields from nine to 50 pounds of quickfilver per hundred weight. *Brunnich.*

[2.] With iron by fulphur. Pyritous cinnabar. Sir Torbern Bergman inferted this ore in the 177th fection of his *Sciagraphia*, and feems doubtful whether this be a diftinct fpecies from the cinnabar; as the iron is perhaps, fays he, only mechanically diffufed therein. Mr Mongez remarks, that there are but a few inftances of cinnabar in which iron is not found in its calcined form; though, in the act of the ore being reduced, it paffes to its metallic ftate, and becomes capable of being acted on by the loadftone.

Another pyritous ore of cinnabar was found at Menidot, near St Lo in Lower Normandy. It confifted in grains of different fizes, of a red brown colour: they had a vitriolic tafte and fulphureous fmell. Found alfo at Almaden in Spain, and at Stahlberg in the Palatinate; though at this laft place they are of a dodecaedral form.

[3.] With filver by the aerial acid, and fulphur.

This feems to be a native precipitate *per fe*, or calx of mercury. It is faid to have been lately found in Idria, in hard compact maffes of a brownifh-red colour; fee *Journal de Phyfique* for January 1784, p. 61. If this account can be relied upon, it will prove, that quickfilver, even in a calciform ftate, is naturally found mineralifed with filver by means of fulphur.

[4.] With fulphur and copper.

This ore is blackifh grey, of a glaffy texture, and brittle; crackles and fplits exceffively in the fire; and when the quickfilver and fulphur are evaporated, the copper is difcovered by its common opaque red colour in the glafs of borax, which, when farther forced in the fire, or diluted, becomes green and tranfparent. It is found at Mufchlanfberg in the duchy of Deux Ponts.

[5.] Mineralifed by the marine and vitriolic acids.

Mineralogy owes the difcovery of this ore to Mr Woulfe, who publifhed an account of it in the Philofophical Tranfactions for 1776. It was found in the duchy of Deux Ponts, at the mine diftinguifhed by the name of *Obermofchal*. It had a fpar-like appearance. This ore is either bright and white, or yellow or black. It was mixed with cinnabar in a ftony matrix; and being well mixed with one-third of its weight of vegetable alkali, afforded cubic and octagonal cryftals; that is, falt of Sylvius and vitriolated tartar.

The marine falt of this mercury is in the ftate of fublimate corrofive.

Order II. Imperfect or base Metals.

I. Tin. *Stannum; Jupiter.* (See the detached article Tin: Alfo Chemistry-*Index*; and Metallurgy, Part II. fect. vi. and Part III. fect. vi.)

This is diftinguifhed from the other metals by the following characters and qualities. It is,

a. Of a white colour, which verges more to the blue than that of filver.

b. It is the moft fufible of all metals; and,

c. The leaft ductile; that is, it cannot be extended or hammered out fo much as the others (x).

d. In

(x) Tin is fufficiently ductile to be beaten into very thin leaves. But ductility and extenfibility are two different properties, lefs connected with one another than is generally imagined. Iron and fteel are drawn into exquifite fine wire, but cannot be beat into very thin leaves. Tin, on the other hand, is beat into fine leaves, and may be exended between rollers to a confiderable furface. The tin-fheet ufed in various arts, is commonly about $\frac{1}{600}$th part of an inch; but may be extended twice as much in its dimenfions without difficulty. Notwithftanding this extenfibility, tin cannot be drawn into wire, on account of the weak cohefion of its particles. A tin wire, however, of one-tenth of an inch diameter, is able to fupport a weight of $49\frac{1}{2}$ pounds, according to Fourcroy. Gold and filver poffefs both properties of ductility and extenfibility the moft eminently of all metallic bodies; whilft lead, notwithftanding its flexibility and foftnefs, cannot be made either into leaves or wire of any finenefs.

d. In breaking or bending, it makes a crackling noise

e. It has a smell particular to itself, and which cannot be described.

f. In the fire it is easily calcined to white ashes, which are 25 per cent. heavier than the metal itself. During this operation, the phlogiston is seen to burn off in form of small sparkles among the ashes or calx.

g. This calx is very refractory; but may, however, with a very strong degree of heat be brought to a glass of the colour of colophony. But this calx is easily mixed in glass compositions, and makes with them the white enamel.

h. It unites with all metals and semimetals; but renders most of them very brittle, except lead, bismuth, and zinc.

i. It amalgamates easily with quicksilver.

k. It dissolves in aqua-regia, the spirit of sea-salt, and the vitriolic acid; but is only corroded into a white powder by the spirit of nitre. The vegetable acid, soaps, and pure alkaline salts, also corrode this metal by degrees.

l. Its specific gravity to water is as 7400 to 1000, or as 7321 to 1000.

m. Dissolved in aqua-regia, which for this purpose ought to consist of equal parts of the spirit of nitre and sea-salt, it heightens the colour of the cochineal, and makes it deeper; for otherwise that dye would be violet.

(1.) Native Tin.

The existence of native tin has long been questioned: but it has undoubtedly been found some years ago in Cornwall, as Mr Kirwan remarks.

1. Malleable tin, in a granular form, and also in a foliaceous shape, issuing out of a white hard matter like quartz: but which, after being properly assayed, proved to be arsenical crystals; a circumstance that evinces its being native tin, since the arsenic could not remain in this form if the tin had been melted. It appeared like a thick, jagged, or scolloped lace or edging; and was found near St Austle in Cornwall.

2. In the form of crystalline metallic laminæ, or laminated crystals, rising side by side out of an edging, which shone like melted tin: they were almost as thin as flakes or scales of talc, intersecting each other in various directions, with some cavities between them, within which appeared many specks and granules of tin, that could be easily cut with a knife: this was also found in Cornwall.

3. In a massy form, more than one inch thick in some places, and inclosed in a kind of quartzous stone; or rather in an hard crust of crystallised arsenic.

(2.) Calciform Ores of Tin.

A. In form of a calx, *Stannum calciforme*.

A. Indurated, or vitrified.

1. Mixed with a small portion of the calx of arsenic.

a. Solid tin ore, without any determinate figure. Tin-stone.

It resembles a garnet of a blackish brown colour, but is much heavier; and has been considered at the English tin-mines as a stone containing no metal, until some years ago it began to be smelted to great advantage.

B. Crystallised.

a. Tin spar, or white tin ore. This is generally of a whitish or grey colour; sometimes it is yellowish, semi-transparent, and crystallised, either of a pyramidical form, or irregularly.

b. Tin-grains. This ore, like the garnets, is of a spherical polygonal figure; but seems more unctuous on its surface.

1. In large grains.
2. In small grains.

B. Mixed with metals.

1. With the calx of iron, as in the garnet.
2. With manganese. See the *Semimetals*.

C. Mineralised.

1. With sulphur and iron.
2. With sulphur. *Aurum musivum*.

This was discovered by Professor Bergman, among some minerals which he received from Siberia. He observed two sorts of it, analogous to the two artificial combinations of tin with sulphur.

1. One nearly of the colour of zinc, and of a fibrous texture, which contained about 20 *per cent.* of sulphur, and the remainder tin.

2. The other enveloped the former like a crust; resembled aurum musivum; and contained about 40 *per cent.* of sulphur, a small proportion of copper, and the remainder tin. *Mem. Stockh.* for 1721, p. 328.

At Huel Rock, in St Agnes in Cornwall, there has been found a metallic vein, nine feet wide, at 20 yards beneath the surface. Mr Raspe was the first who discovered this to be a sulphurated tin-ore: it is very compact, of a bluish white colour, approaching to grey steel, and similar to the colour of grey copper ore: it is lamellar in its texture, and very brittle. It consists of sulphur, tin, copper, and some iron. Mr Raspe proposes to call it *bell-metal ore*.

According to Mr Klaproth's analysis of this ore, 119 grains contain 30 of pure sulphur; 41 of tin; 43 of copper; two of iron; and three grains of the stony matrix. In another specimen of the same sulphurated tin-ore from Cornwall, there were in the hundred 25 parts of sulphur, 34 of tin, 36 of copper, three of iron, and two of the stony matrix.

II. Lead; *Plumbum*, *Saturnus*. (See the article LEAD, and CHEMISTRY-*Index*: Also METALLURGY, Part II. sect. v, and Part III. sect. vii.)

Imperfect Metals. Lead.

The properties of lead are as follows.

a. It is of a bluish white colour when fresh broke, but soon dulls or sullies in the air.

b. It is very heavy; viz. to water as 11,325 to 1000.

c. It is the softest metal next to gold; but it has no great tenacity, and is not in the least sonorous.

d. It is easily calcined; and, by a certain art in managing the degrees of the fire, its calx becomes white, yellow, and red.

e. This calx melts easier than any other metallic calx to a glass, which becomes of a yellow colour, and semitransparent. This glass brings other bodies, and the imperfect metals, into fusion with it.

f. It dissolves, 1st, In the spirit of nitre; 2dly, In a diluted oil of vitriol, by way of digestion; 3dly, In the vegetable acid; 4thly, In alkaline solutions; and 5thly, In expressed oils, both in the form of metal and of calx.

g. It gives a sweet taste to all solutions.

h. It amalgamates with quicksilver.

i. With the spirit of sea-salt it has the same effect as silver, whereby is produced a *saturnus corneus*.

k. It does not unite with iron, when it is alone added to it in the fire.

l. It works on the cupel, which signifies that its glass enters into certain porous bodies, destitute of phlogiston and alkaline salts.

m. It melts in the fire before it is made red-hot, almost as easily as the tin.

n. Its calx or glass may be reduced to its metallic state by pot-ashes.

[1.] Native Lead.

For proofs of lead being naturally found in its metallic state, see the article Lead.—It may be here added, that Henckel likewise affirms its existence, in his *Flora Saturnisans*; (see Kirwan's *Elements of Mineralogy*, p. 297, 298.) Wallerius asserts, that it has been so found in Poland, a specimen of which was kept in the collection of Richter; and adds, that a similar one found at Schneberg, was seen in the collection of Spener. (*Mineralogy*, vol. ii. p. 301.)

Dr Lawson, in his English edition of Cramer's Art of Essaying Metals, says, that some pure native malleable lead had been lately found in New England; (p. 147.) And lastly, Professor Bergman did not hesitate to insert, by itself alone, the *plumbum nativum*, in Sect. 180. of his *Sciagraphia*.

[2.] Calciform Lead.

Lead is found,

A. In the form of a calx.

A. Pure.

a. Friable lead ochre, native ceruse.

b. Indurated lead spar, or spatose lead ore.

i. Radiated, or fibrous.

1. White, from Mendip-hills, in England.

ii. Crystallised in a prismatic figure.

1. White, from Norrgrufva in Westmanland.

2. Yellowish green, from Zchopau in Saxony.

B. Mixed,

1. With the calx of arsenic, arsenical lead spar.

2. Indurated.

a. White. Mr Cronstedt has tried such an ore from an unknown place in Germany, and found that no metallic lead could be melted from it by means of the blow-pipe, as can be done out of other lead spars; but it must be performed in a crucible. (See the article Lead. par. iii.)

3. With a calcareous earth.

This ore effervesces with aqua-fortis, and contains 40 *per cent.* of lead; on which account is is placed here rather than among the calcareous earths.

B. Mineralised.

1. With sulphur alone: the *bley-schweiff*, or *bley-glanz*, of the Germans.

a. Steel-grained lead-ore.

b. Radiated, or antimoniated lead-ore.

c. Tessellated, or potter's lead-ore.

At Villach in Austria there is said to be found a potter's lead-ore, which contains not the least portion of silver.

2. Mineralised by the vitriolic acid.

This ore was discovered by Mr Monnet. It occurs sometimes, though rarely, in the form of a white ponderous calx; and seems to originate from the spontaneous decomposition of the sulphurated lead-ores above mentioned.

3. By the acid of phosphorus.

This ore was lately discovered by Gahn; and is of a greenish colour, by reason of a mixture of iron. See the article Lead, par. 6.

4. With sulphurated silver. *Galena*; also called *bleyglanz* by the Germans. Potter's ore.

a. Steel-grained.

b. With small scales.

c. Fine-grained.

d. Of a fine cubical texture; and,

e. Of coarse cubes. These two varieties are found in all the Swedish silver-mines.

f. Crystallised.

The steel-grained and scaly ores are of a dim and dull appearance when they are broken, and their particles have no determined angular figure: they are therefore in Swedish commonly called *blyschweif*; in opposition to the cubical ores, which are called *blyglanz*. The most part of the ores called *blyglanz* contain silver, even to 24 ounces *per cent.* of which we have instances in the mines of Salberg, where it has been observed, that the coarse cubical lead ores are generally the richest in silver, contrary to what is commonly taught in books; the reason of which may perhaps be, that, in making the essays on these two ores, the coarse cubical can be chosen purer or freer

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freer from the rock than the fine cubical ores.

5. With sulphurated iron and silver. This is found,

a. Fine-grained. *b.* Fine cubical. *c.* Coarse-cubical. When this ore is scorified, it yields a black slag; whereas the preceding lead-ores yield a yellow one, because they do not contain any iron.

6. With sulphurated antimony and silver; antimoniated or radiated lead-ore. This has the colour of a blyglanz, but is of a radiated texture.

It is found,

a. Of fine rays and fibres; and,

b. Of coarse rays or fibres. The lead in this ore prevents any use being made of the antimony to advantage; and the antimony likewise in a great measure hinders the extracting of the silver.

7. Mineralised by arsenic.

This ore was lately discovered in Siberia.—Externally it is of a pale, and internally of a deep red, colour. See the article LEAD, par. 10.

C. Mixed with earth; stony, or sandy lead ores.

These consist either of the calciform or of the galena kind, intimately mixed and diffused through stones and earth, chiefly of the calcareous or of the barytic genus. See LEAD, par. 11.

Uses, &c. *of Lead.* See LEAD, and the other articles above referred to.

III. Copper; *Cuprum, Venus, Æs.* (See the article COPPER: Also CHEMISTRY-*Index*; and METALLURGY, Part II. sect. iv. and Part III. sect. iv.)

This metal is,

a. Of a red colour.

b. It is pretty soft and tough.

c. The calx of copper being dissolved by acids becomes green, and by alkalies blue.

d. It is easily calcined in the fire into a blackish blue substance, which, when rubbed to a fine powder, is red; when melted together with glass, it tinges it first reddish brown, and afterwards of a transparent green or sea-green colour.

e. It dissolves in all the acids, and likewise in alkaline solutions. It is easier dissolved when in form of a calx than in a metallic state, especially by the acids of vitriol and sea-salt, and the vegetable acid.

f. Vitriol of copper is of a deep blue colour; but the vegetable acid produces with the copper a green salt, which is verdigris.

g. It can be precipitated out of the solutions in a metallic state; and this is the origin of the precipitated copper of the mines called *Ziment copper.*

h. It is not easily amalgamated with quicksilver; but requires for this purpose a very strong trituration, or the admixture of the acid of nitre.

i. It becomes yellow when mixed with zinc, which has a strong attraction to it, and makes brass, pinchbeck, &c.

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k. When this metal is exposed to the fire, it gives a green colour to the flame in the moment it begins to melt, and continues to do so afterwards, without losing any thing considerable of its weight.

[1.] Native copper.

Copper found naturally in a metallic state, is called *virgin* or *native copper.* It is met with,

1. Solid.

2. Friable, in form of small, and somewhat coherent grains. Precipitated or ziment copper.

[2.] Calciform.

Copper, in form of a calx, is found,

1.) Pure.

A. Loose or friable; *Ochra veneris.*

1. Blue; *Cæruleum montanum.* Very seldom found perfectly free from a calcareous substance.

2. Green; *Viride montanum.* Both this and the former colour depend on menstrua, which often are edulcorated or washed away.

3. Red. This is an efflorescence of the glass copper ore.

B. Indurated. Glass copper-ore.

a. Red. This is sometimes as red as sealing wax, and sometimes of a more liver-brown colour.

It is always found along with native copper, and seems to have lost its phlogiston by way of efflorescence, and to be changed into this form. It is likewise found with the sulphurated copper, improperly called *glass copper-ore.*

2.) Mixed.

A. Loose or friable; *Ochra veneris friabilis impura.*

1. Mixed with a calcareous substance; *Cæruleum montanum.* In this state copper-blue is mostly found. It ferments during the solution in aquafortis.

2. Mixed with iron. Black. It is the decomposition of the Fahlun copper ore.

B. Indurated.

1. Mixed with gypsum, or plaster. Green.

2. Mixed with quartz. *a.* Red, from Sunnerskog in the province of Smoland.

3. Mixed with lime. *a.* Blue. This is the *Lapis Armenus,* according to the accounts given of it by authors.

3.) Cupreous stones.

Analogous to the calciform copper ores, are,

1. The *lapis armenus.* } See the detached article COPPER, n° 7.
2. The turquoise. }

[3.] Dissolved and mineralised; *Cuprum mineralisatum.*

A. With sulphur alone. Grey copper-ore; also called, improperly, *glass copper-ore.*

a. Solid, without any certain texture, and very soft, so that it can be cut with a knife almost as easily as black lead.

b. Fine cubical. In Smoland this is sometimes found decomposed or weathered, and changed into a deep mountain blue.

B. With sulphurated iron. *Minera cupri pyritacea*; yellow copper ore. Marcasitical copper ore; *Pyrites cupri*. This is various both in regard to colour and in regard to the different proportion of each of the contained metals; for instance,

a. Blackish grey, inclining a little to yellow; *Pyrites cupri griseus*. When decayed or weathered, it is of a black colour; is the richest of all the varieties of this kind of copper ore, yielding between 50 and 60 *per cent*. and is found in Spain and Germany.

b. Reddish yellow, or liver brown, with a blue coat on the surface; *Minera cupri lazurea*. This ore yields between 40 and 50 *per cent*. of copper, and is commonly said to be blue, though it is as red, when fresh broken, as a red copper regulus.

c. Yellowish green; *Pyrites cupri flavo viridescens*. This is the most common in the north part of Europe: and is, in regard to its texture, found,

1. Solid, and of a shining texture.
2. Steel-grained, of a dim texture.
3. Coarse-grained, of an uneven and shining texture.
4. Crystallised marcasitical copper ore.
   a. Of long octoëdrical crystals.

d. Pale yellow. This cannot be described but as a marcasite, though an experienced eye will easily discover some difference between them. It yields 22 *per cent*. of copper.

e. Liver-coloured.

C. With sulphurated silver, arsenic, and some iron. Fallow copper-ore; which contains only a few ounces of silver. This ore is found in Hungary and Germany, where it is called *black copper ore*.

D. With sulphurated arsenic and iron. White copper ore.

E. Pyritous copper, with arsenic and zinc.

According to Mr Monnet, this ore is found at Catharineberg in Bohemia. It is of a brown colour; of a hard, solid, compact, granular texture; and contains from 18 to 30 *per cent*. of copper.

F. Dissolved by the vitriolic acid; *Vitriolum veneris*. See the article copper, n° xiii.

G. With phlogiston. Copper coal ore, consisting of the calces of copper, mixed with a bituminous earth.

H. Mineralised by the muriatic acid. This ore was found in Saxony, and had been generally mistaken for a micaceous substance, which in fact it greatly resembles. It has not yet been found in large masses, but only in a superficial form, like a crust over other ores. It is moderately hard and friable; of a fine green colour, and sometimes of a bluish green, crystallised in a cubic form, or with a foliated texture, or in little scales resembling green mica or talc. This ore is easily dissolved by nitrous acid: the solution takes a green colour; and the metal may be precipitated on a polished plate of iron. If some drops of a nitrous solution of silver be mixed with it, a white powder of *luna cornea* will be precipitated, which discovers the presence of the muriatic acid in this ore.

The uses of copper are very numerous, although not thoroughly known to every one. Several of these have been mentioned under the detached article, and in Chemistry. Others of great importance may be here added. Its great ductility, lightness, strength, and durability, render it of very extensive utility. Blocks, or bars of copper, are reduced into flat sheets of any thickness, by being first heated by the reverberation of the flame, in a low-vaulted furnace, properly constructed for the purpose; and then immediately applied between large rollers of steel, or rather of case-hardened iron, turned by a water-wheel or by the strength of horses, so that the hot metal is there quickly squeezed; and the operation is repeated, bringing the rollers every time nearer to one another, till the metallic sheet acquires the intended thickness.

These copper sheets are very advantageously employed in sheathing the bottoms of men of war and other vessels, which by this means are prevented from being attacked by the sea worms, and are kept clean from various marine concretions, so as to sail with considerably greater swiftness. Copper sheets are also employed to cover the tops of buildings instead of slates or earthen tiles, as is used in Sweden; and some architects have begun to introduce the use of copper covering into Great Britain, which is much lighter, and may be used with great advantage, although it must be much dearer in the prime cost.

Sundry preparations of copper are employed in painting, staining, and for colouring glass and enamels. See Glass and Enamel.

The solution of copper in aqua-fortis stains marble and other stones of a green colour; when precipitated with chalk or whiting, it yields the green and the blue verditer of the painters. According to Lewis, a solution of the same metal in volatile spirits stains ivory and bones: when macerated for some time in the liquor, they become of a fine blue colour, which, however, tarnishes by exposure to the air, and becomes green afterwards.

The same author prepared elegant blue glasses, by melting common glass, or powdered flint and fixed alkaline salt, with blue vitriol, and with an amalgam of copper; fine green ones were made with green verditer, and with blue verditer, as well as with the precipitate of copper made by fixed alkalies, and with a precipitate by zinc; and a reddish glass was produced by the calx and scoria of copper made by fire alone. Even in this vitreous state, it seems as if a continuance of fire had the same effect in regard to colour, as air has upon copper in other forms; as some of the most beautiful blue glasses, by continued fusion, have changed

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changed to a green colour. See farther the article Brass *in the Glaſs-trade*.

Verdegris is a preparation of copper diſſolved by the vegetable acids, which act on this metal, diſſolving it very ſlowly, but in conſiderable quantities. It produces a fine green pigment for painting both in oil and water colours, inclining more or leſs to the bluiſh according to circumſtances.

So great is the tenacity of copper, that a wire of a tenth of an inch in diameter is capable of ſupporting 299.5 pounds weight before it breaks.—Copper may be drawn into very fine wire, and beaten into extremely thin plates. The German artiſts, chiefly thoſe of Nurenberg and Auſburg, are ſaid to poſſeſs the beſt method for giving to theſe thin plates of copper a fine yellow colour like that of gold. See the articles *Brass-Colour* and *Brass-Leaf*.

The parings or ſhreds of theſe very thin leaves of yellow copper being well ground on a marble plate, are reduced to a powder ſimilar to gold, which ſerves to cover, by means of ſome gum-water, or other adheſive fluid, the ſurface of various mouldings or other pieces of curious workmanſhip, giving them the appearance of real bronze, and even of fine gold, at a very trifling expence; becauſe the gold colour of this metallic powder may be eaſily raiſed and improved by ſtirring it on a wide earthen baſon over a ſlow fire.

In ſome of its ſtates, copper is as difficultly extended under the hammer as iron, but proves ſofter to the file, and never can be made hard enough to ſtrike a ſpark with flint or other ſtones; from whence proceeds the uſe that is made of this metal for chiſels, hammers, hoops, &c. in the gun-powder works.

The vitriolic acid does not act on copper unleſs concentrated and boiling: during this ſolution a great quantity of ſulphureous gas flies off; afterwards a brown thickiſh matter is found, which contains the calx of the metal partly combined with the acid. By ſolution and filtration, a blue ſolution is obtained, which being evaporated to a certain degree, produces after cooling long rhomboidal cryſtals of a beautiful blue colour, called vitriol of copper; but if this ſolution be merely expoſed a long time to the air, it affords cryſtals, and a green calx is precipitated, a colour which all calces of this metal aſſume when dried by the air. Blue vitriol, however, is ſeldom formed by diſſolving the metal directly in the vitriolic acid. That ſold in the ſhops is moſtly obtained from copper pyrites. It may alſo be made by ſtratifying copper-plates with ſulphur, and cementing them together for ſome time; becauſe the vitriolic acid of the ſulphur being diſengaged, attacks and corrodes the metal, forming a metallic ſalt, which by affuſion of water yields perfect cryſtals of blue vitriol. See Vitriol.

The nitrous acid, on the contrary, diſſolves copper when cold with great rapidity; and a great quantity of ſmoaking air or gas flies off, which, on being received in a pneumatic apparatus, and mixed in a glaſs tube with atmoſpheric air, ſhows its good or bad quality for the reſpiration of living animals, according as the common bulk is more or leſs diminiſhed. This is one of the moſt important of Dr Prieſtley's diſcoveries; and various inſtruments known by the name of *eudiometers* have been ſince invented for making theſe experiments with eaſe and ſatisfaction. See Eudiometer.

But the moſt common uſe of copper is to make all ſorts of large ſtills, boilers, pots, funnels, and other veſſels employed by diſtillers, dyers, chemiſts, and various other manufacturers, who make uſe of large quantities of hot liquors in their various operations.

Although copper when pure is extremely valuable, on account of its ductility, lightneſs, and ſtrength, it is, however, leſs uſeful on many occaſions from the difficulty of forming large maſſes of work, as it is not an eaſy matter to caſt copper ſolid, ſo as to retain all its properties entire. For if the heat be not ſufficiently great, the metal proves deficient in toughneſs when cold; and if the heat be raiſed too high, or continued for a length of time, the copper bliſters on the ſurface when caſt in the moulds; ſo that the limits of its fuſion are very contracted. And from theſe circumſtances pure copper is rendered leſs applicable to ſeveral purpoſes.

We find, however, that the addition of a certain proportion of zinc removes almoſt all theſe inconveniences, and furniſhes a mixed metal more fuſible than copper, very ductile and tenacious when cold, which does not ſo readily ſcorify in a moderate heat, and which is leſs apt to ruſt from the action of air and moiſture.

Copper is the baſis of ſundry compound metals for a great number of mechanical and œconomical uſes of life, such as braſs (y), prince's-metal, tombac, bell-metal, white copper, &c. See Chemistry, n° 1154, &c.

If the mixture is made of four to ſix parts of copper, with one part of zinc, it is called *Prince's-metal*. If more of the copper is taken, the mixture will be of a deeper yellow, and then goes by the name of *tombac*.

Q 2 Bell-

(y) Braſs is frequently made by cementing plates of copper with calamine, where the copper imbibes one-fourth or one-fifth its weight of the zinc which riſes from the calamine. The proceſs conſiſts in mixing three parts of calamine and two of copper with charcoal duſt in a crucible, which is expoſed to a red heat for ſome hours, and then brought to fuſion. The vapours of the calamine penetrate the heated plates of copper, and add thereby to its fuſiblity, It is of great conſequence for the ſucceſs of this proceſs to have the copper cut into ſmall pieces, and intimately blended with the calamine. See Chemistry, n° 1154.

In moſt foreign founderies the copper is broken ſmall by mechanical means with a great deal of labour; but at

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Bell-metal is a mixture of copper and tin, forming a compound extremely hard and sonorous, and is less subject to alterations by exposure to the air than any other cheap metal. On this account it is advantageously employed in the fabrication of various utensils and articles, as cannons, bells, statues, &c. in the composition of which, however, other metals are mixed in various proportions, according to the fancy and experience of the artist.

White-copper is prepared with arsenic and nitre, as mentioned under CHEMISTRY, n° 1157.

But the principal kind of white-copper is that with which speculums of reflecting telescopes are made. See the article SPECULUM.

VII. Iron; *Ferrum, Mars.* This metal is,

a. Of a blackish blue shining colour.

b. It becomes ductile by repeated heating between coals and hammering.

c. It is attracted by the loadstone, which is an iron ore; and the metal itself may also be rendered magnetical.

d. Its specific gravity to water is as 7,645, or 8000 : 1000.

e. It calcines easily to a black scaly calx, which, when pounded, is of a deep red colour.

f. When this calx is melted in great quantity with glass compositions, it gives a blackish brown colour to the glass; but in a small quantity a greenish colour, which at last vanishes if forced by a strong degree of heat.

g. It is dissolved by all salts, by water, and likewise by their vapours. The calx of iron is dissolved by the spirit of sea-salt and by aqua-regia.

h. The calx of the dissolved metal becomes yellow, or yellowish brown: and in a certain degree of heat it turns red.

i. The same calx, when precipitated from acids by means of the fixed alkali, is of a greenish colour; but it becomes blue when precipitated by means of an alkali united with phlogiston; in which last circumstance the phlogiston unites with the iron: these two precipitates lose their colour in the fire, and turn brown.

k. The vitriol of iron is brown.

Iron is found,

[1.] Native. See the detached article IRON.

[2.] In form of calx.

A. Pure.

A. Loose and friable. Martial ochre; *Minera ochracea.*

1. Powdery; *Ochra ferri.* This is commonly yellow or red, and is iron which has been dissolved by the vitriolic acid.

2. Concreted. Bog-ore.

a. In form of round porous balls.

b. More solid bars.

c. In small flat pieces, like cakes or pieces of money.

d. In small grains.

e. In

at Bristol the workmen employ an easier method. A pit is dug in the ground of the manufacture about four feet deep, the sides of which are lined with wood. The bottom is made of copper or brass, and is moveable by means of a chain. The top is made also of brass with a space near the centre, perforated with small holes, which are luted with clay; through them the melted copper is poured, which runs in a number of streams into the water, and this is perpetually renewed by a fresh stream that passes through the pit. As the copper falls down it forms itself into grains, which collect at the bottom. But great precaution is required to hinder the dangerous explosions which melted copper produces when thrown into cold water; which end is obtained by pouring small quantities of the metal at once. The granulated copper is completely mixed with powdered calamine, and fused afterwards. The process lasts eight or ten hours, and even some days, according to the quality of the calamine.

It is a wonderful thing, says Cramer, that zinc itself, being simply melted with copper, robs it of all its malleability; but if it be applied in form of vapour from the calamine, the sublimates, or the flowers, it does not cause the metal to become brittle.

The method mentioned by Cramer to make brass from copper, by the volatile emanations of zinc, seems to be preferable to any other process, as the metal is then preserved from the heterogeneous parts contained in the zinc itself, or in its ore. It consists in mixing the calamine and charcoal with moistened clay, and ramming the mixture to the bottom of the melting pot, on which the copper, mixed also with charcoal, is to be placed above the rammed matter. When the proper degree of heat is applied, the metallic vapour of the zinc contained in the calamine will transpire through the clay, and attach itself to the copper, leaving the iron and the lead which were in the calamine retained in the clay, without mixing with the upper metal. Dr Watson says, that a very good metallurgist of Bristol, named John Champion, has obtained a patent for making brass by combining zinc in the vapourous form with heated copper plates; and that the brass from this manufacture is reported to be of the finest kind: but he knows not whether the method there employed is the same with that mentioned by Cramer.

Brass is sometimes made in another way, by mixing the two metals directly; but the heat requisite to melt the copper makes the zinc burn and flame out, by which the copper is defrauded of the due proportion of zinc. If the copper be melted separately, and the melted zinc poured into it, a considerable and dangerous explosion ensues; but if the zinc is only heated and plunged into the copper, it is quickly imbibed and retained. The union, however, of these two metals succeeds better if the flux composed of inflammable substances be first fused in the crucible, and the copper and zinc be poured into it. As soon as they appear thoroughly melted, they are to be well stirred, and expeditiously poured out, or else the zinc will be inflamed, and leave the red copper behind.

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e. In lumps of an indeterminate figure.

All these are of a blackish brown, or a light brown colour.

B. Indurated. The blood-stone; *Hæmatites*.

(1.) Of an iron colour; *Hæmatites cœruleſcens*. This is of a bluish grey colour; it is not attracted by the loadstone, yields a red powder when rubbed, and is hard.

a. Solid, and of a dim appearance when broken.

b. Cubical, and of a shining appearance when broken.

c. Fibrous, is the most common *torrſten* of Sweden.

d. Scaly: the *eiſenram* of the Germans.

1. Black.
2. Bluish grey. When this is found along with marcasite, it is not only attracted by the loadstone, but is of itself really a loadstone.

e. Crystallised.

1. In octoedrical crystals.
2. In polyedrical crystals.
3. In a cellular form.

These varieties are the most common in Sweden, and are very seldom blended with marcasite or any other heterogeneous substance except their diffeeent beds. It is remarkable, that when these ores are found along with marcasite, those particles which have lain nearest to the marcasite are attracted by the loadstone, although they yield a red or reddish brown powder, like those which are not attracted by the loadstone: it is likewise worth observation, that they generally contain a little sulphur, if they are imbedded in a limestone rock.

(2.) Blackish brown bloodstone; *Hæmatites nigreſcens*. Kidney ore. This yields a red or brown powder when it is rubbed; it is very hard, and is attracted by the loadstone.

a. Solid, with a glassy texture.

b. Radiated.

c. Crystallised.

1. In form of cones, from Siberia.
2. In form of concentric balls, with a facetted surface. These are very common in Germany, but very scarce in Sweden.

(3.) Red bloodstone; *Hæmatites Ruber*. Red kidney ore.

a. Solid, and dim in its texture.

b. Scaly. The *eiſenran* of the Germans. This is commonly found along with the iron-coloured iron glimmer, and smears the hands.

c. Crystallised, in concentric balls, with a flat or facetted surface.

(4.) Yellow bloodstone; *Hæmatites flavus*.

a. Solid.

b. Fibrous.

The varieties of the colours in the bloodstone are the same with those produced in the calces of iron made by dry or liquid menstrua and afterwards exposed to different degrees of heat.

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B. Mixed with heterogeneous substances.

A. With a calcareous earth. White spathose iron ore. The *ſtahlſtein* of the Germans.

B. With a siliceous earth. The martial jasper of Sinople.

C. With a garnet earth. Garnet and cockle or shirl.

D. With an argillaceous earth. The bole.

E. With a micaceous earth. Mica.

F. With manganese.

G. With an alkali and phlogiston. Blue martial earth. Native Prussian-like blue.

1. Loose or powdery.

H. With an unknown earth, which hardens in water. Tarras; *Cementum*.

1. Loose or granulated; *Terra Puzzolana*. This is of a reddish brown colour, is rich in iron, and is pretty fusible.
2. Indurated; *Cementum induratum*. This is of a whitish yellow colour, contains likewise a great deal of iron, and has the same quality with the former to harden soon in water when mixed with mortar. This quality cannot be owing to the iron alone, but rather to some particular modification of it occasioned by some accidental causes, because these varieties rarely happen at any other places except where volcanoes have been, or are yet, in the neighbourhood.

[3.] Dissolved or mineralised.

A. With sulphur alone.

A. Perfectly saturated; *Ferrum ſulphure ſaturatum*. Marcasite.

B. With very little sulphur. Black iron ore. Iron stone.

This is either attracted by the loadstone, or is a loadstone itself attracting iron; it resembles iron, and yields a black powder when rubbed.

1.) Magnetic iron ore. The loadstone, *Magnes*.

a. Steel-grained, of a dim texture, from Hogberget in the parish of Gagnœf in Dalarne: it is found at that place almost to the day, and is of as great strength as any natural loadstones were ever commonly found.

b. Fine grained, from Saxony.

c. Coarse-grained, from Spetalsgrufvan at Norberg, and Kierrgrufvan, both in the province of Westmanland. This loses very soon its magnetical virtue.

d. With coarse scales, found at Sandswœr in Norway. This yields a red powder when rubbed.

2.) Refractory iron ore. This in its crude state is attracted by the loadstone.

a. Giving a black powder when rubbed; *Tritura atra*. Of this kind are,

1. Steel-grained.
2. Fine grained.

3. Courſe

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3. Coarse grained.

This kind is found in great quantities in all the Swedish iron mines, and of this most part of the fusible ores consist, because it is commonly found in such kinds of rocks as are very fusible: and it is as seldom met with in quartz as the hæmatites is met with in limestone.

b. Rubbing into a red powder. These are real hæmatites, that are so far modified by sulphur or lime as to be attracted by the loadstone.

1. Steel-grained.
2. Fine-grained. Emery. This is imported from the Levant: it is mixed with mica, is strongly attracted by the loadstone, and smells of sulphur when put to the fire.
3. Of large shining cubes.
4. Coarse, scaly. The *eisenglimmer* or *eisenran*.

[4.] Mixed with various fossile substances.

1. With sulphur and clay; Pyrites.
2. With arsenic; called *mispickel* by the Germans, and *plate mundic* in Cornwall.
3. With sulphurated arsenic. Arsenical pyrites.
4. With vitriolic acid. Martial vitriol.
5. With phlogiston. Martial coal ore.
6. With other sulphurated and arsenicated metals. See these in their respective arrangements.

Uses and Properties of Iron. Iron is the most common metal in nature, and at the same time the most useful in common life; notwithstanding which, its qualities are perhaps very little known.

Iron has a particular and very sensible smell when strongly rubbed or heated; and a styptic taste, which it communicates to the water in which it is extinguished after ignition. Its tenacity, ductility, and malleability, are very great. It exceeds every other metal in elasticity and hardness, when properly tempered. An iron wire of one-tenth of an inch thick is able to support 450 pounds weight without breaking, as Wallerius asserts.

Iron drawn into wire as slender as the finest hairs. It is more easily malleable when ignited than when cold; whereas other metals, though ductile when cold, become quite brittle by heat.

It grows red-hot sooner than other metals: nevertheless it melts the most difficultly of all, platina and manganese excepted. It does not tinge the flame of burning matters into bluish or greenish colours, like other imperfect metals, but brightens and whitens it; hence the filings of iron are used in compositions of fire-works, to produce what is called *white-fire*.

Iron, or rather steel, expands the least of all hard metals by the action of heat; but brass expands the most: and on this account these two metals are employed in the construction of compound pendulums for the best sort of regulating clocks for astronomical purposes.

Iron, in the act of fusion, instead of continuing to expand, like the other metals, shrinks, as Dr Lewis observes; and thus becomes so much more dense as to throw up such part as is unmelted to the surface; whilst pieces of gold, silver, copper, lead, and tin, put in the respective metals in fusion, sink quickly to the bottom. But in its return to a consistent state, instead of shrinking, like other metals, it expands; sensibly rising in the vessel, and assuming a convex surface, whilst the others subside, and appear concave. This property of iron was first taken notice of by Reamur, and excellently fits it for receiving impressions from the moulds into which it is cast, being forced into their minutest cavities. Even when poured thick into the mould, it takes, nevertheless, a perfect impression; and it is observed, that cast iron is somewhat larger than the dimensions of the mould, whilst cast figures of other metals are generally smaller.

The vitriolic acid dissolves iron readily, and forms green vitriol.

This acid requires to be diluted with 304 times its quantity of water, to enable it effectually to dissolve iron; and, during the dissolution, a strong aerial fluid arises, called *inflammable air*, which, on being mixed with atmospheric air, takes fire at the approach of the flame of a candle. A glass phial, of about two ounces measure, with one third of inflammable air, and the rest of common air, produces a very loud report if opened in the same circumstance; and if it be filled with two-thirds of inflammable air, mixed with one of dephlogisticated air, the report will be as loud as the explosion of a pistol with gunpowder.

Dilute nitrous acid dissolves iron; but this saline combination is incapable of crystallising. Strong nitrous acid corrodes and dephlogisticates a considerable quantity of iron, which falls to the bottom.

Marine acid likewise dissolves iron, and this solution is also incrystallisable.

The Prussian acid precipitates iron from its solutions in the form of Prussian blue.

This metal is likewise sensibly acted upon by alkaline and neutral liquors, and corroded even by those which have no perceptible saline impregnation; the oils themselves, with which iron utensils are usually rubbed to prevent their rusting, often promote this effect in some measure, unless the oils had been previously boiled with litharge or calces of lead.

Galls, and other astringent vegetables, precipitate iron from its solutions, of a deep blue or purple colour, of so intense a shade as to appear black. It is owing to this property of iron that the common writing ink is made. The infusion of galls, and also the Prussian alkali, are tests of the presence of iron by the colours they produce on any fluid. Acids, however, dissolve the coloured precipitates by the former; and hence it arises that the marine acid is successfully applied to take off ink spots and iron stains from white linens. Alkalis, however, convert these iron precipitates into a brown ochre.

Iron has a strong affinity with sulphur. If a bar of iron be strongly ignited, and a roll of brimstone be applied to the heated end, it will combine

bine with the iron, and form a fusible mass, which will drop down. A vessel of water ought to be placed beneath for the purpose of receiving and extinguishing it, as the fumes would otherwise be very inconvenient to the operator.

A mixture of iron-filings and sulphur in powder, moistened with water, and pressed so as to form a paste, will in a few hours swell, become hot, fume, and even burst into a flame, if the quantity is large. The residuum furnishes martial vitriol. This process is similar to the decomposition of martial pyrites; from which some philosophers account for hot spring-waters and subterraneous fires. The mixture of water in this paste seems to be necessary to enable the vitriolic acid of the sulphur to act on the iron.

For other chemical properties of this metal, see Chemistry-*Index*; for its electrical and magnetic properties, see Electricity and Magnetism. For a more particular account of its nature and uses, and the methods of making and manufacturing it, see the articles Iron and Steel; also Metallurgy, Part II. sect. vii. and Part III. sect. v.

Order III. Semimetals.

I. Bismuth; tin-glass. *Vismutum*, *Bismutum*, *Marcasita officinalis*. It is,

a. Of a whitish yellow colour.

b. Of a laminated texture, soft under the hammer, and nevertheless very brittle.

c. It is very fusible; calcines and scorifies like lead, if not rather easier; and therefore it works on the cuppel. It is pretty volatile in the fire.

d. Its glass or slag becomes yellowish brown, and has the quality of retaining some part of the gold, if that metal has been melted, calcined, and vitrified with it.

e. It may be mixed with the other metals, except cobalt and zinc, making them white and brittle.

f. It dissolves in aquafortis, without imparting to it any colour; but to the aqua-regia it gives a red colour, and may be precipitated out of both these solutions with pure water into a white powder, which is called *Spanish white*. It is also precipitated by the acid of sea-salt; which last unites with it, and makes the *vismutum corneum*.

g. It amalgamates easily with quicksilver. Other metals are so far attenuated by the bismuth, when mixed with it, as to be strained or forced along with the quicksilver through skins or leather.

Bismuth is found in the earth.

A. Native. This resembles a regulus of bismuth, but consists of smaller scales or plates.

1. Superficial, or in crusts.
2. Solid, and composed of small cubes.

B. In form of calx.

1. Powdery or friable; *Ochra visimuti*. This is of a whitish yellow colour; it is found in form of an efflorescence.

It has been customary to give the name of *flowers of bismuth* to the pale red calx of cobalt, but it is wrong; because neither the calx of bismuth, nor its solutions, become red, this being a quality belonging to the cobalt.

C. Mineralised bismuth. This is, with respect to colour and appearance, like the coarse tesselated potter's lead ore; but it consists of very thin square plates or flakes, from which it receives a radiated appearance when broken crosswise.

1. With sulphur.
   a. With large plates or flakes.
   b. With fine or small scales.
2. With sulphurated iron.
   a. Of coarse wedge-like scales.

This mineralised bismuth ore yields a fine radiated regulus; for which reason it has been ranked among the antimonial ores by those who have not taken proper care to melt a pure regulus ore destitute of sulphur from it; while others, who make no difference between regulus and pure metals, have still more positively asserted it to be only an antimonial ore.

3. With sulphur and arsenic.
   a. Of a whitish yellow or ash colour. It has a shining appearance; and is composed of small scales or plates, intermixed very small yellow flakes: It is of a hard and solid texture: Sometimes strikes fire with hard steel: Has a disagreeable smell when rubbed: Does not effervesce with aqua-fortis; but is partially dissolved by the same acid (z).
   b. Grey, of a striated form; found at Helsingland in Sweden, and at Annaberg in Saxony.
   c. With variegated colours of red, blue, and yellow grey; found at Schneeberg in Saxony.
   d. With green fibres like an amianthus; at Misnia in Germany, and at Gillebeck in Norway.
   e. With yellow red shining particles, called *mines de bismuth Tigrées* in French, at Georgenstadt in Germany, and at Annaberg in Saxony.
   f. The *minera bismuthi arenacea*, mentioned by Wallerius and Bomare, belongs also to the same kind of the arsenicated ores.
4. By vitriolic acid. This ore is called *wismuth bluth* by the Germans. It is said to be of a yellowish, reddish, or variegated colour; and to be found mixed with the calx of bismuth, incrusting other ores. *Kirwan*, p. 334.

Uses, &c. *of Bismuth*. See the article Bismuth. Also Chemistry-*Index*; and Metallurgy, Part II. sect. x. and Part III. sect. viii.

II.

(z) This solution, being diluted with water, becomes a kind of sympathetic ink; as the words written with it on white paper, and dried, are not distinguished by the eye; but on being heated before the fire, they assume a yellowish colour.

II. Zinc; ſpeltre. *Zincum.*

a. Its colour comes neareſt to that of lead, but it does not ſo eaſily tarniſh.

b. It ſhows a texture when it is broken, as if it were compounded of flat pyramids (A).

c. Its ſpecific gravity to water is as 6,900 or 7000 to 1000.

d. It melts in the fire before it has acquired a glowing heat; but when it has gained that degree of heat, it burns with a flame of a changeable colour, between blue and yellow. If in an open fire, the calx riſes in form of ſoft white flowers; but if in a covered veſſel, with the addition of ſome inflammable, it is diſtilled in a metallic form: in which operation, however, part of it is ſometimes found vitrified.

e. It unites with all the metals (B) except biſmuth and nickel, and makes them volatile. It is, however, not eaſy to unite it with iron without the addition of ſulphur. It has the ſtrongeſt attraction to gold and copper, and this laſt metal acquires a yellow colour by it; which has occaſioned many experiments to be made to produce new metallic compoſitions.

f. It is diſſolved by all the acids: of theſe the vitriolic acid has the ſtrongeſt attraction to it; yet it does not diſſolve it, if it is not previouſly diluted with much water.

g. Quickſilver amalgamates eaſier with zinc than with copper; by which means it is ſeparated from compoſitions made with copper.

h. It ſeems to become electrical by friction.

Zinc is found,

A. Native.

Zinc has been met with native, though rarely, in the form of thin and flexible filaments, of a grey colour, which were eaſily inflamed when applied to a fire. And Bomarc affirms that he has ſeen many ſmall pieces of native zinc among the calamine-mines in the duchy of Limbourg and in the zinc-mines at Goſlar, where this ſemimetal was always ſurrounded by a kind of ferrugineous yellow earth, or ochraceous ſubſtances. See the detached article Zinc.

B. In form of calx.

(1.) Pure.

a. Indurated.

1. Solid

2. Cryſtalliſed.

This is of a whitiſh-grey colour, and its external appearance is like that of a lead ſpar; it cannot be deſcribed, but is eaſily known by an experienced eye.—It looks very like an artificial glaſs of zinc; and is found among other calamines at Namur and in England.

(2.) Mixed.

A. With a martial ochre.

1. Half indurated. Calamine; *Lapis calaminaris.*

a. Whitiſh yellow.

b. Reddiſh brown. This ſeems to be a mouldered or weathered blende.

B. With a martial clay or bole.

C. With a lead ochre and iron.

D. With quartz: Zeolite of Friburgh.

The real contents of this ſubſtance were firſt diſcovered by M. Pelletier. It was long taken for a true zeolite, being of a pearl colour, cryſtalliſed, and ſemitranſparent. It conſiſts of laminæ, diverging from different centres, and becoming gelatinous with acids. Its contents are 48 to 52 per cent. of quartz, 36 of calx of zinc, and 8 or 12 of water. (*Kirwan*, p. 318.)

C. Mineraliſed.

(1.) With ſulphurated iron. Blende, mock-lead, black-jack, mock-ore; *pſeudogalena* and *blende* of the Germans

A. Mineraliſed zinc in a metallic form. Zinc ore. This is of a metallic bluiſh-grey colour, neither perfectly clear as a potter's ore, nor ſo dark as the Swediſh iron ores.

1. Of a fine cubical or ſcaly texture.

2. Steel grained

B. In form of calx. Blende. Mock-lead; *Sterile nigrum. Pſeudo-galena* (C). This is found,

1. With courſe ſcales.

a. Yellow; ſemi-tranſparent.

b. Greeniſh.

c. Greeniſh-

(A) It cannot be reduced into powder under the hammer like other ſemimetals. When it is wanted very much divided, it muſt be granulated, by pouring it while fuſed into cold water; or filed, which is very tedious, as it ſtuffs and fills the teeth of the file. But if heated the moſt poſſible without fuſing it, Macquer aſſerts, that it becomes ſo brittle as to be pulveriſed in a mortar.

(B) It brightens the colour of iron almoſt into a ſilver hue; changes that of copper to a yellow or gold colour, but greatly debaſes the colour of gold and deſtroys its malleability. It improves the colour and luſtre of lead and tin, rendering them firmer, and conſequently fitter for ſundry mechanic uſes. Lead will bear an equal weight of zinc, without loſing too much of its malleability.—The proceſs for giving the yellow colour to copper, by the mixture of zinc, and of its ore called *calamine*, has been deſcribed above under the *Uſes of Copper.*

(C) The varieties of pſeudo-galena, or black-jack, are in general of a lamellar or ſcaly texture, and frequently of a quadrangular form, reſembling galena. They all loſe much of their weight when heated, and burn with a blue flame; but their ſpecific gravity is conſiderably inferior to that of true galena. Almoſt all contain a mixture of lead-ore. Moſt of them exhale a ſulphureous ſmell when ſcraped; or at leaſt when vitriolic or marine acid is dropped on them.

c. Greeniſh-black; *pechblende*, or *pitch blende* of the Germans.
d. Blackiſh-brown.

2. With fine ſcales,
   a. White.
   b. Whitiſh-yellow.
   c. Reddiſh-brown.

3. Fine and ſparkling; at Goſlar called *braun blyertz*. Its texture is generally ſcaly; ſometimes cryſtalliſed and ſemitranſparent. It gives fire with ſteel; but does not decrepitate, nor ſmoke when heated: yet it loſes about 13 *per cent.* of its weight by torrefaction.
   a. Dark-brown.
   b. Red, which becomes phoſphoreſcent when rubbed; found at Scharfenberg in Miſnia. (*Brunich*).
   c. Greeniſh, yellowiſh-green, or red. It has different degrees of tranſparency, and is ſometimes quite opaque. When ſcraped with a knife in the dark, it emits light, even in water; and after undergoing a white heat, if it is diſtilled *per ſe*, a ſiliceous ſublimate riſes, which ſhows it contains the ſparry acid, probably united to the metal, ſince it ſublimes.

4. Of a metallic appearance; *glanz blende.*

This is of a bluiſh-grey, of a ſcaly or ſteel grained texture, and its form generally cubical or rhomboidal. It loſes nearly one ſixth of its weight by calcination; and after calcination it is more ſoluble in the mineral acids.

100 parts of this ore afforded to Bergman about 52 of zinc, 8 of iron, 4 of copper, 26 of ſulphur, 6 of ſilex, and 4 of water.

5. Cryſtalline.
   a. Dark-red, very ſcarce; found in a mine near Freyberg. Something like it is found at the Morgenſtern and Himmelsfuſte.
   b. Brown. In Hungary and Tranſilvania.
   c. Black. Hungary.

These varieties may eaſily be miſtaken for rock cryſtals; but by experience they may be diſtinguiſhed on account of their lamellated texture and greater ſoftneſs. Their tranſparency ariſes from a very ſmall portion of iron in them.

(2.) Zinc mineraliſed by the vitriolic acid.

This ore has been already deſcribed among the middle *Salts*, at *Vitriol of zinc.*

Uſes, &c. *of zinc.* See the detached article Zinc: Alſo Chemistry-*Index*; and Metallurgy, Part II. ſect. xii. and Part III. under ſect. iii.

III. Antimony; *Antimonium Stibium.* This ſemimetal is,

a. Of a white colour almoſt like ſilver.

b. Brittle; and, in regard to its texture, it conſiſts of ſhining planes of greater length than breadth.

c. In the fire it is volatile, and volatiliſes part of the other metals along with it, except gold and platina. It may, however, in a moderate fire, be calcined into a light-grey calx, which is pretty refractory in the fire; but melts at laſt to a glaſs of a reddiſh-brown colour.

d. It diſſolves in ſpirit of ſea-ſalt and aqua regia, but is only corroded by the ſpirit of nitre into a white calx; it is precipitated out of the aqua regia by water.

e. It has an emetic quality when its calx, glaſs, or metal, is diſſolved in an acid, except when in the ſpirit of nitre, which has not this effect.

f. It amalgamates with quickſilver, if the regulus, when fuſed, is put to it; but the quickſilver ought for this purpoſe to be covered with warm water: it amalgamates with it likewiſe, if the regulus of antimony be previouſly melted with an addition of lime.

Antimony is found in the earth.

A. Native. *Regulus antimonii nativus.*

This is of a ſilver colour, and its texture is compoſed of pretty large ſhining planes.

This kind was found in Carls Ort, in the mine of Salberg, about the end of the laſt century; and ſpecimens thereof have been preſerved in collections under the name of an arſenical pyrites, until the mine-maſter Mr Von Swab diſcovered its real nature, in a treatiſe he communicated to the Royal Academy of Sciences at Stockholm in the year 1748. Among other remarkable obſervations in this treatiſe, it is ſaid, firſt, That this native antimony eaſily amalgamated with quickſilver; doubtleſs, becauſe it was imbedded in a limeſtone; ſince, according to Mr Pott's experiments, an artificial regulus of antimony may, by means of lime, be diſpoſed to an amalgamation: Secondly, That when brought in form of a calx, it ſhot into cryſtals during the cooling.

B. Mineraliſed antimony.

(1.) With ſulphur.

This is commonly of a radiated texture, compoſed of long wedge-like flakes or plates; it is nearly of a lead-colour, and rough to the touch.

a. Of coarſe fibres.
b. Of ſmall fibres.
c. Steel-grained, from Saxony and Hungary.
d. Cryſtalliſed, from Hungary.
   1. Of a priſmatical, or of a pointed pyramidal figure, in which laſt circumſtance the points are concentrical.

Cronſtedt mentions a ſpecimen of this, in which the cryſtals were covered with very minute cryſtals or quartz, except at the extremities, where there was always a little hole: this ſpecimen was given for a *flos ferri* ſpar.

(2.) With ſulphur and arſenic. Red antimony ore; *Antimonium ſolare.*

This is of a red colour, and has the ſame texture with the preceding, though its fibres are not ſo courſe.

Semi-metals. *Antimony.*

a. With small fibres.
b. With abrupt broken fibres, from Braunsdorff in Saxony, and from Hungary.

All antimonial ores are somewhat arsenical, but this is more so than the preceding kinds.

(3.) With sulphurated silver. Plumose silver-ore, or *federertz* of the Germans.
(4.) With sulphurated silver, copper, and arsenic; the *dal fahl-ertz* of the Germans.
(5.) With sulphurated lead; radiated lead-ore.
(6.) By the aerial acid.

This ore was lately discovered by Mongez, among those of native antimony from the mine of Chalanges in Dauphiny. It consists of a group of white crystallised filaments of a needle-form appearance, diverging from a common centre, like zeolite. They are insoluble in nitrous acid; and, on being urged by the flame of a blow-pipe, upon a piece of charcoal, they are dissipated into white fumes, or antimonial flowers, without any smell of arsenic; from whence it follows, that these needle-formed crystals are a pure calx of antimony, formed by its combination with, or mineralised by, the aerial acid. See *Kirwan*, p. 325, and *Journal de Physique* for July 1787, p. 67.

Uses, &c. By the name of *antimony* is commonly understood the crude antimony (which is compounded of the metallic part and sulphur) as it melted out of the ore; and by the name of *regulus*, the pure semimetal.

1. Though the regulus of antimony is a metallic substance, of a considerably bright white colour, and has the splendor, opacity, and gravity of a metal, yet it is quite unmalleable, and falls into powder instead of yielding or expanding under the hammer; on which account it is classed among the semimetals.
2. Regulus of antimony is used in various metallic mixtures, as for printing types, metallic speculums, &c. and it enters into the best sort of pewter ware.
3. It mixes with, and dissolves various metals; in particular it affects iron the most powerfully; and, what is very remarkable, when mixed together, the iron is prevented from being attracted by the loadstone.
4. It affects copper next, then tin, lead, and silver; promoting their fusion, and rendering them all brittle and unmalleable: but it will neither unite with gold nor mercury; though it may be made to combine with this last by the interposition of sulphur. In this case it resembles the common Æthiops, and is thence called *antimonial Æthiops*.
5. Regulus of antimony readily unites with sulphur, and forms a compound of a very faint metallic splendor: it assumes the form of long needles adhering together laterally: it usually formed naturally also in this shape. This is called *crude antimony*.
6. But though antimony has a considerable affinity to sulphur; yet all the metals, except gold and mercury, have a greater affinity to that compound. If therefore iron, copper, lead, silver, or tin, be melted with antimony, the sulphur will unite with the metal, and be separated from the regulus, which, however, takes up some part of the metal, for which reason it is called *martial regulus*, *regulus veneris*, &c.
7. When gold is mixed, or debased by the mixture of other metals, it may be fused with antimony; for the sulphur combines with the base metals, which, being the lighter, rise up into scoria, while the regulus remains united at the bottom with the gold; which being urged by a stronger degree of heat, is freed from the semimetal, which is very volatile. This method of refining gold is the easiest of all.
8. But the most numerous purposes to which this metal has been applied are those of the chemical and pharmaceutical preparations. Lemery, in his Treatise on Antimony, describes no less than 200 processes and formulæ; among which there are many good and many useless ones. The following deserve to be mentioned on account of their utility.
9. Antimony melts as soon as it is moderately red hot, but cannot sustain a violent degree of fire, as it is thereby dissipated into smoke and white vapours, which adhere to such cold bodies as they meet with, and are collected into a kind of farina or powder, called *flowers of antimony*.
10. If it be only moderately heated, in very small pieces, so as not to melt, it becomes calcined into a greyish powder destitute of all splendor, called *calx of antimony*. This calx is capable of enduring the most violent fire; but at last it will run into a glass of a reddish-yellow colour, similar to that of the hyacinth. The infusion made of this coloured antimonial glass, in acidulous wine (such as that of Bourdeaux) for the space of 5 or 6 hours, is a very violent emetic.
11. If equal parts of nitre and regulus of antimony be deflagrated over the fire, the grey calx which remains is called *liver of antimony*.
12. If regulus of antimony be melted with two parts of fixed alkali, a mass of a reddish-yellow colour is produced, which being dissolved in water, and any acid being afterwards added, a precipitate is formed of the same colour, called *golden sulphur of antimony*.
13. Fixed nitre, viz. the alkaline salt that remains after the deflagration of nitre, being boiled with small pieces of regulus of antimony, the solution becomes reddish; and, on cooling, deposits the antimony in the form of a red powder, called *mineral kermes*.
14. Equal parts of the glass, and of the liver of antimony, well pulverised and mixed with an equal quantity of pulverised cream of tartar, being put into as much water as will dissolve the cream of tartar, and boiled for 12 hours, adding now and then some hot water to replace what is evaporated, the whole is to be filtered while hot; then being evaporated to dryness, the saline matter that remains is the emetic tartar.
15. The regulus of antimony being pulverised, and distilled

SEMI-METALS. *Antimony.*

distilled with corrosive sublimate of mercury, a thick white matter is produced, which is extremely corrosive, and is called *butter of antimony.* This thick substance may be rendered limpid and fluid by repeated distillations.

16. On mixing the nitrous acid with this butter of antimony, a kind of aqua regia is distilled, called *bezoardic spirit of nitre.*

17. The white matter that remains from this last distillation may be redistilled with fresh nitrous acid; and the remainder being washed with water, is called *bezoar mineral,* which is neither so volatile nor so caustic as the antimonial butter. This butter being mixed with water, a precipitate falls to the bottom, which is very improperly called *mercurius vitæ,* for it is in fact a very violent emetic.

18. But if, instead of the regulus, crude antimony be employed, and the same operation be performed, the reguline part separates from the sulphur, unites to the mercury, and produces the substance which is called *cinnabar of antimony.*

19. Crude antimony being projected in a crucible, in which an equal quantity of nitre is fused, detonates; is calcined, and forms a compound called by the French *fondant de Retrou,* or *antimoine diaphoretique non lavé.* This being dissolved in hot water, falls to the bottom after it is cold; and after decantation is known, when dry, by the name of *diaphoretic antimony.* This preparation excites animal perspiration, and is a good sudorific. The same preparation may be more expeditiously made by one part of antimony with two and a half of nitre, mixed together and deflagrated: the residue of which is the mere calx of antimony, void of all emetic power.

20. And if the detonation be performed in a tubulated retort, having a large receiver, containing some water adapted to it, both a clyssus of antimony and the antimonial flowers may be obtained at the same time, as Neumann asserts.

21. When nitre is deflagrated with antimony over the fire, the alkaline basis of the nitre unites with the calx of the semimetal, which may be separated by an acid, and is called *materia perlata.* See farther the article ANTIMONY; also METALLURGY, Part II. sect. ix.

IV. Arsenic. In its metallic form, is,

a. Nearly of the same colour as lead, but brittle, and changes sooner its shining colour in the air, first to yellow, and afterwards to black.

b. It appears laminated in its fractures, or where broken.

c. Is very volatile in the fire, burns with a small flame, and gives a very disagreeable smell like garlic.

d. It is, by reason of its volatility, very difficult to be reduced, unless it is mixed with other metals: However, a regulus may be got from the white arsenic, if it is quickly melted with equal parts of pot ashes and soap; but this regulus contains generally some cobalt, most of the white arsenic being produced from the cobalt ores during their calcination. The white arsenic, mixed with a phlogiston, sublimes likewise into octoedral crystals of a metallic appearance, whose specific gravity is 8,308.

SEMI-METALS. *Arsenic.*

e. The calx of arsenic, which always, on account of its volatility, must be got as a sublimation, is white, and easily melts to a glass, whose specific gravity is 5,000. When sulphur is blended in this calx, it becomes of a yellow, orange, or red colour; and according to the degrees of colour is called *orpiment* or yellow arsenic; *sandarach, realgar,* or red arsenic; and also *rubinus arsenici.*

f. This calx and glass are dissoluble in water, and in all liquids; though not in all with the same facility. In this circumstance arsenic resembles the salts; for which reason it also might be ranked in that class.

g. The regulus of arsenic dissolves in spirit of nitre; but as it is very difficult to have it perfectly free from other metals, it is yet very little examined in various menstrua.

h. It is poisonous, especially in form of a pure calx or glass: But probably it is less dangerous when mixed with sulphur, since it is proved by experience, that the men at mineral works are not so much affected by the smoke of this mixture as by the smoke of lead, and that some nations make use of the red arsenic in small doses as a medicine.

i. It unites with all metals, and is likewise much used by nature itself to dissolve, or, as we term it, to *mineralise,* the metals, to which its volatility and dissolubility in water must greatly contribute. It is likewise most generally mixed with sulphur.

k. It absorbs or expels the phlogiston, which has coloured glasses, if mixed with them in the fire.

Arsenic is found,

[1.] Native; called *Scherbencobolt* and *Fliegenstein* by the Germans.

It is of a lead colour when fresh broken, and may be cut with a knife, like black lead, but soon blackens in the air. It burns with a small flame, and goes off in smoke.

A. Solid and testaceous; *Scherbencobolt.*

B. Scaly.

C. Friable and porous; *Fliegenstein.*

(1.) With shining fissures.

This is by some called *Spigel cobolt.*

[2.] In form of a calx.

A. Pure, or free from heterogeneous substances.

1. Loose or powdery.
2. Indurated, or hardened. This is found in form of white semi-transparent crystals.

B. Mixed.

A. With sulphur.

1. Hardened.

a. Yellow. Orpiment; *Auripigmentum.*

b. Red. Native realgar, or sandarach.

B. With the calx of tin, in the tin-grains.

C. With sulphur and silver; in the *rothgulden* or red silver ore.

D. With calx of lead, in the lead-spar.

E. With calx of cobalt, in the efflorescence of cobalt.

[3.] Mi-

[3.] Mineralised.

A. With sulphur and iron. Arsenical pyrites or marcasite. These kinds in Cornwall are called *silvery* or *white mundics* and *plate mundics*.

This alone produces red arsenic when calcined. It is of a deeper colour than the following.

B. With iron only. This differs with regard to its particles; being,

1. Steel-grained.
2. Coarse-grained.
3. Crystallised.

a. In an octoedral figure. This is the most common kind.

b. Prismatical. The sulphureous marcasite is added to this kind when red arsenic is to be made; but in Sweden it is scarcer than the sulphureous arsenical pyrites.

C. With cobalt, almost in all cobalt ores.

D. With silver.
E. With copper.
F. With antimony.
} See under *Silver*, *Copper*, and *Antimony*, *supra*.

For the *Uses of Arsenic*, see the detached article Arsenic, and Chemistry-*Index*; also Metallurgy, Part II. sect. xiii. and Part III. sect. viii.

V. Cobalt.

This semimetal is,

a. Of a whitish grey colour, nearly as fine-tempered steel.

b. Is hard and brittle, and of a fine-grained texture; hence it is of a dusky, or not shining appearance.

c. Its specific gravity to water is 6000 to 1000.

d. It is fixed in the fire, and becomes black by calcination: it then gives to glasses a blue colour, inclining a little to violet, which colour, of all others, is the most fixed in fire.

e. The concentrated oil of vitriol, aquafortis, and aqua-regia, dissolve it; and the solutions become red. The cobalt calx is likewise dissolved by the same menstrua, and also by the volatile alkali and the spirit of sea salt.

f. When united with the calx of arsenic in a slow (not a brisk) calcining heat, it assumes a red colour: the same colour is naturally produced by way of efflorescence, and is then called the *bloom* or *flowers of cobalt*. When cobalt and arsenic are melted together in an open fire, they produce a blue flame.

g. It does not amalgamate with quiksilver by any means hitherto known.

h. Nor does it mix with bismuth, when melted with it, without addition of some medium to promote their union.

[1.] Native cobalt. Cobalt with arsenic and iron in a metallic form.

Pure native cobalt has not yet been found: that which passes for such, according to Kirwan, is mineralised by arsenic. Bergman, however, in his Sciagraphia, has entered this present ore under the denomination of *native cobalt*: and certain it is, that among all the cobaltic ores, this is the nearest to the native state of this semimetal. It always contains a small quantity of iron, besides the arsenic, by which it is mineralised.

This is of a dim colour when broken, and not unlike steel. It is found,

a. Steel-grained, from Loos in the parish of Farila in the province of Helsingeland, and Schneeberg in Saxony.

b. Fine-grained, from Loos.

c. Coarse-grained.

d. Crystallised:

1. In a dendritical or arborescent form;
2. Polyhedral, with shining surfaces;
3. In radiated nodules.

[2.] Calciform cobalt. Cobalt is most commonly found in the earth mixed with iron.

A. In form of a calx.

1.) With iron without arsenic.

a. Loose or friable; cobalt ochre. This is black, and resembles the artificial zaffre.

b. Indurated: *Minera cobalti vitrea.* The schlacken or slag cobalt. This is likewise of a black colour, but of a glassy texture, and seems to have lost that substance which mineralised it, by being decayed or weathered.

2.) With arsenical acid; cobalt-blut, Germ. *Ochra cobalti rubra*; bloom, flowers, or efflorescence of cobalt.

a. Loose or friable. This is often found of a red colour like other earths, spread very thin on the cobalt ores; and is, when of a pale colour, erroneously called *flowers of bismuth*.

b. Indurated. This is commonly crystallised in form of deep red semitransparent rays or radiations: It is found at Schneeberg in Saxony.

B. Mineralised.

1.) With sulphurated iron.

This ore is of a light colour, nearly resembling tin or silver. It is found crystallised in a polygonal form.

a. Of a slaggy texture.

b. Coarse-grained.

This ore is found in Bastnasgrufva at Raddarshyttan in Westmanland, and discovers not the least mark of arsenic. The coarse-grained becomes slimy in the fire, and sticks to the stirring hook during the calcination in the same manner as many regules do: It is a kind of regule prepared by nature. Both these give a beautiful colour.

2.) With sulphur, arsenic, and iron. This resembles the arsenicated cobalt ore, being only rather of a whiter or lighter colour. It is found,

a. Coarse-grained.

b. Crystallised;

1. In a polygonal figure, with shining surfaces, or *glanzkobolt*. It is partly of a white or light colour, and partly of a somewhat reddish yellow.

3.) With

3.) With ſulphurated and arſenicated nickel and iron; ſee *Kupfer-nickel*, below.

Uſes, &c. See the article COBALT. See alſo CHEMISTRY-*Index;* and METALLURGY, Part II. ſect. xi.

VI. Nickel; *Niccolum.* This is the lateſt diſcovered ſemimetal. It was firſt deſcribed by its diſcoverer Mr Cronſtedt, in the Acts of the Royal Academy of Sciences at Stockholm for the years 1751 and 1754, where it is ſaid to have the following qualities:

1. It is of a white colour, which, however, inclines ſomewhat to red.
2. Of a ſolid texture, and ſhining in its fractures.
3. Its ſpecific gravity to water is as 8,500 to 1000.
4. It is pretty fixed in the fire; but, together with the ſulphur and arſenic, with which its ore abounds, it is ſo far volatile as to riſe in form of hairs and branches, if in the calcination it is left without being ſtirred.
5. It calcines to a green calx.
6. The calx is not very fuſible, but, however, tinges glaſs of a tranſparent reddiſh-brown or jacinth colour.
7. It diſſolves in aquafortis, aqua-regia, and the ſpirit of ſea-ſalt; but more difficultly in the vitriolic acid, tinging all theſe ſolutions of a deep green colour. Its vitriol is of the ſame colour; but the colcothar of this vitriol, as well as the precipitates from the ſolutions, become by calcination of a light green colour.
8. Theſe precipitates are diſſolved by the ſpirit of ſal ammoniac, and the ſolution has a blue colour; but being evaporated, and the ſediment reduced, there is no copper, but a nickel regulus is produced.
9. It has a ſtrong attraction to ſulphur; ſo that when its calx is mixed with it, and put on a ſcorifying teſt under the muffel, it forms with the ſulphur a regule: this regule reſembles the yellow ſteel-grained copper-ores, and is hard and ſhining in its convex ſurface.
10. It unites with all the metals, except quickſilver and ſilver. When the nickel regulus is melted with the latter, it only adheres cloſe to it, both the metals lying near one another on the ſame plane; but they are eaſily ſeparated with a hammer. Cobalt has the ſtrongeſt attraction to nickel, after that to iron, and then to arſenic. The two former cannot be ſeparated from one another but by their ſcorification; which is eaſily done, ſince,
11. This ſemimetal retains its phlogiſton a long time in the fire, and its calx is reduced by the help of a very ſmall portion of inflammable matter: it requires, however, a red heat before it can be brought into fuſion, and melts a little ſooner, or almoſt as ſoon, as copper or gold, conſequently ſooner than iron.

Nickel is found,

A. Native.

This is mentioned by Mr Rinman to have been lately met with in a mine of cobalt in Heſſe. It is very heavy, and of a liver colour, that is, dark red. When pulveriſed and roaſted under a muffle, it forms green excreſcences, and ſmokes; but its ſmoke has no particular ſmell: and no ſublimate, whether ſulphureous or arſenical, can be caught. It is ſoluble in acids, and the ſolution is green; but a poliſhed iron plate diſcovers no copper.

B. In form of a calx. Nickel ochre, aerated nickel.

1. Mixed with the calx of iron. This is green, and is found in form of flowers on kupfernickel.

C Mineraliſed.

1. With ſulphurated and arſenicated iron and cobalt; *Kupfernickel.* This is of a reddiſh yellow colour; and is found,
   a. Of a ſlaggy texture.
   b. Fine-grained; and
   c. Scaly. Theſe two are often from their colour confounded with the liver-coloured marcaſite.
2. With the acid of vitriol. This is of a beautiful green colour, and may be extracted out of the nickel ochre, or effloreſcence of the Kupfernickel.

For a full account of this ſemimetal, ſee the article NICKEL, and CHEMISTRY-*Index.*

VII. Mangancſe. *Manganeſium.*

The ores of this kind are in Swediſh called *brunſten;* in Latin *ſydereæ*, or *magneſiæ nigræ*, in order to diſtinguiſh them from the *magneſia alba officinalis;* and in French *manganeſe*, &c.

1. Manganeſe conſiſts of a ſubſtance which gives a colour both to glaſſes and to the ſolutions of ſalts, or, which is the ſame thing, both to dry and to liquid menſtrua, viz.
   a. Borax, which has diſſolved manganeſe in the fire, becomes tranſparent, of a reddiſh brown or hyacinth colour.
   b. The microcoſmic ſalt becomes tranſparent with it, of a crimſon colour, and moulders in the air.
   c. With the fixed alkali, in compoſitions of glaſs, it becomes violet; but if a great quantity of manganeſe is added, the glaſs is in thick lumps, and looks black.
   d. When ſcorified with lead, the glaſs obtains a reddiſh brown colour.
   e. The lixivium of deflagrated manganeſe is of a deep red colour.
2. It deflagrates with nitre, which is a proof that it contains ſome phlogiſton.
3. When reckoned to be light, it weighs as much as an iron ore of the ſame texture.
4. When melted together with vitreous compoſitions, it ferments during the ſolution: but it ferments in a ſtill greater degree when it is melted with the microcoſmic ſalt.
5. It does not excite any effervefcence with the nitrous acid: aqua-regia, however, extracts the colour out of the black manganeſe, and diſſolves likewiſe a great portion of it, which by means of an alkali is precipitated to a white powder.

6. Such

SEMI-METALS. *Molybdena.*

6. Such colours as are communicated to glaſſes by mangancſe, are eaſily deſtroyed by the calx of arſenic or tin: they alſo vaniſh of themſelves in the fire.
7. It is commonly of a looſe texture, ſo as to colour the fingers like ſoot, though it is of a metallic appearance when broken.

Mangancſe is found,

[1.] Native; of the diſcovery and qualities of which, an account is given under the article MANGANESE in its alphabetieal order. See alſo CHEMISTRY-*Index.*

[2.] Calciform.

A. Looſe and friable.

a. Black; which ſeems to be weathered or decayed particles of the indurated kind.

B. Indurated.

1.) Pure, in form of balls, whoſe texture conſiſts of concentric fibres. *Pura ſphærica radiis concentratis.*

a. White; very ſcarce.

2.) Mixed with a ſmall quantity of iron.

a. Black manganeſe, with a metallic brightneſs. This is the moſt common kind, and is employed at the glaſs-houſes and by the potters. It is found,

1. Solid, of a ſlaggy texture.
2. Steel-grained.
3. Radiated.
4. Cryſtalliſed, in form of coherent hemiſpheres.

VIII. Molybdena.

A. Lamellar and ſhining, its colour ſimilar to that of the potter's lead-ore.

This ſubſtance reſembles plumbago or black-lead; and has long been confounded with it, even by Cronſtedt. But it poſſeſſes very different properties; in particular,

1. Its laminæ are larger, brighter: and, when thin, ſlightly flexible. They are of an hexagonal figure.
2. It is of a lead colour, and does not ſtrike fire with hard ſteel.
3. Its ſpecific gravity is = 4,569, according to Kirwan; and 4,7385, according to Briſſon.
4. When rubbed on white papper, it leaves traces of a dark brown or bluiſh colour, as the plumbago or black lead does; but they are rather of an argentine gloſs; by which circumſtance the molybdena, according to Dr d'Arcet, may be eaſily diſtinguiſhed from black-lead, as the traces made by this laſt are of leſs brilliant, and of a deeper tinge.
5. In an open fire, it is almoſt entirely volatile and infuſible. Microcoſmic ſalt or borax ſcarcely affect it; but it is acted upon with much effervescence by mineral alkali, and forms with it a reddiſh maſs, which ſmells of ſulphur.
6. It conſiſts of an acid of peculiar nature (ſee CHEMISTRY-*Index.*) united to ſulphur. A ſmall proportion of iron is commonly found in it, but this ſeems merely fortuitous: 100 parts of molybdena contain about 45 of this acid and 55 of ſulphur.

SEMI-METALS. *Wolfram.*

7. It is decompoſed either by detonation with nitre, or by ſolution in nitrous acid.
8. This acid is ſoluble in 570 times its weight of water in the temperature of 60; the ſolution reddens that of litmus, precipitates ſulphur from the ſolution of liver of ſulphur, &c. The ſpecific gravity of the dry acid is 3,460.
9. This acid is precipitable from its ſolution in water by the Pruſſian alkali, and alſo by tincture of galls: the precipitate is reddiſh brown.
10. If this acid be diſtilled with three times its weight of ſulphur, it reproduces molybdena.
11. The ſolution of this acid in water unites to fixed alkalies, and forms cryſtalliſable ſalts; as it alſo does with calcareous earth, magneſia, and argil: theſe laſt combinations are difficultly ſoluble. It acts alſo on the baſe metals, and with them aſſumes a bluiſh colour.
12. This ſolution procipitates ſilver, mercury, or lead, from the nitrous acid, and lead from the marine, but not mercury.
13. It alſo precipitates barytes from the nitrous and marine acids, but no other earth. Molybdenous baroſelenite is ſoluble in cold water.
14. This acid is itſelf ſoluble in the vitriolic acid by the aſſiſtance of heat; and the ſolution is blue when cold, though colourleſs while hot; it is alſo ſoluble in the marine acid, but not in the nitrous.
15. Molybdena tartar and ammoniac precipitate all metals from their ſolutions by a double affinity. Gold, ſublimate corroſive, zinc, and manganeſe, are precipitated white; iron or tin, from the marine acid, brown; cobalt, red; copper, blue; alum and calcareous earth, white.
16. This acid has been lately reduced by Mr Hielm; but the properties of the regulus thus obtained are not yet publiſhed.
17. Mr Pelletier obtained alſo the regulus or molybdena, by mixing its powder with oil into a paſte, and expoſing it with powdered charcoal in a crucible to a very violent fire for two hours. See CHEMISTRY-*Index*, nº 14, 97.
18. This ſemimetal being urged by a ſtrong fire for an hour, produces a kind of ſilvery flowers, like thoſe of antimony.
19. Molybdena is ſaid to be ſoluble in melted ſulphur; which ſeems highly probable, as ſulphur is one of its component parts.

See farther the article MOLYBDENA, and CHEMISTRY-*Index.*

IX. Wolfram. *Wolfranum, Spuma Lupi*, Lat. See the detached article WOLFRAM.

This mineral has the appearance of manganeſe, blended with a ſmall quantity of iron and tin.

1. With coarſe fibres.

a. Of an iron-colour, from Altenberg in Saxony. This gives to the glaſs compoſitions, and alſo to borax and the microcoſmic ſalt, an opaque whitiſh yellow colour, which at laſt vaniſhes.

X. Siderite. } See thoſe words in the order of the
XI. Saturnite. } alphabet.

APPENDIX.

Of Saxa and Petrifactions.

THOUGH the *Saxa*, and foſſils commonly called *Petrifactions*, cannot, in ſtrictneſs, be ranked in a mineral ſyſtem, for the reaſons formerly given; yet as theſe bodies, eſpecially the latter, occupy ſo conſiderable a place in moſt mineral collections, and the former muſt neceſſarily be taken notice of by the miners in the obſervations they make in ſubterranean geography, it appeared proper to ſubjoin them in ſuch an order as might anſwer the purpoſe for which they are regarded by miners and mineralogiſts.

Order I. SAXA. *Petræ.*

Theſe may be divided into two kinds.

1. Compound ſaxa, are ſtones whoſe particles, conſiſting of different ſubſtances, are ſo exactly fitted and joined together, that no empty ſpace, or even cement, can be perceived between them; which ſeems to indicate, that ſome, if not all, of theſe ſubſtances have been ſoft at the inſtant of their union.

2. Conglutinated ſtones, are ſtones whoſe particles have been united by ſome cementitious ſubſtance, which, however, is ſeldom perceivable, and which often has not been ſufficient to fill every ſpace between the particles: in this caſe the particles ſeem to have been hard, worn off, and in looſe, ſingle, unfigured pieces, before they were united.

I. Compound ſaxa.

A. Ophites. Scaly limeſtone with kernels or bits of ſerpentine ſtone in it.

1. *Kolmord marble.* It is white and green.
2. *Serpentino antico,* is white, with round pieces of black ſteatites in it. This muſt not be confounded with the *ſerpentino verde antico.*
3. The *Haraldſio marble.* White, with quadrangular pieces of a black ſteatites.
4. The *marmor pozzevera di Genova.* Dark green marble, with white veins. This kind receives its fine poliſh and appearance from the ſerpentine ſtone.

B. Stellſten or *geſtelſtein.* Granitello.

1. Of diſtinct particles. In ſome of theſe the quartzoſe particles predominate, and in others the micaceous: in the laſt caſe it is commonly ſlaty, and eaſy to ſplit.
2. Of particles which are wrapt up in one another.
   a. Whitiſh grey.
   b. Greeniſh.
   c. Reddiſh.

C. Norrka. Murkſten of the Swedes. *Saxum compoſitum mica, quartzo, et granato.*

1. With diſtinct garnets or ſhirl.
   a. Light grey.
   b. Dark grey.
   c. Dark grey, with priſmatical, radiated, or fibrous cockle or ſhirl.
2. With kernels of garnet-ſtone.
   a. Of pale red garnet ſtone.

The firſt of this kind, whoſe ſlaty ſtrata makes it commonly eaſy to be ſplit, is employed for mill-ſtones, which may without difficulty be accompliſhed, if ſand is firſt ground with them; becauſe the ſand wearing away the micaceous particles on the ſurfaces, and leaving the garnets predominent, renders the ſtone fitter for grinding the corn.

D. The whetſtone, *Cos. Saxum compoſitum mica, quartzo, et forſan argilla martiali in nonnullis ſpeciebus.*

1. Of coarſe particles.
   a. White.
   b. Light grey.
2. Of fine particles.
   a. Liver brown colour.
   b. Blackiſh grey.
   c. Light grey.
   d. Black. The table-ſlate, or that kind uſed for large tables and for ſchool ſlates.
3. Of very minute and cloſely combined particles. The Turkey-ſtone *. This is of an olive colour, and ſeems to be the fineſt mixture of the firſt ſpecies of this genus. The beſt of this ſort come from the Levant, and are pretty dear. The whetſtone kinds, when they ſplit eaſily and in thin plates, are very fit to cover houſes with, though moſt of them are without thoſe properties.

* See V. (p. 86. col. 1.)

F. Porphyry; *Porphyrites.* Italorum *porfido. Saxum compoſitum jaſpide et feltſpato, interdum mica et baſalte* (D). See the article PORPHYRY.

a. Its colour is green, with light-green feltſpat, *Serpentino verde antico.* It is ſaid to have been brought from Egypt to Rome, from which latter place the ſpecimens of it now come.
b. Deep red, with white feltſpat.
c. Black, with white and red feltſpat.
d. Reddiſh brown, with light red and white feltſpat.
e. Dark grey, with white grains of feltſpat alſo. The dark red porphyry has been moſt employed for ornaments in building; yet it is not the only one known by the name

(D) Great part of the hill of Bineves in Lochaber is compoſed of a kind of porphyry. It is remarkably fine, beautiful, and of an elegant reddiſh colour; "in which (ſays Mr Williams) the pale roſe, the bluſh, and the yellowiſh white colours, are finely blended and ſhaded through the body of the ſtone; which is of a jelly-like texture, and is undoubtedly one of the fineſt and moſt elegant ſtones in the world. On this hill alſo is found a kind of porphyry of a greeniſh colour, with a tinge of browniſh red. It is ſmooth, compact, and heavy; of a cloſe uniform texture, but has no brightneſs when broken. It has angular ſpecks in it of a white quartzy ſubſtance."

Appendix. SAXA.

name of *porfido*, the Italians applying the ſame name alſo to the black kind.

G. The *trapp* of the Swedes. *Saxum compoſitum jaſpide martiali molli, ſeu argilla martiali indurata.* See the article TRAPP.

This kind of ſtone ſometimes conſtitutes or forms whole mountains; as, for example, the mountain called *Hunneberg* in the province of Weſtergotland, and at Drammen in Norway; but it is oftener found in form of veins in mountains of another kind, running commonly in a ſerpentine manner, contrary or acroſs to the direction of the rock itſelf. It is not homogeneous, as may be plainly ſeen at thoſe places where it is not preſſed cloſe together; but where it is preſſed cloſe, it ſeems to be perfectly free from heterogeneous ſubſtances.—When this kind is very coarſe, it is interſperſed with feltſpat; but it is not known if the finer ſorts likewiſe contain any of it. Beſides this, there are alſo ſome fibrous particles in it, and ſomething that reſembles a calcareous ſpar; this, however, does not ferment with acids, but melts as eaſy as the ſtone itſelf, which becomes a black ſolid glaſs in the fire. By calcination it becomes red, and yields in aſſays 12 or more *per cent.* of iron. No other ſort of ore is to be found in it, unleſs now and then ſomewhat merely ſuperficial lies in its fiſſures; for this ſtone is commonly, even to a great depth in the rock, cracked in acute angles, or in form of large rhomboidal dice. It is employed at the glaſs-houſes, and added to the compoſition of which bottles are made. In the air it decays a little, leaving a powder of a brown colour; it cracks commonly in the fire, and becomes reddiſh brown if made red-hot. It is found,

1. Of coarſe chaffy particles.
   a. Dark grey.
   b. Black.
2. Coarſe-grained.
   a. Dark grey.
   b. Reddiſh.
   c. Deep brown.
3. Of fine imperceptible particles.
   a. Black. The touchſtone; *Lapis lydius.*
   b. Bluiſh.
   c. Grey.
   d. Reddiſh.

The black variety (3. *a.*) is ſometimes found ſo compact and hard, as to take a poliſh like the black agate: it melts, however, in the fire to a black glaſs; and is, when calcined, attracted by the load-ſtone.

H. *Amygdaloides.* The carpolithi or fruit-ſtone rocks of the Germans.

It is a martial jaſper, in which elliptical kernels of calcareous ſpar and ſerpentine ſtone are included.

a. Red, with kernels of white limeſtone, and of a green ſteatites. This is of a particular appearance, and when calcined is attracted by the loadſtone; it decays pretty much in the air, and has ſome affinity with the trapp, and alſo with the porphyry. There are ſometimes found pieces of native copper in this ſtone.

I. The *gronſten* of the Swedes.

Its baſis is horneblende, interſperſed with mica. It is of a dark green colour, and in Smoland is employed in the iron furnaces as a flux to the bog-ore.

K. The granite. *Saxam compoſitum feltſpata, mica et quartzo, quibus accidentaliter interdum horneblende ſteatites, granatus et baſaltes immixti ſunt.* Its principal conſtituent parts are felt-ſpat, or rhombic quartz, mica, and quartz. See the article GRANITE.

It is found,

(1.) Looſe or friable. This is uſed at the Swediſh braſs-works to caſt the braſs in, and comes from France.

(2.) Hard and compact.
   a. Red.
      1. Fine-grained;
      2. Coarſe-grained.
   b. Grey, with many and various colours (E).

II. Con-

(E) Mr Wiegleb has analyſed a ſpecies of green granite found in Saxony. The cryſtals are heaped together, and form very compact layers; the colour ſometimes an olive green, ſometimes reſembling a pear, and ſometimes of a reddiſh brown; ſome of them being perfectly tranſparent, and others nearly ſo. According to Mr Warren, they contain 25 per cent. of iron; whence they have been called green ore of iron. An ounce of theſe cryſtals heated red hot in a crucible loſt two grains in weight, and became of the colour of honey. The remainder was put into a retort, and diſtilled with marine acid, with which it evidently effervesced. The reſiduum was lixiviated with diſtilled water, freſh muriatic acid added, and the diſtillation and lixiviation repeated. The iron precipitated from this lixivium, and reduced partly to its metallic ſtate, weighed two drachms. M. Wiegleb concludes, that the ſpecimen contained two drams 26½ grains of lime. From further experiments he concludes, that 100 parts of the ſubſtance contained 36.5 of ſiliceous earth; lime 30.8; iron 28.7; and water and fixed air 4.0.

Scotland is remarkable for a great number of excellent granites, little or nothing inferior to porphyry. Of theſe the following kinds are mentioned by Mr Williams.

1. The grey granite, or *moor-ſtone* as it is called in Cornwall, is very common in this country. In ſome places it ſhows no marks of ſtrata; and in others it is diſpoſed in thick unwieldy irregular beds, which are commonly broken tranſverſely into huge maſſes or blocks of various ſizes and ſhapes. There is a great variety in this kind of ſtones; ſome of them differing but little in appearance from baſaltes; others are compoſed of almoſt equal parts of black and white grains, about the ſize of ſmall peaſe, whence it is called *peaſy-whin* by the

II. Conglutinated saxa.

A. Of larger or broken pieces of stones of the same kinds conglutinated together. *Breccia.*

1. Of limestone cemented by lime.

a. Calcareous breccia; the *marmi brecciati* of the Italians.

When these kinds have fine colours, they are polished and employed for ornaments in architecture and other œconomical uses.

b. The *lumachella* of the Italians, or shell marbles. These are a compound of shells and corals, which are petrified or changed into lime, and conglutinated with a calcareous substance. When they have many colours, they

the common people. In Galloway and other places it frequently has a longitudinal grain, as if the component parts had been all moved one way by a gentle flow of water. When this kind of granite begins to undergo a spontaneous decomposition by exposure to the atmosphere, we observe that it is composed of pretty large grains of the figures of cubes, rhomboids, &c. some of them so large as to deserve the name of fragments; and the largest of these are always of quartz or feldspath, and talc.

2. Reddish granite, of a gellied texture, which, Mr Williams says, is one of the finest and most elegant stones in the world. The mountains of Bineves, he says, are principally composed of this stone; and it is found in great abundance in many other parts of Scotland, but he never saw it exhibit any marks of stratification.

3. The fine reddish granites, in which several fine shades of colours are blended together, not spread out in tints as in the former. Neither this nor the former are stratified: "On the contrary (says our author), both exhibit such a degree of uniform regularity, that in some places there is no difference between a stone and a mountain, excepting only in magnitude; as many mountains of granite are nothing more than one regularly uniform mass throughout, in which not the least mark of a bed is to be seen, nor hardly a crack or fissure, unless it be at the edge of some precipice or declivity. These two varieties of elegant red granite are met with in the Highlands and Lowlands of Scotland, in Galloway, and many other places. We often find masses of talc so large in this second variety, that some of them may be called fragments, not disposed in any order, but higgledy-piggledy through the body of the stone.

4. Stratified reddish granite, resembling the third in colour and quality, but not always quite so pure or free from admixture of other stony matter of a different quality. This variety frequently contains larger and smaller fragments of fine laminated talc. Mr Williams, however, has seen this kind of granite disposed in pretty regular strata in the shires of Moray and Nairn, and other parts of Scotland.

5. Granite of a white and whitish colour, generally of a granulated texture, containing a great quantity of mica, or small-leaved talc, and the grains of quartz sometimes large and angular. This variety is subject to spontaneous decomposition; part frequently dissolves and falls into lakes, in such an exceedingly fine and attenuated state, that it does not sink in the water. "I have found (says Mr Williams) this substance in many places where water had been accidentally drained off, resembling fine shell marle, only much lighter. When thoroughly dry, it is the lightest fossile substance I ever handled; and, when blanched with rain, it is as white as snow. This variety of granite is either not stratified, or exhibits thick irregular beds. It frequently contains a considerable quantity of talc, in masses and scales too large to be called mica."

Our author is of opinion, that this fine white substance produced from the decomposition of the granite, is the true kaolin of the Chinese, one of the component parts of porcelain ware. "The authors of the History of China (says he) informs us, that the fine porcelain ware is composed of two different fossile substances, called by them *petuntse* and *kaolin.* We are further told, that the petuntse is a fine white vitrescible stone, compact and ponderous, and of considerable brightness in the inside when broken, which they grind to a fine powder; and that the kaolin is not a stone, but a fine white earthy substance, not vitrifiable, at least not in the heat of a common potter's furnace: that they mix the kaolin and the flour of the petuntse together, and form a paste of this mixture, which they mould into all sorts of porcelain vessels. Now, from the best accounts of this matter which I have been able to obtain, after a good deal of search and inquiry, it appears to me, that the sediment which I have mentioned above is the true kaolin; and that as the fine white glassy quartz, which is found in irregular masses, and in irregular discontinuous veins or ribs, in some of the rocks of schistus, is the true petuntse; and if this observation is really true, it deserves to be remarked, that Scotland is as well furnished with the best materials for making fine porcelain as most countries in the world. The species of quartz which I suppose to be petuntse is of a pure fine uniform glassy texture, semitransparent, and of a pure snowy whiteness. A broken piece of this stone, and a newly broken piece of fine porcelain, are very like one another. There is a great quantity of petuntse, or pure white quartz, in many places of Scotland, particularly in the north and Highlands. There is a considerable quantity of it upon the shore and washed by the tide between Banff and Cullen, generally in pretty large masses in rocks of bluish schistus; and to the best of my memory it is very fine of the kind. There is also a considerable quantity of it in discontinuous ribs and masses, in rocks of blue schist, about three or four miles north of Callendar in Monteith, upon the side of the high road which runs parallel to Loch eodunich, which I think also very fine. In some places this sort of quartz is tinged with a flesh colour from the neighbourhood of iron, which renders it unfit for porcelain; but there is plenty to be found of a pure white in almost all parts of Scotland, without any mineral tinge whatever. The kaolin is perhaps as plentiful in Scotland as the petuntse, there being many extensive lakes easily drained, which contain a considerable depth of it; and moreover, it is to be found in many places that have been lakes, which are now laid dry by accident. There is a quantity of kaolin about they are called *marbles*, and employed for the ſame purpoſes as the preceding (F).

2. Of kernels of jaſper cemented by a jaſpery ſubſtance. *Breccia jaſpidea. Diaſpro brecciato* of the Italians.

Of this kind ſpecimens from Italy are ſeen in collections. A coarſe jaſper breccia is ſaid to be found not far from Frejus in Provence in France.

3. Of ſiliceous pebbles, cemented by a jaſpery ſubſtance,

100 yards below the high road upon the ſouth ſide of a bridge, about a mile and a half or two miles ſouth of the inn of Aviemore in the Highlands. It lies beneath a ſtratum of peat bog, in a place which has been a lake, but is now drained by the river Spey cutting through one ſide of the mound which formed the lake.— There is more than one ſtratum of the kaolin in this place, and ſome of it is exceeding white, eſpecially when blanched by the rain: and there is a white granite rock up the rivulet, at ſome diſtance above the bridge, the decompoſition and diſſolution of which is ſuppoſed to produce this fine and curious ſediment. Several lakes in the Highlands of Scotland are nearly full of kaolin. One of them is ſituated in the country of Strathe-rig in Invernefs-ſhire, leſs than a mile north of the public road, and upon the weſt ſide of the farm of Drimin. It is a pretty long lake, and there is a conſiderable depth of kaolin in it, which may be drained at a moderate expence; and, if I remember well, the granite rocks which ſurround it are pretty white and fine. If the kaolin originates from coloured granite, it is good for nothing, eſpecially if it contains the leaſt tinge of iron, becauſe this will diſcolour and ſpoil the beauty of the porcelain; but wherever white granite is found compoſed of quartz, feldſpath, and mica, without any admixture of ſhirl, and eſpecially iron, the kaolin ſhould be diligently ſought after in that neighbourhood. Lochdoon, in Galloway, is ſaid to contain a great quantity of kaolin. It was drained ſome years ago on the ſuppoſition of its containing ſhell marle; but on trying the ſubſtance contained in it, it was found not to be marle but kaolin. Theſe ſubſtances may eaſily be miſtaken for one another at firſt; but they are eaſily diſtinguiſhed by trying them with acids, the marle readily effervefcing with the weakeſt, and the kaolin not at all with the ſtrongeſt acid liquors."

6. Grey compoſite granite is a very beautiful ſtone, and when broken looks as if compoſed of ſmall fragments of various ſizes and ſhapes, not unlike calve's-head jelly. When poliſhed, the fragments appear as if ſet or inlaid in a fine pellucid or water-coloured matter. There is a ſingle ſtratum of very curious compoſite granite, a little to the weſt of Loſſiemouth, in the county of Moray, in Scotland of about ſix or eight feet thick. It is compoſed chiefly of grains and fragments of various bright and elegant colours, moſt of which are as large as peaſe and beans, all fine, hard, and ſemipellucid; there is about an eighth part of good lead ore in the compoſition of this ſtone, of the kind commonly called potter's ore; and it is likewiſe remarkable, that there is no other granite in that neighbourhood but this ſingle ſtratum, all the ſtrata above and below it being moſtly a coarſe, imperfect, grey ſand-ſtone.

7. Granite of a looſe friable texture, ſubject to ſpontaneous decompoſition, and reduction to granite gravel. There is a remarkable rock of this kind near the Queen's-ferry in Scotland, on the road to Edinburgh, which appears in prodigious thick irregular ſtrata. This rock ſeems to be compoſed chiefly of quartz, ſhirl, and ſome iron; and produces excellent materials for the high roads.

8. In many parts of the north of Scotland, in the Highlands, and in Galloway, there is found an excellent ſpecies of grey granite, compoſed chiefly of red and black coloured grains. This is a fine and very durable ſtone, very fit for all kinds of architecture.

In ſpeaking of theſe ſtones, Mr Williams obſerves, that the finer and moſt elegant red granites, and the fineſt granite-like porphyries, ſo much reſemble one another, that he does not attempt to diſtinguiſh them; and Scotland is remarkable for a great number and variety of them. "The elegant reddiſh granite of Bineves, near Fort William (ſays he), is perhaps the beſt and moſt beautiful in the world; and there is enough of it to ſerve all the kingdoms on earth, though they were all as fond of granite as ancient Egypt. There are extenſive rocks of red granite upon the ſea-ſhore to the weſt of the ferry of Ballachyliſh in Appin, and likewiſe at Strontian, as well as many other parts of Argyleſhire. I have ſeen beautiful red granite by the road ſide, near Dingwall, and in ſeveral other parts of the north of Scotland, which had been blown to pieces with gunpowder, and turned off the fields. There are extenſive rocks of reddiſh granite about Peterhead and Slains, and both of red and grey granite in the neighbourhood of Aberdeen. The hill of Cruffel in Galloway, and ſeveral lower hills and extenſive rocks in that neighbourhood, are of red and grey granite, where there are great varieties of that ſtone, and many of them excellent. Upon the ſea ſhore near Kinnedore, weſt of Loſſiemouth, in Moray, there is a bed of ſtone about eight feet thick, which I think ſhould be called a compoſite granite. It is compoſed of large grains, or rather ſmall pieces of bright and beautiful ſtones of many different colours; and all the ſtony parts are exceedingly hard, and fit to receive the higheſt poliſh. About a ſixth or eighth part of it alſo conſiſts of lead ore, of that ſpecies called potter's ore. The ſeparate ſtony parts compoſing this ſtratum are all hard, fine, ſolid, and capable of the moſt brilliant poliſh; and if ſolid blocks can be raiſed free from all cracks and blemiſhes, I imagine, from the beauty and variety of colours of the ſtony part, and the quantity of bright lead ore which is blended through the compoſition and body of the ſtone, that this would be a very curious and beautiful ſtone when poliſhed."

(F) The ſtones called *Ludi Helmontii* or *Paracelſi*, have ſome ſimilarity in their form to the *brecciæ, a. b.*: for they are compoſed of various lumps of a marly whitiſh-brown matter, ſeparated into a great number of polygonous compartments, of various ſizes, formed of a whitiſh-yellow cruſt of a red calcareous ſpar, ſometimes substance, or something like it. The plum-pudding stone of the English; *Breccia silicea.* Its basis, which at the same time is the cement, is yellow; wherein are contained single flinty or agaty pebbles, of a grey colour or variegated. This is of a very elegant appearance when cut and polished: it is found in England and Scotland (G).

4. Of quartzose kernels combined with an unknown cement. *Breccia quartzosa.*

5. Of kernels of several different kinds of stones. *Breccia saxosa.*

a. Of kernels of porphyry, cemented by a porphyry or coarse jaspery substance; *Breccia porphyrea.*

b. Of kernels of several saxa; *Breccia indeterminata.*

c. Of conglutinated kernels of sandstone; *Breccia arenacea.* This kind consists of sandstone kernels, which have been combined a second time together.

The above mentioned brecciæ of themselves must demand the distinctions here made between, but which perhaps may seem to be carried too far,

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times pyritous, which often rise a little above the external surface, and inclose each of them on the inside. According to Bomare, the *ludus stellatus helmontii*, found in the county of Kent, is covered with a kind of striated selenite resembling the zeolite. They are for the most part of a globose figure, seldom flat, but often convex on the outside; and sometimes with a concave surface.

According to Wallerius, the *ludus helmontii* loses by calcination about half of its weight; and, on being urged by fire, is melted into a black glassy slag. It effervesces strongly with aqua-fortis, and this solution is of a yellow colour. But what seems very extraordinary, by adding to it some oil of tartar *per deliquium*, bubbles are produced, from which a great number of slender black threads or filaments are produced, sticking like a cobweb to the sides and bottom of the vessel.

These stones are found quite separate by themselves, as well as various stalagmites and crustaceous bodies, on the strata of argillaceous earth, in various parts of Europe, chiefly in Lorrain, Italy, England (in the counties of Middlesex and Kent), and elsewhere.

Wallerius ranges the *ludus helmontii* among the *tophi*, in the Spec. 425. of his System of Mineralogy. Paracelsus had attributed to these stones a lithontriptic power, and Dr Grew says that they are diuretic; but there is not the least proof of their really possessing such qualities.

(G) The breccia stratum, or plumpudding-rock, exhibits a singular appearance as it lies in the ground; being composed of water-rounded stones of all qualities and of all sizes, from small gravel up to large rounded stones of several hundreds weight each; the interstices being filled up with lime and sand. It frequently also contains lime and iron. Sometimes it exhibits a grotesque and formidable appearance; containing many large bullets of various sizes and shapes, without any marks of regular stratification, but looking like one vast mass of bullets of unequal thickness; and in this manner frequently swelled to the size of a considerable mountain. It is frequently cemented very strongly together; so that parts of the hills composed of it will frequently overhang in dreadful precipices, less apt to break off than other rocks in the same situation; one reason for which, besides the strength of the cement, is, that the breccia, when composed of bullets, is less subject to fissures and cutters than other rocks; being frequently found in one solid mass of great extent and thickness. Some of the plumpudding-rocks are made up of smaller parts, coming near to the size of coarse gravel. It is evident, however, that all the parts of the breccia, whether course or fine, have been rounded by agitation in water, as the rocks differ nothing in appearance from the coarser and finer gravel found upon the beach of the sea, excepting only that the parts are strongly cemented together in the rocks, and are loose upon the shores of the ocean.

Some of the breccia is composed of finely rounded stones of various and beautiful colours, about the size of plums or nuts, all very hard and fine. Were this species sawed and polished, it would appear as beautiful and elegant as any stone in Europe; much resembling mosaic work in small patterns.

In general, the breccia is regularly stratified or not according to the size of the component parts of the stone. Such rocks as are composed of round gravel and small bullets are generally very regular in their stratification, while those which contain bullets somewhat larger in size are commonly disposed in thick and coarse beds, and such rocks as are made up of the largest kind of bullets seldom show any marks of stratification at all.

Among many other places in Scotland, where breccia or pudding-stone abounds, there are extensive rocks and high cliffs of it upon the south shore at the west end of the Pentland Frith, to the westward of Thurso in Caithness, which stretch quite across the county of Caithness into Sutherland; and in Sutherland as well as Caithness, this rock is of a rough contexture, and appears in pretty high hills, deep glens, overhanging rocks, and frightful precipices, to the west of Brora, Dunrobin, and Dornoch, which gives it a grotesque and formidable appearance in that country. This range of breccia stretches also quite through Sutherland, and likewise through Rossshire, the west side of Ferndonald, and Dingwall, where it exhibits the very same phenomena as in Sutherland and Caithness. It continues the same longitudinal line of bearing, which is nearly from north-east to south-west, quite through the highland countries of Inverness and Perthshire; and it forms considerable hills, and very high and rugged rocks, upon both sides of that beautiful piece of fresh water Lochness. Much of the stone here, as well as in other places in this range, is composed of large bullets; the rock is very hard and strong, and it hangs in frightful precipices upon both sides of the lake, through which rock General

Appendix. Saxa.

far, since their particles are so big and plain as to be easily known from one another. These stones are a proof both of the subversions which the mountains in many centuries have undergone, and of some hidden means which nature makes use of in thus cementing different kinds of stones together. Any certain bigness for the kernels or lumps in such compounds, before they deserve the name of *breccia*, cannot be determined, because that depends on a comparison which every one is at liberty to imagine. In some places, the kernels of porphyry have a diameter of six feet, while in others they are no bigger than walnuts. Sometimes they have a progressive size down to that of a fine sandstone. Most of this kind of stone is fit for ornaments, though the workmanship is very difficult and costly.

B. Conglutinated stones of granules or sands of different kinds. Sandstone; *Lapis arenaceus*.

In this division are reckoned those which consist of such minute particles, that all of them cannot easily be discovered by the naked eye. The greatest part, however, consist of quartz and mica; which substances are the most fit to be granulated, without being brought to a powder.

1. Cemented by clay.
   a. With an apyrous or refractory clay. This is of a loose texture; but hardens, and is very refractory in the fire.
   b. With common clay.
2. With lime; resembles mortar made with coarse sand.
   a. Consisting of transparent and greenish grains of quartz and white limestone.
   b. Of no visible particles. This is of a loose texture, and hardens in the air.
3. With an unknown cement.
   a. Loose.
   b. Harder.
   c. Compact.
   d. Very hard.
4. Cemented by the rust or ochre of iron. Is found in form of loose stones at several places, and ought perhaps to be reckoned among the *mineræ arenaceæ* or sand ores; at least when the martial ochre makes any considerable portion of the whole.
5. Grit-stone. This is of greater or less hardness, mostly of a grey, and sometimes of a yellowish colour; composed of a siliceous and micaceous sand, and rarely of a sparry kind, with greater or lesser particles closely compacted and united by an argillaceous cement. It gives some sparks with steel, is indissoluble for the most part in acids, and vitrifiable in a strong fire. It is used for millstones and whetstones, sometimes for filtering stones and for building. *Fabroni.*

   N. B. The *argillaceous* grit has been before described, p. 89. col. 1.
6. Elastic. A singular species of sandstone, of which a specimen was shown some years ago to the Royal Academy of Sciences at Paris by the Baron de Dietrich. It is flexible and elastic; and consists of small grains of hard quartz, that strike fire with tempered steel, together with some micaceous mixture. The elasticity seems to depend on the micaceous part, and softness of the natural gluten between both. It is said, that this elastic stone was found in Brazil, and brought to Germany by his excellency the Marquis de Lavradio.

   There are also two tables of white marble, kept in the palace Borghese at Rome, which have the same property But the sparry particles of their substance, though transparent, are rather soft; may be easily separated with the nail, and effervesce with aqua-fortis; and there is also in it a little mixture of small particles of talc or mica. See *Journ. de Phys.* for Oct. 1784, p. 275. See also the article Marble (*Elastic.*)

C. Stones and ores cemented together; *Mineræ arenaceæ*.

1. Of larger fragments.
   a. Mountain green, or *viride montanum cupri*, and pebbles cemented together, from Siberia.
   b. Potters lead-ore, with limestone, slate-kernels, and shells.
   c. Yellow or marcasitical copper ore, with small pebbles.
2. Of smaller pieces.
   a. Potter's lead-ore with a quartzose sand.
   b. Mountain green with sand from Siberia.
   c. Cobalt ore with sand.
   d. Martial ochre with sand.

Order II. Mineral changes, or Petrifactions.

These are mineral bodies in the form of animals or vegetables, and for this reason no others belong to this order than such as have been really changed from the subjects of the other two kingdoms of nature.

I. Earthy changes; *Terræ larvatæ*.

A. Extraneous bodies changed into a lime substance, or calcareous changes; *Larvæ calcareæ*.

(1.) Loose or friable. Chalky changes; *Cretæ larvatæ*.

a. In

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neral Wade cut a fine military road upon the south side of the lake, at a great expence of time, labour, and gunpowder. These rocks are seen stretching through the mountains of Stratherig into Badenoch, where it forms a remarkable rock and precipice called *Craigdow* or the *Black Rock*. The same range is again seen farther towards the south-west, in several places to the south of the Black Mount, and in the country of Glenorchy in Argyleshire: and Mr Williams supposes, that the longitudinal line of this rock, so far as it has been just pointed out, is little less than 200 miles, and in some places it spreads eight or ten miles in what may be called the latitudinal line across the bearing of the rocks.

a. In form of vegetables.
b. In form of animals.
1. Calcined or mouldered shells; *Humus conchaceus.*
(2.) Indurated; *Petrifacta calcarea.*
a. Changed and filled with solid limestone.
1. In form of animals.
2. In form of vegetables.
b. Changed into a calcareous spar; *Petrifacta calcarea spatosa.*
1. In form of animals.
2. In form of vegetables.

B. Extraneous bodies changed into a flinty substance. Siliceous changes; *Larvæ silicea.* These are, like the flint,
(1.) Indurated.
a. Changed into flints.
1. Carnelians in form of shells, from the river Tomm in Siberia.
2. Agat in form of wood. Such a piece is said to be in the collection of Count Tessin.
3. Coralloids of white flint, (*Millepora.*)
4. Wood of yellow flint.

C. Extraneous bodies changed into clay. Argillaceous changes; *Larvæ argillaceæ.*
A. Loose and friable.
1. Of porcelain clay.
a. In form of vegetables.

A piece of white porcelain clay from Japan, with all the marks of the root of a tree, has been observed in a certain collection.

B. Indurated.
1. In an unknown clay.
a. In form of vegetables. *Osteocolla.* It is said to be changed roots of the poplar tree, and not to consist of any calcareous substance.

A sort of fossile ivory is said to be found, which has the properties of a clay; but it is doubtful if it has been rightly examined.

II. Saline extraneous bodies, or such as are penetrated by mineral salts. *Corpora peregrina insalita. Larvæ insalitæ.*
A. With the vitriol of iron.
1. Animals.
a. Human bodies have been twice found in the mine at Falun in Dalarne; the last was kept a good many years in a glass-case, but began at last to moulder and fall to pieces.
2. Vegetables.
a. Turf, and
b. Roots of trees.

These are found in water strongly impregnated with vitriol. They do not burn with a flame, but only like coal in a strong fire; neither do they decay in the air.

III Extraneous bodies penetrated by mineral inflammable substances, or mineral phlogiston
A. Penetrated by the substance of pit-coals.
1. Vegetables, which commonly have been woods, or appertaining to them.
a. Fully saturated. *Gagas,* Jet. (See p. 104. col. 2.) The jet is of a solid shining texture.
b. Not perfectly saturated; *Mumia vegetabilis.* It is loose; resembles umber, and may be used as such.

B. Penetrated by rock-oil or asphaltum.
1. Vegetables.
a. Turf

The Egyptian mummies cannot have any place here, since art alone is the occasion that those human bodies have in length of time been penetrated by the asphaltum, in the same manner as has happened naturally to the wood in pit coal strata. See MUMMY.

C. Penetrated by sulphur which has dissolved iron, or by marcasite and pyrites. *Pyrite impregnata. Petrifacta pyritacea.*
1. Animals.
a. Human.
b. Bivalves.
c. Univalves.
d. Insects.

IV. Metals in form of extraneous bodies; *Larvæ metalliferæ.*
A. Silver; *Larvæ argentiferæ.*
(1.) Native.
a. On the surfaces of shells.
(2.) Mineralised with copper and sulphur.
a. Fahlertz, or grey silver ore in form of ears of corn, &c. and supposed to be vegetables, are found in argillaceous slate at Frankenberg and Tahlitteren in Hesse.

B. Copper; *Larvæ cupriferæ.*
(1.) Copper in form of calx.
a. In form of animals, or of parts belonging to them.
1. Ivory and other bones of the elephant. The Turcois or Turquoise; which is of a bluish green colour, and much valued in the east.

At Simore in Languedoc bones of animals are dug, which during the calcination assume a blue colour; but it is not probable that the blue colour is owing to copper.

(2.) Mineralised copper, which impregnates extraneous bodies; *Cuprum mineralisatum corpora peregrina ingressum.*
A. With sulphur and iron. The yellow or marcasitical copper ore that impregnates,
1. Animals.
a. Shells.
b. In form of fish.
B. With sulphur and silver. Grey silver ore or fahlerts, like ears of corn, from the slate-quarries in Hesse.

C. Changes into iron; *Larvæ ferriferæ.*
(1.) Iron in form of calx, which has assumed the place or the shape of extraneous bodies; *Ferrum calciforme corpora peregrina ingressum.*
a. Loose; *Larvæ ochraceæ.*
1. Of vegetables.

Roots of trees, from the lake Langelma in Finland. See the acts of the Swedish Academy of Sciences for the year 1742.

b. Indu-

b. Indurated; *Larvæ hæmatiticæ*.
1. Of vegetables.
(2.) Iron mineralised, assuming the shape of extraneous bodies.
a. Mineralised with sulphur. Marcasite. *Larvæ pyritaceæ*.

V. Extraneous bodies decomposing, or in a way of destruction; *Corpora peregrina in gradibus destructionis considerata*. Mould; *Humus*. Turf; *Turba*.

A. From animals. Animal-mould; *Humus animalis*.
1. Shells. *Humus conchaceus*.
2. Mould of other animals; *Humus diversorum animalium*.

B. Vegetable mould; *Humus vegetabilis*.
1. Turf; *Turba*.
a. Solid, and hardening in the air; *Turba solida aere indurescens*. This is the best of the kind to be used for fuel, and comes nearest to the pit-coals. It often contains a little of the vitriolic acid.
b. Lamellated turf; *Turba foliata*. This is in the first degree of destruction.
2. Mould of lakes; *Humus lacustris*. This is a black mould which is edulcorated by water.
3. Black mould; *Humus ater*. This is universally known, and covers the surface of that loose earth in which vegetables thrive best.

Order III. Volcanic Products (H).

I. Slags; *Scoriæ vulcanorum*.

Slags are found in great abundance in many places of the world, not only where volcanoes yet exist, but likewise where no subterraneous fire is now known: Yet, in Mr Cronstedt's opinion, they cannot be produced but by means of fire. These are not properly to be called *natural*, since they have marks of violence, and of the last change that mineral bodies can suffer without the destruction of the world; nor are they *artificial*, according to the universally received meaning of this word. We cannot, however, avoid giving them a place here, especially after having admitted the petrifactions; and shall therefore arrange the principal of them, according to their external marks.

A. Iceland agate; *Achates islandicus niger*.

It is black, solid, and of a glassy texture; but in thin pieces it is greenish and semitransparent like glass-bottles, which contain much iron. The most remarkable circumstance is, that such large solid masses are found of it, that there is no possibility of producing the like in any glass-house.

It is found in Iceland, and in the island of Ascension: The jewellers employ it as an agate, though it is too soft to resist wear.

B. Rhenish millstone; *Lapis molaris Rhenanus*.

Is blackish-grey, porous, and perfectly resembles a sort of slag produced by mount Vesuvius. A variety of lava, according to Kirwan.

C. Pumice-stone; *Pumex*.

It is very porous and blistered, in consequence of which it is specifically very light. It resembles that frothy slag which is produced in our iron furnaces.
1. White.
2. Black.

The colour of the first is perhaps faded or bleached, because the second kind comes in that state from the laboratory itself, *viz*. the volcanoes.

D. Pearl slag; *Scoriæ constantes globulis vitreis conglomeratis*.

It is compounded of white and greenish glass particles, which seem to have been conglutinated while yet soft or in fusion. Found on the Isle of Ascension.

E. Slag-sand or ashes; *Scoriæ pulverulentæ, cineres vulcanorum*.

This is thrown out from volcanoes in form of larger or smaller grains. It may perhaps be the principle of the Terra Puzzolana; because such an earth is said at this time to cover the ruins of Herculaneum near Naples, which history informs us was destoyed by a volcano during an earthquake.

II. Lavas.

Lava has been generally understood to denote the aggregate mass of melted matters which flow out of the mouths, or burst out from the sides, of burning mountains. According to Mr Kirwan, however, lavas are the immediate produce of liquefaction or vitrification by the volcanic fires, and "should carefully be distinguished from the subsequent productions affected by the water either in a liquid or fluid state, which generally is ejected at the same time." And of lavas, so distinguished, he describes several varieties. See the article Lava, in the order of the alphabet; where the nature, origin, kinds, and phenomena of lavas, are copiously described and explained.

III. Basaltes.

This sort of stone was by Cronstedt, in the first edition of his Mineralogy, ranked among the garnet earths, and confounded with the shoerls; an impropriety which was pointed out by Bergman in his *Sciagraphia*, sect. 120.—Mr Kirwan considers basaltes as an imperfect lava, and ascribes its origin both to fire and water. He describes it as found, either, 1. In opaque triangular or polyangular columns; which is the proper basaltes: Or, 2. In amorphous masses of different magnitudes; forming solid blocks, from the smallest size to that of whole mountains: which kind is called *trapp*. See the detached article Basaltes (I); where its species and varieties

(H) For the nature, history, theory, &c. of volcanoes, see the article Volcano.

(I) In that article, p. 46. col. 1. l. 9. *dele* the words, "The English miners call it *cockle*, the German *schoerl*."—P. 47. col. 2. l. 28. for "a kind of marble," read "a volcanic production." The *Lapis Lydius*, or Touchstone, mentioned in the same paragraph, should have been specified to be of the sort called *Trapp*.

rieties are particularly deſcribed, and different opinions ſtated concerning its formation. See alſo the article Trapp.—Some plauſible arguments againſt the volcanic origin of baſaltes will be mentioned in the courſe of the ſubjoined note (K), extracted from *Williams's Natural Hiſtory of the Mineral Kingdom.*

(K) There is a great variety of baſaltes in Scotland, particularly of the grey kinds; ſome of which are capable of the higheſt degree of poliſh. A good black kind is met with on the ſouth ſide of Arthur's Seat near Edinburgh, where it forms a ſmooth perpendicular rock, with ſeveral of the columns broken off, and the ſuſpended pieces threatening to fall down upon the paſſengers below. This ſtone is capable of receiving a fine poliſh; and, in the opinion of Mr Williams, would be fit for all ſorts of ornaments about ſepulchral monuments. It will poliſh to a bright and beautiful black, which will be unfading.

There is another kind, heavy and hard, of a black or blackiſh-grey colour; of which great quantities have been carried from the Frith of Forth to pave the ſtreets of London. This, for the moſt part, is coarſely granulated in the inſide, though ſometimes the grain is pretty fine. Sometimes it is bright in the inſide when broken. It is compoſed of grains of quartz and ſhirl of different ſizes, and commonly contains ſome iron. It always appears in thick, irregular, beds, ſome of which are enormouſly thick; and ſeldom or ever equally ſo: on the contrary, where it is found uppermoſt, it frequently ſwells into little hills of various ſizes. Moſt of the ſmall iſlands in the Frith of Forth are compoſed of this kind of ſtone; as well as ſome hills in the neighbourhood of Inverkeithing and of Edinburgh.

The known characteriſtic of the baſaltes is to form itſelf into balls, columns, and other regular figures. The columnar kind aſſumes a pentagonal, hexagonal, or heptagonal figure; but quadrangular columns are not common. They are all ſmooth on the outſide, and lie parallel and contiguous to one another; ſometimes perpendicular, ſometimes inclining, in proportion to the poſition of the ſtratum which is thus divided: If the ſtratum lies horizontal, the columns are perpendicular; if inclining, the pillars alſo incline in exact proportion to the declivity of the ſtrata, being always broken right acroſs the ſtratum. Some are of one piece from top to bottom; others divided by one or more joints laid upon one another, which form a column of ſeveral parts. The rock called the *Giant's Cauſeway* in Ireland is a pretty good ſpecimen of the jointed columnar baſaltes: but there is a more beautiful ſpecies above Hillhouſe lime-quarry, about a mile ſouth of Linlithgow in Scotland; and a coarſer one near the toll-bar north ſide of Queen's Ferry, and ſeveral other places in Fife. In ſome places the baſaltes are formed into magnificent columns of great length; and in others afford an aſſemblage of ſmall and beautiful pillars reſembling a range of balluſtrades or organ pipes. Some of the columns on the ſouth ſide of Arthur's Seat already mentioned are very long; and there are likewiſe magnificent columns of great length in the iſland of Egg, and others of the Hebrides. Theſe columns, when broken, are frequently of a black, or blackiſh grey, in the inſide; ſome of them being compoſed of ſmall grains, which gives them an uniform and ſmooth texture; but much of this ſpecies of ſtone has larger grains in its compoſition, rough, ſharp, and unequal, when broken. All the grains, however, are fine, hard, and bright; and the ſtone in general is capable of a fine poliſh.

The other ſpecies of baſaltes which forms itſelf into diſtinct maſſes, aſſumes ſometimes a quadrangular, ſometimes an oval, globular, or indeterminate figure. They are found of all ſizes from the ſize of an egg to that of an houſe: but though they differ in ſhape from the columnar baſaltes, they agree in almoſt every other reſpect; whence Mr Williams thinks that they are only to be accounted a variety of the columnar kind. It is common to ſee one ſtratum of the baſaltine rocks exhibiting, in one place, regular pillars or globes; and near theſe, very irregular ones, differing very little from the common cutters found in all rocks; and at no great diſtance, the ſame rock is found to run into one entire maſs, exhibiting no tendency to be broken or divided into any columns whatever. Of this the rock of Arthur's Seat is an inſtance. Some of theſe only produce ſolid maſſes of different figures and ſizes; while others produce quantities of a ſofter, friable, ſtony matter, of the ſame quality in which the hard maſſes of different figures are found imbedded. Pretty good ſpecimens of the ſecond kind or variety of baſaltes are met with on the road-ſide between Cramond bridge and the Queen's Ferry, and in ſeveral other places in the Lothians and in Fife.

The cruſtated baſaltes are of two kinds; 1. Such as have the cruſts more dry and friable than the internal parts; and, 2. Such as are dry and friable throughout the whole maſs.

The firſt of theſe has not only a cruſt of the friable matter adhering to it, but is likewiſe imbedded in a quantity of the ſame. Our author has ſeen many quarries of this kind of baſaltes dug for the high roads, in which the quantity of ſoft friable matter greatly exceeded that of the hard maſſes, and in which incruſted ſtones of various ſizes and ſhapes appeared. In ſuch quarries, ſome of the largeſt maſſes have only a few coats of penetrable friable matter, ſurrounding a nucleus which varies in ſize, but is uniformly hard throughout; and we ſhall find other yolks in the ſame quarry imbedded in the ſofter matter, which, when broken, exhibit a neſt of ſtones including one another like the ſeveral coats of an onion. Theſe cruſtated baſaltes which envelope one another are a curious ſpecies of ſtone. The ſeveral coats of ſurrounding matter differ nothing in quality from the ſtones contained in them, and ſome of the inner cruſts are often very hard; but the nucleus within, though ſmall, is always the hardeſt. The decompoſition by the weathering of the ſofter matter found ſurrounding and enveloping the harder maſſes of ſtone in this and the ſecond ſpecies of basaltine rocks, has produced a phenomenon frequently met with in Great Britain, especially in Scotland, which greatly puzzles many. It is very common in low grounds, and upon some moderate eminences, to see a prodigious multitude of stones of all shapes and sizes, very hard, and pretty smooth on the outside. These stones are sometimes so numerous and large, that it is often found impracticable to clear a field of them. Where those stones are a species of basaltes, which they commonly are, and of the second species of basaltes described above, they alway originate from a decomposition of the more soft or friable parts of those rocks, which moulder or fall away, and leave the harder stones detached and scattered about, and the decomposed matter dissolves by degrees, and becomes good corn mould.

Here Mr Williams takes occasion to contest the opinion of those who think that stones grow or vegetate like plants. He owns indeed that they increase in bulk: but this, he says, is only in such situations as are favourable for an accretion of matter carried down and deposited by the water; in all other situations they grow less and less. "Others (says he) imagine, that these stones (on which this extraneous matter has been deposited) were rolled about; that the asperities and sharp angles were by that means worn off; and that they were all at last deposited as we see them, by the waters of the universal deluge: and, having their obtuse sides and angles, as if they had been rounded by rolling in water, makes these gentlemen confident that they are right; and if we did not frequently find stones exactly of the same figure, size, and quality in the rock, it would be very difficult to overthrow this hypothesis. I have taken great pains to investigate this point, having frequently examined circumstances; and never failed to discover the stratum of rock which those detached stones originally belonged to. "The strata or beds of the several species of basaltes spread as wide, and stretch as far, as the other concomitant strata in the neighbourhood where they are found: but they often lie very flat, or with a moderate degree of declivity; and consequently, when the softer and more friable matter found in the interstices of these rocks, which incloses and binds the harder masses in their native beds, is decomposed, the harder stones must then lie scattered wide upon the face of the ground."

The second species of the crustated basaltes, viz. that which is dry and friable throughout the whole mass, is generally of a coarse and granulated texture, and of all the various shades of grey colours; from a rusty black to a light-coloured grey. This kind of crustated basaltes is developed when the masses are either broken or in a state of decomposition; and there are masses of it of all sizes and shapes found in the rocks, resembling the second and third species of the basaltes; appearing alike smooth on the outside, with obtuse angles; in short, resembling the basaltes in every respect: but when they are exposed to the external air and weather for any considerable time, the several incrustations decay, decompose, and crumble down by degrees. When they quarry this species of basaltes for the roads, they are able to break and pound them small with ease; but the harder species are so hard and cohesive, that they are with the greatest difficulty broken into sufficiently small parts.

Composite basaltes resembles the three last species, in figure, colour, and all other external appearances; being distinguishable from them only in the internal structure or grain of the stone. It resembles some of the granites, as consisting of much larger grains than the other basaltes. Many of the larger grains in the composite basaltes are more than an eighth part of an inch over, and some more than a fourth; appearing with smooth flat surfaces, and of a tabulated texture, exactly resembling the quartzy grains so commonly found in the composition of most of the granites. The chief, if not the only, distinguishable difference between the grains in each of them is the colour. They are evidently large grains of quartz, &c. which exhibit flat shining surfaces in both. Those grains or fragments are commonly white, yellowish, red, or black, in the composition of most of the granites; whereas they are often seen of a pale blue, or a bluish grey colour, in the composite basaltes, and some of them approaching to white. It is only in the *internal* structure, however, that these basaltes have any resemblance to the granites; in all the external characters, they differ nothing from the rest of their own genus.

A fifth species of basaltes is indurated through the whole stratum, solid and uniform through all its parts, and exhibiting only such cracks and fissures or cutters as are commonly met with in other hard beds of stones. Many beds of this species are frequently met with in the coal-fields, and the miners are often obliged to sink through them in their coal-pits. "The Salisbury craigs at Edinburgh (says our author) might be singled out as a good example of this species of stone, were it not that part of the same stratum is formed into columns on Arthur's seat; though, I believe, this is no good exception, as it evidently appears that the beds of basaltes which are formed into columns, glebes, &c. only assume these figures where they are exposed to the influence of the external air, or have but little cover of rock above them. When any of those beds strike deep under the cover of several other strata, they are not found in columns, &c. Nothing but an uniform mass then appears, although the same bed is regularly formed near the surface; which proves that the columnar and other basaltes are formed by shrinking and chapping.

"The strata of basaltes spread as wide, and stretch as far in the longitudinal bearing, as the other different strata which accompany them in the countries where they are found. The rocks of basaltes also are generally found in very thick strata; and that generally in places where no other rock is found above the basaltes, the strata of it are often very unequal in thickness. But this, in general, is only in situations where no other rock is found above it; for when it fairly enters into the surface of the earth, so as to have other regular strata above it, which is seen in an hundred places in the Lothians, Fife, and other parts of Scotland, it then appears pretty equal in thickness, as equal as most other beds of such great thickness are; and yet it is remarkable, that although most of the strata of basaltes are of great thickness, there are frequently thin strata

Appendix. Volcanic Products

ſtrata of various kinds found both above and below it. We have numerous examples of this in all the parts of Scotland where baſaltes is found; as for inſtance, there are thin and regular ſtrata ſeen and quarried both above and below the thick bed of that rock in the Saliſbury craigs near Edinburgh. In the Bathgate hills, ſouth of Linlithgow, and in many other parts of Scotland, there are ſeveral ſtrata of baſaltes, and likewiſe of coal, limeſtone, freeſtone, and other concomitants of coal blended promiſcuouſly *ſtratum ſuper ſtratum;* and the baſalt is frequently found immediately above, and immediately below regular ſtrata of coal; of courſe baſaltes *is not the lava of volcanoes.* We can prove to ocular demonſtration, from the component parts, and from the ſituation, ſtretch, and bearing of the ſtrata of baſaltes, that they are real beds of ſtone, coeval with all the other ſtrata which accompany them; and are blended with them in the ſtructure of that part of the globe where they are found, as they dip and ſtretch as far every way as the other ſtrata found above and below them. If baſaltes, therefore, be a volcanic production, the other ſtrata muſt of neceſſity be ſo likewiſe. But how volcanoes ſhould produce coal, and how that coal ſhould come into contact with burning lava, is not a little problematical; or rather it is ſtrangely abſurd to imagine that burning lava can come into contact with coal without deſtroying it.

The regularly ſtratified quartzy white-mountain rock is ſcarce or rather not to be found in moſt parts of Britain. In the Highlands, however, it is very common; and in ſome places of them Mr Williams has ſeen it ſtratified as regularly as any of the ſand-ſtones, with other regular ſtrata of different qualities immediately above and below it; and ſometimes compoſing large and high mountains entirely of its own ſtrata. This ſtone is exceedingly hard, dry, and brittle, full of cracks and ſharp angles; the different ſtrata ſometimes moderately ſolid, but often naturally broken into ſmall irregular maſſes, with angles as ſharp as broken glaſs, and of an uniformly fine and granulated texture, reſembling the fineſt ſugar-loaf. There are large and high mountains of this ſtone in Roſsſhire and Invernefsſhire, which, in a clear day, appear at a diſtance as white as ſnow, without any ſort of vegetation on them except a little dry heath round the edge of the hill.

Minerva.

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 breaſt-plate, 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,* (anc. geogr.), 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 (anc. geogr.), 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 *Surrentinum.* Now *Capo della Minerva,* on the weſt coaſt of Naples, over-againſt the iſland Capri.

Minervalia Mingrelia.

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.

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 the 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 Phasus, 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, tigers, 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 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 broad-sword, 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, martin-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 μιχρος "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

Drawing and Designing.

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 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.

But a ſurer and eaſier help than all theſe, for one who knows nothing of deſigning, is a mathematical compaſs; it is generally made of ten pieces of wood, in form of rulers, half a quarter of an inch thick, half an inch broad, and a foot long, or more, according as you have a mind to draw pieces of a greater or leſs ſize. To facilitate the conſtruction of this inſtrument, a figure is given, with an explanation of the manner in which it is to be uſed.

Drawing and Deſigning.

The little board A is to be of fir, and covered with linen or any other cloth; becauſe the piece you copy, and the vellum or paper you copy upon, muſt be fixed upon it. Upon this board muſt the compaſs alſo be fixed with a pin, by the end of the firſt foot B, deep enough to keep it cloſe, but not ſo deep as to hinder it from turning eaſily. When you have a mind to reduce things, place your original on the ſide of the foot C, and the vellum or paper you would draw upon on the ſide of the foot B; removing the vellum, or drawing it nearer, according as you intend to reduce or enlarge. Plate CCCXIV.

In order to enlarge a piece, you have nothing to do but to change the places of your original and your copy; placing the laſt towards C, and the other on the ſide of B.

And in both one and the other method, a crayon or leaden needle muſt be put in the foot under which the vellum lies; and a pin, a little blunted, in that over the original, with which all the traces are to be followed; conducting the pin with one hand, and with the other preſſing gently upon the crayon or needle that marks the vellum. When the crayon or needle bears ſufficiently upon the vellum, you have no occaſion to touch it.

By this inſtrument you may alſo draw in equal dimenſions: but in order to this, the compaſs muſt be fixed in another manner upon the board; for if it is to be faſtened upon it by the middle at D, your original and your copy muſt be fixed on each ſide of this middle foot, at the equal diſtances, or from corner to corner; that is, from C to E, when the pieces are large. One may likewiſe draw ſeveral copies at once of equal and different dimenſions.

When your piece is marked out upon the vellum, you muſt paſs with a pencil of very clear carmine over all the traces, to the end they may not be effaced as you work: then clean your vellum with the crumb of bread, that no black may remain upon it.

Your vellum muſt be paſted upon a little 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

Carmine.
Venice and Florence lake.

Colours, &c.

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.
Verdigrise.
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 pre ared 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 cleareft, 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, grey, 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.

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.

Colours, &c.

All these colours are diluted in little cups of ivory, made on purpose, or in sea-shells, with water in which gum arabic and sugar-candy are put. For instance, in a glass of water put a piece of gum as big as a walnut, and half that quantity of sugar-candy. 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 d ys 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.

Masticot.
Dutch-pink.
Orpiment.

Yellow

Colours, &c.

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.

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.

Of Working.

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 greyer, 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

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what has been laid on at the first, especially when you lean a little too hard upon the pencil.

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 interfection. 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 a good deal of white, in such a manner that the mixture be still paler than the former, without any visible interfection 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 you 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.*

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 interfection. 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.

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 car-

Of Draperies.

mine 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 likewiſe 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 greens 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. 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.

Of Draperies.

The light-grey 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.

They may be done in another manner, by making a general lay of this mixture of ultramarine, black,

and

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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 of; 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, 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 flower-work 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.

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For doing a building, if it be of ftone, take indigo, biftre, and white, with which make the beginning or firft form of it; and for fhadowing it, put lefs of this laft; and more biftre than indigo, according to the colour of the ftone you would paint. To thefe you may likewife add a little ochre, both for the forming and the finifhing. But to make it finer, you muft give, here and there, efpecially for old fabrics, blue and yellow teints, fome with ochre, others with ultramarine, mixing always white with them, whether before the firft-forming, provided they appear through the draught, or whether upon it, lofing or drowning them with the reft when you finifh.

When the building is of wood, as there are many forts, it is done at difcretion; but the moft ordinary way is to begin or firft-form with ochre, biftre, and white, and finifh without white, or with very little; and if the fhades are deep, with pure biftre In the other they add fometimes vermilion, fometimes green or black; in a word, juft according to the colour they would give it; and they finifh with dotting, as in draperies and every thing elfe.

Sect. V. *Of Carnations, or the naked parts of Painting.*

There are in carnation fo many different colourings, that it would be a difficult thing to give general rules upon fo variable a fubject. Nor are they minded, when one has got, by cuftom and practice, fome habit of working eafily: and fuch as are arrived to this degree, employ themfelves in copying their originals, or elfe they work upon their ideas, without knowing how: infomuch, that the moft fkilful, who do it with lefs reflection and pains than others, would likewife be more put to it to give an account of their maxims and knowledge in the matter of painting, if they were to be afked what colours they made ufe of for fuch and fuch a colouring, a teint here, and another there.

Neverthelefs, as beginners want fome inftruction at the firft, we will fhow in general after what manner feveral carnations are to be done.

In the firft 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 compofition; but let it hardly be feen.

And for men, inftead of blue, they put in this firft 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 fhades with this mixture, adding white in proportion as they are weaker; and putting but little in the darkeft, and none, in a manner, in certain places where ftrong touches are to be given: for inftance, in the corner of the eye; under the nofe; at the ears; under the chin; in the feparations of the fingers; in all joints; at the corners of the nails; and generally in every part where you would mark out feparations in fhades that are obfcure Neither need you fear to give to thofe places all the force and ftrength they ought to have as foon as you begin or firft-form them, becaufe in working at top with green, the red you have put there is always weakened.

After having begun, or firft-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 fay, upon the temples; under and in the corners of the eyes; on both fides the mouth, above and below; a little upon the middle of the forehead; between the nofe and the eyes; on the fide of the cheeks; on the neck and other places where the flefh affumes a bluifh caft. Yellowifh teints are likewife made with ochre or orpiment, and a little vermilion mixed with white, under the eye-brows, on the fides of the nofe towards the bottom, a little underneath the cheeks, and upon the other parts which rife and come nearer the eye. It is efpecially from thefe teints that the natural complexion is to be obferved, in order to catch it; for painting being an imitation of nature, the perfection of the art confifts in the juftnefs and fimplicity of the reprefentation, efpecially in face-painting.

When, therefore, you have done your firft lay, your dead colouring, and your teints, you muft work upon the fhades, 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 thofe that are more fenfible; that is to fay, which rife, and come nearer the eye: and at the end of the fhades, on the fide of the light, you muft blend and lofe your colour infenfibly 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 firft, pafs over the fhades feveral times, now with red, and now with green; always dotting: and this do till they are as they fhould be.

And if you cannot with thefe colours give the fhades all the force they ought to have, finifh, in the darkeft, with biftre mixed with orpiment, ochre, or vermilion, and fometimes with pure biftre, according to the colouring you would make, but lightly, laying on your colour very clear.

You muft dot upon the clear and bright places with a little vermilion or carmine, mixed with much white, and a very fmall matter of ochre, in order to lofe them with the fhadowy, and to make the teints die away infenfibly into one another; taking care, as you dot, or hatch, to make your ftrokes follow the turnings and windings of the flefhy parts. For though the rule be to crofs always, this dotting or hatching ought to appear a little more here, becaufe it rounds the parts. And as this mixture might make a colouring too red, if it was always to be ufed, they work likewife in every part, to blend the teints and the fhades, with blue and a little green, and much white, fo mixed as to be very pale; excepting, neverthelefs, that this colour muft not be put upon the cheeks, nor upon the extremities of the clear parts, no more than the other mixture upon thefe laft, which muft be left with all their light; as certain places of the chin, of the nofe, and of the forehead, and upon the cheeks; which, and the cheeks, ought neverthelefs to be redder than the reft, as well as the feet, the hollows of the hands, and the fingers of both.

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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 grey. 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 eye-lids, 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 in 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 eye-brows 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 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.

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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. Grey 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 eye brows 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 teints 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 is 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

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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 gall stone. Silver is done the same way; excepting that it must be shadowed with indigo.

One great means to acquire 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.*

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 fore-ground, 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 gall-stone, if you would have them appear withered.

The grounds or lands at a little distance are formed 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.

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In a word, the farther they go, the more bluish they are to be made; and the farthest distances 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 greyish they are made.

Castles, old houses, and other buildings of stone and wood, are done in the manner abovementioned; 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 gall-stone, with white; and finished with gall-stone, 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 teints 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

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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 gall-stone.

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.

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 teints 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 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, gall-stone, and bistre; heightening the clear and light places with masticot and white.

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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 in 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 rose-pink 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

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likewise that have sallow teints, 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 gall-stone 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 umbre 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 any where 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 mastieot. 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

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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 formed with verditer and maſticot, 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 gall-ſtone. 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 gall-ſtone, 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 gall-ſtone, and ſhadowed with gamboge and gall-ſtone: 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 gall-ſtone. 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

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thoſe on the outſide, they put in the ſame place a lay of maſticot, which is ſhadowed with gall-ſtone 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 gall-ſtone, 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.

The Jasmin.—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 taint, 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 gall-ſtone. 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 gall-ſtone. And the green is done with ſea and ſap-green.

The Jonquil.—It is laid with maſticot and gall-ſtone, and finiſhed with gamboge and gall-ſtone. 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 gall-ſtone, 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.

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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 gall-ſtone 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 gall-ſtone; 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 gall-ſtone 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 gall-ſtone 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

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ing the inside of the leaves with this 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 black 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 gall-stone 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.—There are of two colours, the yellow and the red. The first is done by putting a lay of orpiment, and shadowing it with gall-stone and orpiment, with a little vermilion. The other is laid with orpiment and vermilion, and shadowed with gall-stone 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 Gilliflower.—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 gall-stone. 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 taints 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

Of Flowers.

all your implements in your pockets, and work when and wherever you pleafe, without fuch a number of preparations. You may quit and refume 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 greatnefs of the fubject, but upon the manner in which it is handled. Some catch the airs of a face well; others fucceed better in landfcapes: fome work in little who cannot do it in large: fome are fkilled in colours who know little of defign: others, laftly, have only a genius for flowers: and even the Baffans got themfelves a fame for animals; which they touched in a very fine manner, and better than any thing elfe.

Minim || Minium.

MINIM, in mufic, a note equal to two crotchets, or half a femibreve. 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 coarfe black woollen ftuff, with a woollen girdle, of the fame colours, tied in five knots. They are not permitted to quit their habit and girdle night nor day. Formerly they went bare-footed, but are now allowed the ufe of fhoes.

MINIMUM, in the higher geometry, the leaft quantity attainable in a given cafe.

MINISTER, a perfon who preaches, performs religious worfhip in public, adminifters the facraments, &c.

Minister of State, a perfon to whom the prince intrufts the adminiftration of government. See Council.

Foreign Minister, is a perfon fent into a foreign country, to manage the affairs of his province or of the ftate to which he belongs. Of thefe there are two kinds: thofe of the firft rank are ambaffadors and envoys extraordinary, who reprefent the perfons of their fovereigns; the minifters of the fecond rank are the ordinary refidents.

MINIUM, or Red-lead, is a calx of lead of a vivid red colour, which colour it acquires by a flow calcination and reverberation. See Chemistry, n° 1213. The minium in commerce is chiefly brought from Holland, where large quantities of it are manufactured.

The method in which minium is made in large quantities with us is this—They firft burn lead in a furnace into a kind of litharge, by continually ftirring it while melted with an iron rake; this they afterwards grind with two pair of ftones, which deliver it from one to another, the firft pair grinding it coarfer, the fecond finer; thefe are worked by means of a mill which moves fix pair of them at once. When thus reduced to a fine powder, it is wafhed and then put into a furnace, and is burnt with a reverberatory fire for two or three days, all the while they continue ftirring it with a large iron rake, hung on a fwivel or iron hook; and toward the end of the time they watch its being of the right colour. When this is doing, the fire muft not be carried beyond a certain degree, left the matter clod and run together.

The procefs by which minium is prepared is defcribed in the following manner by M. Jars *. The furnace is of the reverberatory kind, with two fire-places at the ends; each fire-place being feparated from the area, or body of the furnace, by a wall twelve inches high. The fire-places are fifteen inches broad, and their length is equal to the breadth of the whole furnace, which is about eight or nine feet. The length of the area from one place to the other is nine or ten feet. The quantity of lead ufed in one operation is about 1500 pounds, of which nine parts are lead obtained from furnaces where the ore is fmelted, and one part is lead extracted from the fcoria which is formed in fmelting the ore. This latter kind is faid to be neceffary, as the former could not alone be reduced into powder. All the lead is at once put into the area, the bottom of which is level. The calx, as faft as it is formed, is drawn to one fide, by means of a rake fufpended by a chain before the mouth of the furnace. In four or five hours the whole quantity of the lead is calcined, or, if any pieces remain uncalcined, they are feparated, and kept for the next operation. The heat employed is that of a cherry-red, and the fire-places and mouth are kept open, that the air may accelerate the calcination. The powder or calx is to be frequently ftirred to prevent its concreting; and when this operation has been continued about 24 hours, the matter is taken out of the furnace, and laid on a flat pavement. Then cold water is thrown on it, to give it weight, as the workmen fay; but rather (as M. Jars thinks) to make it friable. It is then to be ground in a mill, and the finer part is feparated by wafhing, while the coarfer part, referved for fome following operation, is to be placed at the mouth of the furnace in order to retain the melted lead. The fine powder, which is now of a yellow colour, is again put into the fame or a fimilar furnace, and expofed to a very moderate fire, from 36 to 48 hours; during which time, it is ftirred frequently to prevent its concreting; and the powder gradually acquires its proper red colour. The minium is then to be taken out of the furnace, cooled, and fifted through an iron fieve placed in a cafk.

The bright colour of minium might render it valuable in painting, if it could ftand with certainty in either oil or water. But as it is fubject to become black, it cannot be fafely trufted, except in hard varnifhes: and is, therefore, feldom ufed in oil, or even in water, unlefs for very grofs purpofes, or as a ground for vermilion. The goodnefs of minium may be diftinguifhed by the brightnefs of its colour: and the adulteration to which it is liable may be detected by putting an ounce of it into a crucible with an equal quantity of charcoal duft, well mixed together, and placing the crucible in a common fire fufficient to melt lead, which is to be covered with another fmall crucible inverted into it. When it has been continued for fome time on the fire, take it out and ftrike it against

* Mem. de l'Acad. Royal, 1770.

against the ground. The minium will thus be reduced to its metallic state; and its diminished weight, when freed from the charcoal dust and cold, will indicate the proportion of adulterated matter. Minium is also used as a flux in forming the enamel for grounds, and in glazing, &c.

In medicine, minium is used as an external application. It obtunds the acrimony of the humours, allays inflammations, and is excellent in the cleansing and healing of old ulcers: It is used on these occasions in many of the plasters and ointments of the shops. It was an ingredient in the officinal composition called *emplastrum deminio*, employed as a desiccative and cicatrizer; but now disused for that made in the same manner with litharge, because it does not stick so well, and is more difficult of preparation.

MINNIN, a stringed instrument of music among the ancient Hebrews, having three or four chords to it. See Plate CCCXIV. Though 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, and the French in the late war; but it was restored to Britain by the treaty of Paris in 1763.

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 gulph 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

Minorca. ſing 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 ſair 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 aſter ſunſet. In autumn the weather becomes leſs ſerene; whirlwinds and thunder become frequent; and in the night-time lightning, and thoſe meteors called *falling 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 ſquals 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 incloſed 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 an 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 N. S. and the wheat is reaped in June, ſo that the whole harveſt is commonly got in by midſummer-day. The grain is not threſhed 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 ſallads, 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

Minorca. 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 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 800 l. *per annum*.—The wool they send abroad may produce 900 l. 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 1600 l. a-year. In honey, wax, and salt, their yearly exports may be about 400 l. and this comes pretty near the sum of their exports, which we estimate together at 18,000 l. 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, hard-ware, 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 cabinet-makers 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, relics, 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 were removed to Mahon, were fully inhabited; and there are still more gentlemens 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 *Adaia*, 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

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 the other side 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 shew 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 (fab. hist.), 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 confident 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 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 (fab. hist.), 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, so well known that it needs no description.

Minster, Minstrel.

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 word *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 a 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.

Minstrel.

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 people, 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 splendor of their appearance.

"In the year 1316, Edward II. did solemnise 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 his 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

Minstrel. 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 sign 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 smugly shaven: and yet his shirt after the new trink, with ruffs fair starched, sleeked 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 batchelor yet.

"His gown had side [i. e. long] sleeves down to mid-leg, slit from the shoulder to the hand, and lined with white cotton. His doublet-sleeves of black worsted: upon them a pair of pointes 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 mens 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 wrest; 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 Elisabeth 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. 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 warden, 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 dyes 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

charged 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 impanelled 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 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 abovementioned, 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, in botany. See Mentha.

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 pace. 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 Lacedemonians.

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 desart island to the south-west 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 the monogynia order, belonging to the pentandria class of plants; and in the natural method ranking with those of which the order is doubtful. The corolla is funnel-shaped above; the calyx inferior; the nectarium globular, containing the germen. The most remarkable species are,

1. The jalappa, or common marvel of Peru. It has a large, thick, fleshy root; an upright, thick, jointed stalk, dividing and branching numerously, widely, and erectly, a yard or more high; garnished with oblong, broad, opposite leaves; and all the branches and shoots terminated by numerous flowers in clusters, of different colours in the varieties. Of this there are varieties with white flowers—with yellow flowers—with purple flowers—with red flowers—with white and yellow flowers—white and purple flowers—purple and yellow flowers—red and yellow flowers. Several other varieties often rise from seed; and it is remarkable, that although several of the above colours and variegations are sometimes common to the same plant, yet it is rare that a plant of this species produces flowers of one of those colours alone; sometimes, however, the same plant will exhibit only white and purple flowers separate, and sometimes both colours in the same flowers, intermixed with the plain ones: the same is also observable in the red and yellow; others have plain flowers of several different colours, and sometimes variegated flowers also on the same plants. This species has a large tap root, which, when cut across, is not unlike that of the true jalap; but, when dried, is white, light, and spungy. 2. The longiflora, or long-flowered mirabilis, hath a large, thick, fleshy root; a thick stalk, dividing low into many declinated spreading branches, extending two or three feet every way; large, heart-formed, hairy, viscous leaves, in opposite pairs; and all the branches and shoots terminated by white flowers in clusters, having very long tubes, nodding downward. 3 The dichotoma, dichotomous, or forked mirabilis, has a thick fleshy root; an upright, thick, swollen, jointed stem, branching forkedly two or three feet high; oblong opposite leaves; and smallish red flowers at the axillas, singly and close-fitting.

All these plants flower in July, continuing in plentiful succession until October, very conspicuous and elegant. They have the singularity of being shut all day, and expanding towards the evening when the sun declines; hence the inhabitants of the Indies, where they grow naturally, called them *four o'clock flowers*: their time of opening here, however, depends on the weather; for if cloudy, or that the sun is not very vehement, they often open great part of the day. They are naturally perennial in root: but in this country are commonly considered as annuals: for they rise from seed in the spring, and the same year produce flowers and perfect seed; and if left to nature in the open air, totally perish in winter, at the first attack of frost or excessive wet. If in autumn, however, when the stalks begin to assume a state of decay, the roots are taken up, and preserved in sand in a dry room all winter, and planted again in spring, they shoot out afresh stronger than at first, and sometimes obtain four or five feet stature, with very spreading heads; or if plants growing in pots, having the stems cut down in autumn, and the pots placed in a green-house, or garden-frames under glasses, the roots may also be preserved sound, and will shoot out again in spring as above.

The roots of all these plants are purgative; but require to be given in a great quantity to operate equal to the true jalap, which is a species of convolvulus. See Convolvulus.

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 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 judgment can be formed concerning them; though with it their reality may be so apparent as to prevent all possibility of a dispute.

Miracle.

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.

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 bee xpected; 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 creatures, 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 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

(A) Ευ γαρ χρη ειδεναι, ὁ, τι περ αν σωθη τε και γενηται οἷον δει, εν τοιαυτη καταστασει πολιτειων. Θεου μοιραν αυτο σωσαι. De repub. Lib. 6.

Miracle. 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 some 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 assertion 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.

Miracle. 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 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

Miracle. those miracles univerſally received as ſuch, men would be ſo overwhelmed with the *nature* 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 ABRIDGEMENT.

* *Eſſay on Miracles.*

† *Diſſertation on Miracles.*

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 the 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 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 philoſophical 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, nº 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

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 impudent 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 recompence 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 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 ſuſpence. 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 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 is it, 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. The town is divided into two parts by the river, over which there is a handsome bridge. W. Long. 3. 10. N. Lat. 42. 52.

MIRANDE, a town of Gascony in France, capital of the county of Astarac; seated on a mountain near the river Bause. E. Long. 0. 21. N. Lat. 42. 53.

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 river 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. It is a pretty large place, well fortified, and has also a strong citadel and fort. It has been several times taken and retaken; the last time by the king of Sardinia in 1742. E. Long. 11. 5. N. Lat. 44. 52.

MIRANDULA. See PICUS.

MIREVELT (Michael Jansen), portrait-painter, was the son of a goldsmith, and born at Delft in 1568. His father, perceiving his early inclination for the arts, placed him at first with one of the Wierixes, of whom he learned to draw in crayons and to engrave. At the age of twelve he executed a print of the Samaritan woman; and not long after a figure of Judith holding the head of Holofernes. These juvenile performances attracted the notice of Anthony Blockland, an historical painter of great note; and under his instructions Mirevelt took up the pencil. He was very successful in his attempts at painting history; but finding portraits to be more profitable, he quitted the former by degrees, and applied himself to portrait painting only. His reputation, according to De Piles, was so great, that he exacted what price for his pictures he pleased, never taking less than 150 florins a piece. The portraits drawn and painted by this artist are exceedingly numerous; and many of them were excellently engraved by William James Delft, his near relation, a very skilful artist. He died in 1641.

MIREVELT (Peter), son of Michael, was born at Delft in 1596, and died in 1632. In his manner of design, in his style of colouring, and in the delicacy of his pencil, he exactly resembled his father; and by the best judges of that time he was accounted to be in no degree inferior to him.

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 plain, 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 in 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, tho' 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 plain 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 Mr Macquer melted platina, though only 22 inches diameter, and which was made of quicksilvered glass, produced much greater effects than M. Villette'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

tions by Mr Mudge. See *Glass-Grinding*, and the *Mechanical Part* of Optics.

MIRE-CROW, sea-crow, or *Pewit*. See Larus.

MISADVENTURE, in common language, signifies 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 (formed 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 Jerusalem 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 Simeon 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. Connect.* vol. ii. p. 468, &c. ed. 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 vols. 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 an 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 500 l. 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 earldoms, 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, (anc. geog.); 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 more austere among the Romans, who thought

Miser.

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 was eclipsed by the splendour of the palace which the emperors raised upon the same spot. To these proud abodes of heroes and monarchs, which have long been levelled to the ground, a few fishing huts, as Mr Swinburn 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 centered 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 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 (L. 125,000 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 L. 100,000 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 Sydney 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 L. 250,000, 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. And for 15 years previous to this period, it was that he was 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, nor 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 Thaydon-hall, 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

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 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 cloaths 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 œconomy; for to all appearance it was the caſt-off wig of ſome beggar!

* Mr Topham; from whoſe *Life of John Elwes, Eſq;* the particulars of this article are extracted.

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 amongſt 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 two-pence halfpenny, while that into Berkſhire amounted to four-pence!

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

Miser. ftom of members in general, by fitting on any particular fide of the houfe, but fat as occafion prefented itfelf on either indifcriminately; and he voted much in the fame manner, but never rofe to fpeak. In his attendance at the houfe, he was always early and late; and he never left it for dinner, as he had accuftomed himfelf to fafting, fometimes for 24 hours in continuance.

When he quitted parliament, he was, in the common phrafe, "a fifh out of water!" The ftyle of Mr Elwes's life had left him no domeftic fcenes to which he could retire—his home was dreary and poor—his rooms received no cheerfulnefs from fire; and while the outfide had all the appearance of a "Houfe to be Let," the infide was a defert; but he had his penury alone to thank for this, and for the want of all the little confolations which fhould attend old age, and fmooth the paffage of declining life. At the clofe of the fpring of 1785, he wifhed again to vifit, which he had not done for fome years, his feat at Stoke. But then the journey was a moft ferious object to him. The famous old fervant was dead; all the horfes that remained with him were a couple of worn-out brood-mares; and he himfelf was not in that vigour of body in which he could ride 60 or 70 miles on the fuftenance of *two boiled eggs*. The mention of a poft-chaife would have been a crime—"He afford a poft-chaife, 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 fo rich as Mr Elwes. When he reached Stoke—the feat of more active fcenes, of fomewhat refembling hofpitality, and where his fox hounds had fpread fomewhat like vivacity around—he remarked, "he had expended a great deal of money once very foolifhly; but that a man grew wifer by time."

The rooms at this feat, which were now much out of repair, and would have all fallen in but for his fon John Elwes, Efq; who had refided there, he thought too expenfively furnifhed, as worfe things might have ferved. 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 glafs; which had at length been done fo frequently, and in fo many fhapes, that it would have puzzled a mathematician to fay "what figure they defcribed." To fave fire, he would walk about the remains of an old greenhoufe, or fit with a fervant in the kitchen. During the harveft he would amufe himfelf with going into the fields to glean the corn on the grounds of his own tenants; and they ufed to leave a little more than common to pleafe the old gentleman, who was as eager after it as any pauper in the parifh. In the advance of the feafon, his morning employment was to pick up any ftray chips, bones, or other things, to carry to the fire, in his pocket—and he was one day furprifed by a neighbouring gentleman in the act of pulling down, with fome difficulty, a crow's neft for this purpofe. On the gentleman wondering why he gave himfelf this trouble—"Oh, Sir, (replied old Elwes), it is really a fhame that thefe creatures fhould do fo. Do but fee what wafte they make! They don't care how extravagant they are!"

As no gleam of favourite paffion, or any ray of amufement, broke through this gloom of penury, his infatiable defire of faving was now become uniform and fyftematic. He ufed ftill to ride about the country on one of thefe mares—but then he rode her very economically, on the foft turf, adjoining the road, without putting himfelf to the expence of fhoes, as he obferved, "The turf was fo pleafant to a horfe's foot!" And when any gentleman called to pay him a vifit, and the boy who attended in the ftables was profufe enough to put a little hay before his horfe, old Elwes would flily fteal back into the ftable, and take the hay very carefully away. That very ftrong appetite which Mr Elwes had in fome meafure reftrained during the long fitting of parliament, he now indulged moft voracioufly, and on every thing he could find. To fave, as he thought, the expence of going to a butcher, he would have a whole fheep killed, and fo eat mutton to the—*end of the chapter*. When he occafionally had his river drawn, though fometimes horfe-loads of fmall fifh were taken, not one would he fuffer to be thrown in again; for he obferved, "He fhould never fee them again!" Game in the laft ftate of putrefaction, and meat that *walked about his plate*, would he continue to eat, rather than have new things killed before the old provifion was finifhed. With this diet—the *charnel-houfe of fuftenance*—his drefs kept pace—equally in the laft ftage of *abfolute diffolution*. Sometimes he would walk about in a tattered brown-coloured hat, and fometimes in a red and white woollen cap, like a prifoner confined for debt. His fhoes he never would fuffer to be cleaned, left they fhould be worn out the fooner. But ftill, with all this *felf-denial*—that penury of life to which the inhabitant of an *alms-houfe* is not doomed—ftill did he think he was profufe, and frequently fay, "He muft be a little more careful of his property." His difquietude on the fubject 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 reft, and fometimes in the middle of the night, he would come down to fee if it was there.

The fcene of mortification at which Mr Elwes was now arrived was all but a denial of the common neceffaries of life: and indeed it might have admitted a doubt, whether or not, if his manors, his fifh-ponds, and fome grounds in his own hands, had not furnifhed a fubfiftence, where he had not any thing *actually to buy*, he would not, rather than have *bought any thing*, have ftarved. 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 eat an undigefted part of a pike which a larger one had fwallowed, but had not finifhed, and which were taken in this ftate in a net. At the time this laft circumftance happened, he difcovered a ftrange kind of fatisfaction; for he faid to a friend, "Aye! this was killing two birds with one ftone!" 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 thoufand pounds!* and, at this period, he had not made his will, of courfe was not faving from any fentiment of affection for any perfon.

The fummer of 1788 Mr Elwes paffed at his houfe in Welbeck-ftreet, London; and he paffed that fummer without any other fociety than that of two maid-fervants;

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 regular every morning, and who concluded, from his apparel, 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 this house, regardless of the greater property he had at 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 L. 50 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 symptoms 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

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, in botany. See VISCUM.

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 misdemeanour: 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 comera*.

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.

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 authorised 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.

MISSISIPPI, alſo called the *river of St Louis*, in North America, is one of the largeſt in the world. Its ſource is unknown. It paſſes ſouth through Louiſiana, and runs above 2000 miles, till it falls into the gulph of Florida. Like the Nile, it has periodical inundations, by the melting of ſnow in the north, ſo that in May it overflows the country on each ſide, from 60 to 90 miles, and the inundation continues till near the end of July. In the loweſt parts of the country there are moraſſes, lakes, and canals, along the banks, which are generally covered with trees, and in ſome places the courſe of the river is confined between high precipices. Its inundations always leave a great quantity of mud upon the land, and ſometimes carry down trees to the river's mouth, where they form new iſlands, and render the entrance difficult.

MISSON (Francis Maximilian), whoſe pleadings before the parliament of Paris in favour of the reformers bear genuine marks of eloquence and ability, retired into England after the revocation of the edict of Nantz, and became a ſtrenuous aſſertor of the Proteſtant religion. In the years 1687 and 1688 he travelled to Italy as governor to an Engliſh nobleman: in conſequence of which he publiſhed at the Hague, "A new voyage to Italy," 3 vols 12mo; which has been tranſlated into Engliſh with many additions. He publiſhed alſo the "Sacred Theatre at Cevennes, or an account of Prophecies and Miracles performed in that part of Languedoc," London 1707. "Obſervations and Remarks of a Traveller," 12mo, Hague. He died at London in 1721.

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 thro' an evil deſign, but through an error of judgement.

MISTAKE, in LAW. See IGNORANCE.

MISUSER, in law, is an abuſe of any liberty or benefit; as "He ſhall make fine for his MISUSER." Old. Nat. Br. 149. By miſuſer a charter of a corporation may be forfeited; ſo alſo an office, &c.

MISY, in natural hiſtory, a ſpecies of the chalcantha, a foſſile very common in the Turkiſh dominions, and ſometimes found in the mines of Cremnitz in Hungary. It is a conſiderably firm ſubſtance, of an irregular texture, not compact; much reſembling ſome of our more gaudy marcaſites, but wanting in their hardneſs and weight. It is of no determinate ſhape or ſize; but is often found in ſmall detached maſſes, which are uſually broad, flat, and very rugged at the edges. As to its medical virtues, they are no other than thoſe of the green vitriol.

MITCHELSTOWN, a poſt-town of Ireland, in the county of Cork and province of Munſter in Ireland, 102 miles from Dublin. Here is a college for the ſupport of 12 decayed gentlemen and 12 decayed gentlewomen, who have L. 40 yearly, and handſome apartments, and a chaplain at L. 100 a-year, with a houſe: divine ſervice is daily performed in a neat chapel belonging to the college: the whole was founded by the late earl of Kingſton. Here is alſo a moſt magnificent ſeat of Lord Kingſborough.—Fairs are held at this town 30th July and 12th November.

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 two-pence of our money.

MITE, in zoology. See ACARUS.

MITELLA, BASTARD AMERICAN SANICLE: A genus of the digynia order, belonging to the decandria claſs of plants; and in the natural method ranking under the 13th order, *Succulentæ*. The calyx is quinquefid; the corolla pentapetalous, and inſerted into the calyx; the petals pinnatifid; the capſule unilocular and bivalved, with the valves equal. There are two ſpecies, both natives of North America, riſing with annual herbaceous ſtalks from five or ſix to eight or nine inches in height, and producing ſpikes of ſmall whitiſh flowers, whoſe petals are fringed on their edges. They are eaſily propagated by parting their roots; and ſhould be planted in a ſhady ſituation, and in a ſoft loamy ſoil.

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 Chaldæa, where they had been inſtituted for celebrating the entrance of the ſun into the ſign Taurus.

MITHRAS, or MITHRA, a god of Perſia and Chaldæa, 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, in pharmacy; an antidote, or compoſition, in form of an electuary, ſuppoſed to ſerve either as a remedy or a preſervative againſt poiſons. (See PHARMACY). 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. The receipt of it was found in his cabinet, written with his own hand, and was carried to Rome by Pompey. It was tranſlated into

 verſe

Mithridates.

verse by Damocrates, a famous physician; and was afterwards translated by Galen, from whom we have it: though there is room to imagine it has undergone considerable alterations since the time of its royal prescriber.

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 coheirefs 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 Nicomedes 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 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 negociations 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 horses, 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 was 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

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 Annibal, 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 leters 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 antidote 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 ſplendor 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 workmens 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 diſpatch, 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 beſide 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 $10\frac{1}{2}$ 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 (anc. geog.), a celebrated, powerful, and affluent city, capital of the iſland of Leſbos. It receives 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 Mityleneans 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. Simple mixture, conſiſts only in the ſimple appoſition of parts of different bodies to each other. Thus, when powders of different kinds are rubbed together, the mixture is only ſimple, and each of the powders retains its particular characters. In like manner, when oil and water are mixed together, though the parts of both are confounded, ſo that the liquor may appear to be homogeneous, we cannot ſay that there is any more than a ſimple

simple appoſition of the parts, as the oil and water may very eaſily be again ſeparated from each other. But the caſe is very different when bodies are *chemically* mixed; for then one or both bodies aſſume new properties, and can by no means be diſcovered in their proper form without a particular chemical proceſs adapted to this purpoſe. Hence chemical mixture is attended with many phenomena which are never obſerved in ſimple mixtures; ſuch as heat, efferveſcence, &c. To chemical mixture belongs 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 (fab. hiſt.), 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. The anthera is operculated; the calyptra ſmooth; the female capitulum naked and powdery, remote. There are 18 ſpecies, of which ſeven are natives of Britain; but none have any remarkable property except the two following. 1. The fontanum is an elegant moſs, frequent in bogs, and on the borders of cold ſprings. It is from two to four inches high: the ſtalks are ſimple at the baſe, and covered with a ruſty down; but higher up are red, and divided into ſeveral round, ſingle, taper branches, which proceed nearly from the ſame point. The leaves are not more than $\frac{1}{12}$th of an inch long, lanceolate and acute, of a whitiſh green colour; and ſo thinly ſet, that the red ſtalk appears between them. This moſs, as it may be ſeen at a conſiderable diſtance, is a good mark to lead to the diſcovery of clear and cold ſprings. Linnæus informs us, that the Laplanders are well acquainted with this ſign. Mr Withering informs us, that wherever this moſs grows, a ſpring of freſh water may be found without much digging. 2. The hygrometricum grows in woods, heaths, garden-walks, walls, old trees, decayed wood, and where coals or cinders have been laid. It is ſtemleſs, hath tips inverſely egg-ſhaped, nodding, and bright yellow. If the fruit-ſtalk is moiſtened at the baſe with a little water or ſteam, the head makes three or four revolutions: if the head is moiſtened, it turns back again.

MOAB (anc. geog.), 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, granades, 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

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; is ſurrounded with walls after the ancient manner; and has four gates and four towers, the laſt mounted with cannon; but there is no ditch. 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 deſart, 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. It ſtands cloſe to the ſea, in a large, dry, and ſandy plain, that affords no good water within 20 miles of the city; what they drink comes from Moſa, and coſts as dear as ſmall-beer in England. The water near the town, as it is thought, produces a worm, which the naturaliſts call the *dracunculus*, which is about two feet and a half long, very ſlender, and breeds in the fleſhy parts of the body: in extracting it great care muſt be uſed, the conſequence being dangerous if any part of it remains in the body. 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 Mokha, 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 ſuperſtitious, 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 camaſſic, 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. As to their weights, they are almoſt infinite, according to the nature of the thing to be weighed: they have the banian weight, the magnet, the ambergris, the agala, the gold and ſilver weights, &c.

MOCK-ORE, or *Mock-Lead.* See BLINDE.

MOCKING-BIRD, in ornithology. See TURDUS.

MOCOCO. See LEMUR.

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 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*.

There is this difference between the mode and the tone, that the latter only determines the principal ſound, and indicates the place which is moſt proper to be occupied by that ſyſtem which ought to conſtitute the baſs of the air; whereas the former regulates the thirds, and modifies the whole ſcale agreeably to its fundamental ſounds.

Our *modes* are not, like thoſe of the ancients, cha-

racteriſed

Mode.

racterised 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: (See Tone and Tonic). 2. The dominant, which is a fifth from the tonic: (See Dominant). 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.

The major mode is immediately generated by the resonance of sounding bodies, which exhibit the third major of the fundamental sound: but the minor mode is not the product of nature; it is only found by analogy and inversion. This is equally true upon the system of Sig. Tartini as upon that of M. Rameau.

This last author, in his various and successive publications, has explained the origin of this minor mode in different ways, of which his interpreter M. d'Alembert was satisfied with none. It is for this reason that he has founded this origin on a different principle, which cannot be better explained than in the words of that eminent geometrician. See Music, Art. 28, 29, 30, and 31.

When the mode is once determined, every note in the scale assumes a name expressive of its relation to the fundamental sound, and peculiar to the place which it occupies in that particular mode. We subjoin the names of all the notes significant of their relative values and places in each particular *mode*, taking the octave of *ut* as an example of the major *mode*, and of *la* as an example of the minor.

Major,	*ut*	*re*	*mi*	*fa*	*sol*	*la*	*si*	*ut*,
Minor,	*la*	*si*	*ut*	*re*	*mi*	*fa*	*sol*	*la*.
	Tonic.	Second note.	Mediant.	Fourth note, or Sub-dominant:	Dominant.	Sixth note, or Sub-dominant.	Seventh note.	Octave.

It is necessary to remark, that when the seventh note is only a semitone distant from the highest in the octave, that is to say, when it forms a third major with the dominant, as *si* natural in the major *mode*, or *sol* sharp in the minor, that seventh sound is then called a *sensible note*, because it discovers the tonic and renders the tone apreciable.

Nor does each gradation only assume that name which is suitable to it; but the nature of each interval is determined according to its relation to the *mode*. The rules established for this are as follow:

1. The second note must form a second major above the tonic, the fourth note and the dominant should form a fourth and fifth exactly true; and this equally in both modes.

2. In the major mode, the mediant or third, the sixth and the seventh from the tonic, should always be major; for by this the mode is characterized. For the same reason these three intervals ought always to be minor in the minor mode: nevertheless, as it is necessary that the sensible note should likewise there be perceived, which cannot be effectuated without a false relation whilst the sixth note still remains minor; this occasions exceptions, of which in the course of the air or harmony care must be taken. But it is always necessary that the cleff, with its transpositions, should preserve all the intervals, as determined with relation to the tonic, according to the species of the *mode*. For this a general rule will be found at the word *Cleff*, in Rousseau's Musical Dictionary.

As all the natural chords in the octave of *ut* give, with relation to that tonic, all the intervals prescribed for the major *mode*, and as the case is the same with the octave of *la* for the minor mode, the preceding example, which was only given that we might have an opportunity of naming the notes, may likewise serve as a formula for the rule of the intervals in each *mode*.

This rule is not, as one might imagine, established upon principles that are merely arbitrary: it has its source in the generation of harmony, at least in a certain degree. If you give a perfect major chord to the tonic, to the dominant, and the sub-dominant, you will have all the sounds of the diatonic scale for the major *mode*: to obtain that of the minor, leaving still its third major to the dominant, give a third minor to the two other chords. Such is the analogy of the mode.

As this mixture of major and minor chords introduces into the minor mode a false relation between the sixth and the sensible note, to avoid this false relation, they sometimes give the third major to the fourth note in ascent, or the third minor to the dominant in descending, chiefly by inverting the chords; but these in this case are licences.

There are properly no more than two *modes*, as we have seen: but there are twelve different sounds in the octave which may be made fundamental sounds, and of consequence form as many keys or tones; and as each of these tones are susceptible of the major or minor mode, music may be composed in twenty-four modes or manners. Nay, in the manner of writing music, there are even thirty-four passable modes: but in practice ten are excluded; which when thoroughly examined are nothing else but a repetition of the other ten, under relations much more difficult, in which all the chords must change their names, and where it must cost any one some trouble to know what he is about. Such is the major mode upon a note raised above its natural pitch by a semitone, and the minor mode upon a note depressed by a semitone. Thus, instead of composing upon *sol* sharp with a third major, it is much more eligible to operate upon *la* flat, which will give you an opportunity to employ the same tones; and instead of composing upon *re* flat with a third minor, you will find it more convenient to choose *ut* sharp for the same reason; viz. on one hand to avoid a *fa* with a double sharp, which would be equivalent to a *sol* natural; and on the other hand a *si* with a double flat, which would become a *la* natural.

The composer does not always continue in the same *mode*, nor in the same *key*, in which he has begun an air; but, whether to alter the expression or introduce variety, *modes* and *keys* are frequently changed, according to the analogy of harmony; yet always returning to those which have been first heard: this is called *modulation*.

Mode.

From thence arises a new division of *modes* into such as are *principal* and such as are *relative:* the principal is that in which the piece begins and ends; the relative modes are such as the composer interweaves with the principal in the flow of the harmony. (See MODULATION).

Others have proposed a third species, which they call a *mixed mode,* because it participates the modulation of both the others, or rather because it is composed of them; a mixture which they did not reckon an inconveniency, but rather an advantage, as it increases the variety, and gives the composer a greater latitude both in air and harmony.

This new mode, not being found by the analysis of the three chords like the two former, is not determined, like them, by harmonics essential to the mode, but by an entire scale which is peculiar to itself, as well in rising as descending; so that in the two modes above-mentioned the scale is investigated by the chords, and in this mixed mode the chords are investigated by the scale. The following notes exhibit the form of this scale in succession, as well rising as descending:

mi fa sol la si ut re mi.

Of which the essential difference is, as to the *melody,* in the position of the two semitones; of which the first is found between the first and the second note, and the last between the fifth and sixth; and, with respect to the *harmony,* the difference consists in this, that upon its tonic it carries a third minor in the beginning, and major in ending, in the accompaniment of this scale, as well in rising as descending, such as it has been given by those who proposed it, and executed at a spiritual concert, May 30, 1751.

They object to its inventor, That his mode has neither chords nor harmony essential to itself, nor cadences which are peculiar to it, and which sufficiently distinguish it from the major or minor mode. He answers to this, That the distinction of his mode is less in harmony than in melody, and less even in the mode itself than in the modulation; that in its beginning it is distinguished from the major mode by its third minor, and in its end from the minor mode by its plagal cadence. To which his opponents reply, That a modulation which is not exclusive cannot be sufficient to establish a mode; and that his must inevitably occur in the two other modes, and above all in the minor: and, as to his plagal cadence, that it necessarily takes place in the minor mode as often as transition is made from the chord of the tonic to that of the dominant, as has long been the case in practice, even upon final notes, in plagal modes, and in the tone proper to the fourth. From whence it is concluded, that his mixed mode is not so much a particular species, as a new denomination for the manner of interweaving and combining the major and minor modes, as ancient as harmony, practised at all periods; and this appears to be so true, that, even when he begins his scale, its author will neither venture to give the fifth nor the fixth to his tonic, for fear lest by the first the tonic should be determined in the minor mode, or the mediant in the major mode by the second. He leaves the harmony equivocal by not filling up his chord.

But whatever objections may be made against the mixed mode, whose name is rather rejected than its practice, this will not prevent the author from appearing as a man of genius, and a musician profoundly learned in the principles of his art, by the manner in which he treats it, and the arguments which he uses to establish it.

Mode, Model.

MODE *Major.* }
MODE *Minor.* } See INTERVAL.

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 woman, disposed in several postures, to afford an opportunity to the scholars to design him 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 an 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

Model. though this be the cafe with the foft original fubftance, it is not fo with the inflexible model when once it is caft.

The moulds are to be made of various degrees of thicknefs, according to the fize of the model to be caft; and may be from half an inch to an inch, or, if very large, an inch and an half. Where a number of models are to be taken from one mould, it will likewife be neceffary to have it of a ftronger contexture than where only a few are required, for very obvious reafons.

3
Anatomical models.

It is much more eafy to make a mould for any foft fubftance than a rigid one, as in any of the vifcera of the animal body: for the fluidity of the mixture makes it eafily accommodate itfelf to the projecting parts of the fubftance; and as it is neceffary to inflate thefe fubftances, they may be very readily extracted again by letting out the air which diftended them.

Pole's Anatomical Inftructor.

When a model is to be taken, the furface of the original is firft to be greafed, in order to prevent the plafter from fticking to it; but if the fubftance itfelf is flippery, as is the cafe with the internal parts of the human body, this need not be done: when neceffary, it may be laid over with linfeed oil by means of a painter's brufh. The original is then to be laid on a fmooth table, previoufly greafed or covered with a cloth, to prevent the plafter fticking to it; then furround the original with a frame or ridge of glazier's putty, at fuch a diftance from it as will admit the plafter to reft upon the table on all fides of the fubject for about an inch, or as much as is fufficient to give the proper degree of ftrength to the mould. A fufficient quantity of plafter is then to be poured as uniformly as poffible over the whole fubftance, until it be every where covered to fuch a thicknefs as to give a proper fubftance to the mould, which may vary in proportion to the fize. The whole muft then be fuffered to remain in this condition till the plafter has attained its hardnefs; when the frame is taken away, the mould may be inverted, and the fubject removed from it; and when the plafter is thoroughly dry let it be well feafoned.

Having formed and feafoned the moulds, they muft next be prepared for the cafts by greafing the infide of them with a mixture of olive oil and lard in equal parts, and then filled with fine fluid plafter, and the plain of the mould formed by its refting on the furface of the table covered to a fufficient thicknefs with coarfe plafter, to form a ftrong bafis or fupport for the caft where this fupport is requifite, as is particularly the cafe where the thin and membranous parts of the body are to be reprefented. After the plafter is poured into the mould, it muft be fuffered to ftand until it has acquired the greateft degree of hardnefs it will receive; after which the mould muft be removed: but this will be attended with fome difficulty when the fhape of the fubject is unfavourable; and in fome cafes the mould muft be feparated by means of a fmall mallet and chiffel. If by thefe inftruments any parts of the model fhould be broken off, they may be cemented by making the two furfaces to be applied to each other quite wet; then interpofing betwixt them a little liquid plafter; and laftly, the joint fmoothed after being thoroughly dry. Any fmall holes that may be made in the mould can be filled up with liquid plafter, after the fides of them have been thoroughly wetted, and fmoothed over with the edge of a knife.

In many cafes it is altogether impracticable to prepare a mould of one piece for a whole fubject; and therefore it muft be confidered how this can be done in fuch a manner as to divide the mould into the feweft pieces. This may be effected by making every piece cover as much of the pattern as poffible, without furrounding fuch projecting parts, or running into fuch hollows as would not admit a feparation of the mould. It is impoffible, however, to give any particular directions in this matter which can hold good in every inftance, the number of pieces of which the mould is to confift being always determined from the fhape of the pattern. Thus the mould of the human calculus will require no more than three pieces, but that of an *os femoris* could fcarce have fewer than ten or twelve.—Where any internal pieces are required, they are firft to be made, and then the outer pieces after the former have become hard.

To make a mould upon an hard and dry fubftance, we muft, in the firft place, rub the furface of it fmoothly over with the mixture of oil and lard abovementioned. Such hollows as require internal pieces are then to be filled up with fluid plafter; and while it continues in this ftate, a wire loop muft be introduced into it, by which, when hardened, it can be pulled off. The plafter fhould be fomewhat raifed in a pyramidal form around this wire, and afterwards cut fmooth with a knife while yet in its foft ftate; preferving two or three angular ridges from the loop to the outer edge, that it may fix the more fteadily in the outer piece of the mould to be afterwards made upon it. Let the outer piece then be well greafed, to prevent the fecond piece from adhering; the loop being inclofed with fome glazier's putty, both to prevent the fecond piece from adhering and to preferve an hollow place for the cord.

To form the fecond or outfide piece, mix a quantity of plafter proportioned to the extent of furface it is to cover and the intended thicknefs of the mould: when it is juft beginning to thicken, or affumes fuch a confiftence as not to run off very eafily, fpread it over the internal piece or pieces as well as the pattern, taking care at the fame time not to go too far left it fhould not deliver fafely; and as the plafter becomes more tenacious, add more upon the pattern until it has become fufficiently thick, keeping the edges fquare and fmooth like the edge of a board. The plafter fhould be fpread equally upon all parts, which is beft done by a painter's pallet-knife or apothecary's bolus-knife: but for this the inftrument fhould be fomewhat lefs pliable than it is commonly made.

When the outfide piece is hardened, the edges are to be pared fmooth, and neatly made fquare with a fmall pointed knife. Little holes of a conical fhape are to be made with the point of a knife about an inch diftant from one another, according to the fize of the piece. Thefe are defigned to receive the fluid plafter in forming the adjacent parts of the mould, and occafion points correfponding to the hollows; and are intended to preferve the edges of the different pieces fteadily in their proper relative fituations. The third piece is then to be formed in a manner fimilar to the fecond;

Model. 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 inclosed, 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 inclose 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 fore-head, 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 model by means of a small mallet and chissel. The eyes, which are necessarily shown closed, are to be carved, so that the eye-lids 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. 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 $20\frac{1}{2}$ 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 $18\frac{1}{2}$ 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

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 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 of 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 pulverised, 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. 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, Correggio 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 Correggio, 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 Estè, 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 porticos, as at Bologna. The city is fortified, and on its south side stands the citadel.

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

Modesty. 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 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 || Modulation.

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.

MODREVIUS (Andreas Frichius), secretary to Sigismund Augustus king of Poland, acquired considerable reputation by his learning and works. He broke off from the Romish church, favoured the Lutherans and Anti-trinitarians, and took great pains in order to unite all Christian societies under the same communion. Grotius has placed him in the class of the reconcilers of the different schemes of religion. His principal work is intitled, *De republica emendanda*.

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. In what remains to be said upon the subject we follow Rousseau.

Modulation (says he) is properly the manner of ascertaining and managing the modes; but at this time the word most frequently signifies the art of conducting the harmony and the air successively through several modes, in a manner agreeable to the ear and conformed to rules.

If the different modes be produced by harmony, from thence likewise must spring the laws of modulation.

Modulation.

tion. These laws are simple in conception, but difficult in practice. We proceed therefore to show in what they consist.

To modulate properly in the same tone, it is necessary, 1. To run through all the sounds of it in an agreeable air, frequently repeating the sounds which are most essential to it, and dwelling upon these sounds with the most remarkable emphasis; that is to say, that the chord containing the sensible notes, and that of the tonic, should frequently be heard in it, but under different appearances, and obtained by different procedures to prevent monotony. 2. That reposes or cadences should only be established upon these two chords: the greatest liberty, however, which ought to be taken with the rule is, that a cadence or repose may be established on the chord of the subdominant. 3. In short, that none of the sounds of the mode ought ever to be altered; for without quitting it we cannot introduce a sharp or a flat which does not belong to it, nor abstract any one which in reality does belong to it.

But passing from one mode to another, we must consult analogy, we must consider the relations which a key bears to the other notes in the series, and to the number of sounds common to both the modes, that from whence we pass, and that into which we enter.

If we pass from a mode major, whether we consider the fifth from the key as having the most simple relation with it except that of the octave, or whether we consider it as the first sound which enters into the harmonics of the same key, we shall always find, that this fifth, which is the dominant of the mode, is the chord upon which we may establish the modulation most analogous to that of the principal key.

This dominant, which constituted one of the harmonics of the first key, makes also one of its own peculiar key, of which it is the fundamental sound. There is then a connection between these two chords. Besides, that same dominant carrying, as well as the tonic, a perfect chord major upon the principle of resonance, these two chords are only different one from the other by the dissonance, which passing from the key to the dominant is the sixth superadded, and when reascending from the dominant to the key is the seventh. Now these two chords, thus distinguished by the dissonance which is suitable to each, by the sounds which compose them when ranged in order, form precisely the octave, or the diatonic scale, which we call a *gammut*, which determines the mode.

This same series of the key, altered only by a sharp, forms the scale belonging to the mode of the dominant; which shows how striking the analogy is between these two tones, and gives the easiest opportunity of passing from one to the other by means of one single alteration alone. The mode then of the dominant is the first which presents itself after that of the key in the order of modulations.

The same simplicity of relations which we find between a tonic and its dominant, is likewise found between the same tonic and its sub-dominant: for that fifth, in ascending, which is formed by the dominant with the tonic, is likewise formed by the sub-dominant in descending: but that sub-dominant does not form a fifth with the tonic, except by inversion; it is directly a fourth, if we take that tonic below, as it ought to be; and which fixes the degree of their relations: for in this sense the fourth, whose ratio is as 3 to 4, immediately follows the fifth, whose ratio is as 2 to 3. So that, if that sub-dominant does not enter into the chord of the tonic, in return the tonic enters into its perfect chord. For let *ut mi sol* be the chord of the tonic, that of the sub-dominant shall be *fa la ut*: thus it is the *ut* which here forms the connection, and the two other sounds of this new chord, are exactly the two dissonances of the preceding. Besides, we need not alter more sounds for this new mode than for that of the dominant; they are both in the one and the other quite the same chords of the principal mode, except one. Add a flat to the sensible note *si* or B, and all the notes in the mode of *ut* or C will serve for that of *fa* or F. The mode of the sub-dominant then is scarcely less analogous to the principal mode than that of the dominant.

It ought likewise to be remarked, that after having made use of the first modulation in order to pass from a principal mode *ut* or C, to that of the dominant *sol* or G, we are obliged to make use of the second to return to the principal mode: for if *sol* or G be the dominant in the mode of *ut* or C, *ut* is the sub-dominant in the mode of *sol*: thus one of these modulations is no less necessary than the other.

The third sound which enters into the chord of the tonic is that of third formed by its mediant; and, after the preceding, it is likewise the most simple of relations $\frac{2\,3\,4}{3\,4\,5}$. Here then is a new modulation which presents itself, and which is so much the more analogous, because two of the sounds of the principal tonic enter likewise into the minor chord of its mediant: for the former chord being *ut mi sol*, the latter must be *mi sol si*, where it may be perceived that *mi* and *sol* are common. But what renders this modulation a little more remote, is the number of sounds which are necessary to be altered, even for the minor mode, which is most suitable to this *mi*. In the article MUSIC (234.) will be found a table for all the modes; and Rousseau, in his Musical Dictionary, has given the formula of a scale both for the major and minor: now, by applying this formula to the minor mode, we find nothing in reality, but the fourth sound *fa* heightened by a sharp in ascending; but in rising, we find two others which are altered, *viz.* the principal tonic *ut*, and its second *re*, which here becomes a sensible note: it is certain that the alteration of so many sounds, and particularly of the tonic, must remove the mode and weaken the analogy.

If we should invert the third as we have inverted the fifth, and take that third below the tonic on the sixth note *la*, which ought here to be called a *sub-mediant*, or the *mediant below*, we shall form upon this note *la* a modulation more analogous to the principal tone than that of *mi*; for as the perfect chord of this sub-mediant is *la ut mi*, there once more we find, as in that of the mediant, two of the sounds which enter into the chord of the tonic, viz. *ut* and *mi*: and moreover, since the scale of this new key is composed, at least in descending, of the same sounds with that of the principal key; and since it has only two sounds altered in ascending, that is to say, one fewer than the series of the

the mediant; it follows that the modulation of this sixth note is preferable to that of the mediant; and by so much the more, that there the principal tonic forms one of the sounds essential to the mode; which is more proper for approximating the idea of the modulation. The *mi* may afterwards follow.

Here then are four sounds, *mi fa sol la*, upon each of which we may modulate in passing from the major mode of *ut*. *Re* and *si* remain, which are the two harmonics of the dominant. This last, as being a sensible note, cannot become a tonic by any proper modulation, at least it cannot immediately become one: this would be an abrupt application of ideas too much opposed to the same sounds, and would likewise be to give it a harmony too remote from the principal sound. As to the second note *re*, we may likewise, by favour of a consonant procedure in the fundamental base, modulate upon it in a third minor; but this must be only continued for an instant, that the audience may not have time to forget the modulation of *ut*, which is itself altered in that place; otherwise, instead of returning immediately to *ut*, we must pass through intermediate modes, where we must run great hazard of deviation.

By following the same analogies, we may modulate in the following order, to make our exit from a minor mode; first upon the mediant, afterwards the dominant, next the sub-dominant, then the sub-mediant, or sixth note. The mode of each of these accessory keys is determined by its mediant taken from the principal sound. For instance, issuing from the major mode of *ut*, to modulate upon its mediant, we render the mode of that mediant minor; because *sol*, the dominant of the principal sound, forms a third minor with that mediant, which is *mi*. On the contrary, in our egress from the minor mode of *la*, we modulate upon its mediant *ut* in the major mode; because *mi*, the dominant of the tone from whence we issue, forms a third major with the key of that into which we enter, &c.

These rules, comprehended in one general formula, import, that the modes of the dominant and of the sub-dominant are like that of the tonic, and that the mediant and the sixth note require a mode opposed. We must, however, remark, that, by the right which we have of passing from the major to the minor, and *vice versa*, upon the same key, we may likewise change the order of modes from one key to another; but whilst we thus remove ourselves from the natural modulation, we must presently think of our return: for it is a general rule, that every piece of music ought to terminate in that key with which it began.

In his Musical Dictionary, plate B, fig. 6. and 7. Rousseau has collected in two examples, which are very short, all the modes to which we may immediately pass; the first, in passing from the major mode; and the second, from the minor. Each note indicates a particular modulation; and the value of the notes in each example likewise shows the relative duration suitable to each of these modes, according to its relation with the principal mode.

These immediate transitions from one mode to another, furnish us with the means of passing by the same rules to modes still more remote, and from thence to return to the principal mode, of which we never should lose sight. But it is not sufficient to know what course we ought to pursue; we must likewise be acquainted with the method of entering into it. A summary therefore of the precepts which are given in this department shall immediately follow.

In melody, in order to discover and introduce the modulation which we have chosen, nothing is necessary but to render perceptible the alterations which it causes in the sounds of that mode from whence we issue, to make them proper for the mode into which we enter. Are we now in the major mode of *ut?* there needs no more than to sound the note *fa* sharp, that we may discover the mode of the dominant; or a *si* flat, that we may show the mode of the sub-dominant. Afterwards you may run over the sounds essential to the mode in which you enter; if it is well chosen, your modulation will always be just and regular.

In harmony, the difficulty is a little increased: for as it is necessary that the change of modes should be made at the same time through all the parts, care must be taken of the harmony, and of the air, that we may avoid pursuing different modulations at the same time. Huygens has happily remarked, that the prohibition of two fifths in immediate succession proceeds upon this rule as its principle: in reality, between two parts it is scarcely possible to form a number of just fifths in uninterrupted succession without operating in two different modes.

To introduce a mode, a great many pretend that it is sufficient to form the perfect chord of its principal sound, and this is indispensable in order to produce the mode. But it is certain, that the mode cannot be exactly determined but by the chord containing the sensible note, or the dominant: we must then cause this chord to be heard when we enter into a new modulation. The most eligible rule would be, That in it the seventh, or minor dissonance, should always be prepared, at least the first time in which it is heard: but this method is not practicable in every admissible modulation; and provided that the fundamental basis proceeds by consonant intervals, that the connection of harmony be observed, the analogy of the mode pursued, and false relations avoided, the modulation will always be approved. Composers prescribe as another rule, That a mode should not be changed except after a perfect cadence: but this interdict is useless, and no person observes it.

All the possible methods of passing from one mode to another, are reducible to five with respect to the major mode, and to four with respect to the minor; which, in the Musical Dictionary, plate B, fig. 8. will be found implied in a fundamental basis intended for each modulation. If there be any other modulation which cannot be resolved into some one of these nine, unless that modulation be enharmonic, it must infallibly be illegitimate. See ENHARMONIC.

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.

MOEBIUS (Godfrey), professor of physic at Iena, was

Moensui || Mogodor.

was born at Lauch in Thuringia in 1611. He became first physician to Frederic William elector of Brandenburg, to Augustus duke of Saxony, and to William duke of Saxe-Weimar. He wrote several medical works, which are esteemed; and died at Halle, in Saxony, in 1664.

MOENIUS (Caius), a celebrated Roman consul, conqueror of the ancient Latins, 338 B. C. He was the first who hung up the prows, &c. of the galleys he had taken at the naval engagement of Actium, upon the place where the tribunes harangued the people; from whence it was called the *rostra*.

MŒONIA, or MÆONIA. See MÆONIA and LYDIA.

MŒSIA, or MYSIA, (anc. geog.) 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 the shire of Annandale, 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 scrophulous complaints; and for its chalybeate spring, perhaps the strongest in Britain, which was discovered about 45 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 one of the best inns between London and Edinburgh.

MOFFETTA. See AMPSANCTI.

MOGODORE, or MOGADORE, 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, elephant's 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-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.

Moguls.

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.

1 Moguls descended from Japhet.

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.

2 Almost exterminated.

Having

Moguls.

3 They arrive in a delightful valley.

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 track, interspersed with rivulets and charming meadows, abounding with a vast variety of delicious fruits, and inclosed 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."

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 abovementioned 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 desart 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 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 Hya-chew, 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 Kavar 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.

5 State of Asia at the time of Jenghiz Khan.

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.

Moguls.

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 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.

10 Assumes the title of Jenghiz Khan.

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.

11 Invades Hya, China, &c.

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 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.

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.

I Its

Moguls.

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, nº 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 a 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 khalif 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 Bagdat, 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.

* See *China*, nº 38.

13 Bagdad reduced.

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, Cochinchina, 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 Cochinchina, 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.

14 It begins to decline.

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 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. 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.

15 Tamerlane crowned emperor of Balkh.

16 Becomes a great conqueror.

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. 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.

17 Invades and conquers Indoſtan.

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 Dehli, the capital of the country. Here he ſeated himſelf on the throne of the Indian emperors, and here the ſharifs, kadis, and 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.

Dehli at this time conſiſted of three cities, called *Seyri*, *Old Dehli*, and *Jehan Penah*. Seyri was ſurrounded with a wall in form of a circle. Old Dehli 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 Dehli. Penah

18 The city of Dehli deſtroyed, and the inhabitants ſlaughtered.

Moguls.

nah had ten gates; Seyri had seven, three of which looked towards Jehan Penah; this last had thirteen 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 Dehli, 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 soltanas having a curiosity to see the rarities of Dehli, 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 Dehli, 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 Dehli, 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. 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.

19 Timur quarrels with Bajazet the Turkish sultan.

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.

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.

20 Bajazet defeated and taken prisoner.

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

21 Death of Tamerlane, and dissolution of his empire.

year

Moguls. 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 Indoſtan. 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 Indoſtan. 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 the articles HINDOSTAN and INDIA. What remains to be ſupplied here is an account of the revolution that has lately happened at Delhi the capital of the Mogul empire.

Gholam Kahdur, author of the revolution, was the ſon of Zabda Khan. His father diſinherited him, and drove him from his preſence on account of his vices and his crimes. Shah Allum, the king of Delhi, took him under his protection, treated him as his own ſon, and conferred on him the firſt title in the kingdom, Amere ul Omraow. He lived with the king, and raiſed a body of about 8000 troops of his own countrymen the Moguls, which he commanded. Gholam Khadur was of a paſſionate temper, haughty, cruel, uugrateful, and debauched. In the latter end of the year 1788, the king had formed ſuſpicions that ſome of the neighbouring rajahs (princes) would make an attempt to plunder and deſtroy his territories. Theſe ſuſpicions were verified by the approach of a conſiderable army towards his capital, commanded by Iſmael Beg Khan, and aſſiſted by Scindia. Gholam Khadur told the king on this, that he had nothing to fear; for that he had an army ſufficiently ſtrong to oppoſe the enemy: that all the king had to do was to march out with his troops, give them a ſupply of caſh, and he would lay his head on the enemy's being overcome. The king on this replied, that he had no money to carry on a conteſt. Gholam Khadur ſaid, that this objection would ſoon be obviated, as he (Gholam Khadur) would advance the neceſſary ſupply of caſh, and that all his majeſty had to do was to head the army. "This (ſaid he) will animate them and give them confidence; the preſence of a monarch is above half the battle." The king agreed in appearance, and requeſted Gholam Khadur to aſſemble the army, pay their arrears, and inform them of his intentions. Gholam Khadur retired contented: but great was his aſtoniſhment, when he intercepted the next day a letter from the king to Scindia, deſiring him to make as much haſte as poſſible, and deſtroy Gholam Khadur; for, ſays he, Khadur wiſhes me to act contrary to my wiſhes, and oppoſe you. On this diſcovery, Gholam Khadur marched out with his Moguls, croſſed the Jumna, and encamped on the other ſide oppoſite the fort of Delhi. He ſent to the king the intercepted letter, and aſked him if his conduct did not deſerve to be puniſhed by the loſs of his throne?—He began to beſiege the fort, and carried it in a few days. He entered the palace in arms; flew to the king's chamber; inſulted the old man in the moſt barbarous manner; knocked him down; and, kneeling on his breaſt, with his knife took out one of his eyes, and he ordered a ſervant of the king's to take out the other.

After this he gave up the palace to pillage, and went to the king's zazana (the reſidence of his women); where he inſulted the ladies, and tore their jewels from their noſes and ears and off their arms and legs. As he had lived with the king, he was well acquainted with the different places where the king's treaſures were hid; he dug up the floor of the king's own bed-room, and found there two cheſts, containing in ſpecie 120,000 gold mohurs, or L. 192,000 ſterling; this he took, and vaſt ſums more. To get at the hidden jewels of the women, he practiſed one of the moſt villainous ſchemes that ever was thought of. The third day after theſe horrid cruelties, he ordered that all the king's ladies and daughters ſhould come and pay their reſpects to him, and promiſed to ſet thoſe free who could pleaſe him by their appearance and dreſs. The innocent, unthinking women, brought out their jewels, and adorned themſelves in their richeſt attires to pleaſe this ſavage. Gholam Khadur commanded them to be conveyed into a hall, where he had prepared common dreſſes for them; theſe dreſſes he made them put on by the aſſiſtance of eunuchs; and taking poſſeſſion of their rich dreſſes and jewels, ſent the women home to the palace to lament their loſs and curſe his treachery. Gholam Khadur did not even ſtop here; but inſulted the princes, by making them dance and ſing. The moſt beautiful of the king's daughters, Mobaruck ul Moulk, was brought to this tyrant to gratify his luſt: but ſhe reſiſted, and is ſaid to have ſtabbed herſelf in order to avoid force.

Scindia ſoon after this came to the aſſiſtance of the king, rather to make him his prey. Gholam Khadur fled and took refuge in the fort of Agra, a large city about 150 miles from Delhi. Scindia's troops beſieged him there. Perceiving at laſt that he muſt be taken if he continued in the fort, he took the advantage of a dark night, ſtuffed his ſaddle with a large ſtock of precious ſtones, took a few followers, and fled from the fort towards Perſia. Unluckily for him, he fell off his horſe the ſecond night after his flight; by this means a party of horse which had been sent in pursuit of him came up with him, and took him prisoner. He was brought to Scindia; who, after exposing him for some time in irons, and some time in a cage, ordered his ears, his nose, his hands, and his feet, to be cut off, and his eyes taken out; in which state he was allowed to expire.

Scindia has rewarded himself by seizing upon the kingdom which he came to guard: And all that now belongs to Shah Allum, the nominal emperor, is the city of Delhi, with a small district around it, where, even deprived of sight, he remains an empty shadow of royalty; an instance of the instability of human greatness, and of the precarious state of despotic governments.

MOHAIR, in commerce, the hair of a kind of goat frequent about Angria 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 calendered, the other not. There are also mohairs both plain and watered, whose woof is of wool, cotton, or thread.

Mohair-Shell, in conchyliology, a name given to a peculiar 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 silk-worm'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 Comorra islands in the Indian sea, between the north end of the island 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 which descend from the mountains; and the grass is green all the year, so that it affords a most delightful habitation. There are plenty of 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.

MOINE (Peter le), was born at Chaumont in Bassigni, A. D. 1602, and died at Paris August 22. 1672, aged 70. He joined the society of Jesuits, and enjoyed several offices among them. He is chiefly known by his verses, which were collected into one volume folio in 1671. Father le Moine is the first of the French poets belonging to that famous society, who acquired reputation by this species of writing. It cannot be denied that this poet possessed genius and fancy; but his imagination was ungoverned, which is particularly the case in his poem of *Saint Louis*. Despreaux, when asked his opinion of this poet, replied, That "he was too extravagant for praise, and too much a poet for censure." To give his character in one word, he was a pedant who had a lively imagination without taste, and who, far from restraining his impetuous genius, abandoned himself without reserve to its direction. Hence his gigantic figures, his crowd of metaphors, his ridiculous antitheses, his hyperbolical expressions, &c. This Jesuit somewhere says, "that the water of the river on the banks of which he had composed his verses, was so admirably qualified to make poets, that though it were converted into holy water, it would not protect a man against the dæmon of poetry." The prose of father le Moine is in the same brilliant and bombast style. Senault, a father of the oratory, used to say of him, that he was Balzac in a theatrical dress" Among his prose works are, 1. *La Devotion aiseé*, Paris, 1652, 8vo; an extraordinary book which produced more mirth than devotion. 2. *Pensées Morales*. On these two books the reader may consult Paschal's ninth and tenth provincial letters. 3. A short Treatise on History, in 12mo; in which we find many pleasant and curious thoughts mixed with a good deal of common-place.

Moine (Stephen le), a very learned French minister of the Protestant religion, was born at Caen in 1624. He became extremely skilled in the Greek, Latin, and Oriental tongues, and professed divinity with high reputation at Leyden, in which city he died in 1689. Several dissertations of his are printed together, and intituled *Varia Sacra*, in 2 vols 4to; besides which, he wrote other works.

Moine (Francis le), an excellent French painter, was born at Paris in 1688, and trained up under Galloche professor of the academy of painting; which office he himself afterwards filled. Le Moine painted the grand saloon which is at the entrance into the apartments of Versailles, and which represents the apotheosis of Hercules. He was four years about it; and the king, to show how well pleased he was with it, made him his first painter in 1736, and gave him a pension of 4000 livres. A fit of lunacy seized this painter the year after; during which he run himself through with his sword, and died, June 4. 1737, aged 49.

MOIRA (sometimes written *Moyra*), a town of Ireland, situated in the county of Down and province of Ulster, 69 miles from Dublin; noted for its linen manufacture, and a monthly market for vending the same. It gives title of earl to the family of Rawdon. Lord Moira has here a very beautiful seat; and here is a handsome church, a charity school, and two dissenting meeting-houses.

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,

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), was born at Vitri in Champagne, A. D. 1667. His father was a surgeon. At the revocation of the edict of Nantes, he determined to fly into England rather than abandon the religion of his fathers Before he left France, he had begun the study of Mathematics; and having perfected himself in that science in London, he was obliged, by the meanness of his circumstances, 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, nor 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. "I show you that I am a Christian (said he one day to a person who thought to pay him a compliment by observing that mathematicians were attached to no religion), by forgiving the speech you have now made." The practice of giving vails to servants was not laid aside in his time; and, on this account, when a nobleman asked him why he did not dine oftener with him? "You must excuse me, my lord (replied he), I cannot afford it."

MOLA (Pietro Francesco), an eminent painter, was born, according to most authors, at Lugano, a city belonging to the Switzers, in the year 1609. Others affirm, that the place of his birth was Coldra, in the district of Como. He was at first the disciple of Giuseppe d'Arpino, and afterwards of Albano. When he quitted the school of the latter, he went to Venice, and studied assiduously the pictures of Titian, Tintoretto, Basan, and Paolo Veronese. He painted historical subjects and landscapes with great success; but his genius seemed more particularly adapted to the latter. His pictures, in both styles, are spoken of with the warmest commendations. He died in 1665.—He had a brother, *Giovanni Batista*, who was also a painter, and of some merit, but very inferior to that of the older.

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 ουλη or ουλοχυτη.

MOLARES, or DENTES MOLARES, in anatomy, the large teeth, called in English the *grinders*. See ANATOMY, nº 27.

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 Transilvania; it being 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 ever 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. They pay a large yearly tribute; besides which, they are obliged to raise a great body of horse at their own expence.

MOLE, a river in Surry, which has taken its name from running under ground. It firſt diſappears at Box-hill, near Darking, in the county of Surry, and emerges again near Leatherhead.

MOLE, in zoology. See TALPA.

Moles in the fields may be deſtroyed by taking a head or two of garlic, onion, or leek, and putting it into their holes; on which they will run out as if frighted, and you may kill them with a ſpear or dog. Or pounded hellebore, white or black, with wheat-flour, the white of an egg, milk, and ſweet-wine, or metheglin, may be made into a paſte, and pellets as big as a ſmall nut may be put into their holes: the moles will eat this with pleaſure, and will be killed by it. In places where you would not dig nor break much, the fuming their holes with brimſtone, garlic, or other unſavoury things, drives them away; and if you put a dead mole into a common haunt, it will make them abſolutely forſake it.

Or take a mole-ſpear or ſtaff, and where you ſee them caſt, go lightly; but not on the ſide betwixt them and the wind, leſt they perceive you; and at the firſt or ſecond putting up of the earth, ſtrike them with your mole-ſtaff downright, and mark which way the earth falls moſt: if ſhe caſts towards the left hand, ſtrike ſomewhat on the right hand; and ſo on the contrary, to the caſting up of the plain ground, ſtrike down, and there let it remain; then take out the tongue in the ſtaff, and with the ſpattle, or flat edge, dig round about your grain to the end thereof, to ſee if you have killed her; and if you have miſſed her, leave open the hole and ſtep aſide a little, and perhaps ſhe will come to ſtop the hole again, for they love but very little air; and then ſtrike her again; but if you miſs her, pour into the hole two gallons of water, and that will make her to come out for fear of drowning: mind them going out of a morning to feed, or coming home when fed, and you may take a great many.

MOLE, in midwifery, a maſs of fleſhy matter, of a 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, in zoology. See GRYLLOTALPA.

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 hindering 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 plough-ſhares, 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 in eight, and would be of very great advantage to the kingdom if brought into general uſe. It is to be obſerved, that this leaving a naked ſpace in the place of every hill, it will be neceſſary to go over the land, and ſow them with hay ſeed, otherwiſe theſe ſpots will want the produce of graſs the firſt years. The farmers in ſome parts of England are not willing to deſtroy the mole-hills, but let them ſtand from year to year, ſuppoſing that they get ſome ground by them, but the advantage by this means is ſo little, that it does not balance the unſightlineſs and damage to the mowing.

MOLESWORTH (Robert), Viſcount Moleſworth, an eminent ſtateſman and polite writer, born at Dublin in 1656, where his father was a merchant. He was attainted by King James for his activity on the prince of Orange's invaſion; but the latter, when he was ſettled on the throne, called up Mr Moleſworth into the privy-council, and ſent him envoy-extraordinary to the court of Denmark. Here he reſided above three years, and then returned upon ſome diſguſt, without an audience of leave. Upon his return, he drew up his Account of Denmark, a work well known, in which he repreſented that government as arbitrary; and hence gave great offence to George prince of Denmark. The Daniſh envoy preſented a memorial to King William concerning it; and then furniſhed materials for an anſwer, which was executed by Dr William King. Mr Moleſworth was member of the houſes of commons in both kingdoms: King George I. made him a commiſſioner of trade and plantations, and advanced him to the peerage of Ireland, by the title of *Baron Philipſtown*, and *Viſcount Moleſworth of Swords*.

Swords. He died in 1725. Befides his Account of Denmark, he wrote an addrefs to the houfe of commons, for the encouragement of agriculture: and tranflated Franco Gallia, a Latin treatife of the civilian Hottoman, giving an account of the free ftate of France, and other parts of Europe, before the encroachments made on their liberties.

MOLIERE (John Baptift), a famous French comedian, whofe true name was *Pocquelin*, which for fome reafon or other he funk for that of Moliere He was the fon of a valet de chambre, and was born at Paris about the year 1620. He went through the ftudy of the claffics under the Jefuits in the college of Clermont, and was defigned for the bar; but at his quitting the law-fchools, he made choice of the actor's profeffion. From the prodigious fondnefs he had for the drama, his whole ftudy and application being directed to the ftage, he continued till his death to exhibit plays, which were greatly applauded It is faid the firft motive of his going upon the ftage was to enjoy the company of an actrefs for whom he had contracted a violent fondnefs. His comedies are highly efteemed. And it is no wonder he fo juftly reprefented domeftic feuds, and the torments of jealous hufbands, or of thofe who have reafon to be fo, it being afferted that no man ever experienced all this more than Moliere, who was very unhappy in his wife. His laft comedy was *La Malade imaginaire*, which was brought on the ftage in 1673; and Moliere died on the fourth night of its reprefentation; fome fay in acting the very part of the pretended dead man, which gave fome exercife for the wits of the time; but according to others he died in his bed that night, from the burfting of a vein in his lungs by coughing. The king, as a laft mark of his favour, prevailed with the archbifhop of Paris to fuffer him to be buried in confecrated ground; though he had irritated the clergy by his *Tartuff*. The moft efteemed editions of his works are that of Amfterdam, 5 vols 12mo, 1699; and that of Paris, 6 vols 4to, 1734.

MOLINA (Lewis), a Spanifh lawyer, who was employed by Philip II king of Spain in the councils of the Indies and of Caftile. He is the author of a learned treatife concerning the entails of the ancient eftates of the Spanifh nobility, entitled, *De Hifpanorum Primogenitorum Origine et Natura*, publifhed in 1603, in folio. This book is likewife applicable to feveral provinces in France. Lewis Molina muft not be confounded with John Molina, a Spanifh hiftorian, author of *Cronica antiqua d' Aragon*, publifhed in 1524, in folio; and alfo of *De las Cafas memorables d'Efpagna*, in folio. The firft work appeared at Valencia, and the fecond at Alcala.

MOLINÆUS. See Moulin.

MOLINISTS, in ecclefiaftical hiftory, a fect in the Romifh church, who follow the doctrine and fentiments of the Jefuit Molina, relating to fufficient and efficacious grace. He taught that the operations of divine grace were entirely confiftent with the freedom of human will; and he introduced a new kind of hypothefis to remove the difficulties attending the doctrines of predeftination and liberty, and to reconcile the jarring opinions of Auguftines, Thomifts, Semi-Pelagians, and other contentious divines. He affirmed, that the decree of predeftination to eternal glory was founded upon a previous knowledge and confideration of the merits of the elect; that the grace, from whofe operation thefe merits are derived, is not efficacious by its own intrinfic power only, but alfo by the confent of our own will, and becaufe it is adminiftered in thofe circumftances, in which the Deity, by that branch of his knowledge which is called *fcientia media*, forefees that it will be efficacious. The kind of prefcience, denominated in the fchools *fcientia media*, is that foreknowledge of future contingents that arifes from an acquaintance with the nature and faculties of rational beings, of the circumftances in which they fhall be placed, of the objects that fhall be prefented to them, and of the influence which their circumftances and objects muft have on their actions.

MOLINOS (Michael), a Spanifh prieft, who endeavoured to fpread new doctrines in Italy. He was born in the diocefe of Saragoffa in 1627; and entered into prieft's orders, though he never held any ecclefiaftical benefice. He was a man of good fenfe and learning, and his life was examplary; though, inftead of practifing aufterities, he gave himfelf up to contemplation and myftical devotion. He wrote a book intitled, *Il Guida Spirituale*, containing his peculiar notions, which was greedily read both in Italy and Spain. His followers are called *Quietifts*; becaufe his chief principle was, that men ought to annihilate themfelves in order to be united to God, and afterwards remain in quietnefs of mind, without being troubled for what fhall happen to the body. He was taken up in 1687; and his 68 propofitions were examined by the pope and inquifitors, who decreed that his doctrine was falfe and pernicious, and that his books fhould be burned. He was forced to recant his errors publicly in the Dominicans church, and was condemned to perpetual imprifonment. He was 60 years old when he was taken, and had been fpreading his doctrine 22 years before. He died in prifon in 1692.

MOLINOSISTS, a fect among the Romanifts, who adhere to the doctrine of Molinos. Thefe are the fame with what are otherwife called *Quietifts*.

MOLLOY (Charles, Efq;), defcended from a good family in the kingdom of Ireland, was born in the city of Dublin, and received part of his education at Trinity college there, of which he afterwards became a fellow. At his firft coming to England he entered himfelf of the Middle Temple, and was fuppofed to have had a very confiderable hand in the writing of a periodical paper called "Fog's Journal;" as alfo fince that time to have been almoft the fole author of another well-known paper, intitled "Common Senfe." All thefe papers give teftimony of ftrong abilities, great depth of underftanding, and clearnefs of reafoning. Dr King was a confiderable writer in the latter, as were lords Chefterfield and Lyttleton. Our author had large offers made him to write in defence of Sir Richard Walpole, but thefe he rejected: notwithftanding which, at the great change in the miniftry in 1742, he was entirely neglected, as well as his fellow labourer Amherft, who conducted "The Craftfman." Mr Molloy, however, having married a lady of fortune, was in circumftances which enabled him to treat the ingratitude of his patriotic friends with the contempt it deferved. He lived many years after this period, dying fo lately as July 16. 1767.

He also wrote three dramatic pieces, viz. The perplexed Couple; The Coquet; and, The Half-pay Officers; none of which met with much success.

MOLLUGO, African chickweed: A genus of the trigynia order, belonging to the triandria class of plants; and in the natural method ranking under the 22d order, *Caryophyllei*. The calyx is pentaphyllous; there is no corolla; the capsule is trilocular, and trivalved. Its characters are these: The empalement of the flower is composed of five oblong small leaves, coloured on their insides, and permanent; the flower has five oval petals shorter than the empalement; and three bristly stamina, which stand near the style, terminated by single summits; it has an oval germen, having three furrows, supporting three very short styles: the germen becomes an oval capsule with three cells, filled with small kidney-shaped seeds. There are several species, few of which are admitted into gardens. Miller reckons two and Linnæus five species. This plant is said to have an aperitive virtue.

MOLUSCA, in the Linnæan system, is the denomination of the second genus of vermes or worms. These are simple naked animals, not included in a shell, but furnished with limbs, and compre[h]end eighteen subordinate genera, and one hundred and ten species.

MOLO, a philosopher of Rhodes, called also Apollonius. Some are of opinion that Apollonius and Molo are two different persons, who were both natives of Alabanda, and disciples of Menecles of the same place. They both visited Rhodes, and there opened a school; but Molo came some time after Apollonius. Molo had Cicero and J. Cæsar among his pupils.

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 *Milkom*; as appears from what is said of Solomon, that he went after Ashtaroth the abomination of the Zidonians, and Milkom 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 to 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 molasses was very dear and scarce, provided this for the supply of his own family, and soon made 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, n° 10.

Molosses spirit coming dearer than that of malt, it is frequently met with basely adulterated with a mixture of that spirit, and indeed seldom is to be bought without some dash of it. Many have a way of mixing malt in the fermenting liquor; by this the yield of the whole is greatly increased, and the maker may assure the buyer that the spirit is pure as it ran from the worm.

In most of the nice cases in our compound distillery,

lery, the molosses spirit supplies the place of a pure and clean spirit. Our cinnamon, citron, and other fine cordial waters, are made with it; for the malt spirit would impart to these a very disagreeable flavour.

Molosses spirit gives a yellow stain to the hands or other substances dipped into it; and may therefore be of use in dyeing. It is possible also that the vinegar-makers may find use for it in their way; but the most advantageous of all its uses is to the distiller himself; a quantity of it added to new treacle intended for fermentation will be of great use in the process, and increase very considerably the quantity of spirit; but the proportion in regard to the new matter must not be too great.

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*, & *canius*.

MOLSA (Francis Maria), an eminent poet of the 16th century, was born at Modena. He gained so prodigious a reputation by his Latin and Italian poetry, that, as Paul Jovius tells us, "for 30 years together the patrons of wit at Rome strove to promote him." If he had behaved with the least prudence, he might easily have raised himself to considerable preferments and fortunes in the world; but he managed so ill that it was not possible to serve him.—He was entirely debauched, and at the same time devoid of all prudence and decency in the management of his pleasures. Hence he destroyed his reputation, and put an absolute stop to the progress of his fortunes. He died, in 1544, of the French disease. Molsa was a great orator as well as a great poet. He met once with a favourable opportunity of displaying his talent this way; for having seen the people of Rome highly incensed against Lorenzo de Medicis, who had struck off the heads of a great number of ancient statues, he accused him of that action, and (according to Paul Jovius) made so lively an oration upon it, that he perfectly overwhelmed him with confusion and despair: and it was generally believed that Lorenzo de Medicis was so confounded at the infamy with which he was branded in that oration, that, in order to efface it, he resolved to restore the city of Florence to its liberty, by assassinating Alexander de Medicis his near relation, which he did in 1537.

MOLSA (Tarquinia), daughter of Camillo Molsa, knight of the order of St James of Spain, and granddaughter of Francis Maria Molsa, was one of the most accomplished ladies that ever appeared in the world; wit, learning, beauty, and virtue, all uniting in her in a most extraordinary degree. Her father observing, while she was yet very young, the goodness and excellence of her genius, procured her the best masters in every branch of literature and science. Lazaro Labadini, a celebrated grammarian of those times, taught her polite literature; and her Latin compositions in prose and verse show that she attained the art of writing well, and composing correctly. She became learned in Aristotle under Camillo Corcapani; Anthony Guarini the mathematician taught her the doctrine of the sphere; she learned poetry under Francis Patricius the famous philosopher; and logic and philosophy under P. Latoni, who also instructed her thoroughly in the Greek tongue. The rabbi Abraham taught her the principles of the Hebrew language; and John Marier Barbier formed her in the politeness of the Tuscan tongue; in which she has not only written a great number of easy and elegant verses, but likewise several letters and other pieces which are in high esteem with the polite and learned in Italy. Besides her original works, she has translated several things from Greek and Latin in a manner which shows her to have understood those languages as well as her own. Afterwards she learned music, as a relaxation and diversion from her more serious studies; and in this art she attained the highest degree of perfection. She used to play upon the violin as well as upon the lute, and sing to it at the same time in so exquisite a taste as charmed every hearer; and she instituted at length a choir of ladies, over which she herself used to preside. This lady was in high reputation at the court of Alphonsus II. duke of Ferrara, a prince of great judgment, and a passionate lover of every thing that was elegant; and we are told, that he stood ravished with admiration upon finding so many more accomplishments than he had been taught to expect in her. But the most authentic testimony and declaration of her high merit and character, was that which she received from the city of Rome; which, by a decree of the senate, in which all her excellences and qualifications are set forth, honoured her with the title of *Singular*, and bestowed the rights of a Roman citizen upon her and the whole family of Molsa. Molsa was married; but losing her husband without having any children, would never consent to be married again, although she was very young. She gave such lively tokens of her grief, that Patricius compares her to another Artemisia.

MOLUCILLA, in botany: A genus of the gymnospermia order, belonging to the didynamia class of plants; and in the natural method ranking under the 42d order, *Verticillatæ*. The calyx is campanulated, gradually widening larger than the corolla, and spinous.

MOLTEN-GREASE, in farriery. See there § xxii.

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

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 very strong there, 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 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, in chemistry, a mineral often confounded with plumbago or black lead, but possessed of different properties. It is composed of scaly laminæ of various magnitudes, scarcely adhering to each other; somewhat greasy to the touch, soiling the fingers, and leaving traces on paper of a blackish grey colour. In powder it is of a bluish colour.

"Perfect molybdena (says Mr Fourcroy) slightly detonates with nitre; the residue contains molybdena, tartar, and calx of iron. From the experiments of Mr Scheele, molybdena appears to consist of a peculiar combustible matter and iron. The nature of the combustible matter is not yet perfectly known. Mr Hielm, a disciple of the celebrated Bergman, appears to have succeeded in converting it into a regulus. Mr Pelletier affirms, that he has had the same success; but the properties of this new metal have not yet been examined. The molybdenic acid appears to be a metallic one. Its weight, its styptic and austere taste, its dry and pulverulent form, its fusibility, insolubility, the colour it assumes by action of flame and combustible matters, its precipitation by nut-galls and the acid of Prussian blue, show that it is somewhat similar to the arsenical acid. This substance is so rare in France, that no chemist except M. Pelletier has had an opportunity of making a regular series of experiments upon it. It is greatly to be wished that they should be continued, especially with a view of deciding whether the molybdenic acid be truly different from all others; for I cannot avoid thinking, notwithstanding its peculiar characters, that a substance which does not become acid but by the assistance of 30 parts of weak nitrous acid, and is with so much difficulty brought to assume the saline state, ought not to be considered as an acid truly peculiar." See CHEMISTRY-*Index*; and MINERALOGY, p. 134.

Molybdena is found sometimes alongst with tin-ores and iron-ores, that are attracted by the magnet, among copperish pyrites; and also with wolfram, in Saxony, Iceland, Sweden, France, Spain, &c.

MOLYBDIA, in natural history, the name of a genus of crystals of a cubic form, or composed of six sides, at right angles, like a dye.

MOLYN (Peter), called *Tempesta* and *Pietro Mulier*, an eminent painter, was born at Haerlem in 1637. According to some authors, he was the disciple of Snyders, whose manner of painting he at first imitated. But his genius led him to the study of dismal subjects; and he so far excelled in painting tempests, storms at sea, and shipwrecks, that he was called by way of distinction *Tempesta*. His pictures are very rare, and held in the greatest estimation. The name of *Pietro Mulier*, or *de Mulieribus*, was given him on account of having caused his wife to be assassinated, in order to marry a young lady of Genoa with whom he was in love. But this villanous transaction being discovered, he was seized, imprisoned, and capitally condemned. However, the greatness of his merit as an artist occasioned a mitigation of the sentence; but he was still detained in prison, where he diligently followed his profession, and would have continued there in all probability for life, had he not met with an opportunity of escaping to Placentia, at the time Louis XIV. bombarded the city of Genoa, after he had been in confinement 16 years. To this artist are attributed several very neat prints, executed with the graver only, in a style greatly resembling that of John Vander Velde. They consist chiefly of candle-light pieces and dark subjects. M. Heinekin mentions *Peter Molyn* the elder, who was a native of Holland, and a painter; but not so eminent as Tempesta. Some suppose the prints above mentioned ought to be ascribed to the latter; as, though very neatly executed, they are laboured heavy performances, and not equal in any degree to what one might expect from the hand of an artist of so much repute as Tempesta.

MOLYNEUX (William), an excellent mathematician and astronomer, was born at Dublin in 1656, and admitted into the university of that city; which when he left, he carried with him a testimonial drawn up in an uncommon form, and in the strongest terms, signifying the high opinion conceived of his genius, the probity of his manners, and the remarkable progress he had made in letters. In 1675, he entered in the middle-temple, where he spent three years in the study of the laws of his country; but the bent of his genius lay strongly toward mathematics and philosophical studies; and even at the university he conceived a dislike to scholastic learning, and fell into the methods of Lord Bacon. Returning to Ireland in June 1678, he shortly after married Lucy the daughter of Sir William Domvile the king's attorney-general. Being master of an easy fortune, he continued to indulge himself in prosecuting such branches of natural and experimental philosophy as were most agreeable to his fancy; wherein astronomy having the greatest share, he began, about 1681, a literary correspondence with Flamstead the king's astronomer, which he kept up for several years. In 1683, he formed a design of erecting a philosophical society at Dublin, in imitation of the Royal Society at London; and, by the countenance and encouragement of Sir William Petty, who accepted the office of president, they began a weekly meeting that year, when our author was appointed their first secretary.

Mr Molyneux's reputation for learning recommended him in 1684, to the notice and favour of the first and great duke of Ormond, then lord-lieutenant of Ireland; and chiefly by his grace's influence he was appointed, that year, with Sir William Robinson, surveyor general of his majesty's buildings and works, and chief engineer. In 1686, he was sent abroad by the government to view the most considerable fortresses in Flanders. He travelled, in company with Lord Mountjoy, through that country, Holland, part of Germany, and France. Upon his return from Paris to London, in April 1680, he published his *Sciothericum Telescopium*, containing a description of the structure and use of a telescopial dial invented by him. The severities of Tyrconnel's government forced him, with many others, into England, where he spent two years with his family, his place of residence being at Chester. In this retirement he wrote his Dioptrics, dedicated to the Royal Society. Here he lost his lady, who died soon after she had brought him a son. Illness had deprived her of her eye-sight 12 years before, that is, soon after she was married; from which time she had been very sickly, and afflicted with extreme pains of the head. As soon as the public tranquillity was settled in his native country, he returned home; and, upon the convening of a new parliament in 1692, was chosen one of the representatives for the city of Dublin. In the next parliament, in 1695, he was chosen to represent the university there, and continued to do so to the end of his life; that learned body having, before the end of the first session of the former, conferred on him the degree of doctor of laws. He was likewise nominated by the lord-lieutenant one of the commissioners for the forfeited estates, to which employment was annexed a salary of 500l. a-year; but looking upon it as an invidious office, he declined it. In 1698, he published "The Case of Ireland stated, in relation to its being bound by Acts of Parliament made in England:" in which he is supposed to have delivered all, or most, that can be said upon this subject, with great clearness and strength of reasoning. Among many persons with whom he maintained correspondence and friendship, Mr Locke was in a particular manner dear to him, as appears from their letters. In the above year, which was the last of his life, he made a journey to England, on purpose to pay a visit to that great man; and not long after his return to Ireland was seized with a fit of the stone, of which died. Besides the works already mentioned, he published several pieces in the Philosophical Transactions.

Molyneux (Samuel), son of the former, was born at Chester in July 1689; and educated with great care by his father, according to the plan laid down by Locke upon that subject. When his father died, he fell under the management of his uncle, Dr Thomas Molyneux, an excellent scholar and physician at Dublin, and also an intimate friend of Mr Locke; who executed his trust so well, that Mr Molyneux became afterwards a most polite and accomplished gentleman, and was made secretary to his late majesty when he was prince of Wales. Astronomy being his favourite study, as it had been his father's, he projected many schemes for the advancement of it, and was particularly employed in the years 1723, 1724, and 1725, in perfecting the method of making telescopes; one of which, of his own making, he had presented to John V. king of Portugal. In the midst of these thoughts, being appointed a commissioner of the admiralty, he became so engaged in public affairs, that he had not leisure to pursue these enquiries any farther; and gave his papers to Dr Robert Smith, professor of astronomy at Cambridge, whom he invited to make use of his house and apparatus of instruments, in order to finish what he had left imperfect. Mr Molyneux dying soon after, Dr Smith lost the opportunity; yet, supplying what was wanting from Mr Huygens and others, he published the whole in his "Complete Treatise of Optics."

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, 70 miles south of Melinda, and subject to Portugal. E. Long. 48. 0. N. Lat. 44. 0.

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, turned Mahometan, and murdered all the Christians, in 1631; 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 the syngenesia order, belonging to the monoecia class of plants; and in the natural method ranking under the 34th order, *Cucurbitaceæ*. The male calyx is quinquefid; the corolla sexpartite; the filaments are three in number. The female calyx is trifid; the corolla quinquepartite; the style trifid; the fruit is an apple parting asunder with a spring. The most remarkable species are, 1. The balsamina, or male balsam apple. This is a native of Asia; and has a trailing stalk like those of the cucumber or melon, with smooth leaves, cut into several segments, and spread open like a hand. The fruit is oval, ending in acute points, having several deep angles, with sharp tubercles placed on their edges. It changes to a red or purplish colour when ripe, opening with an elasticity, and throwing out its seeds. 2. The elaterium, wild or spurting cucumber, has a large fleshy root, somewhat like briony, from whence come forth every spring several thick, rough, trailing stalks, dividing into many branches, and extending every way two or three feet; these are garnished with thick, rough, almost heart-shaped leaves, of a grey colour,

colour, standing upon long foot-stalks. The flowers come out from the wings of the stalks: these are male and female, growing at different places on the same plant like those of the common cucumber: but they are much less, of a pale yellow colour, with a greenish bottom; the male flowers stand upon thick, short, foot-stalks, but the female flowers sit upon the young fruit; which, after the flower is faded, grows of an oval form, an inch and a half long, swelling like a cucumber, of a grey colour like the leaves, and covered over with short prickles. This species has one of its names from the property of casting out its seeds, together with the viscid juice in which the seeds are lodged, with a violent force, if touched while ripe.

Uses. The first species is famous in Syria for curing wounds. The natives cut open the unripe fruit, and infuse it in sweet oil, which they expose to the sun for some days, until it becomes red; and then present it for use. Dropped on cotton, and applied to a fresh wound, the Syrians reckon this oil the best vulnerary next to balsam of Mecca, having found by experience that it often cures large wounds in three days. The leaves and stems of this plant are used for arbours or bowers. The elaterium of the shops is the fruit, or rather the inspissated fæcula, of the juice of the unripe fruit of the wild cucumber. It is usually sent us from Spain and the southern parts of France, where the plant is common. We receive it in small, flat, whitish lumps, or cakes, that are dry, and break easily between the fingers. It is of an acrid, nauseous, bitter taste, and has a strong offensive smell when newly made; but these, as well as its other properties, it loses after being kept for some time. It is a very violent purge and vomit, and is now but seldom used. From the property which the plant has of throwing out its seeds, it has sometimes been called *Noli me tangere.*

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 an 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, two islands of this name in the sea lying between Britain and Ireland. The one described by Cæsar, as situated in the mid-passage between both islands, and stretching out in length from south to north. Called *Monaæda* (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, or male organs of generation, are united below into one body or cylinder, through which passes the pointal or female organ. See Botany, p. 437.

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 boggy and mountainous tract, but in some places is well improved. It contains 170,090 Irish plantation acres, 24 parishes, five baronies, and one borough, and sends four members to parliament. It is about 30 miles long and 22 broad. The linen trade of this county is averaged at L. 104,000 yearly.

Monaghan, a post, fair, and market town, and chief of the county of that name, is distant 62 miles from Dublin; it is a borough, and returns two members to parliament; patron Lord Clermont. It gives title of baron to the family of Blayney, and has six fairs. 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.

MONAMY (P.), a good painter of sea-pieces, was born in Jersey; and certainly (says Mr Walpole), from his circumstances or the views of his family he had little reason to expect the fame he afterwards acquired, having received his first rudiments of drawing from a sign and house painter on London-bridge. But when nature gives real talents they break forth in the homeliest school. The shallow waves that rolled under his window taught young Monamy what his master could not teach him, and fitted him to imitate the turbulence of the ocean. In painter's hall is a large piece by him, painted in 1726. He died at his house in Westminster the beginning of 1749.

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 or male organ.

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

Monarchy, Monarda.

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 conſtitute 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, in botany: A genus of the monogynia order, belonging to the diandria claſs of plants; and in the natural method ranking under the 42d order, *Verticillatæ*. The corolla is unequal, with the upper lip linear, involving the filaments; there are four ſeeds. The moſt remarkable ſpecies is the zeylanica, a native of the Eaſt Indies. It riſes with an herbaceous, four cornered, hoary ſtalk, and bears leaves that are entire, nearly heart-ſhaped, woolly, deep notched on the edges, and having footſtalks. The flowers, which are purpliſh and fragrant, ſurround the ſtalk in whorls, each whorl containing about 14 flowers; and are ſucceeded by four ſmall kidney-

kidney-shaped shining seeds, lodged in the bottom of the permanent flower-cup. The Indians superstitiously believe that a fumigation of this plant is effectual for driving away the devil; and from this imaginary property its name in the Ceylonese language is derived. Grimmius relates, in his *Laboratorium Ceylonicum*, that for taste and smell this species of horehound stands remarkably distinguished. A water and subtile oil are obtained from it, both of which are greatly commended in obstructions of the matrix. A syrup is likewise prepared from this plant, which is useful in the abovementioned disorders as well as in discases of the stomach.

MONARDES (Nicholas), an excellent Spanish physician of Seville, who lived in the 16th century: and deservedly acquired great reputation by his practical skill and the books which he wrote. His Spanish works have been translated into Latin by Clusius, into Italian by Annibal Brigantus, and those upon American drugs have appeared in English. He died about the year 1578.

MONASTEREVAN, a post town of Ireland, in the county of Kildare and province of Leinster, 36 miles from Dublin. This town takes its name 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. St Evan's festival is held on the 22d of December. 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 George Lord Audley, who assigned it to Adam Loftus, 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. It is a market-town, and also holds four fairs in the year.

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 licence 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 relics, had been discovered, which brought the monks into disgrace; the Observant friars had opposed the king's divorce from Queen Catherine; 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 L. 200 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 L. 30,000 or L. 32,000 a-year came to the crown; besides about L. 100,000 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 Hen. 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 Hen. VIII. c. 24. The suppression of these greater houses by these two acts produced a revenue to the king of above L. 100,000 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 Hen. 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:

Monastery. 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 follows:

Of the greater monasteries,	L.104,919	13	$3\frac{1}{2}$
Of all those of the lesser monasteries of which we have the valuation,	29,702	1	$10\frac{1}{2}$
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	$0\frac{3}{4}$
Total	L.140,784	19	$3\frac{1}{4}$

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 Elisabeth 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 Grey-friars 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 licences, had led the way.

Monastic || Moncrif.

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 Antony 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 desarts 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.

MONCAON, or Monzon, a town of Portugal, in the province of Entre-Douro-de-Minho, with a strong castle. The Spaniards have several times attempted to take it, but in vain. W. Long. 8. 2. N. Lat 41. 52.

MONCON, or Monzon, a strong town of Spain, in the kingdom of Arragon. It was taken by the French in 1642, but the Spaniards retook it the following year. It is seated at the confluence of the rivers Sosa and Cinca. E. Long. 0. 19. N. Lat. 41. 43.

MONCRIF (François Augustin Paradis de), secretary

cretary to M. le comte de Clermont, reader to the queen, one of the 40 of the French academy, and a member of the academies of Nanci and Berlin, was born at Paris of respectable parents A.D. 1687, and died there Nov. 12. 1770, aged 83.

Avec des mœurs dignes de l'age d'or,
Il fut un ami sur, un auteur agréable ;
Il mourut vieux comme Nestor,
Mais il fut moins bavard et beaucoup plus aimable.

Such was Moncrif. He possessed an elegant mind, an engaging person, an unceasing desire to please, and a gentle, equable, and obliging temper. The advantage of reading in a very superior and interesting manner, of singing tender airs, and of composing agreeable couplets, soon procured him a great number of friends, and many of these of the first rank. He asked permission to accompany a celebrated minister who was banished in 1757; but though such disinterested attachment was highly admired, he was only allowed to go every year to express his gratitude to him in his retreat. He was never ashamed of the poverty of his relations, but assisted them and brought them forward by his influence at court. He had been at first a fencing-master; and it is said that he foresaw he would be obliged to employ his sword in defence of his works. Most of them needed not this precaution. The principal are, 1. *Essai sur la necessitè et sur les moyens de plaire*, in 12mo. This production is written in a lively ingenious manner, is full of excellent maxims, and has gone through many editions. In the present age, a greater share of argument would be expected; but the chief merit of the work is, that, unlike the productions of many moralists, it contains nothing which the author himself did not reduce to practice. He had made it his study to contribute to the delight and amusement of those respectable societies into which he was admitted. 2. *Les Ames rivales*, an agreeable little romance, in which there occur several ingenious observations on French manners; the *Abderites*, a comedy of but ordinary merit; *Poesies diverses*, full of delicacy (his *Romances* and his *Rajeunissement inutile* are particularly distinguished for smooth versification, elegant reflections, and pleasing narration); and some dissertations which display considerable wit and information. These pieces are to be found in the miscellaneous works of the author, published at Paris 1743, in 12mo. 3. Some little pieces of one act; which make part of different operas, called the *Fragmens*, *Zelindor*, *Ismene Almasis*, the *Genies tutelaires*, and the *Sibylle*. He was devoted to lyric poetry, and cultivated it with success. In this species of writing we have from his pen the *Empire de l'Amour*, a ballet; the *Tropheé;* the *Ames reunis*, a ballet which was never acted; and *Erosine*, a heroic pastoral. 4. *L'Histoire des Chats*, a trifling performance, too severely censured at the time, and now almost wholly fallen into oblivion. This work gave the Comte d'Argenson an opportunity of being witty at the author's expence. When Voltaire retired into Prussia, Moncrif applied to the minister for the vacant place of historiographer: "*Historiographe!* (said the Comte d'Argenson), vous voulez sans doute dire historiogriphe." His works were collected, in 1761, into 4 vols, 12mo.

MONDA, or MUNDA (anc. geog.), a river of Lusitania, running midway 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. 15. N. Lat. 44. 23.

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 Monomotopa, and east of Congo and of the northern parts of Monomotopa. 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 tawny complexion, who traded with those islanders, and with the people of Monemugi.

This country of Monemugi affords also abundance of palm-wine and oil, and such great plenty of honey, that above half of it is lost, the blacks not being able to consume it. The air is generally very unwholesome, and excessively hot, which is the reason why no Christians undertake to travel in this empire. De Lisle gives the division of this country as follows: The Maracates, the Messeguaries, the kingdom of the Buengas, the kingdom of Masti, and that of Maravi. But we are not acquainted with any particulars relating to these nations or kingdoms.

MONETARIUS, or MONEYER, a name which antiquaries and medalists give to those who struck the ancient coins or monies.

Many of the old Roman, &c. coins have the name of the *monetarius*, either written at length or at least the initial letters of it. See MEDAL.

Money.

MONEY, a piece of matter, commonly metal, to which public authority has affixed a certain valne 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 Lacedemonians, 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 had 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 mintmaſter'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 ſcillings made their pound; and 400 of theſe pounds were a legacy, or a 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 *penining;* 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 bizantine 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 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 twentypence, 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 half-penny 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. and 8d. half-nobles called *half-pennies*, at 3s. and 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, an 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 L. 400,000 per annum, every pound being equal to that weight of silver, consequently the whole may be estimated at L. 1,200,000 of the present computation; a sum which, considering the different value of money between that period and the present, was equivalent to L. 12,000,000 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 L. 4 : 13 : 9, was worth about L. 50 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 rent 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 L. 3 in this reign was equivalent to L. 28 or L. 30 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

The commodities whose price has risen the most since before the time of Henry VII. are butchers meat, 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 grasing; which was more profitable, notwithstanding the low price of butchers meat. So that there was constant occasion for statutes to restrain grasing, 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 run for 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 Conqneror, who had a revenue nearly in value equal to L. 12,000,000 of our money (allowance being made for the standard of coin and the proportion it bore to 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, mar avedies, &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 3*l.* 4*s.* 7*d.* Sterling; 60 minæ made the talent, equal to 193*l.* 15*s.* Sterling: hence 100 talents amounted to 19,375*l.* 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 Eubæan 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 Eubæan 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 1*d.* $3\frac{1}{4}$*q.* Sterling. One thousand of these made the sestertium, equal to 8*l.* 1*s.* 5*d.* 2*q.* Sterling. One thousand of these sestertia made the decies sestertium (the adverb *centies* being always understood) equal to 8072*l.* 18*s.* 4*d.* Sterling. The decies sestertium they also called *decies centena millia nummum.* Centies sestertium, or centies HS, were equal to 80,729*l.* 3*s.* 4*d.* Millies HS to 807,291*l.* 13*s.* 4*d.* Millies centies HS to 888,020*l.* 16*s.* 8*d.*

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

matter,

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 realiſing 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 realiſed in the metals, or the whole operation fails in the moſt eſſential part. This realiſing 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 proportoin of both metals to the money-unit, realiſed 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 any how 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 adoped the expedient of mixing them with a determinate proportion of other metals, which hurts neither their fuſibility, malleability, beauty, or 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

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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 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.

1mo, 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.

2do, 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.

3tio, 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.

4to, The last inconvenience is, that by fixing the money of account entirely to the coin, without having any independent common measure, (to mark and control 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

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 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 realising 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, merchandise, 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

Money. 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 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 Interest 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. Money.

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.

1*mo*, 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 $14\frac{1}{2}$.

2*do*, Great part of the current money is worn and light.

3*tio*, 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.

4*to*, 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 penny-weights, and every penny-weight of 24 grains. The pound troy, therefore, consists of 240 penny-weights and 5760 grains.

The fineness of the silver is reckoned by the number of ounces and penny-weights 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 grins of fine silver, and 432 grains of copper, called *alloy*.

Thus standard silver is 11 ounces 2 penny-weights of fine silver in the pound troy to 18 penny-weights copper, or 111 parts fine silver to 9 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

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 5 *s.* 2 *d.* or 62 *d.* : whoever carries an ounce of ſtandard gold receives in gold coin 3*l.* 17*s.* 10½*d.* the one and the other making exactly an ounce of the ſame fineneſs with the bullion. Coin, therefore, can 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 as 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 21 s. is now worth 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 Eliſabeth, 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 ſome 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 15⅕ 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 3*l.* 17*s.* 10½*d.* 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 fells it for bullion, at fo many pence an ounce; the price of which bullion is, in the Englifh market, always above the price of filver at the mint, for the reafons now to be given.

When you fell ftandard-filver bullion at the mint, you are to be paid in weighty money; that is, you receive for your bullion the very fame weight in ftandard coin; the coinage coft nothing: but when you fell bullion in the market, you are paid in worn out filver, in gold, in bank-notes, in fhort, in every fpecies of lawful current money. Now all thefe payments have fome defect: the filver you are paid with is worn and light; the gold you are paid with is overrated, and perhaps alfo light; and the bank-notes muft have the fame value with the fpecie with which the bank pays them; that is, with light filver or overrated gold.

It is for thefe reafons, that filver bullion, which is bought by the mint at 5*s.* 2*d.* *per* ounce of heavy filver money, may be bought at market at 65 pence the ounce in light filver, over-rated gold, or bank-notes, which is the fame thing.

Further, we have feen how the impofition of coinage has the effect of raifing coin above the value of bullion, by adding a value to it which it had not as a metal.

Juft fo, when the unit is once affixed to certain determined quantities of both metals, if one of the metals fhould afterwards rife in value in the market, the coin made of that metal muft lofe a part of its value as coin, although it retains it as a metal. Confequently, as in the firft cafe it acquired an additional value by being coined, it muft now acquire an additional value by being melted down. From this we may conclude, that when the ftandard 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 fpecies which rifes in the market is melted down, and the bullion is fold for a price as much exceeding the mint price as the metal has rifen in its value.

If, therefore, in England, the price of filver bullion is found to be at 65 pence the ounce, while at the mint it is rated at 62; this proves that filver has rifen $\frac{3}{65}$ above the proportion obferved in the coin, and that all coin of ftandard weight may confequently be melted down with a profit of $\frac{3}{65}$. But as there are feveral other circumftances to be attended to which regulate and influence the price of bullion, we fhall here pafs them in review, the better to difcover the nature of this diforder in the Englifh coin, and the advantages which money-jobbers may draw from it.

The price of bullion, like that of every other merchandife, is regulated by the value of the money it is paid with.

If bullion, therefore, fells in England for 65 pence an ounce, paid in filver coin, it muft fell for 65 fhillings the pound troy; that is to fay, the fhillings it is commonly paid with do not exceed the weight of $\frac{1}{65}$ of a pound troy: for if the 65 fhillings with which the pound of bullion is paid weighed more than a pound troy, it would be a fhorter and better way for him who wants bullion to melt down the fhillings and make ufe of the metal, than to go to market with them in order to get lefs.

We may, therefore, be very certain, that no man will buy filver bullion at 65 pence an ounce, with any fhilling which weighs above $\frac{1}{65}$ of a pound troy.

We have gone upon the fuppofition that the ordinary price of bullion in the Englifh market is 65 pence *per* ounce. This has been done upon the authority of fome late writers on this fubject: it is now proper to point out the caufes which may make it deviate from that value.

I. It may vary, and certainly will vary, in the price, according as the currency is better or worfe. When the expences of a war, or a wrong balance of trade, have carried off a great many heavy guineas, it is natural that bullion fhould rife; becaufe then it will be paid for more commonly in light gold and filver; that is to fay, 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 occafion a fcarcity of the metals in the market, as well as a fcarcity of the coin; confequently, an advanced price muft be given for it in proportion to the greatnefs and height of the demand. In this cafe, both the fpecie and the bullion muft be bought with paper. But the rife in the price of bullion proceeds from the demand for the metals and the competition between merchants to procure them, and not becaufe the paper given as the price is at all of inferior value to the fpecie. The leaft difcredit of this kind would not tend to diminifh the value of the paper; it would annihilate it at once. Therefore, fince the metals muft be had, and that the paper cannot fupply the want of them when they are to be exported, the price rifes in proportion to the difficulties in finding metals elfewhere than in the Englifh market.

III. A fudden call for bullion, for the making of plate. A goldfmith can well afford to give 67 pence for an ounce of filver, that is to fay, he can afford to give one pound of gold for 14 pounds of filver, and perhaps for lefs, notwithftanding that what he gives be more than the ordinary proportion between the metals, becaufe he indemnifies himfelf amply by the price of his workmanfhip; juft as a tavern-keeper will pay any price for a fine fifh, becaufe, like the goldfmith, 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 raifing it. In countries where the metals in the coin are juftly proportioned, where all the currencies are of legal weight, and where coinage is impofed, the operations of trade make the price of bullion conftantly to fluctuate between the value of the coin and the mint-price of the metals.

Now let us fuppofe that the current price of filver 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 fhillings which are above $\frac{1}{65}$ of a pound troy, he throws into his melting pot, and fells them as bullion for 65d. per ounce; all thofe which are below that weight he carries to market, and buys bullion with them at 65d. per ounce.

What is the confequence of this?

That thofe who fell the bullion, finding the fhillings which the money-jobber pays with perhaps not above $\frac{1}{66}$ of

Money. $\frac{1}{65}$ of a pound troy, they on their side raise the price of their 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 above $\frac{1}{65}$. 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 have 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

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 in fact a pound Sterling has acquired a determinate 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 proportionally 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 every where. From this it follows, that all augmention 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 every where 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

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; nothwithstanding 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 every where be received in payment for a pound Sterling; although the pound Sterling should continue to consist of 3 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 penny-weight, 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. and 6d. and the half 7s. and 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 by regulating the footing of ſuch converſations 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 realiſed 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 of December 1749.

Were the ſtate, by any 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 augmment 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?

This 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 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 inconveniences than 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 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 repaid 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 every where. 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 well-being 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

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, will 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 upon 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 inconveniences 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 $\frac{1}{26}$ 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

raiſed in its denomination $\frac{1}{18}$, and all the gold coin muſt be lowered in its denomination $\frac{1}{18}$; 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 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 denominations 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.

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 fought for in the regulations of the mint of the country where it is coined, and is expreffed in the grains in ufe in that mint. From that weight it is converted into thofe 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 fuppofed to be equal weights; and the coins in the Table are converted according to thofe proportions.

Table of Coins, reduced to Grains of fine Metal, according to the Troy, Paris, Colonia, and Holland weights.	Gold Coins. Troy.	Gold Coins. Paris.	Gold Coins. Colonia.	Gold Coins. Holland.	Silver Coins. Troy.	Silver Coins. Paris.	Silver Coins. Colonia.	Silver Coins. Holland.
English Coins.								
1 A Guinea by ftatute	118.651	144.46	143.65	160.45				
2 A Crown by ftatute	—	—	—	—	429.68	523.2	520.2	581.
3 A Shilling by ftatute	—	—	—	—	85.935	104.65	104.	116.2
4 A Silver Pound Sterling by ftatute 1601	—	—	—	—	1718.7	2093.	2080.8	2324.1
5 A Gold Pound Sterling by ftatute 1728	113.	137.61	136.8	152.8				
6 A Silver Pound Sterling in currency $=\frac{20}{62}$ lb. Troy	—	—	—	—	1639.38	1996.4	1984.7	2216.
7 A Silver pound Sterl. at the proportion of gold to filver as 1 to $14\frac{1}{2}$	113.	137.61	136.8	152.8	1638.5	1995.3	1983.7	2215.7
8 A Gold Pound Sterling at the fame proportion of 1 to $14\frac{1}{2}$	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 filver	115.769	140.98	140.16	156.55	1678.6	2044.2	2032.2	2269.9
10 A Shilling current $=\frac{1}{62}$ of a pound Troy	—	—	—	—	81.961	99.8	99.	110.82
11 A Guinea in Silver, or 21 Shillings ftandard weight	—	—	—	—	1804.6	2197.6	2184.8	2440.3
12 A Guinea at the proportion of 1 to $14\frac{1}{2}$, worth in Silver	—	—	—	—	1720.4	2095.1	2082.8	2326.4
13 A Pound Troy, or 12 ounces Englifh 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 fix 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 filver	—	—	—	—	1639.7	1996.9	1985.2	2217.4
6 A Marc of Paris weight, fine gold or filver	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 Mark of filver coin effective weight, in fine	—	—	—	—	3402.3	4143.4	4119.2	4600.9
German Coins.								
1 A 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 filver, at the proportion of 1 to $14\frac{1}{2}$	—	—	—	—	1674.	2038.6	2026.8	2263.8
Dutch Coins.								
1 A 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 MONIES 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*.

EUROPE, Northern Parts.

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.

		£.	s.	d.
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.

		£.	s.	d.
†A Pening		0	0	$0\frac{9}{160}$
4 Peningens	= an Urche	0	0	$0\frac{9}{40}$
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	$6\frac{3}{10}$
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.

		£.	s.	d.
†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 Rix-dollar	0	4	$4\frac{1}{4}$

EUROPE, Northern Parts.

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

GERMANY.

HAMBURG. *Altena, Lubec, Bremen, &c.*

		£.	s.	d.
†A Tryling	=	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
[illegible] Marcs	a Rix-dollar	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. *Lunenburgh, Zell, &c.*

		£.	s.	d.
†A Fening	=	0	0	$0\frac{7}{48}$
3 Fenings	a Dreyer	0	0	$0\frac{7}{16}$
8 Fenings	a Marien	0	0	$1\frac{1}{6}$
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 Rix-dollar	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.

		£.	s.	d.
†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 Rix-dollar	0	3	6
32 Groshen	a Specie-dollar	0	4	8
4 Goulds	a Ducat	0	9	4

BRANDENBURGH AND POMERANIA.

Berlin, Potsdam, &c. Stetin, &c.

		£.	s.	d.
†A Denier	=	0	0	$0\frac{7}{270}$
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	$9\frac{1}{3}$

30 Groshen

EUROPE, Northern Parts. GERMANY.

BRANDENBURGH, &c.

			£.	s.	d.
30 Groshen		a Florin	0	1	2
90 Groshen		†a Rix-dollar	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.*

			£.	s.	d.
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	$8\frac{2}{5}$
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.

			£.	s.	d.
A Fening			0	0	$0\frac{7}{60}$
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 Rix-dollar	0	3	6
2 Goulds		a Hard Dollar	0	4	8
4 Goulds		a Ducat	0	9	4

AUSTRIA AND SWABIA.

Vienna, Tiest, &c. Ausburg, Blenheim, &c.

			£.	s.	d.
A Fening			0	0	$0\frac{7}{60}$
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	$1\frac{19}{30}$
4 Cruitzers		a Batzen	0	0	$1\frac{13}{15}$
15 Batzen		a Gould	0	2	4
90 Cruitzers		†a Rix-dollar	0	3	6
30 Batzen		a Specie-dollar	0	4	8
60 Batzen		a Ducat	0	9	4

FRANCONIA, *Francfort, Nuremburg, Dettingen, &c.*

			£.	s.	d.
A Fening			0	0	$0\frac{7}{60}$
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
60 Cruitzers		a Gould	0	2	4
90 Cruitzers		†a Rix-dollar	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.

			£.	s.	d.
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 Tinfe	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 Rix dollar	0	3	6
8 Florins		a Ducat	0	9	4
5 Rix-dollars		a Frederic d'Or	0	17	6

LIVONIA.

Riga, Revel, Narva, &c.

			£.	s.	d.
A Blacken			0	0	$0\frac{7}{90}$
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 Rix dollar	0	3	6
108 Groshen		an Albertus	0	4	$2\frac{6}{15}$
64 Whitens		a Copper-plate Dollar	0	5	0

DENMARK, ZEALAND, AND NORWAY.

Copenhagen, Sound, &c. *Bergen, Drontheim,* &c.

			£.	s.	d.
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 Rix-marc	0	0	$11\frac{1}{4}$
24 Skillings		a Rix ort	0	1	$1\frac{1}{2}$
4 Marcs		a Crown	0	3	0
6 Marcs		a Rix dollar	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.

			£.	s.	d.
† 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 Rix dollar	0	4	8
2 Rix dollars		a Ducat	0	9	4

RUSSIA AND MUSCOVY.

Petersburg, Archangel, &c. Muscow, &c.

			£.	s.	d.
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.

			£.	s.	d.
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 Fe-

EUROPE, Southern Parts.

SWITZERLAND.

BASIL, &c.

			£.	s.	d.
15 Fenings	=	a Coarfe 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 Rix dollar	0	4	6

St GALL. *Apenfal*, &c.

			£.	s.	d.
An 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	0 $\frac{1}{2}$
4 Cruitzers		a Coarfe 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 Rix-dollar	0	4	3

BERN. *Lucern*, *Neufchatel*, *&c.*

			£.	s.	d.
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.

			£.	s.	d.
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
10½ Florins		a Patacon -	0	3	11 $\frac{1}{4}$
15¾ Florins		a Croifade -	0	5	10 $\frac{7}{8}$
24 Florins		a Ducat -	0	9	0

FRANCE and NAVARRE.

Lifle, *Cambray*, *Valenciennes*, &c.

			£.	s.	d.
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
10½ Livres		a Ducat -	0	9	3
24 Livres		a Louis d'Or	1	0	0

Dunkirk, *St Omers*, *St Quintin*, &c.

			£.	s.	d.
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
25½ Livres		a Guinea -	1	1	0
32⅖ Livres		a Moeda -	1	7	0

Paris, *Lyons*, *Marfeilles*, *&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 Piftole -	0	8	4
24 Livres		a Louis d'Or	1	0	0

PORTUGAL. *Lifbon*, *Oporto*, *&c.*

			£.	s.	d.
† 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 Teftoon -	0	0	6 $\frac{3}{4}$
4 Teftoons		a Crufade of Ex.	0	2	3
24 Vintins		a New Crufade -	0	2	8 $\frac{2}{5}$
10 Teftoons		†a Milre - -	0	5	7 $\frac{1}{2}$
48 Teftoons		a Moeda - -	1	7	0
64 Teftoons		a Joanefe -	1	16	0

SPAIN and CATALONIA.

Madrid, *Cadiz*, *Seville*, *&c. New Plate.*

			£.	s.	d.
A Maravedie		- -	0	0	0 $\frac{43}{272}$
2 Maravedies	=	a Quartil -	0	0	0 $\frac{43}{136}$
34 Maravedies		a Rial -	0	0	5 $\frac{3}{8}$
2 Rials		a Piftarine	0	0	10 $\frac{3}{4}$
8 Rials		†a Piaftre 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 Piftole of Ex.	0	14	4
36 Rials		a Piftole -	0	16	9

Gibraltar, *Malaga*, *Denia*, *&c. Velon.*

			£.	s.	d.
† A Maravedie		- - -	0	0	0 $\frac{23}{272}$
2 Maravedies	=	a 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 Piaftre of Ex.	0	3	7
512 Maravedies		a Piaftre	0	3	7
60 Rials		†a Piftole of Ex.	0	14	4
2048 Maravedies		a Piftole of Ex.	0	16	9
78 Rials		a Piftole -	0	16	9

Barcelona, *Saragoffa*, *Valencia*, *&c. Old Plate.*

			£.	s.	d.
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 Piftole -	0	16	9

ITALY.

GENOA. *Novi*, &c. CORSICA. *Baftia*, &c.

			£.	s.	d.
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 Teftoon	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
7½ 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 $\frac{3}{20}$
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. *Gaieta, 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 $\frac{1}{30}$
6 Pichili	=	a Grain -	0	0	0 $\frac{2}{15}$
8 Pichili		a Ponti -	0	0	0 $\frac{8}{30}$
10 Grains		a Carlin -	0	0	1 $\frac{7}{15}$
20 Grains		a Tarin - -	0	0	3 $\frac{1}{15}$
6 Tarins		†a Florin of Ex.	0	1	6 $\frac{6}{15}$
13 Tarins		a Ducat of Ex.	0	3	4
60 Carlins		†an Ounce -	0	7	8 $\frac{4}{15}$
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 $\frac{1}{3}$
6½ 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	1 $\frac{4}{5}$
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 Caragroueh -	0	5	0
10 Solotas		a Xeriff -	0	10	0

ASIA.

ARABIA. *Medina, Mecca, Mocha, &c.*

A Carret		- - -	0	0	0 $\frac{1}{8}$
5¼ Carrets	=	a Caveer -	0	0	0 $\frac{125}{200}$
7 Carrets		a Comashee -	0	0	0 $\frac{9}{16}$
80 Carrets		a Larin -	0	0	10 $\frac{1}{8}$
18 Comashees		an Abyss -	0	1	4 $\frac{1}{3}$
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

5 Abashees

		£.	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.

GUZZURAT. *Surat, Cambay, &c.*

		£.	s.	d.
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.

		£.	s.	d.
†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.

		£.	s.	d.
†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.*

		£.	s.	d.
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.*

		£.	s.	d.
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

SIAM. *Pegu, Malacca, Cambodia, Sumatra, Java, Borneo, &c.*

		£.	s.	d.
A Cori		0	0	$0\frac{3}{40000}$
800 Cori =	a Fettee	0	0	$0\frac{3}{50}$
125 Fettees	a Sataleer	0	0	$7\frac{1}{2}$
250 Fettees	a Sooco	0	1	3
500 Fettees	a Tutal	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

ASIA.

CHINA. *Pekin, Canton, &c.*

		£.	s.	d.
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 Rix-dollar	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. *Jedda, Meaco, &c.*

		£.	s.	d.
A Piti		0	0	$0\frac{1}{5}$
20 Pitis =	a Mace	0	0	4
15 Maces	an Ounce Silver	0	4	$10\frac{1}{5}$
20 Maces	a Tale	0	6	8
30 Maces	an Ingot	0	9	$8\frac{2}{5}$
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.*

		£.	s.	d.
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.*

		£.	s.	d.
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
15 Doubles	a Pistole	0	16	9

MOROCCO. *Santa Cruz, Mequinez, Fez, Tangiers, Sallee, &c.*

		£.	s.	d.
A Fluce		0	0	$0\frac{1}{12}$
24 Fluces =	a Blanquil	0	0	2

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, Cayena, &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.

Ancient Money. See Coins and Medals.

Paper Money. See the article Bank.

Mongault.

MONGAULT (Nicholas Hubert), an ingenious and learned Frenchman, and one of the best writers of his time, was born at Paris in 1674. At 16 he entered into the congregation of the fathers of the oratory, and was afterwards sent to Mans to learn philosophy. That of Aristotle then obtained in the schools, and was the only one which was permitted to be taught: nevertheless Mongault, with some of that original spirit which usually distinguishes men of uncommon abilites from the vulgar, ventured in a public thesis which he read at the end of the course of lectures, to oppose the opinions of Aristotle, and to maintain those of Des Cartes. Having studied theology with the same success, he quitted the oratory in 1699; and soon after went to Thoulouse, and lived with Colbert archbishop of that place, who had procured him a priory in 1698. In 1710 the duke of Orleans, regent of the kingdom, committed to him the education of his son the duke of Chartres; which important office he discharged so well, that he acquired an universal esteem. In 1714, he had the abbey of Chartreuve given him, and that of Villeneuve in 1719. The duke of Chartres, becoming colonel-general of the French infantry, chose the Abbé Mongault to fill the place of secretary-general; made him also secretary of the province of Dauphiny; and, after the death of the regent his father, raised him to other considerable employments. All this while he was as assiduous as his engagements would permit in cultivating polite literature; and, in 1714, published at Paris, in 6 vols. 12mo, an edition of Tully's Letters to Atticus, with an excellent French translation, and judicious comment upon them. This work has been often reprinted, and is justly reckoned admirable; for, as Middleton has observed, in the preface to his Life of Cicero, the Abbé Mongault "did not content himself with retailing the remarks of other commentators, or out of the rubbish of their volumes with selecting the best, but entered upon his task with the spirit of a true critic, and by the force of his own genius has happily illustrated many passages which all the interpreters before him had given up as inexplicable." He published also a very good translation of Herodian from the Greek; the best edition of which is that of 1745, in 12mo. He died at Paris in 1746. He was a member of the French academy, and of the academy of inscriptions and belles lettres; and was fitted to do honour to any society.

Mongooz, Monk.

MONGOOZ, in zoology. See Lemur.

MONK anciently denoted, "a person who retired from

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 original 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 desarts 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 *solitaires*, *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.

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 Antony; 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 Antony 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 in a short time the whole east was filled with a lazy set of mortals, who, abandoning all human connections, 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 Jerom, 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 5th 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 Epicureans, whose views in life were confined to opulence, idleness, and pleasure. However, the Reformation had a manifest

influence

Monk. 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*, *grey*, &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 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 dextrously, 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 7000 l. *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, intitled, "Observations on Military and Political Affairs," a small folio.

Monkey, Monmouth

Monk-Fish. See SQUALUS.

Monks-Head, or *Wolf's bane*. See ACONITUM.

MONKEY, in zoology. See APE and SIMIA.

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.—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 is a populous and well built place, and carries on a con-

Monmouth
Monnoye.

considerable trade with Bristol by means of the Wye. It has a weekly market, and three fairs.

Monmouthshire, a county of England; anciently reekoned a part of Wales, but in Charles the Second's time taken into the Oxford circuit, and made an English county. It is bounded on the north by Herefordshire, on the east by Glocestershire, on the south by the river Severn, and on the west by the Welch 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 contains seven market-towns, 127 parishes, about 6494 houses, 38,900 inhabitants; but 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 Glocestershire, 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.

MONNOYE (Bernard de la), born at Dijon in 1641, was a man of fine parts and great learning. He was admirably formed for poetry; and used to win the first prizes instituted by the members of the French academy, till he discontinued to write for them (it is said) at the solicitation of the academy; a circumstance which, if true, would reflect higher honour on him than a thousand prizes. All his pieces are in a most exquisite taste; and he was no less skilful in Latin poetry than in the French. Menage and Bayle have both bestowed the highest encomiums on his Latin poetry. His Greek poems are likewise looked upon as very good; and so are his Italian, which are written with great spirit. But poetry was not La Monnoye's only province: to a perfect skill in poetry, he joined a very accurate and extensive knowledge of the languages. He had great skill in criticism; and no man applied himself with greater assiduity to the study of history, ancient and modern. He was perfectly acquainted with all the scarce books that had any thing curious in them; very well versed in the history of the learned; and what completes all, is the wonderful clearness with which he possessed these various kinds of knowledge. He wrote Remarks on the Menagiana; in the last edition of which, in 4 vols 12mo, printed in 1715, are ineluded several pieces of his poetry, and a curious dissertation on the famous book *De tribus Impostoribus*. His Dissertation on *Pomponius Lætus*, at least an extract of it, is inserted in the new edition of Baillet's *Jugemens des sçavans*, published in 1722, with a great number of remarks and corrections by La Monnoye. He also embellished the Anti-Baillet of Menage with a multitude of corrections and notes. It would employ several pages to enumerate the various services this ingenious and learned man did to the republic of letters; as well by enriching it with productions of his own, as by the assistance which he communicated very freely upon all occasions to the learned of his times. Thus, among others, he favoured Bayle with a great number of curious particulars for his Dictionary, and was highly applauded by him on that account. He died at Paris, October 15th 1728, in his 88th year. —Mr de Sallinger published at the Hague A Collection of Poems by La Monnoye, with his elogium, from whence many of the above particulars are taken. He also left behind him a Collection of Letters, mostly critical; several curious Dissertations; 300 Select Epigrams from Martial, and other poets ancient and modern, in French verse; several other works in prose and verse, in French, Latin, and Greek, all ready for the press.

Monnoyer
||
Monochord.

MONNOYER (John Baptist), "one of the greatest masters (according to Mr Walpole) that has appeared for painting flowers. They are not so exquisitely finished as Van Huysum's, but his colouring and composition are in a bolder style." He was born at Lisle in 1635; and educated at Antwerp as a painter of history, which he soon changed for flowers. Going to Paris in 1663, he was received into the academy with applause; and employed at Versailles, Trianon, Marly, and Meudon; and painted in the hotel de Bretonvilliers at Paris, and other houses. The duke of Montague brought him to England; where much of his hand is to be seen, at Montague-house, Hampton-court, the duke of St Alban's at Windsor, Kensington, Lord Carlisle's, Burlington-house, &c. But his most curious work is said to be a looking-glass at Kensington palace, which he adorned with flowers for Queen Mary, who held him in such high esteem, that she honoured him with her presence nearly the whole time he was busied in the performance.—Baptist passed and repassed several times between France and England; but having married his daughter to a French painter who was suffered to alter and touch upon his pictures, Baptist was offended and returned to France no more. He died in Pall-mall in 1699. —His son Antony, called *young Baptist*, painted in his father's manner, and had merit.

MONOCEROS, unicorn, in astronomy, a southern constellation formed by Hevelius, containing in his catalogue 19 stars, and in the Britannic Catalogue 31.

MONOCEROS, in zoology. See Monodon.

MONOCHORD; an instrument by which we are enabled to try the several proportions of musical sounds and intervals, as well in the natural as in tempered scales. Originally it had, as its name implies, only one string; but it is better constructed with two, as we have by means of this additional string an opportunity of judging of the harmony of two tempered notes in every possible variety of temperament (see Temperament and Tuning). It consists of a brass rule placed upon a sound-board, and accurately divided into different scales according to the purposes for which it is chiefly intended. Above this rule the strings are to be stretched over two fixed bridges, between which there is a moveable fret, so contrived as to divide at pleasure one of the strings into the same proportional parts as are engraved upon the scales beneath. The figure of the instrument, the manner of striking

Monochord. ſtriking the ſtrings ſo as to produce the ſound, as likewiſe the conſtruction of the moveable bridge, may be varied at pleaſure according to the wiſh and ingenuity of the artiſt: But with the aſſiſtance of ſuch an inſtrument accurately conſtructed, any perſon with a good ear may be enabled to tune a keyed inſtrument with ſufficient preciſion to anſwer every practical purpoſe.

The following table contains the chief ſcales that have hitherto been computed. In column 1ſt. is given the natural ſcale, or ſcale of perfect intervals. The ſecond column contains a new tempered ſcale, which ſeems better adapted than any other to keyed inſtruments, when chiefly deſigned for leſſon-playing, or playing without accompanyments. The third is a ſcale propoſed by Mr Emerſon in his Mechanics, and ſince recommended by Mr Jones in his Phyſiological Diſquiſitions, and by Mr Cavallo in the Philoſophical Tranſactions for 1788. The fourth and fifth exhibit the ſyſtems of mean tones, and of equal harmony, calculated by Dr Smith for inſtruments of a more perfect conſtruction than thoſe now in uſe.

Note.	Natural Scale.	Tempered Scale.	Emerſon, Jones, &c.	Mean Tones.	Equal harmony
C		1000			
C ※	937.5	952.9	943.8	957	959.3
D♭				934.5	933
D	888.9	893.3	890.9	894.4	895
D ※	833.3	837.5	840.8	856	858.6
E♭				836	835
E	800	798	793.7*	800	801
F♭				781	779
E ※				765.6	768.5
F	750	748.1	749.1	747.6	747.4
F ※	711.1	712.9	707.1	715.5	717
G♭				698.7	697.3
G	666.7	668.3	667.4	668.7	669
G ※	625	632	629.9	640	641.7
A♭				625	624
A	600	597	594.0	598	598.7
A ※	562.5	559.7	561.2	572.4	574.4
B♭				559	558.6
B	533.3	533.3	529.7*	535	536
C♭				522.4	521
B ※				512	514
C	500	500	500	500	500

N. B. Mr Jones propoſes to have the two numbers which are denoted by ſtars reſpectively altered to the numbers 796 and 531.

The method of tuning any inſtrument by means of the monochord is as follows: Firſt, you muſt tune the C of the monochord to the concert pitch by means of a tuning-fork; next, you are to put the middle C of your inſtrument in perfect uniſon with the C of the monochord: Then move the ſliding fret to the next diviſion on the ſcale, and proceed in the ſame manner with all the ſeveral notes and half notes within the compaſs of an octave. When this is done with accuracy, the other keys are all to be tuned, by comparing them with the octave which is already tempered. [The monochord is here ſuppoſed to be made to the pitch of C; but this may be varied at the will of the conſtructor.]

The curious reader who may wiſh for further information reſpecting the conſtruction and uſe of monochords, will be highly gratified in peruſing the appendix of Mr Atwood's Treatiſe on Rectilinear Motion, and Mr Jones's ingenious and entertaining 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, in zoology; the name of a genus of inſects of the order of *aptera*, in the Linnæan ſyſtem. Its body is ſhort, of a roundiſh figure, and covered with a firm cruſtaceous ſkin; the fore-legs are ramoſe, and ſerve for leaping and ſwimming; it has but one eye, which is large, and compoſed of three ſmaller ones.

Of this genus, many of which have been reckoned among the microſcopic animals, authors enumerate a great number of ſpecies. The figure in Plate CCCXV. repreſents the quadricornis, or four-horned monoculus, a very ſmall ſpecies about half a line in length, and of an aſhen grey colour. From the head ariſe four antennæ, two forwards and two backwards; all four furniſhed with a few hairs, which give them the figure of a branch. Between the antennæ, on the fore part of the head, is ſituated a ſingle eye. From the head to the tail the body goes down, decreaſing in ſhape like a pear; and is compoſed of ſeven or eight rings, which grow continually more ſtraitened. The tail is long, divided into two; each diviſion giving riſe outwardly to three or four briſtly hairs. The animal carries its eggs on the two ſides of its tail in the form of two yellowiſh parcels filled with ſmall grains, and which taken together, nearly equal the inſect in bigneſs. This minute inſect is found in ſtanding pools. A number of them being kept in a bottle of water, ſome will be ſeen loaded with their eggs, and after a while depoſiting the two parcels, either jointly or ſeparately.

The name *monoculus* has been given to this genus, as conſiſting of individuals which apparently have but one eye: and from the manner in which they proceed forward in the water by leaping, they have alſo been called *water-fleas*. The branching antennæ ſerve them inſtead of oars, the legs being ſeldom uſed for ſwimming. "The tail, forked in ſome ſpecies, in others ſimple, ſerves them for a rudder. Their colour varies from white to green, and to red, more or leſs deep, doubtleſs in a ratio to the fragments of the vegetables on which they feed. The red tincture they ſometimes give to the water, has made ſome ignorant men think that the water had turned to blood. Too weak to be carnivorous, they on the contrary fall a prey to other aquatic inſects, even to polypi. Their body, compact and hard, is ſo tranſparent that in ſome the eggs with which the abdomen is filled are diſcernible. The water-parrot and the ſhell-monoculus, are remarkable. This latter is provided with a bivalvular ſhell, within which he ſhuts himſelf

Barbut's Genera of Inſects, p. 360.

himſelf up, if drawn out of the water. The ſhell opens underneath, the inſect puts forth its antennæ, by means of which it ſwims very expeditiouſly in various directions, ſeeking a ſolid body to adhere to, and then it is it uſes its feet in walking, by ſtretching them out through the aperture of its ſhell.

"I preſerved a pair of theſe inſects (ſays our author), laſt year, in a ſmall glaſs tumbler, the one male the other female, having a bag filled with eggs affixed on each ſide the abdomen. In the ſpace of 14 days the increaſe was aſtoniſhing: it would have been impoſſible to have taken a ſingle drop of water out of the glaſs without taking with it either the larva or a young monoculus. I again repeated the experiment by ſelecting another pair; and at the expiration of the laſt 14 days my ſurpriſe was increaſed beyond meaſure. The contents of the glaſs appeared a maſs of quick-moving, animated matter; and being diverſified by colours of red, green, aſh-colour, white, &c. afforded, with the aſſiſtance of the magnifier, conſiderable entertainment."

MONODON, in ichthyology, a genus of fiſhes belonging to the order of *cete;* the characters of which are: There are too very long, ſtraight, and ſpirally twiſted teeth, which ſtick out from the upper jaw; and the ſpiracle, or breathing hole, is ſituated on the anterior part of the ſkull. There is but one ſpecies, the monoceros, or horned narwhal, which ſometimes grows to 25 feet in length, excluſive of the horn; but the uſual ſize is from 16 to 20. It is particularly noted for its horn or horns, as they are called; but which are real teeth. Of theſe there are always two in young animals; though the old ones have generally but one, ſometimes none. From the circumſtance of only one tooth being uſually found, the animal has acquired the name of *Unicorn Fiſh*, or *Sea Unicorn.* They inhabit the northern ſeas, from Norway to within the arctic circle: they are plentiful in Davis's ſtraits and the north of Greenland; where the natives, for want of wood, make rafters of the teeth. From the tooth or horn may be diſtilled a very ſtrong *ſal volatile:* the ſcrapings are eſteemed *alexipharmic*, and were uſed of old in malignant fevers and againſt the bites of ſerpents. The uſe of it to the animal ſeems to be chiefly as a weapon of offence, and a very powerful one it appears to be: there are many inſtances of its having been found in the bottoms of ſhips which returned from the northern ſeas, probably owing to the animal's having miſtaken the ſhip for a whale, and attacked it with ſuch fury as not to be able to get out the weapon from the wood. It may alſo ſerve as an inſtrument to looſen and diſengage from the rocks or bottom of the ſea the ſea plants on which it feeds. Theſe fiſhes ſwim ſwiftly, and can only be ſtruck when numbers happen to be found together, and obſtruct their own courſe with their teeth. Their ſkin is white, with black ſpots on the back, and has a great quantity of blubber underneath.

Plate CCCXV.

The tooth of this animal was in old times impoſed upon the world as the horn of an unicorn, and ſold at a very high price. The heirs of the chancellor to Chriſtian Friſius of Denmark, valued one at 8000 imperials. There is a magnificent throne made of this ſpecies of ivory for the Daniſh monarchs, which is ſtill preſerved in the caſtle at Roſenberg. The price of this material was ſuperior to gold.

MONODY, in ancient poetry, a mournful kind of ſong, ſung by a perſon all alone, to give vent to his grief. The word is derived from μονος "alone," and κιϱω "I ſing."

MONOECIA, from μονος *alone*, and οικια 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 (anc. geog.), a mart-town of the Hither India, ſituated on the Sinus Canthi, into which the Indus empties itſelf. Said to be Mangajor 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, or female organ.

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 Monoemugi. 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 hence. There are many gold-mines, and the rivers that run through their veins carry a great deal of gold-duſt along with them. 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 nature 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

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 patriarchs 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 intreaties 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 licence 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 Elisabeth; 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 statute; and, in general, by statute 2 & 3 Edward VI. c. 15. with the forfeiture of L. 10 or 20 days imprisonment, with an allowance of only bread and water for the first offence; L. 20 or the pillory for the second; and L. 40 for the third, or else the pillory, loss of one year, 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 are delivered in one unvaried tone. See READING.

MONOTROPA, BIRD'S-NEST: A genus of the monogynia order, belonging to the monandria class of plants; and in the natural method ranking with those of which the order is doubtful. There is no calyx, but 10 petals; and of these the five exterior have a melliferous hollow at the base. The capsule is quinquevalved. In some of the flowers a fifth part of the number is excluded as in the *M. hippopithys*. There are two species; of which the only remarkable one is the hippopithys, a native of Britain and some of the more northerly kingdoms of Europe. It is about five inches high, having no other leaves than oval scales, and terminated with a nodding spike of flowers, which in the seeding state becomes erect: the whole plant is of a pale yellow colour, smelling like the primrose, or like beans in blossom. The country people in Sweden give the dried plant to cattle that have a cough.

MONREAL. See MONTREAL.

MONRO (Dr Alexander, senior), a most eminent physician and anatomist, was descended by his father from the family of Monro of Milton, which had large possessions in the county of Ross; and by his mother, from that of Forbes of Culloden.

His father John, youngest son of Sir Alexander Monro of Bearcrofts, was bred to physic and surgery, and

Monro. and ferved for fome years as a furgeon in the army under King William in Flanders: but, for feveral fucceffive years, obtaining leave of abfence from the army in the winter, he during that feafon refided with his wife in London, where his fon Alexander was born in the 1697. About three years thereafter, he quitted the army, and went to fettle as a furgeon at Edinburgh; where his knowledge in his profeffion, and engaging manners, foon introduced him into an extenfive practice.

The fon fhowed an early inclination to the ftudy of phyfic; and the father, after giving him the beft education that Edinburgh then afforded, fent him fucceffively to London, Paris, and Leyden, to improve himfelf further in his profeffion. At London, he attended the lectures of Meffrs Hawkfbee and Whifton on experimental philofophy, and the anatomical demonftrations of Mr Chefelden. At Paris, he attended the hofpitals, and the lectures which were read on the different branches of phyfic and furgery at that time. Towards the end of autumn 1718, he went to Leyden, and ftudied under the great Boerhaave; by whom he was particularly efteemed.

On his return to Edinburgh in autumn 1719, Meffrs Drummond and Macgill, who were then conjunct nominal profeffors and demonftrators of anatomy to the furgeons company, having refigned in his favour, his father prevailed on him to read fome public lectures on anatomy, and to illuftrate them by fhowing the curious anatomical preparations which he had made and fent home when abroad. He at the fame time perfuaded Dr Alfton, then a young man, to give fome public lectures on botany. Accordingly, in the beginning of the winter 1720, thefe two young profeffors began to give regular courfes of lectures, the one on the materia medica and botany, the other on anatomy and furgery; which were the firft regular courfes 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 fchool which has fince acquired fuch great reputation all over Europe.

In fummer 1721 and 1722, Dr Monro, by the perfuafion of his father, read fome lectures on chirugical fubjects; particularly on wounds and tumors, which he never would publifh, having wrote them in a hurry and before he had much experience; but inferted from time to time the improvements he thought might be made in furgery, in the volumes of Medical Effays and Obfervations to be hereafter mentioned.

About the year 1720, his father communicated to the phyficians and furgeons at Edinburgh, a plan, which he had long formed in his own mind, of having the different branches of phyfic and furgery regularly taught at Edinburgh; which was highly approved of by them, and by their intereft regular profefforfhips of anatomy and medicine were inftituted in the univerfity. His fon, Dr Monro, was firft made univerfity-profeffor of anatomy; and two or three years afterwards, Drs Sinclair, Rutherford, Innes, and Plummer, were made profeffors of medicine; the profefforfhip of materia medica and botany, which Dr Alfton then held, having been added to the univerfity many years before. Immediately after thefe gentlemen were elected profeffors, they began to deliver regular courfes of lectures on the different branches of medicine, and they and their fucceffors have uniformly continued fo to do every winter.

The plan for a medical education at Edinburgh was ftill incomplete without an hofpital, where ftudents could fee the practice of phyfic and furgery, as well as hear the lectures of the profeffors. A fcheme was therefore propofed by Dr Monro's father, and others, particularly the members of the royal college of phyficians and board of furgeons, for raifing by fubfcription a fund for building and fupporting an hofpital for the reception of difeafed poor; and our author publifhed a pamphlet fetting forth the advantages that would attend fuch an inftitution. In a fhort time a confiderable fum of money was raifed, a fmall houfe was fitted up, and patients were admitted into it, and regularly attended by many of the phyficians and furgeons in town. The fund for this charity increafing very confiderably, in a great meafure from the activity and influence of that very worthy citizen and magiftrate George Drummond, Efq; the foundation was laid of the prefent large, commodious, and ufeful hofpital, the *Royal Infirmary;* in the planning of which Dr Monro fuggefted many ufeful hints, and in particular the elegant room for chirurgical operations was defigned and executed under his direction. Provoft Drummond and he were nominated the building committee; and the fabric was entirely completed in a fhort fpace of time. It has fince been fo largely endowed, as to be capable of receiving a great number of difeafed poor, whofe cafes the ftudents of phyfic and furgery have an opportunity of feeing daily treated with the greateft attention and care by phyficians and furgeons eminent in their profeffion; and a regifter of the particulars of all the cafes which have been received into the houfe fince its firft opening has been kept, in books appropriated for that purpofe, for the ufe of the ftudents.

In order to make the hofpital of ftill further ufe to the ftudents, Dr Monro frequently, while he continued profeffor of anatomy, gave lectures on the chirurgical cafes; and the late judicious phyfician, Dr Rutherford profeffor of the practice of phyfic, began, in the year 1748, to deliver clinical lectures, to be continued every winter, on the moft remarkable cafes in the hofpital.

Doctor Monro, though he was elected profeffor of anatomy in the year 1721, was not received into the univerfity 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 ftricteft friendfhip. From this time he regularly every winter gave a courfe of lectures on anatomy and furgery, from October to May, upon a moft judicious and comprehenfive plan: A tafk in which he perfevered with the greateft affiduity, and without the leaft interruption, for near 40 years; and fo great was the reputation he had acquired, that ftudents flocked to him from the moft diftant corners of his majefty's dominions.

In 1759, our profeffor entirely relinquifhed the bufinefs of the anatomical theatre to his fon Dr Alexander, who had returned from abroad, and had affifted him in the courfe of lectures the preceding year. But after this refignation, he ftill 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 possibly 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.

Few men were members of more societies than Dr Monro; still fewer equally assiduous in their attendance of those which in any way tended to promote public utility. He was a manager of many public charities; and not only a member of different medical societies, but likewise of several others instituted for promoting literature, arts, sciences, and manufactures, in Scotland, and was one of their most useful members.—While he was held in high estimation at home, he was equally esteemed and respected abroad, and was elected member of the Royal Society of London, and an honorary member of the Royal Academy of Surgery at Paris.

He 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 10th 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 every where 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 tranfmit 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.

nault. 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 has been lately taken by the armies of the French Republic. E. Long. 3. 39. N. Lat. 50. 25.

Mons *Sacer*, (anc. geog.), 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*.

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.

MONSON (Sir William), a brave English admiral, third son of Sir John Monson of South Carlton in Lincolnshire, was born in 1569. He was employed in many expeditions against the Spaniards in Queen Elizabeth's time, and was highly honoured; the queen knighted him for his services in the earl of Essex's expedition to Cadiz, where he assisted much by his wise and moderate counsel to the earl. Military men were no favourites with James I. therefore, on the death of the queen, he received no recompence or pay beyond the ordinary service in which he was engaged: nevertheless, as admiral of the narrow seas, he supported the honour of the British flag against the infant insolence of the Dutch states, of which he frequently complains in his Navy Tracts; and protected our trade against the encroachments of France. He had the misfortune to fall into disgrace by his vigilance, and was imprisoned in the Tower through the resentment of some powerful courtiers; yet he was discharged, and wrote a vindication of his own conduct, intituled, "Concerning the insolencies of the Dutch, and a Justification of Sir William Monson." He spent his latter days in peace and privacy, which he employed in digesting his Navy Tracts, and died in 1643.—Part of these tracts were printed in 1682; and they were afterwards all included in Churchill's Collection of Voyages.

MONSONIA, in botany: A genus of the dodecandria order, belonging to the polyadelphia class of plants. The calyx is pentaphyllous; the corolla pentapetalous and irregular; the stamina are 15 in number, and coalited into five filaments; the style bifid; the capsule pentacoccous.

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 near 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 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 Wind.

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 relics 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, & 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.

F. Malebranche accounts for the production of monsters in the animal world in the following manner:

ner: "The Creator has established such a communication between the several parts of his creation, that we are not only naturally led to imitate one another, *i. e.* have a disposition to do the same things and assume the same manners with those with whom we converse; but also have certain natural dispositions which incline us to compassion as well as imitation. These things most men feel, and are sensible of; and therefore need not be proved. The animal spirits, then, are not only naturally carried into the respective parts of the body to perform the same actions and the same motions which we see others do, but also to receive in some manner their wounds, and take part in their sufferings.

"Experience tells us, that when we look attentively on any person severely beaten, or that hath a large wound, ulcer, or the like, the spirits immediately flow into those parts of our body which answer to those we see suffer in the other; unless their course be stopped from some other principle. This flux of spirits is very sensible in persons of a delicate constitution, who frequently shudder, and find a kind of trembling in the body on these occasions; and this sympathy in bodies produces compassion in the mind.

"Now it must be observed, that the view of a wound, &c. wounds the person who views it the more strongly and sensibly, as the person is more weak and delicate; the spirits making a stronger impression on the fibres of a delicate body than in those of a robust one. Thus strong, vigorous men, &c. see an execution without much concern, while women, &c. are struck with pity and horror. As to children still in their mother's womb, the fibres of their flesh being incomparably finer than those in women, the course of the animal spirits must necessarily produce much greater alterations.

"These things being laid down, monsters are easily accounted for. Suppose, *v. gr.* a child born a fool, and with all its legs and arms broke in the same manner as those of criminals in some countries are; which case we choose to instance in, because we are told from Paris that such a monster was actually born there, and lived in one of their hospitals 20 years: the cause of this accident, according to the principles laid down, was, that the mother seeing a criminal executed, every stroke given to the poor man, struck forcibly the imagination of the woman; and, by a kind of counterstroke, the tender and delicate brain of the child.—Now, though the fibres of the woman's brain were strangely shaken by the violent flux of animal-spirits on this occasion, yet they had strength and consistence enough to prevent an entire disorder; whereas the fibres of the child's brain being unable to bear the shock of those spirits, were quite ruined, and the ravage was great enough to deprive him of reason all his lifetime.

"Again, the view of the execution frighting the woman, the violent course of the animal spirits was directed forcibly from the brain to all those parts of the body corresponding to the suffering parts of the criminal; and the same thing must happen in the child. But in regard the bones of the mother were strong enough to resist the impulse of those spirits, they were not damaged: and yet the rapid course of these spirits could easily overpower and break the tender and delicate fibres of the bones of the child; the bones being the last parts of the body that are formed, and having a very slender consistence while the child is yet in the womb."

To which it may be here added, that had the mother determined the course of these spirits towards some other part of her body, by tickling or scratching herself vehemently, the child would not in all probability have had its bones broken; but the part answering that to which the motion of the spirits was determined, would have been the sufferer. Hence appears the reason why women in the time of gestation, seeing persons, &c. marked in such a manner in the face, impress the same mark on the same parts of the child: and why, upon rubbing some hidden part of the body when startled at the sight of any thing or agitated with any extraordinary passion, the mark or impression is fixed on that hidden part rather than on the face of the child. From the principles here laid down, may most, if not all, the phenomena of monsters be easily accounted for.

Various other theories have been formed by different philosophers and physiologists. But after all, it must be confessed, that we seem as yet to be very little acquainted with Nature in her sports and errors. For each organised being there appears to exist a primitive germ or model of the different species drawn by the Creator, determined by forms and sexes, and realised 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 we call *monsters*.

With respect to structure, we have already remarked, that 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.

Monſter.

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 Sciences 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 thoſe 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 or 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 fourfold. 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.

Everhard Hume, Eſq; F. R. S. ſome time ago preſented to John Hunter, Eſq; F. R. S. 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 Tumlock, 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*.

Monster. ternal. 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 who 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 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 part 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 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.

Monster.

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 are only accidental and passing. 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. All the parts of plants are subject to some of these monstruosities, which vary with respect to their situation, figure, proportion, and number. Some trees are naturally of so great a size, that they may be considered as a kind of whale species in the vegetable kingdom: of this kind are the baobab and the ceiba. Others, as the oak, the yew, the willow, the lime, and many others, sometimes, though rarely, attain so extraordinary a bulk that they are likewise monsters among the vegetables. It is conjectured, in short, that monsters are more common in the vegetable than in the animal kingdom, because in the latter the methods of propagation are not so numerous. Plants are seldom monstrous in all their parts: some are monstrous only through excess in the calyx and corolla; others are so through defect only in the leaves, stamina, and fruit. Now, a monstruosity, says M. Adanson, has never changed the name or affected the immutability of a species. Every skilful succeeding botanist has arranged these monstruosities in plants among accidental circumstances, which, in whatever manner they are

Mont-alban are propagated, have always a tendency to revert to the order and regularity of their original species when they are multiplied by means of seed; which method of reproduction is the most natural and the most certain for determining the species. One species may be compared with another; but a monster can only be put in comparison with an individual of the species from which it comes. The reader may consult the *Observations Botaniques* of M. Schlotterbec, of the Society of Basil, concerning monsters in plants, wherein he pretends to demonstrate, that in their production nature follows the same course in the vegetable as in the animal kingdom.

MONT-ALBAN, a strong town of Spain, in the kingdom of Arragon, with a strong citadel; seated on the river Riomartin, 44 miles south of Saragossa, and 92 north by west of Valencia. W. Long. 0. 30. N. Lat. 41. 9.

Mont-Didier, an ancient town of France in Picardy, where the kings of France formerly had a palace and kept their court. It is seated on a mountain, 17 miles from Amiens and Compeigne, and 58 north of Paris. W. Long. 2. 34. N. Lat. 49. 39.

Mont-Lheri, a town of the isle of France, 15 miles from Paris. Here are the remains of a tower, which may be seen at a great distance. E. Long. 2. 0. N. Lat. 48. 38.

Mont-Louis, a small but strong town of France, in the Pyrenees, with a strong citadel; seated on an eminence, 430 miles south of Paris. E. Long. 2. 5. N. Lat. 42. 30.

Mont-Luel, a town of France in Bresse, and capital of the territory of Valbonne; seated in a fertile pleasant country on the river Seraine, eight miles from Lyons, and 205 south-east of Paris. E. Long. 5. 8. N. Lat. 45. 49.

Mont-Luzon, a town of France in Bourbonnois; seated on the river Cher, 35 miles south-west of Moulins, and 150 south of Paris. E. Long. 2. 45. N. Lat. 46. 22.

Mont-Blanc. See *Mont-Blanc*.

MONTABOUR, a small fortified town of Germany, in the electorate of Treves, between Coblentz and Limpurg. E. Lon. 7. 50. N. Lat. 50. 30.

MONTAGNIAC, a considerable town of Asia, in Natolia, and in the province of Bec-Sangel, on the sea of Marmora. It carries on a great trade, especially in fruits, and is seated on a bay of the same name. 12 miles from Bursa, and 60 south-east of Constantinople. E. Long. 29. 40. N. Lat. 40. 20.

Montague. MONTAGUE (Edward), earl of Sandwich, an illustrious Englishman, who shone from the age of 19, and united the qualifications of general, admiral, and statesman; yet there were strange inconsistencies in his character. He acted early against Charles I; he persuaded Cromwell, whom it is said he admired, to take the crown; and he was zealous for the restoration of Charles II. All this is imputed to a fond and unaccountable passion which he had for royalty. Upon general Monk's coming into England, he sailed with the fleet to Holland, and soon after he had the honour to convoy his majesty to England. For this he was created knight of the garter; and on the 12th of July 1660 he was created baron Montague of St Neot's in the county of Huntingdon, Viscount Hinchinbrooke in the same county, and earl of Sandwich in Kent, sworn one of his majesty's most honourable privy-council, made master of the king's wardrobe, admiral of the Narrow Seas, and lieutenant-admiral to the duke of York, as lord high admiral of England.

When the Dutch war broke out in 1694, and the duke of York took upon himself the command of a fleet as high-admiral, his lordship commanded the blue squadron, and by his industry and care abundance of the enemies ships were taken; and in the great battle fought on the third of June 1665, in which the Dutch lost admiral Opdam, and had 18 men of war taken and 14 destroyed, a large share of the honour of the victory was justly given to the conduct of the earl of Sandwich. On the return of the English navy, the command of the whole fleet was given to the earl of Sandwich, which he was ordered to put as speedily as possible in a condition to return to the coast of Holland. Accordingly the earl sailed on the 5th of July with 60 men of war to the Dutch coast; when finding that their East India and Smyrna fleets were to return home north about, he steered for the coast of Norway, and found they had taken shelter in the port of Bergen, where the fleet were attacked: but leaving them there, and sailing back towards the coast of Holland, he met with four Dutch East Indiamen, with several other merchant ships, under a good convoy, and took eight men of war, two of their East India ships, and 20 sail of merchant men; and a few days after, a part of the fleet falling in with 18 of the Hollanders, the greatest part of them were also taken, with four Dutch men of war, and above 1000 prisoners. On his return he was received by the king with distinguished marks of favour; and soon after, he was sent ambassador extraordinary to the court of Madrid, to mediate a peace between the crowns of Spain and Portugal; when he had the happiness to conclude a peace between the two nations to their mutual satisfaction.

On the breaking out of the last Dutch war, his lordship went to sea with the duke of York, and commanded the blue squadron; the French admiral, count d'Estrees, commanding the white. The fleet was at sea in the beginning of the month of May; and coming to an anchor in Southwold-bay in order to take in water, we are told, that on the 27th many officers and seamen were permitted to go on shore, and were at Southwold, Dunwich, and Aldborough; when, the weather being hazy, the earl gave it as his opinion, that, the wind standing as it did, the fleet rode in danger of being surprised by the Dutch; and indeed, between two and three the next morning, they were informed of their approach, upon which his royal highness made the signal for weighing anchor. The blue squadron was out first, the red next, and the white was much astern. The earl of Sandwich in the Royal James, which carried 100 guns, began the fight, and fell furiously on the squadron of Van Ghent in order to give the rest of his fleet time to form; when captain Brakel, in the Great Holland, attacked the Royal James; but was soon disabled, as were several other men of war, and three fire-ships sunk. By this time most of his men were killed; and the hull of the Royal James was so pierced with shot, that it was impossible to carry her off. In this distress he might have been

Montague. been relieved by his vice-admiral Sir Joſeph Jordan, had not that gentleman been more ſolicitous about aſſiſting the duke. When therefore he ſaw him ſail by, heedleſs of the condition in which he lay, he ſaid to thoſe who were about him, "There is nothing left for us now, but to defend the ſhip to the laſt man." Being at length grappled by a fourth fire-ſhip, he begged his captain Sir Richard Haddock, and all his ſervants, to get into the boat and ſave themſelves, which they did: yet ſome of the ſailors refuſed to quit the admiral, and ſtaying endeavoured to extinguiſh the fire, but in vain; the ſhip blew up about noon. His lordſhip's body was found about a fortnight after, and was interred with great ſtate in Henry VII.'s chapel.—We have of his lordſhip's writing, 1. The Art of Metals, in which is declared the manner of their generation, tranſlated from the Spaniſh of Albaro Alonzo Barba. 8vo. 2. Several letters during his embaſſy to Spain, publiſhed with Arlington's letters. 3. A letter to ſecretary Thurloe. 4. Original letters and negociations of Sir Richard Fanſhaw, the earl of Sandwich, the earl of Sunderland, and Sir William Godolphin, wherein divers matters between the three crowns of England, Spain, and Portugal, from the year 1663 to 1678, are ſet in a clear light, 2 vols 8vo.

Montague (Charles), earl of Halifax, fourth ſon of George Montague of Harton in Northamptonſhire, Eſq; ſon of Henry the firſt earl of Mancheſter, was born in 1661. He was educated at Weſtminſter-ſchool and Cambridge, ſhowed very early a moſt pregnant genius, and quickly made great progreſs in learning. In 1684, he wrote a poem on the death of King Charles II. in which he diſplayed his genius to ſuch advantage, that he was invited to London by the earl of Dorſet: and upon his coming thither he ſoon increaſed his fame, particularly by a piece which he wrote in conjunction with Prior, publiſhed at London in 1687, under the title of, "The Hind and the Panther tranſverſed to the Story of the Country-mouſe and the City-mouſe." Upon the abdication of King James II. he was choſen one of the members of the convention, and recommended by the earl of Dorſet to King William, who immediately allowed him a penſion of 500 l. *per annum*. Having given proofs of his great abilities in the houſe of commons, he was made one of the commiſſioners of the treaſury, and ſoon after chancellor of the exchequer: in which poſt he brought about that great work of recoining all the current money of the nation. In 1698, he was appointed firſt commiſſioner of the treaſury; and in 1699 was created a peer of England, by the title of *Baron Halifax* in the county of York. In 1701, the houſe of commons impeached him of ſix articles, which were diſmiſſed by the houſe of Lords. He was attacked again by the houſe of commons in 1702, but without ſucceſs. In 1705, he wrote, An Anſwer to Mr Bromley's Speech in relation to the occaſional Conformity-bill. In 1706, he was one of the commiſſioners for the Union with Scotland; and upon paſſing the bill for the naturalization of the illuſtrious houſe of Hanover, and for the better ſecurity of the ſucceſſion of the crown in the Proteſtant line, he was made choice of to carry that act to Hanover. Upon the death of Queen Anne, when the king had taken poſſeſſion of his throne, his lordſhip was appointed firſt commiſſioner of the treaſury, and created earl of Halifax and knight of the garter. He died in 1715. His lordſhip wrote ſeveral other pieces beſides thoſe above-mentioned; all which, with ſome of his ſpeeches, were publiſhed together in 1716 in an octavo volume. Montague.

Montague (Lady Mary Wortley) accompanied her huſband who was ſent on an embaſſy to Conſtantinople in the beginning of this 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 no where 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 vagabondiſing 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,

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.

MONTANINI (Pietro), called *Petruccio Perugino*, an eminent landscape painter, was born at Perugia in 1619. At first he was instructed by his uncle Pietro Barsotti; but was afterwards placed as a disciple with Ciro Ferri. Yet he did not long adhere to the manner of either of those masters, choosing preferably to study under Salvator Rosa; and he imitated the style of that celebrated painter with exceeding great success. The taste of his landscapes was generally admired; the rocks, situations, torrents, and abrupt precipices, were designed with spirit, and in a grand style; and his figures recommended themselves to the eye by a very uncommon correctness, propriety, and elegance. He died in 1689.

MONTANISTS, Christian heretics, who sprung 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

other of Æschines. The latter are charged with following the heterodoxy of Praxeas and Sabellius concerning the Trinity.

MONTANUS (Benedict Arias), a most learned Spanish theologian, born in the dioeese of Badajox, about the year 1528. He assisted at the council of Trent with great reputation; and his merit and writings recommended him to Philip II. of Spain, who employed him in publishing a new polyglot bible after the Complutensian edition, which was printed by the care of Cardinal Ximenes. This bible was printed at Antwerp, whither Montanus went in 1571; and on his return to Spain he refused the bishopric which Philip offered him for his reward, but spent the rest of his days at Sevilla, where he died about the year 1598. Montanus had not only vast erudition, but great good sense; he loved solitude, was very laborious, never drank wine, and seldom ate flesh.

MONTARGIS, a considerable town of France, in the Orleannois, and capital of the Gatinois; seated on the river Loir, near a handsome forest, 15 miles south of Nemours, and 62 south of Paris. E. Long. 2. 36. N. Lat. 48. 1.

MONTAUBAN, a considerable town of France, in Guienne, and territory of Quercy, with a bishop's see, and an academy. The fortifications were demolished in 1629, because it took the part of the Huguenots. It is seated on the river Tarne, 20 miles north of Toulouse, and 30 south of Cahors. E. Long. 1. 27. N. Lat. 43. 56.

MONTBAZON, a town of France, in Touraine, with the title of a duchy; agreeably seated at the foot of a hill, on which there is an ancient castle, 135 miles south-west of Paris. E. Long. 0. 45. N. Lat. 47. 17.

MONTBELLIARD, a handsome and strong town of France, capital of a province of the same name, between Alsace and the Franche Compte. It is seated at the foot of a rock, on which there is a large, strong castle, in the form of a citadel. The prince of Montbelliard has a voice and seat in the college of the princes of the empire. It was taken by the French in 1674, who demolished the fortifications, but it was restored to the prince. It is seated near the rivers Alaine and Doux, 33 miles west of Basle, and 45 north-east of Bezanzon. 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 Spalatto; seated on a mountain near the river Clitunno, 12 miles west of Spalatto E. Long. 12. 40. N. Lat. 42 58.

Monte-Falcone, a town of Italy, in Friuli, 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-Faiscone, 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 towm 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. Long. 9. 35. W. 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.

Montr-Sancto, formerly called *Mount-Athos*, a mountain of Turky in Europe, on the gulph 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.

MONTECUCULI (Raymond de), generalissimo of the emperor's army, and one of the greatest commanders of his time, was born in the duchy of Modena, of a distinguished family, in 1608. Ernest Montecuculi his uncle, who was general of the artillery in the Imperial army, resolved that he should serve first as a common soldier, and that he should pass through all the military degrees before he was raised to command. This the young Montecuculi did with applause. In 1644, when he was at the head of 2000 horse, he surprised by a precipitate march 10,000 Swedes, who laid siege to Nemessau in Silesia, and obliged them to abandon their artillery and baggage; but a short time after, he was defeated and taken prisoner by the general Banier. Having obtained his liberty at the end of two years, he joined his troops to those of John de Wert; and defeated general Wrangel in Bohemia, who was killed in the battle. In 1657 the emperor made him general marshal de camp; and sent him to the assistance of John Casimir, king of Poland. Montecuculi vanquished Ragotzi prince of Transilvania, drove out the Swedes, and distinguished himself in an extraordinary manner against the Turks in Transilvania and Hungary. In 1673 he commanded the Imperial army against the French, and took Bonne; he then proceeded

ceeded with feint marches in order to deceive Turenne, in which he obtained great honour. However, the command of that army was taken from him the next year; but it was restored to him in 1675, in order that he might make head against the great Turenne. All Europe had their eyes fixed on these two able warriors, who then made use of all the stratagems which genius and military knowledge were capable of suggesting. The marshal de Turenne was obtaining the superiority when he was taken off by a cannon ball. Montecuculi wept at the death of so formidable an enemy, and bestowed upon him the greatest praises. The great prince de Conde was the only French general that could deprive Montecuculi of the superiority he had obtained by Turenne's death. That prince was therefore sent to the Rhine, and stopped the Imperial general; who considered this last campaign as the most glorious of his life, not from his being conqueror, but for his not being conquered, when he was opposed by a Turenne and a Conde. He spent the rest of his life at the Imperial court; and died at Lintz in 1680. He wrote *Memoirs;* the best edition of which is that of Strasburg, in 1735,

MONTEGO-BAY, a town of Jamaica, and, next to Kingston, the most flourishing in the island, contains above 350 houses; and carries on a very considerable commerce with Great Britain and our remaining colonies in North America. The harbour is capacious; but rather exposed to the north winds, which at certain times in the year blow with great violence. It is the capital of the parish of St James; in which are 70 sugar-plantations, 70 other settlements, and 27,000 slaves.

MONTESA, a very strong town of Spain, in the kingdom of Valentia. It is the seat of an order of knighthood of the same name; and is five miles from Xativa. W. Long. 0. 10. 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 1789. 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 elogist, 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 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

Montezuma || Montferrat

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 characterises 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 quarter. 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.

MONTFAUCON (Bernard de), a very learned Benedictine of the congregation of St Maur, singularly famous for his knowledge in Pagan and ecclesiastical antiquities, was born of an ancient and noble family in Languedoc, in 1655. He served for some time in the army; but the death of his parents mortified him so with regard to the world, that he commenced Benedictine monk in 1675, and applied himself intensely to study. Though Montfaucon's life was long, healthy, retired, and laborious, his voluminous publications seem sufficiently to have employed the whole; exclusive of his greatest undertaking, for which he will be always memorable. This was his *Antiquité expliqué*, written in Latin and French, illustrated with elegant plates, in 10 vols folio; to which he added a supplement of 5 vols more. He died at the abbey of St Germain in 1741.

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.

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, an 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, 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.

MONTFORT (Simon Count de), descended from an illustrious and flourishing family, was lord of a small town of the same name ten leagues from Paris. He was one of the greatest generals of the age in which he lived; and he displayed his bravery in a voyage beyond seas, and in the wars with the English and Germans. The strength of his constitution enabled him to support without inconvenience the severest labours of the field: his majestic stature distinguished him in the midst of the battle; and the motion of his sword was sufficient to strike terror into his boldest enemies. In the greatest dangers he possessed the utmost coolness and presence of mind: he observed every emergency; and was ready to bring assistance, while he himself was employed in attacking the bravest who made head against him. He was appointed to conduct the crusade against the Albigenses in 1209; and the name of Simon de Montfort is highly celebrated in this war. He took Beziers and Carcassonne, raised the siege of Castelnau, and gained a great victory in 1213 over Peter king of Arragon, Raimond VI. count of Toulouse, and the counts de Foix and de Cominge. Simon de Montfort was killed at the siege of Toulouse on the 25th of June 1218, by a blow with a stone discharged by the hands of a woman.— Such was the fate of one who had sullied the glory of his victories by the cruelty of his executions.— Some historians have given him the name of *Maccabeus* and of *Defender of the Faith*; but men, animated with the true spirit of Christianity, have revolted against such titles. "We cannot (says the Abbé Nonotte) read the accounts of his severity, or rather cruelty, towards the Albigenses without horror. He was not guided by the spirit of the religion of Je-

sus

Montgatz, Montgeron.

fus in the maffacre of Beziers, the pillage of Carcaffoune, and the taking of Lavaur. But our horror is fomewhat diminifhed by the confideration of the dreadful revolt, and maffacres committed by the Albigenfes themfelves." Simon de Montfort treated them at the beft with as great cruelty as they had done the Catholics. His younger fon afterwards made a great figure in England, and is known by the title of Earl of Leicefter.

MONTGATZ, a town of Lower Hungary, in the county of Pereczas, with a fortrefs compofed of three caftles, feated on a craggy rock. It is encompaffed with a great morafs, and art and nature have rendered it almoft impregnable. It was defended by the Princefs Ragotfky, wife of Count Tekeli, when befieged by an army of the Imperialifts, who were obliged to raife the fiege in 1688.

MONTGERON (Louis-Bafile-Carré de), was born at Paris, A. D. 1686; his father was mafter of requefts. He was fcarcely 25 years of age when he purchafed the place of counfellor in parliament, where by his wit and external qualifications he gained confiderable reputation. Deeply engaged in all the vices which flow from irreligion, he was converted by an unexpected circumftance. He went on the 7th of September 1731 to the tomb of Deacon Paris, with an intention to examine, with the rigour of the fevereft critic, the miracles which were reported to be performed there. But, according to his own account, he felt himfelf fuddenly beat to the earth by innumerable flafhes of light with which he was furrounded. His incredulity was converted into flaming zeal, and he became the apoftle of the faint whom he formerly ridiculed. From that moment he devoted himfelf to the fanaticifm of *convulfions*, with the fame impetuofity of character with which he had run into the moft fhameful exceffes. He had not long been the difciple of Janfenifm when he fuffered perfecution. When the chamber of inquefts was banifhed in 1732, he was fent into the mountains of Auvergne; which, inftead 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 compofing what he called a *Demonftration of them.* On his return to Paris, he prepared to execute this plan; and on the 29th of July 1737, he actually prefented to the king at Verfailles a volume in quarto fuperbly bound. This work he accompanied with a fpeech, which is a mixture of zeal and argument in a tolerable ftyle. In confequence of this work, which fome confider as a mafterpiece of eloquence, and others as a mafs of abfurdities, he was committed to the Baftile. After a few months confinement, he was fent to an abbey of Benedictine monks in the diocefe of Avignon; whence he was, in a fhort time, carried to Viviers. He was afterwards confined in the citadel of Valence, where he died, A. D. 1754, aged 68. The work which he prefented to the king was entitled *La verité des Miracles operées par l'interceffion de M. Paris*, &c. &c.—The critics, even to this day, feem to be guided in their opinion concerning this book either by hatred or by enthufiafm. "It would be extremely rafh (fays the Abbé de St Pierre, in the fecond volume of his *Annales*, p. 593.) to maintain with the Molenifts, that no miraculous cure was ever performed at the tomb of the Abbè Paris; and to fay with the Janfenifts, that thefe cures were performed by a fupernatural power, would be the height of fanaticifm. The truth is (adds the fame author), that no miracle appears ever to have been performed at this tomb except in the cure of the human body; in all other cafes, there would have been the want of that imagination on which the whole miracle depended." Thus, although Montgeron ventured to compare thefe prodigies with the miracles of Jefus Chrift and his apoftles, yet we find no perfon raifed from the dead, no multiplication of loaves, no command obeyed by the elements, and no blind or deaf reftored to their fight or hearing. It belongs to the Author of nature alone, or to thofe who have derived power from him, to work fuch miracles as are recorded by the evangelifts, or in the hiftory of the apoftles. Montgeron added a fecond and third volume on the fame fubject: he left alfo in manufcript a work which he compofed in prifon *contre les Incredules.* Religion, it muft be confeffed, has had much more powerful advocates. Fortunately Pafcal and Boffuet are among the number: and it could well have wanted both Paris and Montgeron, whatever virtues they might poffefs in other refpects.

Montgomery.

MONTGOMERY, the capital of a county of the fame name in North Wales, 158 miles from London, took its name from Roger de Montgomery earl of Shrewfbury, who built the caftle: but it is called by the Welfh *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 Welfh, after having put the garrifon to the fword, demolifhed it in 1095; but Henry III. rebuilt it, and granted it the privileges of a free borough, with other liberties. It is a large and tolerably well built town, in a healthful fituation and fertile foil. It fends a member to parliament, and has the title of an earldom. It had formerly a tower and caftle; but they were demolifhed in the civil wars. It has a weekly market, and four fairs.

MONTGOMERY (Gabriel de), count de Montgomery in Normandy, was remarkable for his valour and noble atchievements, but ftill more fo for being fo unfortunate as to put out the eye of Henry II. on the 29th of June 1559. That prince having engaged feveral knights in a tournament, given by him on occafion of the marriage of his daughter the princefs Elizabeth with Philip king of Spain, at laft wifhed to break a lance with the young Montgomery, at that time lieutenant of the Scotch guard. Montgomery, as if he had forefeen the fatal confequences, again and again declined the combat, and it was with great reluctance he at length yielded, when he faw the king about to take offence at his refufal. In the courfe, his lance broke in the king's vifor, and wounded him in the eye. Henry died on the 11th day after receiving the wound, and gave orders on his death-bed that Montgomery fhould not be profecuted, or haraffed in any refpect, on account of what had happened. After this unlucky accident, Montgomery retired for fome time to his eftate in Normandy. He next vifited Italy and other foreign countries; and did not return to France till the commencement of the civil wars, when he joined the party of the Proteftants, and became one of their principal leaders. In 1562, he defended Rouen againft the royal army with great valour and obftinacy. The city being at length taken by ftorm, he

Montgomery. he threw himſelf into a galley; and having, with equal temerity and good fortune, ſurmounted by dint of rowing a chain which had been thrown acroſs the Seine at Candebec for the purpoſe of preventing ſuccours from England, he eſcaped to Havre. In 1569 Montgomery was ſent to the aſſiſtance of Bearn, which the Catholics, under the command of Terrides, had almoſt entirely wreſted from the hands of Jane d'Albret, queen of Navarre. He executed this commiſſion with ſo great diſpatch, that Terrides was obliged to raiſe the ſiege of Navarreins, and to retire with great precipitation to Orthez. Montgomery purſued him to this city, which he took by aſſault; and before Terrides had time to recover himſelf, he and his principal officers were taken priſoners in the caſtle. After this defeat, the reſt of Bearn ſubmitted to the conqueror wherever he made his appearance. This expedition acquired him the greateſt glory, and has been celebrated by the Catholic no leſs than by the Proteſtant hiſtorians. He was at Paris at the time of the maſſacre on St Bartholomew's day 1572, and lodged in the Faubourg St Germain. Some accident having retarded the execution in that quarter, he was informed of it at the very moment when it was about to begin; and he had juſt ſufficient time to mount his horſe, and, in company with ſome Proteſtant gentlemen who lodged near him, to make his eſcape at full gallop They were purſued as far as Montfort-l'Amaury; and Montgomery, whoſe eſcape alone is particularly attended to, owed his ſafety on this occaſion to the ſwiftneſs of his horſe, which, according to a manuſcript of that time, carried him 30 leagues without halting. Having eſcaped this danger, he took refuge with his family, firſt in the iſland of Jerſey and afterwards in England. The following year, Montgomery carried a conſiderable fleet, which he had armed and fitted out in England, partly on his own credit and partly on that of the inhabitants of Rochelle, to the relief of that city, which was at that time beſieged by the Catholics: But, whether diſtruſting his forces, or for other reaſons about which hiſtorians do not agree, he left the road without fighting the Catholic fleet, and went to pillage Belleiſle on the coaſt of Brittany. Having diſbanded his fleet, he returned to England to Henry de Champernon his ſon-in law, coaſt-admiral of Cornwall. On the renewal of the war in France in 1573, Montgomery, who was then in Jerſey, paſſed over into Normandy, and joined the Proteſtant nobility of that province. Matignon, lieutenant-general in Lower Normandy, to whom Catharine de Medicis had given a particular charge to uſe his utmoſt endeavours to ſeize the perſon of the Count, came unexpectedly upon him in Saint-Lo, and laid ſiege to that city. On the evening of the fifth day of the ſiege, Montgomery left Saint-Lo with between 60 and 80 horſe, forced the guard in the ſuburbs, and eſcaped amid a ſhower of muſket bullets, without loſing a ſingle man, leaving the command of the place to Coulombieres, François de Briqueville. Montgomery arrived at Domfront May 7. 1754, with only twenty followers, intending to make no longer a ſtay in that place than was neceſſary to recruit them after the fatigues of ſo rapid a march. The ſame day he was joined by ſeveral gentlemen, who brought to his aſſiſtance a company of forty horſe.—Meanwhile Matignon, informed of his eſcape, and enraged at having loſt his prey, flew at the head of a party of horſe, with ſome companies of foot mounted on horſeback, and arrived on the morning of the 9th before Domfront. He blocked up the place on all ſides till the infantry and cannon which followed him ſhould arrive. On their arrival, he attacked the city with great violence; and, as it was impoſſible to defend it, Montgomery was ſoon obliged to retire into the caſtle with the garriſon, amounting to no more than 150 men, including 80 foot ſoldiers who guarded the city when he entered it. He ſuſtained a furious aſſault, fought with the greateſt boldneſs and obſtinacy, and expoſed himſelf in the breach like one who wiſhed for death. Perceiving, however, that his ſoldiers, partly by the fire of the enemy, and partly by conſtant deſertion, were reduced almoſt to nothing, he capitulated on the 27th of May. Many Proteſtant hiſtorians affirm, that the articles of capitulation were violated with regard to Montgomery; but, not to mention the teſtimony of others, it appears evident, from the authority of D'Aubigny himſelf, who of all the Proteſtant writers is moſt worthy of credit, that the Count had no promiſe from Matignon, except perſonal ſafety and good treatment while he continued his priſoner. This general gave him no aſſurance of pardon from the king or the queen-mother. After the capture of Domfront, Matignon conducted his priſoner to Saint-Lo, the ſiege of which was ſtill going on, in hopes that he might have ſome influence with his former friend and fellow-ſoldier to perſuade him to ſurrender. For this purpoſe, Montgomery was brought to the ſide of the ditch; and he exhorted Coulombieres, who appeared on the wall, to follow his example. But Coulombieres, full of indignation, reproached him in the ſevereſt and moſt upbraiding terms for his cowardice in entering into a ſhameful capitulation, inſtead of dying in the breach like a ſoldier, with his ſword in his hand. This intrepid governor ſpoke the true ſentiments of his heart; for when the aſſault was made ſome days after, he was killed defending the breach In the mean time, Matignon received orders from Catharine de Medicis, now regent of the kingdom by the death of Charles IX. to ſend Montgomery to Paris under a ſtrong guard. When he arrived there, he was conducted to the gaol belonging to the parliament, and confined in the tower which ſtill bears his name. Commiſſioners were appointed by the queen to conduct his trial. He was interrogated concerning the conſpiracy imputed to the admiral Coligny; but the principal charge on which his condemnation was founded, was his hoiſting the Engliſh flag on board thoſe ſhips which he intended for the relief of Rochelle. The ſentence by which he was condemned alſo deprived his children of the title of nobles. When Montgomery heard this part of the ſentence read, *If they have not the virtue of nobles to retrieve this loſs* (ſaid he), *I conſent to their degradation.*—After undergoing a very ſevere torture, he was carried to the place de Greve, dreſſed in mourning, and there beheaded on the 26th of June 1574. D'Aubigny, who was preſent at his execution, and who ſtood immediately behind Fervaques, ſays that he appeared on the ſcaffold with a firm and undaunted countenance; and gives us a pretty long ſpeech which he delivered on that occaſion, addreſſing himſelf firſt to the ſpectators

tators on one side of the river, and then to those on the other. When he had finished his speech, he fell down on his knees beside the block; bade adieu to Fervaques, whom he perceived in the crowd; requested the executioner not to cover his eyes; and submitted to his fate with a constancy truly admirable.

Montgomery has always been considered as a victim to the unjust revenge of Catherine de Medicis. It is evident that he could not be prosecuted or punished for the death of Henry II.; but it has been said, that, after a misfortune of this kind, which was productive of so many calamities to the state, Montgomery was much less excusable than the other Protestants, in carrying arms against his sovereign, the son of that very king of whom he had deprived France. This consideration is mentioned by the Catholics as one reason for diminishing our concern at the tragical death of this illustrious hero. Montgomery married in 1549 Elisabeth de la Fouche of a noble family in Brittany: he left several children, but their number is not exactly known.

He was the eldest son of *James de Montgomery*, Seigneur de Lorges in the Orleannois, one of the bravest men of his age, and famous under the name of *Lorges* in the wars of Francis I. In 1545 he succeeded John Stuart count d'Aubigny in the command of the hundred archers in the Scotch guard; and his son was lieutenant, or perhaps captain, in survivancy when he killed Henry II. It is singular that the same Lorges, father of Montgomery, had wounded Francis I. in the chin with a firebrand, in some frolic with that prince. This accident occasioned the wearing of long beards in France for 50 years. Lorges died aged above 80, a short time after Henry II. He obtained the title of count de Montgomery in 1453, pretending that it belonged to his ancestors, and that he was descended, by the earls of Eglinton in Scotland, from a younger son of the ancient house of Montgomery established in England. According to a memoir given by the family to the author of the Genealogical Dictionary, James was the son of Robert Montgomery, who left Scotland and entered into the service of the French king about the beginning of the reign of Francis I. and this Robert was grandson to Alexander Montgomery, cousin by the mother's side to James I. king of Scotland.

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 six market-towns, 47 parishes, about 5660 houses, and 33,960 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; however, the south, south-east, and north-east parts, being much more level, are extremely fruitful, especially a pleasant vale, through which the Severn glides in beautiful meanders.

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.	Answering to our	Order of the civil Year.	Answering to our
1 *Nisan*	Mar.	1 *Tisri*	Sep.
2 *Jiar*	Apr.	2 *Marschevan*	Oct.
3 *Sivan*	June	3 *Casleu*	Nov.
4 *Thammuz*	May	4 *Thebet*	Dec.
5 *Ab*	July	5 *Sebat*	Jan.
6 *Elul*	Aug.	6 *Adar*	Feb.
7 *Tisri*	Sep.	7 *Nisan*	Mar.
8 *Marschevan*	Oct.	8 *Jiar*	Apr.
9 *Casleu*	Nov.	9 *Sivan*	May
10 *Thebet*	Dec.	10 *Thammuz*	June
11 *Sebat*	Jan.	11 *Ab*	July
12 *Adar*	Feb.	12 *Elul*	Aug.

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 summer solstice, and was called *hecatombæon*, answering to the latter half of June, and the former

former half of July. The order of the months, with the number of days in each, are as follows:

1 *Hecatombæon*,	30	7 *Posideon*,	30
2 *Metagitnion*,	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 year. 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 11 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, in botany: A genus of the trigynia order, belonging to the triandria class of plants; and in the natural method ranking with those with which the order is doubtful. The calyx is diphyllous; the corolla monopetalous and irregular; the capsule unilocular and trivalved.

MONTINIA, in botany: A genus of the tetrandria order, belonging to the dioecia class of plants. The perianthium of the male is quadridented superior; and there are four petals. The female calyx and corolla are as in the male; the filaments barren; the style bifid; the capsule oblong and bilocular.

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 (Francois 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.

MONTMORENCY (Anne de), a peer, marshal, and constable, of France, and one of the greatest generals of the 16th century, defended, in 1512, the city of Menziers against the emperor Charles V. and obliged the count of Nassau to raise the siege. The following year he was made marshal of France; and in 1525, following king Francis I. into Italy, he was taken with that prince at the battle of Pavia, which was fought contrary to his advice. The important services he afterwards rendered the state were rewarded by the sword of constable of France, with which he was presented by the king on the 10th of February 1538. He afterwards underwent various revolutions of fortune both at court and in the field. At last, being wounded at the battle of St Denis, which he gained on the 10th of November 1567, he died of his wounds two days after, at 74 years of age. It is said, that a cordelier attempting to prepare him for death, when he was covered with blood and wounds, after the battle of St Denis, he replied in a firm and steady voice: "Do you think that a man who has lived near 80 years with honour, has not learnt to die for a quarter of an hour?"

MONTPELIER, one of the handsomest towns of France, and the most considerable in Languedoc excepting Tholouse, is situated in E. Long. 4. 20. N. Lat. 45. 58. It hath a citadel, a bishop's see, an university, a royal academy of sciences, and a mint. This town has been long famous for a salubrious air and skilful physicians. In reality the air may be salutary in catarrhous consumptions from its dryness and elasticity; but it is too sharp in cases of pulmonary imposthumes. The climate, according to some late travellers, is so much altered for the worse, that the inhabitants themselves scarce know it to be the same: it has been changing many years, and every year becomes worse and worse. It has been known to rain almost three months without intermission; and at intervals such thick stinking fogs, as nothing but the banks of Newfoundland could equal; and several times, for two or three days on a stretch, the sky is so heavily loaded, that neither sun, moon, nor star, can be seen. In summer it is so insufferably hot, that till the cool of the evening there is no stirring out. Its situation, though on an eminence, never could be healthy; as between it and the Mediterranean (which is about three leagues distant) it is one continued marsh and swamp, ever cocovered 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 yellow meagre looks, are the most convincing proofs.

The town has nothing curious to induce a stranger to stay longer in it than three or four days, except he arrives there about Christmas; at which time it is very gay, as all the nobility of Languedoc meet there at that time to settle the affairs of the province, though it is not the capital, but esteemed nearly the centre. There is during that time a play, which, with an indifferent concert, are all the public amusements. The people in trade are reputed by the French themselves to be the greatest extortioners, and sure not to let a penny escape them, be the means to come at it ever so unjust: as an instance, they had the conscience to charge an English sea officer that died there, 300 livres (twelve guineas and a half) for eight days lodging.

This city stands upon a rising ground fronting the Mediterranean, which is about three leagues to the southward: on the other side is an agreeable plain, extending about the same distance towards the mountains of the Cevennes. It is reckoned well built, and what the French call *bien percée;* yet the streets are in general narrow and the houses dark. The inhabitants are supposed to amount to 40,000: they are sociable, gay, and good tempered, and they trade very largely in wine, cordials, oil, verdigrease, and salt petre. They have several manufactures in silk and woollen goods. There are many Protestants here and at Nismes. 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 the 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, each esteemed fifty leagues distant; and to the southward a most extensive view of the Mediterranean. Not far from thence is a noble aqueduct, built like two bridges one above the other; 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 place; and the king's garden, where on certain days public lectures are 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; near which is the citadel, a place of no strength, though well walled in, as it is commanded by several rising grounds, and has only a dry ditch. There are commonly kept there four battalions of infantry.—

Should an Engliſhman chooſe to reſide here any time, the Grande Rue, that is the great ſtreet, is the genteeleſt quarter to reſide in, where 12 or 18 livres a month is the price for a genteel chamber, which in the time of the ſtates would let for 60; and if he does not chooſe to meſs with the officers, there is a genteel ordinary, where the Engliſh commonly eat, in the Rue d'Argenterie, which is contiguous to your lodgings. Families who reſide here find their account in keeping houſe; and every traveller who deſigns to ſtay longer than a day or two in any of theſe towns, will do well to write beforehand to his correſpondent to procure furniſhed lodgings, to which he may be driven immediately, without being under the neceſſity of lying in an execrable inn, where he muſt pay four livres a head for every meal, and ſix livres a day for an apartment.

MONTREAL, an iſland of North America, in the river St Laurence, about ſix leagues and a half in length, and three leagues over in the broadeſt parts. It belonged to the French; but was taken by the generals Amherſt and Murray on the 8th of September 1760, without firing a gun. According to the terms of capitulation, all the French forces were to be ſent to Old France; and conſequently all Canada became ſubject to the crown of Great Britain; which ceſſion was confirmed by the peace of 1763. 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, 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. No Indians are ſettled here; nor are they fond of ſettling on iſlands, from an hereditary diſtruſt leſt they ſhould be cut off by the Europeans. 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 of ſituation is infinitely preferable to Quebec. It ſtands on the ſide of a hill, ſloping down 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, Jeſuits Seminary, and Governor. Beſides theſe, there are many other gardens and beautiful plantations without the gates, as the garden of the General Hoſpital, and the improvements of Mr Liniere, which exceed all the reſt, and are at an agreeable diſtance on the north ſide of the town. The three churches and religious houſes are plain, and contain no paintings, nor any thing remarkably curious, but carry the appearance of the utmoſt neatneſs and ſimplicity. The city has ſix or ſeven gates, large and ſmall; but its fortifications are mean and inconſiderable, being encompaſſed by a ſlight wall of maſonry, ſufficient only to overawe or prevent a ſurpriſe from the numerous tribes of Indians with whom they are ſurrounded, and who uſed to reſort in vaſt bodies to the annual fair held here, which continued from the beginning of June till the latter end of Auguſt, when many ſolemnities were obſerved, at which the governor aſſiſted, and guards were placed to preſerve good order among ſuch a concourſe of different ſavage nations, all of whom are extremely fond of ſpirituous liquors, and when drunk commit great exceſſes. The fortifications were by no means capable of ſuſtaining a regular attack; and though the garriſon in 1760 conſiſted of eight battalions of regular troops, a numerous militia, and a great body of ſavages, M Vaudreuil and Chevalier de Levis ſubmitted without firing a gun. There are no guns mounted on the wall; only a dry ditch ſurrounds it, about ſeven feet deep, encompaſſed with a regular glacis. On the inſide of the town is a cavalier on an artificial eminence, with a parapet of logs or ſquared timbers and ſix or eight guns, called the citadel. Such is the ſtrength of Montreal, the number of whoſe inhabitants may be between 5000 and 6000, extremely gay and well dreſſed. 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 lakes and rivers 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 well taſted ſoft ſprings, which form a multitude of pleaſant rivulets. The city now drives a conſiderable trade in furs, &c. and veſſels of 200 tons can come up to it. It ſtands 60 leagues above Quebec.

MONTREAL, a town of Spain, in the kingdom of Arragon, with a caſtle, ſeated on the river Xiloca, 25 miles N. W. of Tervil, and 40 S. E. of Calataud.—W. Lon. 1. 2. N. Lat. 41. 9.

MONTREAL, a town of Italy, in Sicily, and in the valley of Mazara, with an archbiſhop's ſee; ſeated on a rivulet, five miles W. of Palermo, and 50 N. E. of Mazara. E. Lon. 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 N. E. of Triers. E. Lon. 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, but 70 miles diſtance by road. 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 which there have been lately built two very handſome bridges, at a great expence. The ſalmon fiſheries on theſe rivers are very valuable, and form a good branch of commerce. The harbour is a fine femicircular bafon defended by a handfome ftone pier. A great number of trading veffels belong to this port.

Montrose (Marquis of). See Graham; and Britain, n° 137, 138, 143, 265

MONTSERRAT, a mountain of Spain, in Catalonia, one of the moft fingular in the world for fituation, fhape, and compofition. It ftands fingle, towering over a hilly country like a pile of grotto work or Gothic fpires; and its height fo great, that to a beholder on the top the neighbouring mountains appear to be funk to a level with the plain. It is compofed of fteep rocks, which at a diftance feem indented; whence it is faid to have received the name *Montferrat* from the Latin word *ferra* a "faw." It is impoffible to defcribe the beauty, richnefs, and variety, of the landfcapes difcovered from the moft elevated point: but the extenfivenefs of the profpect may be conceived by the reader, upon being told that the iflands of Minorca and Majorca, which are at the diftance of 60 leagues, are difcovered from this elevation.

Montferrat 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 fome fhepherds in the year 880. Over this image, Guthred earl of Barcelona caufed a monaftery 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 aftonifhing miracles are afcribed to this holy image. The convent or monaftery is fituated in a nook of the mountain; it feems as if vaft torrents of water, or fome violent convulfion of nature, had fplit the eaftern face of Montferrat, and formed in the cleft a fufficient platform to build the monaftery upon. The river Llobregat roars at the bottom, and perpendicular walls of rock, of prodigious height, rife from the water edge near half way up the mountain. Upon thefe maffes of white ftone refts the fmall piece of level ground which the monks inhabit. Clofe behind the abbey, and in fome parts impending over it, huge cliffs fhoot up in a femicircle to a ftupendous elevation: their fummits are fplit into fharp cones, pillars, pipes, and other odd fhapes, blanched and bare; but the interftices are filled up with forefts of evergreen and deciduous trees and plants. Fifteen hermitages are placed among the woods; nay, fome of them on the very pinnacles of the rocks, and in cavities hewn out of the loftieft of thefe pyramids.

The monaftery is one of the 45 religious houfes of the Spanifh congregation of the order of St Benedict; their general chapter is held every fourth year at Valladolid, where the deputies choofe abbots and other dignitaries for the enfuing quadrennium. In this monaftery, they elect for abbot a Catalan and a Caftilian alternately. Their poffeffions are great, confifting of nine villages lying to the fouth of the mountain; but the king has lately curtailed their income about 6000 livres a year, by appropriating to his own ufe the beft houfe in each village, fome 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 increafe of their landed property. They are bound to feed and harbour for three days all poor pilgrims that come up to 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 feftivals, 7000 perfons arrive in one day; but people of condition pay a reafonable price for what they eat.—The number of profeffed monks, according to Mr Swinburne, is 76 (according to M. Bourgoanne 60); of lay-brothers, 28; and of finging boys, 25; befides phyfician, furgeon, and fervants. The church is a gloomy edifice; and the gilding is much fullied with the fmoke of 85 lamps of filver, of various forms and fizes, that hang round the cornice of the fanctuary. Funds have been bequeathed by different devotees for furnifhing them with oil. The choir above ftairs is decorated with the life of Chrift, in good wooden carving. A gallery runs on each fide 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 ftands in a nich over the altar, before which burn four tapers in large filver candlefticks, the prefent of the duke of Medina Celi. In the facrifty, and paffages leading to it, are preffes and cupboards full of relics and ornaments of gold, filver, and precious ftones; they point out, as the moft remarkable, two crowns for the Virgin and her fon, of ineftimable value; fome large diamond rings; an excellent cameo of Medufa's head; the Roman emperors in alabafter; and the fword of St Ignatius. But as no offerings to this miraculous ftatue can be rejected or otherwife difpofed of, the fhelves are crowded with moft whimfical *ex votos*, viz. filver legs, fingers, breafts, ear rings, watches, two-wheeled chaifes, boats, carts, and fuch like trumpery.

On different parts of the mountain, as already noticed, are a number of hermitages. Each of thefe folitary retreats, which at a diftance feem deftitute 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 facrament from the hands of the mountain vicar, and after divine fervice dine together. They meet alfo at this hermitage, on the days of the faints to which their feveral hermitages are dedicated, to fay mafs, and commune with each other. But at other times they live in a very folitary and reclufe manner, perform various penances, and adhere to very rigid rules of abftinence; nor do they ever eat flefh; nor are they allowed to keep within their walls either dog, cat, bird, or any living thing, left their attention fhould be withdrawn from heavenly to earthly affections. Moft of thefe hermits are faid to be perfons of fortune and family, difgufted with the world, who have retired thither to devote themfelves to meditation, felf-denial, and contrition.

Montserrat, one of the Caribbee Ifles belonging to Great Britain. It is a very fmall, but very pleafant ifland, fo called by Columbus from its refemblance to the famous mountain near Barcelona in Catalonia. It lies in W. Long. 61. 0. N. Lat 16. 50. having Antigua to the north-eaft, St Chriftopher's and Nevis to to the north-weft, and Gaudaloupe lying fouth fouth-eaft at the diftance of about nine leagues. In its figure it is nearly round, about nine miles in extent every way, 27 in circumference, and is fuppofed to contain about 40,000 or 50,000 acres. The climate is warm, but lefs fo than in Antigua, and is efteemed very healthy. The foil is mountainous, but with pleafant valleys, rich and fertile, between them; 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 iflands, and not at all inferior to them in quality. The inhabitants raifed formerly a confiderable quantity of indigo, which was none of the beft, but which they cut four times a-year. The prefent product is cotton, rum, and fugar. There is no good harbour, but three tolerable roads, at Plymouth, Old Harbour, and Ker's bay, where they fhip the produce of the ifland. Public affairs are adminiftered here as in the other ifles, by a lieutenant-governor, council, and affembly, compofed of no more than eight members, two from each of the four diftricts into which it is divided. The wonderful effects of induftry and experience in meliorating the gifts of nature have been no where more confpicuous than in thefe iflands, and particularly in this, by gradually improving their produce, more efpecially of late years, fince the art of planting hath been reduced to a regular fyftem, and almoft all the defects of foil fo thoroughly removed by proper management and manure, that, except from the failure of feafons, or the want of hands, there is feldom any fear of a crop. In 1770 there were exported from this ifland to Great Britain 167 bags of cotton, 1670 l.; 740 hogfheads of rum, 7400 l. To Ireland 133 ditto, 1330 l.; 4338 hogfheads 232 tierces 202 barrels of fugar, 79,507 l.; in the whole 89,907 l. To North America 17,633 l. There are a few fhips employed in trading to this ifland from London and from Briftol. As to the number of inhabitants, according to the moft probable accounts, they confift of between 1200 and 1500 whites, and from 10,000 to 12,000 negroes, tho' fome fay not fo many.

MONUMENT, in architecture, a building deftined to preferve the memory, &c. of the perfon who raifed it, or the perfon for whom it was raifed; fuch are a maufoleum, a triumphal arch, a pyramid, &c.

MOOD, or MODE. See MODE.

Moods of Syllogifm. See LOGIC n° 85.

MOOD, or *Mode*, in grammar, the different manner of conjugating verbs. See GRAMMAR.

MOON, (*Luna*, ☽), in aftronomy, one of the heavenly bodies, ufually ranked among the planets; but with more propriety accounted a fatellite, or fecondary planet.

Among the ancients, the moon was an object of prime regard.—By the *Hebrews* fhe was more regarded than the fun, and they were more inclined to worfhip her as a deity. The new moons, or firft days of every month, were kept as feftivals among them, which were celebrated with found of trumpets, entertainments, and facrifice. (See Numb. xxviii. 11. x. 16. 1 Sam. xx. 5—18.) People were not obliged on thefe days to reft. The feafts of new moons were a miniature reprefentation of the feaft of trumpets, which was held on the firft of the month Tifri, which was the beginning of the civil year. The Jews not being acquainted with the phyfical caufe of eclipfes, looked upon them, whether of fun or moon, as figns of the divine difpleafure. The Grecians looked upon the moon as favourable to marriage; and the full moons or the times of conjunction of fun and moon, were held the moft lucky feafons for celebrating marriages; becaufe 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 fuppofed both by Greeks and Romans to prefide over child-birth.—The patricians at Rome wore a crefcent on their fhoes, to diftinguifh them from the other orders of men. This crefcent was called *Lunula*. Some fay it was of ivory, others that it was worked upon the fhoe, and others that it was only a particular kind of fibula or buckle.

As all the other planets move primarily round the fun, fo does the moon round the earth: her orbit is an ellipfis, in which fhe is retained by the force of gravity; performing her revolution round the earth, from change to change, in 29 days, 12 hours, and 44 minutes, and round the fun with it every year: fhe goes round her orbit in 27 days, 7 hours, 43 minutes, moving about 2290 miles every hour; and turns round her axis exactly in the time that fhe goes round the earth, which is the reafon of her keeping always the fame fide towards us; and that her day and night taken together are as long as our lunar month.

The mean diftance of the moon from the earth is $60\frac{1}{2}$ femi-diameters of the earth; which is equivalent to 240,000 miles. The mean eccentricity of her orbit is $\frac{55}{1000}$ of her mean diftance, or in miles 13,000, which makes a confiderable variation in that mean diftance. —Her diameter is to that of the earth as 100 to 365, as 11 to 40.15, or 2180 miles: its mean apparent diameter is 31 minutes $16\frac{1}{4}$, and that of the fun 32 minutes 12 feconds. Its mean diameter, as feen from the fun, is 6 feconds.

The moon's furface contains 14,898,750 fquare miles, and its folidity 5,408,246,000 cubical ones. The denfity of the moon's body is to that of the earth as 48,911 to 39,214; to that of the fun, as 48,911 to 10,000; its quantity of matter to that of the earth, nearly as 1 to 39.15; the force of gravity on its furface is to that on the furface of the earth as 139.2 to 407.8; and the moon's bulk to that of the earth as $\frac{1}{50}$ to 1. The moon has fcarce any difference of feafons; becaufe her axis is almoft perpendicular to the ecliptic.

The different appearances of the moon are very numerous; fometimes fhe is increafing, then waning; fometimes horned, then femicircular; fometimes gibbous, then full and round. Sometimes, again, fhe illumines us the whole night; fometimes only a part of it; fometimes fhe is found in the fouthern hemifphere, fometimes in the northern; all which variations having been firft obferved by Endymion, an ancient Grecian who watched her motions, fhe was fabled to have fallen in love with him. The fource of moft of thefe appearances is, that the moon is a dark, opaque, and fpherical body, and only fhines with the light fhe receives from the fun; whence only that half

 turned

turned towards him, at any inftant, can be illuminated, the oppofite half remaining in its native darknefs. The face of the moon vifible on our earth, is that part of her body turned towards the earth; whence, according to the various pofitions of the moon, with regard to the fun and earth, we obferve different degrees of illumination; fometimes a large and fometimes a lefs portion of the enlightened furface being vifible.—But for a particular account of the nature, phenomena, &c. of this fecondary but interefting planet, fee ASTRONOMY-*Index*, at *Moon*.

New Obfervations on the Atmofphere, Twilight, &c. of the MOON. M. Schroeter of the Royal Society of Gottingen has lately publifhed a very curious and elaborate work in German, intitled *Selenotopographifche Fragmente*, &c. or Selenotopographical Fragments, intended to promote a more accurate knowledge of the Moon's furface. The feveral maps of the moon*, which have been delineated by Hevelius, Ricciolus, Caffini, and Mayer, are well known to every perfon converfant with aftronomical fubjects. It is evident that thefe delineations can give only a very general idea of the fpots, together with their relative pofition on the lunar difk; and as, with refpect to us, the appearance of thefe muft vary according to the direction in which the rays of the fun fall on them, the moon's furface will not exactly correfpond with the reprefentation of it laid down in the map, except when it happens to be illuminated under the fame angle as when this map was drawn. This confideration induced the author to apply himfelf to the invention of a more accurate mode of defcribing thefe phenomena than had hitherto been attempted. For this purpofe, having provided himfelf with a telefcope feven feet in length, conftructed by Dr Herfchel, he refolved, repeatedly, and under various angles of illumination, to obferve and delineate very fmall portions of the lunar difk; in order that, by comparing his different drawings of the fame objects, he might compile an accurate topographical defcription of the moon's furface: but, in this manner, to form a complete lunar atlas, was an undertaking too extenfive for a fingle perfon. He therefore found himfelf obliged to prefcribe more narrow limits to his defign, and confined his plan to the delineation of the feveral portions of the moon's furface under one angle only of illumination, and this a very fmall one, that he might obtain more diftinct and accurate obfervations and drawings of the fhadows; intending at the fame time to examine fuch parts as appeared either more remarkable or lefs diftinct than the reft, by repeated obfervations under various angles of illumination: And the prefent volume contains the refult of his obfervations, with refpect to the northern parts of the lunar difk.

* See ASTRONOMY-*Index*, at *Moon*.

The author obferves, that, through a telefcope which magnifies a thoufand times, a lunar object of 190 feet in furface appears like a very fmall point; and that, to be diftinguifhable with refpect to fhape, it muft not be lefs than 800 feet in extent. He tells us, that for his obfervations he preferred thofe times when the fun's rays fell on the moon under the leaft angle; that he carefully and repeatedly examined every object that could be diftinguifhed, and either actually meafured its apparent diameter and the length of its fhadow, or compared thefe dimenfions with others which he had already meafured; and that he never ufed magnifiers of greater power than what was abfolutely neceffary to render the object diftinct. In order to facilitate the delineation, he applied to his telefcope a projecting micrometer, divided into fmall fquares, which, by means of a brafs rod, could be placed at any diftance from the eye, and always be kept parallel to the line of the moon's horns. His maps or drawings are orthographical projections; and his fcale is fo conftructed, that 20 feconds of the moon's difk correfpond with half an Englifh inch on the map; thus the fpace of 4 feconds is reprefented in the compafs of a decimal line, and, according to M. Schroeter's computation, anfwers to a German mile or 3807 toifes. The inconveniences and inaccuracy of the common method of meafuring the lunar mountains, induced him to contrive others capable of greater exactnefs and more general application: thefe he varied as the circumftances of the cafe required; but they are all trigonomical calculations of the height of the mountain, or the depth of the cavity from the angle of illumination and from the length of the fhadow.

If, as fome have fuppofed, a great part of the moon's furface be volcanic, it is natural to expect that the marks of eruptions fhould from time to time be difcernible. A fingle inftance of this kind occurred to our author: ever fince the 27th of Auguft 1788, he had conftantly feen a cavity, or, as he terms it, a *volcanic crater*, in the fpot Hevelius, which he had never before perceived, though he had often examined this part of the moon with the utmoft attention, and in the moft favourable circumftances. According to his conjectures, this phenomenon muft have commenced between the 24th of October 1787 and the 27th of Auguft 1788.

He obferved fome alterations in the appearance of lunar objects, which, though too confiderable to be attributed to the variation of light, were not fufficiently permanent to be confidered as the effect of volcanoes. Thefe he afcribes to meteors; for though he does not fuppofe the moon to be furrounded with air, exactly like that which invefts our globe, he thinks it probable that it may have an atmofphere of fome kind, in which fome of the elements of bodies, decompounded on its furface, may be fufpended; and that fome of the lunar mountains may emit nebulous vapours, not unlike the fmoke of our volcanoes, which obfcure and difguife the objects feen through them.

In regard to thofe bright points, which have been feen on the moon's furface during eclipfes, and at other times on her unenlightened part, and which fome have fuppofed to be burning volcanoes; Schroeter, after the moft attentive examination of them, imagines that moft of them muft be afcribed to the light reflected from the earth to the dark part of the moon's difk, which returns it from the tops of its mountains, under various angles, and with different degrees of brightnefs. Some of thefe phenomena he fufpects to be no more than optical illufions, arifing from igneous meteors floating in our atmofphere, which happen to fall within the field of the telefcope.

But the moft interefting part of this work confifts of the author's "Remarks on the Formation and phyfical Conftitution of the Moon's Surface and Atmofphere."

The

Moon.

The ſurface of the moon appears to be much more unequal than that of our earth; and theſe inequalities have great variety both in form and magnitude. There are large irregular plains, on which are obſerved long and narrow ſtrata of hills running in a ſerpentine direction: ſome of the mountains form extenſive chains; others, which are in general the higheſt, ſtand alone, and are of a conical ſhape: ſome have craters; others form a circular ring incloſing a plain; and in the centre of many of theſe plains, as well as in the middle of ſome of the craters, other mountains are found, which have likewiſe their craters. Theſe mountains are various with reſpect to colour, ſome being much darker than others.

The moſt lofty mountain on the ſurface of our globe is ſuppoſed to be Chimboraco, which is not 20,000 feet in height: but there are many in the moon which are much higher; that which is diſtinguiſhed by the name of *Leibnitz*, is not leſs than 25,000 feet. This elevation will appear more extraordinary, if compared with the moon's diameter, of which it is $\frac{1}{214}$th; whereas Chimboraco is not above $\frac{1}{1017}$th of that of the earth: thus conſidered, the lunar mountains are near five times as high as any on our globe.

The craters of the moon are circular, and ſurrounded with an annular bank of hills: they are remarkable for their width, many of them being from 4 to 15 geographical miles in diameter: ſome are not deeper than the level of the moon's ſurface; others are 9000, 12,000, and 15,000 feet in depth: that of one, which our author calls *Bernouilli*, is above 18,000 feet. The height of the annular bank is ſeldom equal to the depth of the crater which it ſurrounds; but the quantity of matter in the one appears to be in general nearly equal to the capacity of the other. The principal mountains and cavities ſeem to be connected by a ſeries of others of leſs magnitude; and ſometimes by hilly ſtrata, which, like the radii of a circle, may be traced to a common centre; this is generally either a mountain or crater, though not of the greateſt height or depth. Theſe hilly ſtrata, which, through ſmaller teleſcopes, appear like veins on the moon's ſurface, have often been miſtaken for torrents of lava; none of which, M. Schroeter ſays, he could ever diſcover.

From all the preceding circumſtances, the author concludes, that whatever may have been the cauſe of the inequalities of the moon's ſurface, it muſt not only have operated with great violence, but alſo have met with great reſiſtance; which inclines him to think, that the ſubſtance of this planet muſt originally have been very hard and refractory. He is of opinion that theſe mountains and cavities muſt have been produced in conſequence of ſome great revolution occaſioned by the action of a force directed from the centre towards the ſurface, and in this reſpect ſimilar to that which gave birth to our volcanoes: but he obſerves, that we have no reaſon to ſuppoſe it abſolutely volcanic, nor that it originated from fire. In ſome places, this force has only elevated the ſurface, and thus formed hills and mountains; in others, the ground has yielded to its violence, and has either been thrown up as a bank round the crater thus formed, or elſe falling into other cavities, has in part filled them up; after having exerted its greateſt violence in theſe mountainous accumulations, it has diffuſed itſelf in various directions, and produced the hilly ſtrata which are obſerved to diverge from them, like the radii of a circle from the centre. In ſupport of this hypotheſis, it is alleged, that the largeſt craters have the leaſt depth, and that in the deepeſt there is the moſt equal proportion between the capacity of the crater and the volume of the annular bank around it: but beſide the grand revolution here ſuppoſed, M. Schroeter is of opinion that there have been others of later date and leſs extent; to theſe he aſcribes the formation of ſecondary mountains, which ariſe either from the middle of the craters of the primary, or from the centre of a plain ſurrounded by a circle of hills; many of theſe have alſo craters, and, like the primary mountains, are connected by a ſeries of cavities and hilly ſtrata, that mark the progreſs of the cauſe by which they were produced. The new crater diſcovered by our author in the ſpot Hevelius, together with other circumſtances here enumerated, ſeem to indicate that the ſurface of the moon is far from being permanently ſettled and quieſcent.

The author's obſervations confirm the opinion that the cavities viſible on the lunar ſurface do not contain water: hence he concludes, that there can be no extenſive ſeas, and oceans, like thoſe which cover a great part of the earth; but he allows that there may be ſprings and ſmall rivers. The queſtion, whether the moon be inhabited? is not omitted by M. Schroeter, who obſerves, that though it be not adapted to beings organiſed as we are, this is no proof that it may not be peopled with intelligent agents, endued with bodily conſtitutions ſuitable to the nature and economy of the planet for which they are deſtined.

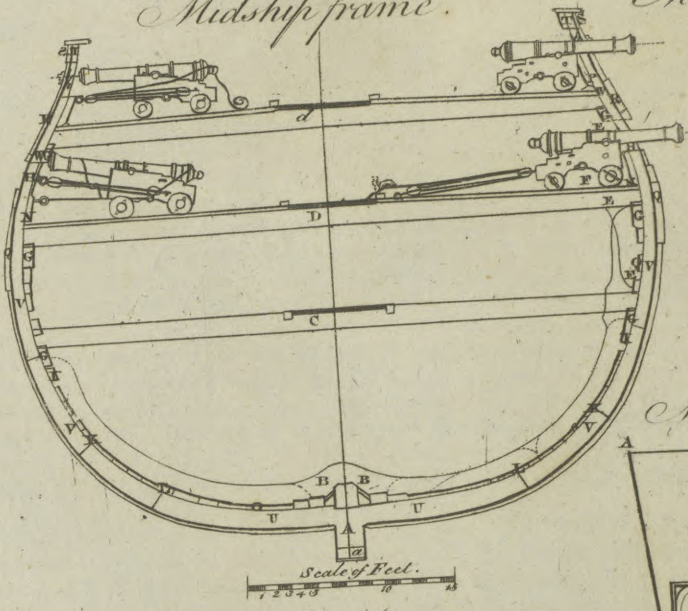
With regard to a lunar atmoſphere, the exiſtence of which has been a ſubject of much diſpute *, our author adduces a variety of proofs in ſupport of the affirmative ſide of the queſtion. He alſo makes a number of obſervations on ſeveral of its relative properties, compared with the ſame in our atmoſphere; ſuch as its greater dryneſs, rarity, and clearneſs, which, however, do not prevent its refracting the ſolar rays, having pointed out the circumſtance, that the mountains in the dark hemiſphere of the moon, near its luminous border, which are of ſufficient height to receive the light of the ſun, are the more feebly illuminated the more diſtant they are from that border: from which proofs of a refracting atmoſphere, he alſo deduced the probability of the exiſtence of a faint twilight, though his long ſeries of obſervations had not yet fully evinced it.—He had, however, aſcertained the exiſtence of a twilight on Venus; and as one fortunate diſcovery often leads to another, he had no ſooner ſucceeded in his obſervations on that planet, than he was induced to direct his attention, for a ſimilar purpoſe, to the moon. In doing this, he applied the calculations and inferences he there made to ſome appearances he had already noticed on this ſatellite. It occurred to him, that if in fact there were a twilight on the moon, as there is on Venus and our earth, it could not, conſidering the greater rarity of its atmoſphere, be ſo conſiderable: that the veſtiges of it, allowing for the brightneſs of the luminous part of the moon, the ſtrong light that is thence thrown upon the field of the teleſcope, and in ſome meaſure the reflected light of our earth, could only be traced on the limb, particularly

* See ASTRONOMY-*Index*, at *Moon*.

Plate CCCXIV.

Minnin.

Midship frame.



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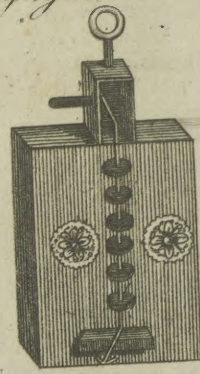
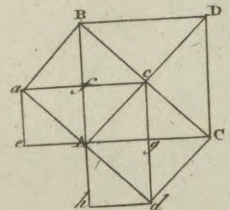
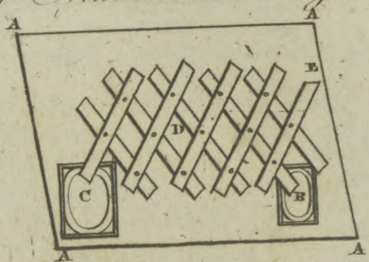


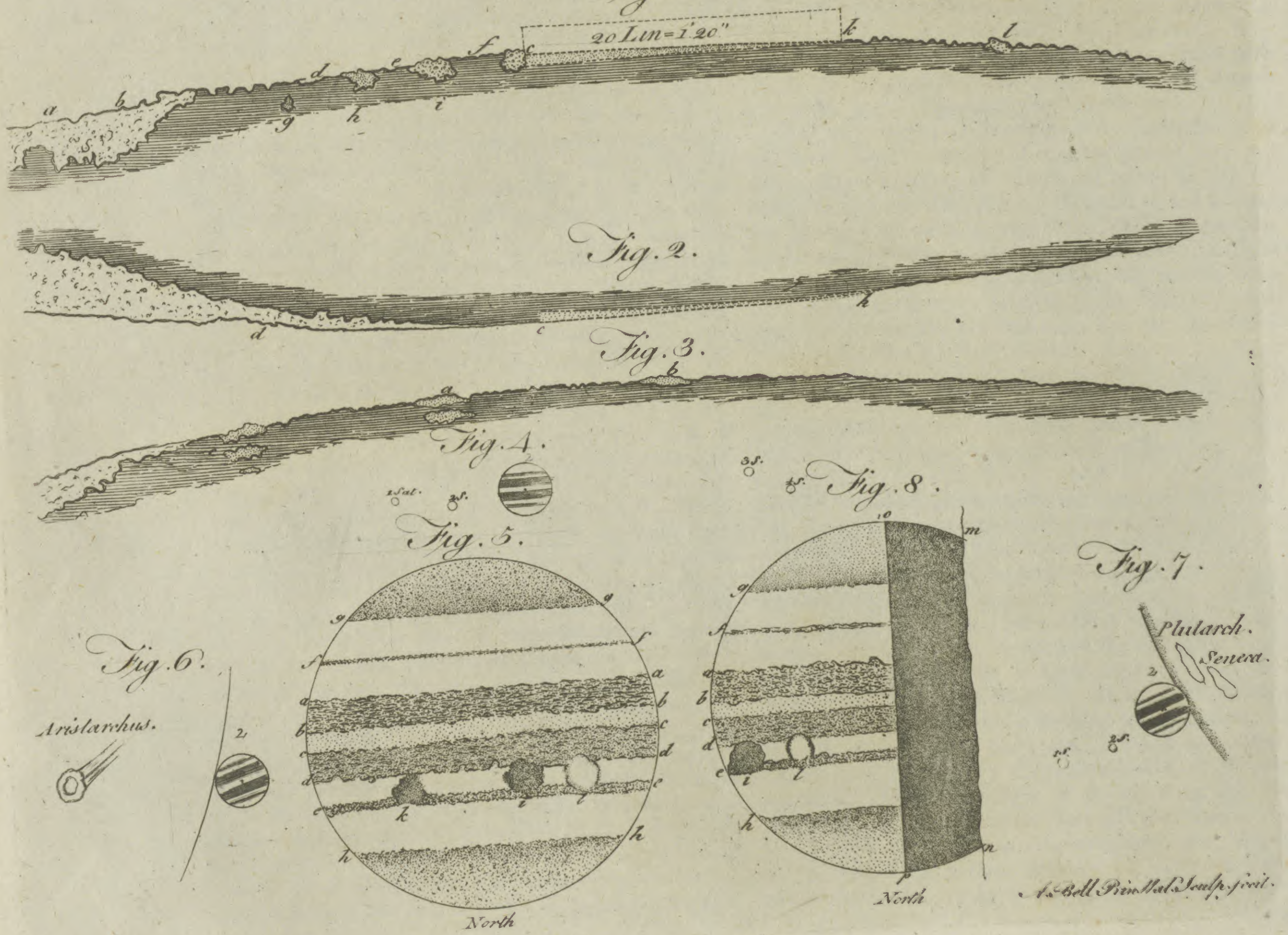
Motion.



Miniature Painting.



Moon.



A. Bell Prin. Hal. Sculp. fecit.

Moon. cularly at the cusps; and even this only at the time when our own twilight is not strong, but the air very clear, and when the moon, in one of its least phases, is in a high altitude, either in the spring, following the sun two days after a new moon; or in the autumn, preceding the sun in the morning, with the same aspect: in a word, that the projection of this twilight will be the greater and more perceptible the more falcated the phase, and the higher the moon above the horizon, and out of our own twilight.

All the requisite circumstances do not often coincide. M. Schroeter, however, was so fortunate as to be favoured with a combination of them on the 24th of February 1792: And the observation proved in every respect so complete, and the inferences deducible from it appeared to him so new and interesting, that he could not with-hold the immediate communication of it from the public. His observations concerning both the Moon and Venus have been accordingly detailed in a paper sent to the Royal Society of London, and inserted in their Transactions for 1792; from which the following respecting the Moon are extracted.

"On the above mentioned evening, at 5^h 40′, two days and 12 hours after the new moon, when in consequence of the libration the western border of the grey surface of the Mare Crisium was 1′ 20″ distant from the western limb of the moon, the air being perfectly clear, I prepared my seven-feet reflector, magnifying 74 times, in order to observe the first clearing up of the dark hemisphere, which was illuminated only by the light of our earth, and more especially to ascertain whether in fact this hemisphere, which, as is well known, is always somewhat more luminous at the limb than in the middle, would emerge out of our twilight at many parts at once, or first only at the two cusps. Both these points appeared now, most distinctly and decidedly, tapering in a very sharp, faint, scarce any where interrupted, prolongation; each of them exhibiting, with the greatest precision, its farthest extremity faintly illuminated by the solar rays, before any part of the dark hemisphere could be distinguished. But this dark hemisphere began soon after to clear up at once at its border, though immediately only at the cusps, where, but more particularly at their points, this border displayed, on both at the same time, a luminous margin, above a minute in breadth, of a very pale grey light, which, compared with that of the farthest extremities of the cusps themselves, was of a very different colour, and relatively as faint as the twilight I discovered on the dark hemisphere of Venus, and that of our own earth, when compared with the light immediately derived from the sun. This light, however, faded away so gradually towards the east, as to render the border on that side perfectly undefined, the termination losing itself imperceptibly in the colour of the sky.

"I examined this light with all possible care, and found it of the same extent at both points, and fading away at both in the same gradual proportion. But I also, with the same caution, explored whether I could distinguish any part of the limb of the moon farther towards the east; since, if this crepuscular light had been the effect of the light reflected from our globe, it would undoubtedly have appeared more sensibly at the parts most remote from the glare of the illuminated hemisphere. But, with the greatest exertion of my visual powers, I could not discover any part of the, as yet, wholly darkened hemisphere, except one single speck, being the summit of the mountainous ridge Leibnitz, which was then strongly illuminated by the solar light: and indeed eight minutes elapsed before the remainder of the limb became visible; when not only separate parts of it, but the whole, displayed itself at once.

"This alone gave me certain hopes of an ample recompence, and satisfied me that the principles I had laid down in my Selenotop. Fragm. § 525. *et seq.* concerning the atmospheres of the planets, and especially of the moon, are founded on truth. But a similar observation made on the 6th, after seven o'clock, afforded me several collateral circumstances, which strongly corroborate what I have there advanced on this subject. The whole limb of the dark hemisphere, illuminated only by the reflected light of our globe, appeared now so clear and distinct, that I could very readily discern not only the large but also the smaller spots, and among these Plato, Aristarchus, Menelaus, Manilius, Copernicus, &c. and even the small speck to the north-west of Aristarchus, marked *b*, Tab. XXVII. fig. 1. of the Fragments. I could apply the usual power, magnifying 161 times; and had full leisure, and the means, to examine every thing carefully and repeatedly, and to take very accurate measurements.

"Although a just idea of so delicate a phenomenon as this crepuscular light cannot possibly be conveyed by a drawing, but must be gathered from actual inspection, I have, nevertheless, attempted a delineation of it, and of the southern and eastern cusps, fig. 1, and 2. as deduced from my measurements, especially at the southern cusp, in hopes thereby to render what I have farther to say concerning this observation the more intelligible. Plate CCCXIV.

"The southern cusp (fig. 1.) extended from *a* to *c*, with a gradually fading but still resplendent solar light, of its usual pale yellow colour, and terminated at *c* with a mountain. That this was really the point of the cusp, appears not only from the general construction of the falcated segment, which was sufficiently narrow even at its beginning *a*, near which it was somewhat disfigured at *b* by a high mountain, but also from the narrowness of its luminous curve at *d e* and *f*, the breadth of which seldom exceeded 1″, and had a sensible interruption so near as *d*. This curve was throughout, from *a* to *c*, except where the glare of the solar rays spread some degree of light, bordered with the pale ash-colour of the dark hemisphere, glimmering with the faint light reflected from our earth; out of which, however, rose the higher mountains *g*, *h*, *i*, *c*, which were now already illuminated by the sun; and farther on, not less than 30 lines, or, according to my usual projection, two minutes distant from the point *c*, was seen another mountain *l*, which belonged to the high ridge Leibnitz, and also received its light immediately from the sun.

"There can hence be no doubt of the termination of the cusp being at *c*; and this being well ascertained, I now distinguished with the greatest certainty the twilight extending from *c* to *k*. The most remarkable circumstances attending this light were, that it was

was broadeſt and brighteſt at *c*, and that it dwindled away and contracted towards *k*, where it loſt itſelf in the faint glimmering of our terreſtrial light; and that at the northern cuſp (fig. 2.), at which there do not appear to be ſo many mountains and inequalities as at the ſouthern, this light exhibited the ſame pyramidal form, and was of equal length, and alike fading in intenſity and colour, as that at the ſouthern.

"This light, compared with that of the thinneſt and leaſt bright part of the cuſp *dc*, was as faint as the pale aſh coloured ſpots in the luminous hemiſphere, when oppoſed to the bright ones. But this is ſtill better illuſtrated by a compariſon between the high mountain *l* (fig. 1.) which now already appeared illuminated by the ſolar light and the ſpot Ariſtarchus, which ſhone moderately merely with the light reflected from our globe. The ſaid mountain had, comparatively with the thin luminous arc *def* of the bright hemiſphere, and the mountains *g*, *b*, *i*, *c*, a very pale, fading, but yet brighter light than Ariſtarchus, as indeed might have been expected from what I ſaid in my Selenotop. Fragm.; but this reflected light upon Ariſtarchus was, however, ſenſibly brighter than the glimmering light from *c* to *k*. And, reſpecting the ſtill fainter terreſtrial light which bordered the luminous curve from *c* to *k* (fig. 1. and 2.), I cannot give a better idea of it than by obſerving, that the light at the extremities of both the cuſps appeared of a pyramidal form, ſimilar to, but though gradually fading, and very undefined, yet brighter than that of our zodiacal light, when, in the months of March and April, it blends itſelf, comparatively with the remaining colour of the ſky, with the terreſtrial light, terminating in a very ſharp point.

"The undefined and gradually fading appearance of this light was the cauſe that, though I had recourſe to a dark projection table, I could not, however, take any accurate meaſurements of it. I found nevertheleſs, by repeated compariſons, that the length of this pyramidal glimmering light, in which I could perceive no ſenſible inequality at the limb of the moon, amounted to about $\frac{2}{3}$ of the diſtance between the two mountains *c*, *l*, (fig. 1.) which ſhone with the ſolar light. Comparing alſo this ſouthern twilight with the northern, it appeared of the ſame length; and, on meaſuring the diſtance *cl*, I found it repeatedly $=$ 30 lines $=$ 2; ſo that the length of the twilight muſt have amounted to 20 lines $= 1' \, 20''$. Its greateſt breadth at *c* could, on the other hand, becauſe of the extent and greater denſity of its light, be eaſily aſcertained by means of the immediate application of the projection table. This meaſurement gave at moſt $\frac{2}{7}$ of a line, or full 2″.

"Although I be poſitively certain of this very remarkable appearance at both cuſps, and of its perfect ſimilarity, in all my obſervations, I could not, however, trace any veſtige of a like crepuſcular light at any other part of the terminating border: nor could I on the very next evening, being the 25th, and alſo on the 26th of February, perceive, even at the cuſps, any of the twilight I expected to ſee there; the very thin, faint, luminous line, which did indeed appear on the 26th, at the ſouthern cuſp between *a* and *b*, (fig. 3.), being undoubtedly the effect of the immediate ſolar light, probably illuminating ſome prominent, flat area, as yet ſituated in the dark hemiſphere.

"Thus far the obſervations: and now for the application of them.

"I need hardly inſiſt upon the proofs, that the very faint pyramidal glimmering light, obſerved on the 24th of February at the extremities of both cuſps, could by no means be the immediate effect of the ſolar light, all the circumſtances of the obſervations militating uniformly and decidedly againſt this ſuppoſition, which, were it true, would oblige us to admit a moſt unaccountable diminution of light, and thence alſo a denſity of the lunar atmoſphere, that ought to exceed even the denſity of ours; a fact abſolutely contradicted by all the lunar obſervations hitherto made. This light, indeed, was ſo very faint, that it diſappeared at $7^h \, 20'$, when the moon approached the horizon; whilſt, on the other hand, Ariſtarchus, which had no light but what it received from the earth, was ſtill very diſtinguiſhable; and the ſummit of Leibnitz *l*, fig. 1. (which, though far within the dark hemiſphere, was, however, illuminated by the immediate ſolar rays) diſplayed a degree of brightneſs, which, although when compared with that of the cuſp *def*, it appeared very faint and dwindling, equalled, however, that of our Peak of Teneriffe. Nor can it be conceived why this glimmering light broke off ſo ſuddenly at both the cuſps, without a progreſſive diminution. It can hardly be ſuppoſed, that ſimilar, grey, prominent, flat areas, of the ſame form and dimenſions, and comparatively of a faint light, which, whilſt in the dark hemiſphere, they derive immediately from the ſun, exiſt on all parts of the moon; more eſpecially as, at the places obſerved, the limb happened to exhibit throughout an exact ſpherical form, without the leaſt ſenſible inequality; and as in both the bordering regions of the northern and ſouthern hemiſpheres, eſpecially in the latter, no ſuch grey prominent planes are any where diſcernible. It may then be aſked, why did this faint glimmering light appear at both cuſps, along equal arcs of the limb, of equal length and breadth, and of the ſame pyramidal form? and why did its farther extremity blend itſelf with the terreſtrial light of the dark hemiſphere, which, according to a great number of my ſelenotopographic obſervations, is by no means the caſe, even with thoſe grey prominent areas, which, being at ſome diſtance on the dark ſide of the terminating border, are nevertheleſs illuminated immediately by the ſun?

"Theſe, therefore, could certainly not derive their light immediately from the ſun; whence this appearance, like the ſimilar ones on the planet Venus, can only be aſcribed to the ſolar rays reflected by the atmoſphere of the moon upon thoſe planes, producing on them a very faint, gradually diminiſhing, glimmering light, which at laſt loſes itſelf in the reflected terreſtrial light, in the ſame manner as our twilight blends itſelf with the light of the moon. Every circumſtance of the above obſervation ſeems to me to confirm this ſuppoſition; and hence the obſervation itſelf, which, though ſingle, was however a moſt fortunate and complete one, muſt appear of no ſmall degree of importance, ſince it not only confirms the obſervations and inferences on the long conteſted lunar atmo-

atmoſphere contained in my Selenotop. Fragm. but alſo furniſhes us with many more lights concerning the atmoſphere of planets in general than had been afforded us by all thoſe obſervations collectively."

This, and the mathematical certainty that the phenomenon is in fact nothing but a real twilight in the lunar atmoſphere, he farther evinces by a ſeries of theoretical deductions and calculations, which do not admit of being here ſtated. Among other reſults, it appears, that the lower and more denſe part of the lunar atmoſphere, that part, namely, which has the power of reflecting this bright crepuſcular light, is only 1356 Paris feet in height; and hence it will eaſily be explained how, according to the different librations of the moon, ridges of mountains, even of a moderate height, ſituated at or near the terminating border, may partially interrupt, or at times wholly prevent, this crepuſcular light, either at one or the other cuſp, and ſometimes at both. "I cannot hence (ſays our author) but conſider the diſcovery I here announce as a very fortunate one, both as it appears to me deciſive, and as it may induce future obſervers to direct their attention to this phenomenon. Admitting the validity of this new obſervation, which I think cannot well be called in queſtion, I proceed now to deduce from it the following inferences.

"1. It confirms, to a degree of evidence, all the ſelenotopographic obſervations I have been ſo ſucceſsful as to make on the various and alternate changes of particular parts of the lunar atmoſphere. If the inferior and more denſe part of this atmoſphere be in fact of ſufficient denſity to reflect a twilight over a zone of the dark hemiſphere 2° 34′, or 10¼ geographical miles in breadth, which ſhall in intenſity exceed the light reflected upon its dark hemiſphere by the almoſt wholly illuminated diſk of our earth; and if, by an incidental computation, this denſe part be found to meaſure 1356 feet in perpendicular height, it may, according to the ſtricteſt analogy, be aſſerted, that the upper, and gradually more rarified ſtrata, muſt, at leaſt, reach above the higheſt mountains in the moon. And this will appear the more evident, if we reflect, that notwithſtanding the inferior degree of gravitation on the ſurface of the moon, which Newton has eſtimated at ſomewhat leſs than one-fixth of that on our earth, the lower part of its atmoſphere is nevertheleſs of ſo conſiderable a denſity. This conſiderable denſity will, therefore, fully account for the diminution of light obſerved at the cuſps, and on the high ridges Leibnitz and Doerfel, when illuminated in the dark hemiſphere; as alſo for the ſeveral obſcurations and returning ſerenity, the eruptions, and other changes, I have frequently obſerved in the lunar atmoſphere. This obſervation alſo implies:

"2. That the atmoſphere of the moon is, notwithſtanding this conſiderable denſity, much rarer than that of our earth. And this indeed is ſufficiently confirmed by all our other lunar obſervations. I think I may aſſert, with the greateſt confidence, that the clearer part of our twilight, when the ſun is 4° below our horizon, and when we can conveniently read and write by the light we receive from it, ſurpaſſes conſiderably in intenſity the light which the almoſt wholly illuminated diſk of our earth reflects upon the dark hemiſphere of the moon 2½ days before and after the new moon. But ſhould we even admit an equal degree of intenſity, it will, however, appear from computation, that our inferior atmoſphere, which reflects as ſtrong a light over 4° as that of the moon does over 2° 34′ of their reſpective circumferences, muſt be at leaſt eight times higher than that of the moon.

"3. The ſtriking diminution of light I noticed in my twelve years obſervations on Venus, likewiſe indicates, that the atmoſphere of that planet, which is in many reſpects ſimilar to ours, is much denſer than that of the moon; and this will be ſtill farther corroborated, if we compare together the ſeveral meaſurements and computations made concerning the twilights of different planets. There is no doubt but that the fainteſt twilight of Venus, as ſeen either before or after the riſing and ſetting of the ſun acroſs our twilight, is much brighter than that of the moon; and it appears, moreover, from computation, that the denſer part of the atmoſphere of Venus meaſures at leaſt 15000 Paris feet in height, and ſpreads its twilight 67 geographical miles into the dark hemiſphere, whilſt the denſer part of the lunar atmoſphere, whoſe height does not exceed 1356 feet, produces a faint twilight not above 10¼ geographical miles in breadth. Thus, as my ſucceſsful obſervations on the twilight of Venus led me to the diſcovery of that of the moon, ſo did theſe latter reciprocally confirm the former: and thus, whichever way we contemplate the ſubject, muſt we be ſtruck with the coincidence that prevails throughout.

"4. But if the lunar atmoſphere be comparatively ſo rare, it follows, that the inflection of light produced by it cannot be very conſiderable; and hence does the computation of M. du Sejour, according to which the inflection of the ſolar rays which touch the moon amounts to no more than 4½″, receive an additional degree of authenticity *. Beſides which,

"5. As the true extent of the brighteſt lunar twilight amounts to 2° 34′, the obliquity of the ecliptic in the moon only to 1° 29′; the inclination of the orbit of the moon, on the contrary, to 5° 15′, and its ſynodic period, during which it performs a revolution round its axis is = $29^d\ 12^h$; it follows, that its brighteſt twilight, to where it loſes itſelf in the light reflected by the almoſt fully illuminated diſk of our earth, muſt, at leaſt at its nodes, laſt $5^h\ 3'$, and that it will be ſtill longer at other parts of the orbit, according to the ſituation of the nodes.

"6. And laſtly, it being a well known fact † that the fixed ſtars, as they approach the moon, diminiſh in ſplendor at the moſt only a very few ſeconds before their occultations, it was natural for me, after the ſucceſsful obſervations I had made on the twilight of the moon, to pay particular attention to this circumſtance. On the 25th of February, at 6^h P. M. the ſky being very clear, the limb of the dark part of the moon appeared uncommonly diſtinct; and only a few ſeconds of a degree from its edge was ſeen a teleſcopic ſtar of about the 10th or 12th magnitude. I counted full 20′ before its occultation, and 18½ of theſe, without the leaſt perceptible diminution of light. The ſtar, however, began now gradually to fade, and after the remaining 1½′, during which I obſerved it with all poſſible attention, it vaniſhed in an inſtant. This obſervation agrees perfectly with the above computations.

* *De la Londe's Aſtron.* § 1992—1994.

† *Selenot. Fragm.* § 531.

Moon.

putations. Although it be proved that the inferior denſe part of the lunar atmoſphere reflects a ſtronger light than that which the dark hemiſphere receives from an almoſt fully illuminated diſk of our earth ; and although, conſidering the inferiority of gravitation on the ſurface of the moon, there be no doubt that this denſe part, together with the ſuperior gradually more rarified regions of its atmoſphere, muſt extend far above its higheſt mountains ; it is yet a fact, that the breadth of this obſerved twilight, to where it loſes itſelf in our reflected terreſtrial light, does not meaſure more than 2° 34 : it is therefore highly probable, that its greateſt extent, in the moſt favourable phaſes near our new moon, can never exceed the double of the above arc, or 5° 8′ ; and hence we can only infer a perpendicular height of an atmoſphere, capable of inflecting the ſolar rays, which at moſt meaſures 5376 feet : nor is it very likely that, unleſs accidental and hitherto unknown circumſtances ſhould occaſionally condenſe different parts of this atmoſphere, theſe upper ſtrata ſhould materially affect the diſtinctneſs of a ſtar ſeen through it.

" But admitting the height of the atmoſphere, which may affect the brightneſs of a fixed ſtar, not to be leſs than 5376 feet, this will amount to an arc of only 0,94″, or not quite one ſecond ; and as the moon deſcribes an arc of 1″ in 2″ of time, it follows, that in general the fading of a ſtar, which approaches to an occultation, cannot laſt quite 2′ in time ; that if the appulſe be at a part of a limb of the moon where a ridge of mountains interferes, the gradual obſcuration will laſt a ſhorter time ; and that it may, under ſome circumſtances of this nature, be even inſtantaneons."

To the foregoing obſervations, M. Schroeter ſubjoins the following account of an occultation of Jupiter by the moon when near its full, which occurred to him by mere accident on the 7th of April 1792.

" The ſky being very ſerene, and Jupiter uncommonly bright, I prepared my ſeven-feet reflector, magnifying 74 times, in hopes that the ſtrong light and diſtinctneſs it afforded would enable me to compare the appearances of this phenomenon with the reſults which I had deduced from my late obſervations on the height and denſity of the atmoſphere of the moon.

Plate CCCXIV. " Fig. 4. repreſents the ſituation of Jupiter's four ſatellites, as they appeared, moſt diſtinctly, two of them to the weſtward, the ſecond about one, and the firſt near two of Jupiter's diameters diſtant from its limb ; and the two others to the eaſtward, the third about ſeven and the fourth near eight of the ſame diameters, diſtant from the ſaid limb.

" Fig. 5. ſhows Jupiter with its belts, and of a ſomewhat ſpheroidical form, as it now appeared to me, and as diſtinctly as I had ever ſeen it. The equatorial belt, from *a* to *d*, was very apparent. It conſiſted properly of two zones, *a b* and *c d*, of a browniſh grey colour, with a more luminous interval *b c* between them. At *e* and *f* were two comparatively well defined ſtripes, which I had noticed for many years back, but which now croſſed the whole diſk ; and the polar regions appeared again, from *g* and *h*, more dim and grey than the bright part of the planet. But what particularly ſtruck me, were two nebulous undefined ſpots, *i* and *k*, which were ſenſibly darker than the principal zone *d d*; and at *l* a ſtill more remarkable, circular, tho' imperfectly defined ſpot, ſomewhat brighter than the luminous interval between the zones, and perfectly ſimilar to the remarkable luminous ſpot which I had obſerved in 1786 and 1787 on the ſame part of Jupiter, and which then led me to ſome very unexpected inferences concerning the atmoſphere of that planet *.

" Theſe favourable circumſtances led me to the following accurate obſervation, which I was certain would prove inſtructive to me. At $10^h\ 40'\ 50''$ I ſaw the ſpot *i* at about the middle of its parallel ; and immediately after began the occultation ; than which a more diſtinct and beautiful one was perhaps never ſeen.

* *Beytr. zu den neuſten Astron. Entd.* p. 75. and Tab. I. fig. 6.

" *Immerſions.* The weſtern, preceding, firſt ſatellite, diſappeared behind the ſharp bright limb of the moon, at $10^h\ 43'\ 12''$.

The ſecond ſatellite diſappeared, without becoming at all indiſtinct, exactly at $10^h\ 45'\ 19''$.

The weſtern limb of Jupiter came in contact, moſt diſtinctly, with the eaſtern limb of the moon, at $10^h\ 46'\ 32'',5$.

Jupiter's eaſtern limb diſappeared, as diſtinctly, at $10^h\ 48'\ 20'',5$. This immerſion took place, as repreſented in fig. 6. to the eaſtward of Ariſtarchus, at about the 25th degree of north latitude.

" The third ſatellite diſappeared, after having been for about one or two ſeconds faint and indiſtinct, at $10^h\ 58'\ 57'',5$.

" The fourth ſatellite, which appeared the leaſt of them all, became undiſcernible near the limb, and vaniſhed at about $11^h\ 2'\ 16''$.

" *Emerſions.* The two preceding firſt and ſecond ſatellites were here likewiſe of uſe in determining preciſely the emerſion of both the limbs of Jupiter from the dark hemiſphere of the moon.

" The firſt appearance of Jupiter's weſtern limb was very diſtinct at $11^h\ 43'\ 54''$.

" Emerſion of the eaſtern limb, as diſtinct, at $11^h\ 45'\ 39'',5$. This emerſion took place, as repreſented in fig. 7. to the north-eaſtward of Seneca (B, Tab. VIII. of the Frag.), at about the 23d degree of north latitude.

" The emerſion of the next, or third ſatellite, was not obſerved.

" That of the fourth was diſtinct at $11^h\ 59'\ 1''$.

" This obſervation gave me the more ſatisfaction, as it ſingularly contributed to confirm the diſcovery I had been ſo fortunate as to make of the twilight in the moon, and the height and denſity of the lower ſtratum of its atmoſphere.

" Experience has ſufficiently proved, that a ſtronger will ever obſcure a fainter light ; and it follows hence, that the light of a bright ſtar approaching the moon, when full or nearly ſo, will loſe ſomething of its luſtre : but little can be inferred in favour of an atmoſphere either of the Moon or of Mars, from the obſervation of Caſſini ; in which, as Dr Herſchel has illuſtrated by ſome obſervations of his own*, a ſtar in Aquarius, of the ſixth magnitude, and as yet ſix minutes diſtant from Mars, diminiſhed in light when both were ſeen in the ſame field of the teleſcope. A mere apparent diminution of light, occaſioned by the glare of a larger luminous object, when ſeen at the ſame time with a ſmaller

* *Phil. Tranſ.* 1784.

ſmaller one in the field of the teleſcope, is one thing; and another thing is a real indiſtinctneſs of the ſmall luminous body, which increaſes in proportion as they approach nearer to each other.

"It was very natural for Jupiter to diminiſh in brightneſs when it approached ſo near to the moon, then almoſt at its full, as to be ſeen at the ſame time in the field of the teleſcope, which was in fact the circumſtance of this obſervation; but I could not obſerve any progreſſive variation of light in the eaſtern and weſtern, equally luminous, diſks, proportional to their diſtances from the limb of the moon, much leſs a real indiſtinctneſs; and this neither when the limbs of the two planets were nearly in contact, nor when Jupiter was partly, or about one half, covered by the moon.

"It was a ſight truly gratifying to an eye accuſtomed to the light of the moon, or in general to ſimilar obſervations, to behold how Jupiter, at its immerſion as well as emerſion, being half or more than half covered by the moon, exhibited its belts and other parts as diſtinctly cloſe to the limb of the moon as it does at ſome diſtance from it; and had I not already ſucceeded in my numerous obſervations on the atmoſphere of the moon, and very recently in thoſe which enabled me to determine its twilight, I ſhould perhaps have adopted the doubts the ancient aſtronomers entertained concerning the exiſtence of a lunar atmoſphere; and this the rather, as when Jupiter in its immerſion was ſo far covered, that the luminous ſpot *l*, fig. 5. was cloſe to the moon, I could plainly diſtinguiſh this ſpot, although it be in itſelf by no means very perceptible.

"Such, however, muſt have been the appearances, according to my new obſervations and meaſurements of the twilight of the moon: for if it be proved, that the extent of this twilight, to where it loſes itſelf in the light reflected from the almoſt wholly illuminated diſk of our earth, amounts to no more than an arc of 2° 34′ of the circumference of the moon, and if it be hence demonſtrable, that its greateſt dilatation does barely amount to 5° 8′, and the perpendicular height of that part of the lower more condenſed ſtratum of its atmoſphere, which is capable of reflecting the ſolar rays, and of producing ſome other, perhaps more remarkable, obſcurities in the ſtars ſeen through it, does not exceed 5000 Paris feet, and hence cannot reach above one ſecond of a degree above the limb of the moon; we need not wonder that ſo ſmall a magnitude, which loſes itſelf in the inequalities of the limb, many parts of which are known to be conſiderably mountainous, ſhould not become ſenſible, eſpecially at the approach of a body of ſo large a diameter as Jupiter, and when ſo ſmall a magnifying power is applied. And thus may I with confidence aſſert a perfect coincidence between this and my many other obſervations.

"The appearance, fig. 8. when Jupiter, at the emerſion, the objects being particularly ſharp and diſtinct, came forth from behind the moon, which now covered no more than one quarter of its diameter, was truly ſplendid and ſatisfactory: and I muſt here particularly mention the circumſtance, that the part of the moon's dark hemiſphere, between its bright terminating edge *mn* and its outward limb, bordering upon the emerging planet *op*, was particularly opaque, and hence produced a very ſtriking effect.

"I omit entering here upon any farther conſiderations; and ſhall conclude with obſerving, that, after the occultation was completely ended, the luminous ſpot *l* had at 12ʰ 1′ ſo far advanced in its parallel *de*, as to have reached to within $\frac{1}{6}$, or at moſt $\frac{1}{5}$, of its whole length of the weſtern limb: and that on the 28th of March, five days after a new moon, I obſerved an occultation of a very diſtinct, though teleſcopic, ſtar, by the dark hemiſphere of the moon; in which, agreeably to the above obſervation, not the leaſt gradual diminution of light or indiſtinctneſs could be perceived, the ſtar being ſeen to vaniſh on a ſudden."

Influence of the Moon *on the Human Body, the Weather*, &c. The vulgar doctrine concerning the influence of the moon on the changes of *weather* is very ancient, and has gained credit among the learned without ſufficient examination; but it ſeems now to be pretty generally exploded by philoſophers, as equally deſtitute of all foundation in phyſical theory, and unſupported by any plauſible analogy. The common opinion is, that the lunar influence is exerted at the ſyzygies and quadratures, and for three days before and after each of thoſe epochs. There are 24 days, therefore, in each ſynodic month, over which the moon at this rate is ſuppoſed to preſide; and as the whole conſiſts but of 29 days 12¾ hours, only 5½ days are exempt from her pretended dominion. Hence, though the changes of the weather ſhould happen to have no connection whatever with the moon's aſpects, and they ſhould be diſtributed in an equal proportion through the whole ſynodic month, yet any one who ſhall predict, that a change ſhall happen on ſome one of the 24 days aſſigned, rather than in any of the remaining 5½, will always have the chances 24 to 5½ in his favour. Men may, therefore, eaſily deceive themſelves, eſpecially in ſo unſettled a climate as ours. Moreover, the writers who treat of the ſigns of the weather, derive their prognoſtics from circumſtances which neither argue any real influence of the moon as a cauſe, nor any belief of ſuch an influence, but are merely indications of the ſtate of the air at the time of obſervation: ſuch are, the ſhape of the horns, the degree and colour of the light, and the number and quality of the luminous circles which ſometimes ſurround the moon, and the circumſtances attending their diſappearance. (See the Διοσημεια of Aratus, and the *Scholia* of Theon.) The vulgar ſoon began to conſider theſe things as cauſes, which had been propoſed to them only as ſigns: and the notion of the moon's influence on all terreſtrial things was confirmed by her manifeſt effect upon the ocean. See, on this ſubject, Phil. Tranſ. vol. lxv. part 2. p. 178, &c.

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, intitled *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.

Harveſt-Moon. It is remarkable, that the moon, during the week in which ſhe is full in harveſt, riſes

 ſooner

sooner after sun-setting than she does in any other full moon week in the year. By doing so, she affords an immediate supply of light after sun-set, 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*. For an account of which, see ASTRONOMY, n° 370, 371.

Moon-Eyes, in the manege. A horse is said to have moon-eyes when the weakness of his eyes 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; but still he is in danger of losing his eye-sight quite.

Moon-Stone, a genus of siliceous earths, of a clear white colour approaching to that of milk. When looked at in a certain position, it reflects a strong light like mother-of-pearl; in others, it shows spots of a carnation colour. It is found in pieces with obtuse angles, sometimes of a quadrangular figure. When broken, it appears evidently foliated. According to Werner it agrees in hardness and most other respects with felt-spar. He tells us, likewise, that it is probably the *androdamas* of Pliny, the common *girasole* of the Italians, and the *water opal* of Ceylon. Sometimes, he tells us, it is classed with the opal, and sometimes with the cat's eye. According to M. Magellan, this stone is of the chalcedony or pseudo-opal kind: it reflects a whitish light, with some various shades of few intermixed colours on a bluish bottom, like the face of the moon when high enough not to appear reddish by the interposition of earthy vapours. The iris, or rainbow-stone, seems to be no other than a moon-stone in which the yellow, purple, and blue rays are most conspicuously reflected. When looked at, it appears of a reddish brown; but on holding it in the light of the sun, we discover the figure of a rainbow. There are, however, several other stones which have the same appearance in the sun's light.

Moon-Wort in botany. See LUNARIA.

MOOR (Sir Karel de), a capital painter of portraits, history, and conversations, was born at Leyden, in 1656: and at first was a disciple of Gerard Douw, with whom he continued for a considerable time. He afterwards studied successively under Abraham Vanden Tempel, Francis Mieris, and Godfrey Schalcken. As soon as he began to follow his profession, the public in a short time did justice to his extraordinary merit; and he took the most effectual method to establish his reputation, by working with a much stronger desire to acquire fame than to increase his fortune. According to Mr Pilkington, he painted portraits in a beautiful style, in some of them imitating the taste, the dignity, the force, and the delicacy of Vandyck; and in others, he showed the striking effect and spirit of Rembrandt. His pictures were always neatly and highly finished; he designed them excellently, and grouped the figures of his subjects with great skill. His works were universally admired; and some of the most illustrious princes of Europe seemed solicitous to employ his pencil. The grand duke of Tuscany desired to have the portrait of De Moor, painted by himself, to be placed in the Florentine gallery; and on the receipt of it, that prince sent him in return a chain of gold and a large medal of the same metal. The Imperial ambassador count Sinzendorf, by order of his master, engaged him to paint the portraits of Prince Eugene and the duke of Marlborough on horseback; and in that performance, the dignity and expression of the figures, and also the attitudes of the horses, appeared so masterly, that it was beheld with admiration, and occasioned many commendatory poems in elegant Latin verse to be published to the honour of the artist; and the emperor, on seeing that picture, created De Moor a knight of the holy Roman empire. He likewise had the honour to paint the portrait of Peter the great czar of Muscovy; and an extraordinary number of other portraits, for which he received very large prices.—His historical paintings were admirable; although he most frequently was employed to paint in a large size, yet he often painted small easel pictures, with subjects of history or conversations; and those are exceedingly valued, having all the merit of neat penciling and sweet colouring added to an elegant taste of design. He died in 1738.

MOOR, in country affairs, denotes an unlimited tract of land, usually over-run with heath.

Moor-Cock, or *Gor-Cock*. See TETRAO.

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.

The uppermost stratum of the fen-lands is usually of this earth, and it commonly constitutes a moderately thick or deep bed. Intermixed with water it cannot easily be worked up into a paste; and when with labour worked up into somewhat of a firm mass, its surface appears spongy and porous; and as soon as dry, it easily moulders away to powder.

It is usually soft to the touch, unless it be worked very closely between the fingers; then it shows a mixture of a small quantity of sand, both to the touch and to the eye. It seems indeed to consist almost entirely of pure vegetable matter; and this lying in such plenty on the surface of the fen-lands is the cause of their being so very fertile.

The great disadvantage of the places which have this soil, is their being liable to be glutted with wet; and to remedy the inconveniences arising from thence, the farmers who rent these lands have a custom of burning the soil at proper seasons. It burns very freely and easily, the surface readily catching flame; and a substance somewhat bituminous, usually contained among the soil, helps the burning.

MOORE, or MORE, (Edward), a late 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 Lyttelton in an elegant kind of panygeric, 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,

ception, 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:
Tho' millions if Fortune should lavishly pour,
I still shou'd 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 sincere 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 before,
It begins with an M, but I dare not say MORE.

In the year 1753, Mr Moore commenced a weekly miscellaneous paper, intitled *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 a 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 in 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 mill-stones; and some of the limestone hills bear such a sweet though short grass, as is very grateful to the oxen, of which here is 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 lord's bailiffs. Every moor has the like office with our bailiff of the hundred.

MOOSE, or ELK. See CERVUS.

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 (fab. hist.), 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 excess of the 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, in botany: A genus of the monogynia order, belonging to the triandria class of plants; and in the natural method ranking under the 6th order, *Ensatæ*. The corolla is hexapetalous; the three interior petals patent, the rest like those of the iris.

MORAI, is the name given at Otaheite in the South Sea to their burying-grounds, which are also places of worship. This is a pile of stone raised piramidically 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 7 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 are 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 connections 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 in the several moral capacities and connections 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 connection 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 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 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 analyſe 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."

3 Modes of communicating inſtruction by the earlieſt moraliſts.

‡ *Bruce's Elements of the Science of Ethics.*

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,* 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 models 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. 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."

‡ *Enfield.*

8 Of the Stoics.

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

† *Enfield.*

wise man will be happy in the midst of torture, because virtue itself is happiness (B)."

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.

‡ *Div. Leg. of Moses.*

§ *Eternal and immutable Morality.*

9 Of Aristippus, Democritus, and Protagoras.

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 measure 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 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

(B) 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.

accurate investigation of their respective merits, men became Platonists, Peripatetics, or Stoics, as fancy or caprice prompted them to choose their leaders. The αυτος εφα 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 expresly 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 (A)." 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, intitled *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 *."

* *Price's Review*, and *Clarke on the Attributes*.

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 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 and 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

(c) Doctrinas de justo et injusto, bono et malo, præter leges in unaquaque civitate constitutas, authenticas esse nullas: et utrum aliqua actio justa vel injusta, bona vel mala futura sit, a nemine inquirendum esse, præterquam ab illis, quibus legum suarum interpretationem civitas demandaverit. *De cive*, p. 343.

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 to society, the instinctive principle of benevolence makes us instantly approve, and this approbation constitutes their morality. Thus, temperance, fortitude, courage, and 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 their 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

5 sufficient

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: *1st*, By what means shall a man in every case discover precisely what is the will of God? and, *2dly*, 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 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 any 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 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.

That these philosophers have not a just view of human nature, when they deny that there is any innate principle of benevolence in man, we shall endeavour to 19 Defects and excellency of the system.

(D) GASTRELL, CUMBERLAND, PUFFENDORF, NORRIS, BERKELEY, GAY, LOW, RUTHERFORTH, SOAME JENYNS, DR JOHNSON, MR PALEY, and MR GISBORNE, &c.

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.

† *Stuart's Elements of the Philosophy of the Human Mind.*

‡ *Johnson.*

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 connections, and to show that the steady practice of virtue must terminate in his ultimate happiness.

PART I.

Chap. I. *Of* Man *and his* Connections.

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 connection* 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 most new. Thus the *love* of *novelty* is formed, and the passion of *wonder* kept awake. By degrees he comes 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 *moral chain*; the early rudiments, or outlines, of his character; his first rude essays towards agency, freedom, manhood.

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. 21 His childhood.

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. Mean while 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.

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 connections spread among his neighbours, fellow-citizens, and countrymen, 22 His youth.

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trymen, his *thirst of praise*, *emulation*, and *social affections* grow more intense and active. Mean while, 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 god-like of all connections.

23 His manhood.

Man having now reached his prime, either new passions succeed, or the old set are wound up to an higher pitch. For, growing more sensible of his connections 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 friendships, grasps at power, courts honour, lays down cooler plans of interest, and becomes more attentive to the concerns of society: he enters into family connections, 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 thatperiod, 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.

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.

26 Their joint effects.

This is a short sketch of the *principal movements* of 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 œconomy 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. 27 The directing power.

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*. 28 The judging or approving powers.

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.

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

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thing 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 childrens 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.

29 An attempt to prove that we have from nature no ſuch powers,

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.

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, 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 connection 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.

30 Examined and ſhown

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.

Hence we ſee how different lines of conduct may in ſimilar circumſtances be approved of as virtuous in different

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ferent 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 undergoing the greatest hardships; and in a state where the people have no fixed habitations, and where the chace 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 authorised 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 enure 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 chace, 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.

31 To originate in the objector's mistaking the extent of those powers;

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; recognise 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.

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 (B), some respect merely the *security* and *defence* of the creature, such as *resentment* and *fear*; whereas 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.

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33 Division of the passions.

34 Defensive passions.

35 Private or appetitive passions.

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 Public passions.

Our *public* or *social* affections are adapted to the several *social connections* 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 analysed 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 The measure of powers.

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 Measure of the defensive passions.

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

(B) Here we use passions and affections without distinction. Their difference will be marked afterwards.

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can we give way to either without painful fenfations. Without a certain degree of them, we are naked and expofed. With too high a proportion of them, we are miferable, and often injurious to others. Thus *cowardice* or *timidity*, which is the excefs of fear, inftead of faving us in danger, gives it too formidable an appearance, makes us incapable of attending to the beft means of prefervation, and difarms us of *courage*, our natural armour. *Fool-hardinefs*, which is the want of a due meafure of *fear*, leads us heedlefsly into danger, and lulls us into a pernicious fecurity. *Revenge*, i. e. *exceffive refentment*, by the violence of its commotion, robs us of the *prefence of mind* which is often the beft guard againft injury, and inclines us to purfue the aggreffor with more feverity than felf-defence requires. *Pufillanimity*, or the want of a juft indignation againft wrong, leaves us quite unguarded, and tends to fink the mind into a paffive enervated tamenefs. Therefore, "to keep the defenfive paffions duly proportioned to our dangers, is their natural pitch and tenor."

39 Meafure of the private paffions.

The *private* paffions lead us to purfue fome *pofitive* fpecies of *private* good: that *good* therefore which is the object and end of each muft be the meafure of their refpective force, and direct their operation. If they are too *weak* or *fluggifh* to engage us in the purfuit of their feveral objects, they are evidently *deficient*; but if they defeat their end by their *impetuofity*, then are they ftrained beyond the juft tone of nature. Thus *vanity*, or an *exceffive paffion for applaufe*, betrays into fuch meanneffes and little arts of popularity, as makes us forfeit the honour we fo anxioufly court. On the other hand, *a total indifference about the efteem of mankind*, removes a ftrong guard and fpur to virtue, and lays the mind open to the moft abandoned profecutions. Therefore, "to keep our private paffions and defires proportioned to our *wants*, is the juft meafure and pitch of this clafs of affections."

40 Comparative force.

The *defenfive* and *private* paffions do all agree in general, in their tendency or conducivenefs to the intereft or good of the individual. Therefore, when there is a collifion of intereft, as may fometimes happen, that *aggregate of good* or *happinefs*, which is compofed of the particular goods to which they refpectively tend, muft be the common ftandard by which their *comparative degrees* of ftrength are to be meafured: that is to fay, if any of them, in the degree in which they prevail, are incompatible with the greateft aggregate of good or moft extenfive intereft of the individual, then are they unequal and difproportionate. For in judging of a particular *fyftem* or *conftitution* of powers, we call that the *fupreme* or *principal* end in which the aims of the feveral parts or powers coincide, and to which they are fubordinate; and reckon them in due proportion to each other, and right with regard to the whole, when they maintain that fubordination of fubferviency. Therefore, "to proportion our defenfive and private paffions in fuch meafure to our dangers and wants as beft to fecure the individual, and obtain the greateft aggregate of private good or happinefs, is their juft balance or comparative ftandard in cafe of competition."

41 Meafure of the public affections.

In like manner as the *public* or *focial* affections point at the good of others, that *good* muft be the meafure of their force. When a particular *focial* affection, as *gratitude* or *friendfhip*, which belongs to a particular *focial connection*, *viz*. that of a *benefactor* or of a *friend*, is too feeble to make us act the *grateful* or *friendly* part, that affection, being infufficient to anfwer its end, is *defective* and *unfound*. If, on the other hand, a particular paffion of this clafs counteract or defeat the intereft it is defigned to promote, by its violence or difproportion, then is that paffion *exceffive* and *irregular*. Thus *natural affection*, if it degenerates into a *paffionate* fondnefs, not only hinders the parents from judging coolly of the intereft of their offspring, but often leads them into a moft partial and pernicious indulgence.

42 Collifion of focial affections.

As every kind affection points at the good of its particular object, it is poffible there may be fometimes a collifion of interefts or goods. Thus the regard due to a *friend* may interfere with that which we owe to a *community*. In fuch a competition of interefts, it is evident that the *greateft* is to be chofen; and that is the greateft intereft which contains the greateft fum or aggregate of public good, greateft in *quantity* as well as *duration*. This then is the *common ftandard* by which the refpective forces and fubordinations of the focial affections muft be adjufted. *Therefore* we conclude, that "this clafs of affections are found and regular when they prompt us to purfue the *intereft* of *individuals* in an entire confiftency 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 ftand to *individuals* or to *fociety*."

Thus we have found, by an induction of particulars, the *natural pitch* or *tenor* of the *different orders of affection*, confidered apart by themfelves. Now, as the *virtue* or *perfection* of every creature lies in following its nature, or acting fuitably to the juft proportion and harmony of its feveral powers; therefore, "the VIRTUE of a creature endowed with fuch affections as *man* muft confift in obferving 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 paffion that ftands by itfelf, without fome relation to the reft, we cannot pronounce of any one, confidered APART, that it is either *too ftrong* or *too weak*. Its ftrength and juft proportion muft be meafured not only by its fubferviency to its own immediate end, but by the refpect it bears to the whole fyftem of affection. Therefore, we fay a paffion is *too ftrong*, not only when it defeats its own end, but when it impairs the force of other paffions, which are equally neceffary to form a *temper of mind* fuited to a certain *œconomy* or *ftate*; and too weak, not merely on account of its infufficiency to anfwer its end, but becaufe it cannot fuftain its *part* or *office* in the balance of the whole fyftem. Thus the *love of life* may be *too ftrong* 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 fecure, or weakens the incentives which make it more active and public-fpirited.

44 Limits of private affections.

If it be afked, "How far may the affections towards private good or happinefs be indulged?" One limit was before fixed for the particular indulgence of each, *viz*. their fubordination to the common aggregate of good to the private fyftem. In thefe therefore a due

Of Moral Obligation. 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 connections." 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 œconomy, 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 controling 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 *controling* principles.

48 In what it consists. We conclude, therefore, from this *induction*, that "the *constitution* or *just œconomy* of *human nature* consists in a regular *subordination* of the *passions* and *affections* to the *authority* of *conscience* and the *direction* of *reason*."

49 Oeconomy 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 connections*, and proportioned to the wants and dangers of others."

But the *natural state*, or the *sound* and *vigorous constitution* of any creature, or the *just œconomy* 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 *œconomy*." 50 Human virtue and perfection.

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 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 *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. 51 How conformable to reason.

If the idea of *moral obligation* is to be deduced merely from this *aptitude* or *connection* 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 connection, the proper judge of *moral obligation*; and on this supposition it may be defined, as hath been done by some, the connection 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 connection 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 connection 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. 52 Connection between affections and ends, not the idea of moral obligation.

But if the mere connection between certain passions, or a certain order of passions and certain ends, are 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 connection 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.

Let us appeal, therefore, to our inmost sense and experience, "how we stand affected to those different sets 53 Idea of it from experience.

Of Moral Obligation. 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 Why the defensive passions approved. 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 over-acted 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 an 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 in 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 affection 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 *deposit* 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 intitled to the applause of every impartial spectator of our conduct.

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." 58 Moral obligation.

And

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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 *connections* often subject him to such

59 Moral agent.

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

60 Moral action good and bad.

action *moral*, i. e. *approveable*, or *blameable*, it must be done *knowingly* and *willingly*, or *from affection* and *choice*. "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 deposit 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 deposit 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, art, 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.

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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 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 scarce approve him who demurs on the obligation to that conduct which the case suggests.

64 Pleasure, not the idea of obligation.

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 The survey proposed.

WE have now taken a *general* prospect of MAN and of his *moral powers* and *connections*, 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 Inward anatomy of the system of the mind.

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-

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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 connections of those effects with their respective causes, or of the various latent energies of natural things.— He is therefore informed of this connection 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.

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, cloaths, 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 connections 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 got not 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

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tive 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 re-action 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.

* Vid. *Hutcheſon's Conduct of the Paſſions*, *treat*. I. § 2.

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 dottage, the moſt torturing anxiety, and downright 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 with-held 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 *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 the other: 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 controuling 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 enquiry, 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

Of Perception and Affection. with private good, though he does not always see that tendency, nor mind that connection. 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 connection 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 œconomy*; 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 consciousness 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 *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 an 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.

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 connections 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. 82 To a progressive state.

In this beautiful œconomy 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. 83 Harmony of our structure and state.

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. 84 In what œconomy virtue consists.

PART

PART II.

CHAP. I. *The principal Distinctions of* DUTY *or* VIRTUE.

WE have now considered the *constitution* and *connections* 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 complection* 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*, *œconomical*, 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.

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. 88 Duties to God.

89 Method. We chose 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*," 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*.

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. 91 Conscience.

92 Its 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; this 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 like-

Of Man's duty to Himself. wise criminal, if that error which misled the conscience was the effect of inattention, or of any criminal passion *.

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

93 How conscience is to be rectified. giving it proper and sufficient materials for judging right, *i. e.* by inquiring into the whole state of the case, the relations, connections, 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.

* *Hutchef. Mor. Inst.* lib. 2. 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 an higher and nobler species of good, towards which we feel that peculiar movement we call *approbation* 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.

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*, 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 connections which open upon us in the different stages of our progressive state. 96 Human happiness.

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 connections, 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. 97 Gradation of goods.

Of man's duty to Himself.

pineſs. 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 human 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 an 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. They are chiefly

102 How attained. 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.

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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*, *aukwardneſs*, 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*, *graceſulneſs;* and there are others, which to our ſenſe of decorum appear *uncomely*, *affected*, *diſingenuous*, and *aukward*, 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 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. The former qualities or goods are beſt attained by a liberal education, 106 How attained. 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 Goods of exterior ſocial connections. We are next to conſider thoſe goods which conſiſt in exterior ſocial connections, as *fame*, *fortune*, *civil authority*, *power*.

108 Fame. The firſt has a two-fold 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.

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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 Fortune, power, &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
110 How far pursuable. power can satisfy them. 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 god-like 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
111 Avarice. far useless to the society to which we belong. "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.*"
To what extent the strict measures of virtue will allow 112 Ambition.
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.

Now the best, and indeed the only way to obtain a 113 How fame and power are attained.
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 over-awed 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.

The next species of objects in the scale of good, are 114 Goods of the intellect.
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.

As *man* is a *rational* creature, capable of knowing 115 Their moment.
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 those opinions, those passions, and that conduct depend *.

* *Philos. Sinic. Confuc.* lib. 1. § 3, 4, &c.

But besides the future consequences and moment of

improving

Of Man's duty to Himself. improving our intellectual powers, their immediate exercise on their proper objects yields the most rational and refined pleasures. Knowledge, and a right taste in

116 The pleasures they give. 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

117 Knowledge and taste; 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 these 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 œconomy by which it is governed! to be acquainted with the human mind, the connections, 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 mentual enjoyments to be the most *refined*, and indeed the *only* luxury. Besides, by a just and large knowledge of nature, we recognise 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 inconveniences 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 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.

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. 120 How attained.

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, that form and 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. 121 Moral goods.

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, 122 Their moment.

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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 (D) 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 inſure 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 moment, 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 inſure 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.

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 over-rated 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 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. 125 Humility.

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. 126 Reſignation.

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 127 Chief good, *objective* and *formal.*

(D) As Ravilliac, who aſſaſſinated Henry IV. of France; and Balthaſar Geraerd, who murdered William I. prince of Orange.

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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. *First*, 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 Connection 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 connection 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.

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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* connection, 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 common parents, and that brotherhood of nature which unites them into a closer community of interest and affection.

SECT. II. *Concerning Marriage.*

132 Connection with the other 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 The grounds of this connection. 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 connection being purely *natural*, and merely for propagating and rearing their offspring, no sooner is that end answered, than the connection 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, there-

Duties of Society. 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 Moral ends of marriage. 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 connections 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 connection, 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 connection* 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.

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 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. 136 Polygamy.

Sect. III. *Of Parental Duty.*

The connection of parents with their children is a natural consequence of the matrimonial connection; and the duties which they owe them result as naturally from that connection. 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 an hardy kind of education for the more honourable and important duties of *public* life. 137 Connection of parents and children.

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 138 The authority founded on that connection.

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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 connection.

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 connection, 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. 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 cloathing; 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 that liberty which neither they nor their parents have forfeited.

142 The conditions of service.

143 The case of great offenders.

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 The case of captives.

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."

* *Hutches. Mor. Inst. Phil.* lib. 3. 3.

Sect. V. *Social Duties of the private Kind.*

Hitherto we have considered only the *domestic œconomical* duties, because these are first in the progress of nature. But as man passes beyond the little circle of a family, he forms connections with relations, friends, neighbours, and others; from whence results a new

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a new train of duties of the more private social kind, as "friendship, chastity, courtesy, good-neighbourhood, charity, forgiveness, hospitality."

145
Man's aptitude for society.

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 an 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.

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 any wise 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 connection with society and subserviency, to a public interest. Therefore it is our duty to regard these closer connections 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 those 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 connection 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 an 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, 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 connections 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 im-

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proved 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 connection 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 is 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 connections, are no less necessary and obligatory to creatures united in 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 unite 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 *foregiveness* 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 uncontrouled 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 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.

* See Part I. chap. ii. and iv.

152 Hospitality.

The most enlarged and humane connection 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 connections 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.

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SECT. VI. *Social duties of the* COMMERCIAL *kind.*

153 Commercial duties.

THE next order of connections 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 Their foundation.

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 has given him an infinite variety of herbs, grain, fossils, minerals, wood, 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 conveniencies 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 conveniencies 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 to 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 connterbalanced 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

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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 irreconcileable 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;—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 connections.

161 Political connections.

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 these 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;

ſons; from the miſtakes or petulant paſſions of their fellow-creatures; from their preference of themſelves to their neighbours; and from all the little exorbitances 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 not 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 exerciſes 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 connections, 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 incroach 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 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.

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. 164 Reſignation and obedience to the laws, &c. 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

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der, 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, intitle 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.

165 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, chusing 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 incroachment 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 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."

* *Essays*, vol. i.

CHAP. IV. *Duty to* GOD.

168 Divine connections.

OF all the *relations* which the human mind sustains, that which subsists between the *Creator* and his *creatures*,

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tures, 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 Existence of 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 *connection* 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 connection. 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 recognise 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 œconomies, 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

170 His relation to the human mind. 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 any where 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 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.

It is evident from the slightest survey of morals, 171 Immorality of impiety.
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 connection 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.

As it has been observed already, that our *affections* 172 Right opinions of God.
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 super-

 stitious,

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ſtitious, 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 ſcrvile 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* full 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, tho' 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 a 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,

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nation, 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 to the selfish passions, and how little to 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 *connections*, *natural religion* will persuade its sincere votary faithfully to comply with the *obligations*, and perform the *duties* which result from those relations and connections. 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 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

Duty to God. 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 an 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*.

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*, 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 an 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*. 186 Ideas of beauty and 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*.

The mind, still pushing onwards and increasing its stock of ideas, ascends from those to an 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*. 187 Moral ideas and a moral taste.

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. 188 Sources of association.

But whatever the reasons are, whether *similitude, co-existence, 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, 189 Laws of association.

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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 Leading passions fol. low 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 The importance and use of the imagination. 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 heightening 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*. When the mind becomes more sensible to those objects or appearances in which it perceives *beauty*, *uniformity*, *grandeur*, and *harmony*, as fine cloaths, 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 conseqence 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 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 extravagent.

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193 In heightening the pleasures of beauty, harmony, &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 intitled, or should intitle, 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. 194 In raising the value of external symbols, &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 œconomy*, 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 195 In heightening the value of wealth, power, &c.

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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 imagination.

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, than 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 *independency*, *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 analysed 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 enflamed *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 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 to virtue.

200 By rightly studying human nature.

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. 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 farther 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 the *many*, the cares of keeping, the fears

201 By comparing the moment and abatements of different goods.

of

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 By observing our own bent and character, &c.

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*, *connections*, *habitudes*, *fortune*, *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.

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 *picturesque* 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 right training, as well as our understandings. For such an employment, by enlarging one's experience, giving an 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 *connection* will give a vast compass and dignity to our sentiments and actions, a noble 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 *œconomy* 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."

† *Vide* Part I. chap. i. ii. &c.

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 arises 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,

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tradiction, 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 irreconcileable 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 shew, 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 acknoledged 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*.

From 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 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 His enjoyments.

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,

* See Part II. chap. ii.

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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 From merited esteem and sympathy.

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.

§ *Vide* Shaftsb. *Inq. into Virtue*, Book II.

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.

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.

**See* Part I. chap. i. ii.

217 In the public affections.

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 dottage*, 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 havoc both within and abroad; as

From Happiness.

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 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

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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 procure indeed 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.

From the Being and Providence of God.

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. 224 On one's family.

CHAP. III. *Motives to* VIRTUE *from the* BEING *and* PROVIDENCE *of* GOD.

BESIDES the intereſting motive mentioned in the laſt Chapter, there are two great motives to *virtue*, 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*. 215 Two external motives to virtue.

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 *connection* 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. 226 Their importance.

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*." 227 Piety.

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, 228 A ſupport to virtue.

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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 A guard and enforcement to 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 animadversion 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.

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 reflections 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 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 subtilties of school-learning. Those proofs which are brought from *analogy*, from the *moral constitution* and *phænomena* 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.

From the Immortality of the Soul.

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*, 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 connection 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

* *Vide* Ludov. Viv. *de Relig. Christ.* Lib. II. *de Vita Uteri*, &c.

sphere

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 an *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 an 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?

* See Butler's *Analogy*, Part I.

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 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 embaraſſed life. Were ſuch mighty powers, ſuch god-like 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 Unſatisfied deſires of exiſtence and happineſs.

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 ignobler 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,

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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 Therefore man immortal.

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 *out-lines* of *reaſon* and *virtue* muſt be drawn at preſent, to be afterwards enlarged to the *ſtature* and *beauty* of angels.

* *Vide* Religion of Nature, § 9.

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 tract 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?

From the Immortality of the Soul.

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, 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

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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 uncorrupt 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.

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 *connections* of our nature, both *material* and *immaterial*, and *future* as well *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.

242 Advantages of the Christian scheme, and its connection with natural religion or morality.

Moral ‖ Morant.

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 (Philip), a learned and indefatigable antiquary and biographer, son of Stephen Morant, was born at St Saviour's in the isle of Jersey, October 6. 1700; and, after finishing his education at Abingdon school, was entered December 16th, 1717 at Pembroke college Oxford, where he took the degree of B. A. June 10th, 1721, and continued till midsummer 1722; when he was preferred to the office of preacher of the English church at Amsterdam, but never went to take possession. He took the degree of M. A. in 1724, and was presented to the rectory of Shellow Bowells, April 20th 1733; to the vicarage of Bromfield, January 17th 1733-4; to the rectory of Chicknal Smeley, September 19th, 1735; to that of St Mary's, Colchester, March 9th, 1737; to that of Wickham Bishop's, January 21st, 1742-3; and to that of Aldham, September 14th, 1745. All these benefices are in the county of Essex. In 1748 he published his History of Colchester, of which only 200 copies were printed. In 1751 he was elected F. S. A.; and in February 1768 he was appointed by the lords sub-committees of the house of peers to succeed Mr Blyke in preparing for the press a copy of the rolls of parliament; a service to which he diligently attended till his death, which happened November 25th, 1770. Besides the above work, and many useful translations, abridgements, and compilations, &c. he wrote, all the Lives in the *Biographia Britannica* marked C; also the life of Stillingfleet, which has no mark at the end: The History of Essex, 1760, 1768, 2 vols folio: The life of King Edward the Confessor, and about 150 sermons. He prepared the rolls of parliament as far as the 16th of Henry IV. The continuation of the task devolved upon Thomas Astle, Esq; who had married his only daughter.

Morant ‖ Morat.

MORANT-Point, the most easterly point or promontory of the island of Jamaica, in America. W. Lon. 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 Geman *marast*, "a muddy place;" and others from *maresc*, of *maricetum*, *à mariscis*, i. e. rushes. See BOG, FEN, and DRAINING.

In Scotland, Ireland, and the north of England, they have a peculiar 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 rich trading, and considerable-

Morat, Morata. ſiderable town of Swiſſerland, capital of a bailiwick of the ſame name, belonging to the cantons of Bern and Friberg, with a caſtle, where the bailiff reſides. 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, the country about it being 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 ampitheatre 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.

* See *Hiſtory of France*.

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 a very extraordinary 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, who had ſtudied phyſic, and taken his doctor's degree at Ferrara, fell in love with her, and married her. She now went with her huſband to Germany, taking her little brother 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, and 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 plane divinæ, opera omnia quæ hactenus inveniri potuerint; quibus Cœlii ſecundi curionis epiſtolæ ac orationes acceſſerunt*; which has had ſeveral editions in octavo.

Moravia. MORAVIA, a river of Turky 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 over-run 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. In this country are likewiſe quarries of marble, baſtard diamonds, amethyſts, alum, iron, ſulphur, ſalt-petre, and vitriol, with wholeſome 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

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 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 & 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 planted in 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 Ferdinand 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, gun-powder, &c. There are also some iron-works and glass-houses in the country.

The inhabitants of Moravia in general are open-hearted, 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 crosses all Moravia, where it 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 his possessing 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

Mordella, More.

of ancient and modern literature; hence his familiar letters, inserted among those of his friend Mr Pope, are an ornament to that excellent collection.

Plate CCCXV.

MORDELLA, in zoology, a genus of insects of the coleoptera order. The antennæ are thread-shaped and serrated; the head is deflected under the neck; the pappi are clavated, compressed, and obliquely blunted; and the elytra are bent backwards near the apex. There are six species, all natives of different parts of Europe.

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 Milk-street, London. He was first sent to a school at St Anthony's in Threadneedle street; and afterwards 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 100 l. 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.

More.

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 appears, 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 this 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

More.

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's 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 Well-hall 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.

MORE (Sir Antonio), an eminent painter, was born at Utrecht in 1719. He became a scholar of John Schorel, but seems to have studied the manner of Holbein, to which he approached nearer than to the freedom of design in the works of the great masters that he saw at Rome. Like Holbein he was a close imitator of nature, but did not arrive at his extreme delicacy of finishing; on the contrary, Antonio sometimes struck into a bold and masculine style, with a good knowledge of the chiaro scuro. In 1522, he drew Philip II. and was recommended by cardinal Granvelle to Charles V. who sent him to Portugal, where he painted John III the king, Catherine of Austria his queen, and the infanta Mary first wife of Philip. For these three pictures he received 600 ducats, besides a gold chain of 1000 florins, and other presents. He had 100 ducats for his common portraits. But still ampler rewards were bestowed on him when sent into England, to draw the picture of queen Mary, the intended bride of Philip. They gave him 100l. a gold chain, and a pension of 100l. a quarter as painter to their majesties. He made various portraits of the queen; one was sent by cardinal Granvelle to the emperor, who ordered 200 florins to Antonio. He remained in England during the reign of Mary, and was much employed; but having neglected, as is frequent, to write the names on the portraits he drew, most of them have lost part of their value, by our ignorance of the persons represented. On the death of the queen, More followed Philip into Spain, where he was indulged in so much familiarity, that one day the king slapping him pretty roughly on the shoulder, More returned the sport with his hand-stick; a strange liberty (Mr Walpole observes), to be taken with a Spanish monarch, and with such a monarch! A grandee interposed for his pardon, and he was ordered to retire to the Netherlands; but a messenger was dispatched to recal him before he had finished his journey. The painter, however, sensible of the danger he had escaped, modestly excused himself, and proceeded. At Utrecht he found the duke of Alva, and was employed by him to draw several of his mistresses, and was made receiver of the revenues of West Flanders; a preferment with which they say he was so elated, that he burned his easel and gave away his painting tools. More was a man of a stately and handsome presence; and often went to Brussels, where he lived magnificently. At what time or where he was knighted, is uncertain. He died at Antwerp in 1575, in the 56th year of his age. His portrait, painted by himself, is in the chamber of painters at Florence, with which the great duke, who bought it, was so pleased, that he ordered a cartel with some Greek verses, written by Antonio Maria Salvini his Greek professor, to be affixed to the frame. Another picture of himself, and one of his wife, were in the collection of Sir Peter Lely. King Charles had five pictures painted by this master. Mr Walpole mentions a number of others that are in England. But More did not always confine himself to portraits. He painted several historic pieces, particularly one much esteemed of the resurrection of Christ with two angels, and another of Peter and Paul. A painter, who afterwards sold it to the prince of Condé, got a great deal of money by showing it at the foire St Germain. He made a fine copy of Titian's Danae for the king; and left unfinished the Circumcision, designed for the altar in the church of our Lady at Antwerp.

MORE (Henry), an eminent English divine and philosopher, in the 17th century, was educated at Eton school, and in Christ-college in Cambridge, of which he became a fellow, and spent his life in a retired way, publishing a great number of excellent works. He refused bishoprics both in Ireland and England. He was an open-hearted sincere Christian philosopher, who studied to establish men in the belief of providence against atheism. Mr Hobbes was used to say, that if his own philosophy was not true, there was none

(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 bid him stay until he had put aside his beard, saying, "That had never committed any treason."

none that he ſhould ſooner like than our philoſopher's. His writings have been publiſhed together in Latin and Engliſh, folio.

More (Alexander), was born at Caſtros in 1616. His father was a Scotſman, and principal of the college which the Calviniſts had in that city. Alexander was ſent to Geneva, where he was made profeſſor of Greek and of Theology, and at the ſame time diſcharged the office of a paſtor. His violent love of women, and the irregularity of his conduct, excited a great number of enemies againſt him. Saumaiſe, informed of his diſagreeable ſituation, invited him to Holland, where he was firſt appointed profeſſor of Theology at Middleburgh, and afterwards profeſſor of hiſtory at Amſterdam. The duties of theſe ſtations he diſcharged with great ability; and in 1655 he went to Italy, where he remained a conſiderable time. It was during his travels in Italy that he publiſhed his beautiful poem on the defeat of the Turkiſh fleet by the Venetians; and this work procured him the preſent of a golden chain from the republic. Having taken a diſlike to Holland, he was tranſlated to Charenton. There his ſermons attracted a numerous audience, not ſo much for their eloquence as for the ſatirical alluſions and witticiſms with which they abounded. This kind of ſtyle ſucceeded with him, becauſe it was natural; but in his imitators it appeared altogether ridiculous. The impetuoſity of his character brought him into new quarrels, eſpecially with Daillé, who had greatly the better of him in the diſpute.—This ſingular man died at Paris September 20th, 1670, aged 54, in the houſe of the ducheſs de Rohan. He was never married. His works are, 1. A Collection of Controverſial Tracts. 2. Beautiful Orations and Poems, in Latin. 3. An anſwer to Milton, intitled, *Alexandri Mori fides publica*. Milton has attacked him with great ſeverity in his writings. Thoſe ſermons of his which are publiſhed, by no means juſtify the reputation which he had acquired for that kind of compoſition.

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 grow there. 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.

MOREAU (James), an eminent French phyſician, born at Chalons-ſur Saone, was the diſciple and friend of the famous Guy Patin. He drew upon himſelf the jealouſy and hatred of the old phyſicians by the public theſes he maintained, and afterwards vindicated in his writings. He died in a very advanced age in 1729. He wrote in French, 1. Conſultations on the Rheumatiſm. 2. A chemical treatiſe on Fevers. 3. A phyſical diſſertation on the Dropſy; and other works which are eſteemed.

MOREELSE (Paul), an eminent painter, was born at Utrecht in 1575, and ſtudied painting under Michael Mirevelt. He was very ſucceſsful, not only in portraits, but hiſtorical ſubjects and architecture, particularly after he had improved his taſte by his ſtudies in Italy. We have ſome excellent wood-cuts in chiaro-ſcuro by this artiſt, who died in 1638.

MOREL, the name of ſeveral celebrated printers to the kings of France, who, like the Stephenſes, 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.

Morel (Dom Robert), a benedictine monk of the ſociety of Saint-Maur, was born at Chaiſe-Dieu in Auvergne, A. D. 1653. He was appointed keeper of the library of Saint-Germain des Pres in 1680. He was afterwards ſuperior of different religious houſes. In 1699 he diſengaged himſelf from every care, and retired to Saint Denys, where he ſpent his time in compoſing works of practical religion. This learned monk, who enjoyed from nature a lively and fruitful imagination, excelled chiefly in ſubjects of piety, in a knowledge of the Chriſtian character, and of the rules which regard the conduct of the Chriſtian life. His converſation was ſprightly and refined, his anſwers were prompt and ingenious, his temper was gentle,

 equable,

equable, and full of gaiety mingled with discretion. His slovenly appearance did not debase the beauty of his mind. All his words breathed charity, piety, uprightness, sincerity, and innocence of manners. Great simplicity and modesty, the limits of which he never transgressed, concealed his excellencies from the vulgar, but made him rank higher in the estimation of the wise and sensible part of mankind. Dom Morel died A. D. 1731, aged 79. His principal works are, 1. *Effusions de cœur sur chaque verse des Pseaumes et des Cantiques de l'Eglise*; Paris, 1716, in 5 vols. 12mo. P. de Tournemine, a Jesuit, esteemed this book (which abounds in pious and affecting thoughts and expressions) so much, that he perused it constantly; and when he was obliged to go to the country, he always carried a volume of it along with him. He earnestly sought to be introduced to the author, and intreated on his knees that he would grant him his benediction (*Histoire litteraire de la congregation de Saint Maur, p.* 504.) 2. *Entretiens spirituels sur les Evangiles des Dimanches et des Mysteres de toute l'année, distribués pour tous les jours de l'Avent*, 1720, 4 vols. 12mo. 3. *Entretiens spirituels, pour servir de preparation à la Mort*. 12mo, 1721. 4. *Imitation de N. S. J. C.* a new translation, with a pathetic prayer, or an effusion of the heart, at the conclusion of every chapter, in 12mo, 1723. 5. *Meditations Chretiennes sur les Evangiles de toute l'année*, 2 vols. 12mo, 1726. 6. *De l'Esperance Chretienne et de la Confiance en la misericorde de Dieu*, 12mo, 1728. The greater part of Morel's works are devotional; and his observations are drawn chiefly from the scriptures, and from the practical writings of the fathers. This circumstance greatly raised the reputation of his works, and at the same time excited the envy and ill-will of his enemies. By them he was considered as a Jansenist; and in this light he is represented in the *Dictionnaire des livres Jansenistes*.

Morel (Andreas), a very eminent antiquary, born at Berne in Switzerland. Having a strong passion for the study of medals, he travelled through several countries, and made large collections: in 1683 he published at Paris, in 8vo, *Specimen universæ rei nummariæ antiquæ*: and the great work of which this was the specimen was to be a complete collection of all ancient medals, of which he had at that time 20,000 exactly designed. Soon after this essay appeared, Louis XIV. gave him a place in his cabinet of antiques, in which capacity he brought himself into great danger by speaking too freely of M. Louvois on account of the neglect in paying his salary, or on some other private account, as he was committed to the Bastile, where he lay for three years; nor was he released until the death of Louvois, nor till the canton of Berne had interceded in his favour. He afterward accepted an invitation from the count of Schwartzburg at Arnstadt, in Germany, with whom he lived in the capacity of antiquary, and was furnished with every thing necessary for carrying on his grand work. In 1703 he died; and in 1734 came out at Amsterdam part of this collection, in 2 vols. folio, under the title of *Thesaurus Morellianus, sive familiarum Romanorum numismata omnia, diligentissimè undique conquisita*, &c. *Nunc primum edidit & commentario perpetuo illustravit Sigibertus Havercampus*. These volumes contain an explication of 3539 medals, engraved, with their reverses.

MORENA, (anc. geog.), 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.

MORESBY, a harbour a litttle above Whitehaven, in Cumberland; in and about which many remains of antiquity have been dug up, such as altars and stones, with inscriptions on them; and several caverns have been found called Pict's Holes. Here is supposed to have been a Roman fortification.

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.

MORETON, a town of Devonshire, with a market on Saturdays, seated on a hill, near Dartmore, and is a pretty large place, with a noted market for yarn. It is 14 miles south-west of Exeter, and 185 west by south of London. W. Long. 3. 46. N. Lat. 50. 39.

Moreton, a town in Gloucestershire, whose market is disused. It is a good thoroughfare, and seated on the Fosseway, 29 miles east-south-east of Worcester, and 83 west-north-west of London. W. Long. 1. 36. N. Lat. 52. 0.

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 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

pied 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 *Advertaria 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 handsome and rich town of Swisserland, in the canton of Bern, and capital of a bailiwick, with a castle where the bailiff resides. It is a place of some trade on account of a canal, from which they transport merchandizes from the lake of Geneva to other parts. There is a fine prospect from it, and it is seated 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, fertile in 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.

MORHANGE, a town of Germany, in Lorrain, whose lord has the title of Rhinegrave, and depends on the empire. It is 24 miles north-east of Nanci, and 200 east of Paris. E. Long. 6. 42. N. Lat. 48. 51.

MORHOFF (Daniel George), a very learned German, born at Wismar in the duchy of Mecklenburgh, in 1639. The duke of Holstein, when he founded an university at Kiel, made him professor of eloquence and poetry there in 1665; to which was afterwards added the professorship of history, and in 1080 the office of librarian to the university. He was the author of many works of a small kind; as orations, dissertations, theses, and poems: but his chief work was his *Polyhistor, sive de notitia auctorum et rerum commentarii*; first published at Lubec in 1688; which has been greatly enlarged since his death in 1691, and gone through several successive editions.

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 bigness of a walnut, pierced with holes like a honeycomb, and said to be good for creating an appetite. They are also accounted restorative, and frequently used in sauces and ragouts.

MORILLOS (Bartholomew), of Seville in Spain, was born A. D. 1613. After having cultivated painting with success in his own country, he travelled into Italy, where he was greatly admired for a manner peculiar to himself, and capable of producing a wonderful effect The Italians, astonished at the excellence of his genius and the freshness of his colouring, did not hesitate to compare him to the celebrated Paul Veronese. On his return to Spain, Charles II. brought him to court, with the intention of making him his first painter; but Morillos declined the offer, pretending, as an excuse, that his age would not permit him to accept of an employment of such importance. His extreme modesty, however, was the sole cause of his refusal. He died in 1685, aged 72 years.

MORIN (John Baptist), physician and regius professor of mathematics at Paris, was born at Villefranche in Beausolois, in 1583. After commencing doctor at Avignon, he went to Paris, and lived with Claude Dormi bishop of Boulogne, who sent him to examine the mines of Hungary; and thereby gave occasion to his *Mundus sublunaris anatomia*, which was his first production, and published in 1619. Upon his return to his patron the bishop, he contracted an attachment to

Morin. judicial astrology, concerning which he furnished the world with many ridiculous stories, and wrote a great number of books not worth enumerating. He died in 1656, before he had finished the favourite labour of his life, which was his *Astrologia Gallica*. Louisa Maria de Gonzaga queen of Poland gave 2000 crowns to carry on the edition, at the recommendation of one of her secretaries, who was a lover of astrology; and it appeared at the Hague in 1661, in one vol. folio, with two dedications, one to Jesus Christ, and another to the queen of Poland.

Morin (John), a very learned Frenchman, born at Blois, of Protestant parents, in 1591; but converted by cardinal du Perron to the catholic religion. He published, in 1626, some Exercitations upon the original of Patriarchs and Primates, and the ancient usage of ecclesiastical censures; dedicated to pope Urban VIII. In 1628 he undertook the edition of the Septuagint Bible, with Nobilus's version; and placed a preface before it, in which he treats of the authority of the Septuagint, and prefers the version in the edition made at Rome by order of Sixtus V. to the present Hebrew text, which he affirms has been corrupted by the Jews. About the same time he gave a French History of the deliverance of the church by the emperor Constantine, and of the temporal greatness conferred on the Roman church by the kings of France. He afterwards published Exercitations upon the Samaritan Pentateuch; and took the care of the Samaritan Pentateuch, for the Polyglot then preparing at Paris. He was greatly caressed at Rome; where, after living nine years at the invitation of cardinal Barbarini, he was recalled by Cardinal Richelieu, and died at Paris in 1659. His works are very numerous; and some of them as much valued by Protestants as Papists for the oriental learning they contain.

Morin (Simon), a celebrated fanatic of the 17th century, was born at Richemont, near Aumale, and had been clerk to Mr Charron, general paymaster of the army. He was very ignorant and illiterate; and therefore it is no wonder if, meddling in spiritual matters, he fell into great errors. He was not content with broaching his whimsies in conversation, but wrote them down in a book, which he caused to be privately printed in 1647, under the title of *Pensées de Morin dediées au Roi*. This book is a medley of conceit and ignorance, and contains the most remarkable errors which were afterwards condemned in the Quietists: only that Morin carries them to a greater length than any one else had done; for he affirms, "that the most enormous sins do not remove a sinner from the state of grace, but serve on the contrary to humble the pride of man." He says, "that in all sects and nations God has a number of the elect, true members of the church; that there would soon be a general reformation, all nations being just about to be converted to the true faith; and that this great reformation was to be effected by the second coming of Jesus Christ, and Morin incorporated with him."—He was in prison at Paris, at the time when Gassendi's friends were writing against the astrologer John Baptist Morin, whom they upbraided (but, as he replied, falsely) with being the brother of this fanatic. This was about 1650; after which Simon Morin was set at liberty as a visionary; and suffered to continue so till 1661, when Des Marets de St Sorlin, who, though a fanatic and visionary himself, had conceived a violent aversion to him, discovered his whole scheme, and had him taken up. The means Des Marets made use of for this discovery was by pretending to be one of his disciples; and he carried his treachery and dissimulation so far, as to acknowledge him for "the Son of man risen again." This acknowledgement so pleased Morin, that he conferred upon him, as a particular grace, the office of being his harbinger, calling him *a real John the Baptist revived*. Then Des Marets impeached him, and became his accuser; upon which Morin was brought to a trial, and condemned to be burnt alive. This sentence was executed on him at Paris, March 14th, 1663, in the form and manner following: After having made the *amende honorable* in his shirt, with a cord about his neck and a torch in his hand, before the principal gate of the church of Notre Dame, he was carried to the place of execution, and there tied to a stake to be burnt alive, together with his book intituled *Pensées de Morin*, as also all his papers and his trial. Afterwards his ashes were thrown into the air, as a punishment for his having assumed the title of the Son of God. His accomplices, too, were condemned to assist at his execution, and then to serve in the galleys for life, after having been whipped by the hangman, and marked with a burning iron with *fleurs de lis* upon the right and left shoulders. Morin gave out that he would rise again the third day; which made many of the mob gather together at the place where he was burnt.—It is said, that when the president de Lamoignon asked him, whether it was written in any part of Scripture, that the great prophet or new Messiah should pass through the fire? he cited this text by way of answer: *Igne me examinasti, et non est inventa in me iniquitas;* that is, "Thou hast tried me with fire, and no wickedness hath been found in me." Morin died with remarkable resolution; and it was then thought the judges had been too rigorous in their sentence, and that sending him to a mad-house would have been sufficient. They replied in defence of themselves, that Morin had owned many impious tenets; and that not in sudden starts and fits of heat, but in cool blood, and with deliberate obstinacy. But then a question will arise, whether a fool, any more than a madman, ought to be capitally punished for any opinion or degree of stubbornness?

Morin (Peter), was born at Paris, A. D. 1531: he went into Italy, and was employed by the learned Paulus Manucius in his printing-house at Venice.—He afterwards taught Greek and cosmography at Vicencia, whence he was called to Ferrara by the duke of that name. St Charles Borromeus, informed of his profound knowledge in ecclesiastical antiquities, of his disinterestedness, of his zeal and piety, offered him his friendship, and engaged him to go to Rome in 1575. The popes Gregory XIII. and Sixtus V. employed him in an edition of the Septuagint, 1587, and in one of the Vulgate, 1590, in folio. He also spent much of his time on an edition of the Bible translated from the Septuagint, and published at Rome, 1588, in folio; on an edition of the Decretals to the time

Morin. the time of Gregory VII. publiſhed at Rome, 1591; and on a Collection of General Councils, likewiſe publiſhed at Rome, 1608, 4 vols. This learned critic died at Rome, 1608, aged 77. His character was open, ſimple, ſincere, gentle, and honeſt: his temper was equal and agreeable. He was an enemy to artifice and cunning; he deſpiſed riches and honours; and he ſeemed to have a paſſion for nothing but ſtudy.—He ſpoke Italian with as much eaſe and propriety as the moſt intelligent native. He left behind him *Un Traité du bon uſage des Sciences*, and ſome other writings, publiſhed by Father Quetif, a Dominican friar, in 1675. His works diſplay great reſearch and excellent principles; and the author appears to have been well acquainted with the belles lettres and the languages. His edition of the Septuagint, printed at Rome, 1687, in folio, is now very ſcarce.

Morin (Stephen), miniſter of the Proteſtant reformed religion at Caen, the place of his birth, was admitted a member of the Academy of Belles Lettres in that city, notwithſtanding an expreſs law which excluded Proteſtants. His great learning gained him this mark of diſtinction. After the revocation of the edict of Nantes, he retired to Leyden in 1685, and from that to Amſterdam, where he was appointed profeſſor of Oriental languages. He died in 1700, at the age of 75, after being long ſubject to infirmities both of body and mind. He publiſhed eight diſſertations in Latin relating to ſubjects of antiquity, which are extremely curious. The Dordrecht edition of 1700, 8vo, is the beſt, and preferable to that publiſhed at Geneva in 1683, 4to. He wrote likewiſe the life of Samuel Bochart.

Morin (Henry), ſon to the preceding, was born at Saint-Pierre-Sur-Dive, in Normandy, and became a Roman Catholic after he had been a Proteſtant miniſter. He is the author of ſeveral diſſertations which are to be found in the Memoirs of the Academy of Inſcriptions, of which he was a member. He died at Caen, on the 16th of July 1728, aged 60, as much eſteemed as his father.

Morin (Lewis,), was born at Mans in 1635. He went on foot to Paris to ſtudy philoſophy, and collected herbs during the whole journey. He afterwards ſtudied phyſic, and lived in the manner of an anchorite, bread and water, or at moſt but a few fruits, being his whole ſubſiſtence. Paris was to him a hermitage; with this exception, that it furniſhed him with books, and with the converſation and acquaintance of the learned. He received the degree of doctor of medicine in 1662; and, after ſeveral years practice, he was expectant at the Hotel-Dieu. His reputation made Mademoiſelle de Guiſe chooſe him for her firſt phyſician, and the Academy of Sciences for one of its members. He died A. D. 1715, aged 80. A long and vigorous life, with a gentle and eaſy death, were the rewards of his temperance. The exerciſes of religion and the duties of his ſtation occupied his whole time. No part of it was ſpent in paying or receiving viſits. "Thoſe who come to ſee me (ſaid he) do me honour; thoſe who do not come, lay me under an obligation." "It was only an Anthony (ſaid Fontenelle) who could viſit this Paul." He left a library valued at 20,000 crowns, an herbal, together with a cabinet of medals; and this ſeems to have been his whole fortune. His mental enjoyments had been much more expenſive than thoſe of the body. An index to Hippocrates in Greek and Latin, much more copious and better finiſhed than that of Pinus, was found among his papers.

Morin || Moriſon.

Morin (John), was born at Meung near Orleans in 1705, and in 1732 he was appointed profeſſor of philoſophy at Chartres. In 1750 the biſhop of Chartres rewarded his long and aſſiduous attention to claſſical learning by a canonry in the cathedral. At the age of 38, Morin publiſhed his *Mecaniſme Univerſel*, one volume 12mo, which contains a great deal of information, but much more conjecture. His next work was a Treatiſe on Electricity, publiſhed in 1748. His third and laſt performance was an anſwer to the Abbé Nollet, who had attacked his opinions concerning electricity. His reputation was not limited to the province in which he lived: he was well known to the academies of ſciences at Paris and Rouen, with whom he frequently correſponded. He continued his application to the ſciences, and diſplayed the virtues of the prieſt and the philoſopher to the laſt hour of his life. This valuable man died at Chartres, on the 28th of March 1764, at the age of 59.

MORINA, in botany: A genus of the monogynia order, belonging to the diandria claſs of plants; and in the natural method ranking under the 48th order, *Aggregatæ*. The corolla is unequal; the calyx of the fruit is monophyllous and dented; the calyx of the flower bifid; there is one ſeed under the calyx of the flower.

MORINORUM Castellum (anc. geog.), 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, in botany: A genus of the monogynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 48th order, *Aggregatæ*. The flowers are aggregate and monopetalous; the ſtigmata bifid; the fruit plums aggregate, or in cluſters.

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 it. 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 of his *phyſician*, and that of *profeſſor royal of botany*, with a penſion of 200 l. *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

Morisonia, Morlachia. 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, in botany: A genus of the polyandria order, belonging to the monadelphia class of plants; and in the natural method ranking under the 25th order, *Putamineæ.* The calyx is single and bifid; the corolla tetrapetalous; there is one pistil; the berry has a hard bark, is unilocular, polyspermous, and pedecellated.

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 (according to these authors) is indicated even 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 hath 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 tracks from the Adriatic sea to the frozen ocean. The emigrations of the various tribes of the Slavi, who, under the names of *Scythians, Geti, Goths, Hunns, Slavini, Croats, Avari,* and *Vandals,* invaded the Roman empire, and particularly the Illyrian provinces during the decline of the empire, must have strangely perplexed the genealogies of the nations which inhabited it, and which perhaps removed thither in the same manner as at more remote periods of time. The remainder of the Ardiæi, Autariati, and other Illyrian people anciently settled in Dalmatia, who probably could not reconcile themselves to a dependence on the Romans, might nevertheless naturally enough form an union with foreign invaders not unlike themselves in dialect and customs; and, according to our author, it seems no ill-founded conjecture, that many families, driven out of Hungary by the irruption of the Moguls under Jenghiz Khan and his successors, might people the deserted valleys between the mountains of Dalmatia. This conjecture is also somewhat confirmed by the traces of the Calmuck Tartars, which are still to be found in a part of that country called *Zara.*

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.*

Morlachia. The Morlacchi are so different from the inhabitants of the sea-coasts in dialect, dress, dispositions, and customs, that they seem clearly to be of a different original, or at least the colonies must have settled at such distant periods from each other, that they have had time to alter in a great measure their national character. There is also a remarkable diversity among the Morlacchi themselves in several districts, probably on account of the different countries from whence they came.

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. The greatest danger is from the *Haiduks* or *Banditti,* of whom there are great numbers among the woods and caves of these dreadful mountains on the confines. There, says our author, a man ought to get himself escorted by a couple of these "honest fellows;" for they are not capable of betraying him although a banditti; and their situation is commonly more apt to raise compassion than diffidence. They lead their life among the wolves, wandering from one precipice to another, exposed to the severity of the seasons, and frequently languish in want of the necessaries of life, in the most hideous and solitary caverns. Yet they very seldom disturb the tranquillity of others, and prove always faithful guides to travellers; the chief objects of their rapine being sheep and oxen, to supply themselves with food and shoes. Sometimes it happens, that, in their extreme necessity, the Haiduks go in parties to the shepherds cottages, and rudely demand something to eat; which they do not fail to take immediately by force if the least hesitation is made. It is seldom indeed that they meet with a refusal, or with resistance, as their resolution and fury are well known to be equal to the savage life they lead. Four Haiduks are not afraid to assault a caravan of 15 or 20 Turks, and generally plunder and put them to flight. The greatest part of the Haiduks look upon it as a meritorious action to shed the blood of the Turks; to which cruelty they are easily led by their natural ferocity, inflamed by a mistaken zeal for religion, and the discourses of their fanatic priests.

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

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When a Morlack is on a journey, and comes to lodge at a friend's houſe, the eldeſt danghter of the family, or the new-married bride if there happens 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 œconomy, 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 œconomiſt 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 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. Thus it happens ſometimes, that, from term to term, and preſent to preſent, he pays double what he owed, without reflecting on it.

Friendſhip, that among us is ſo ſubject to change on the ſlighteſt motives, 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 mean half-brothers and half-ſiſters. Friendſhips between thoſe of different ſexes are not at this day bound with ſo much ſolemnity, though perhaps in more ancient and innocent ages it was alſo the cuſtom.

From theſe 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 Morlacchia 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. The duties of the Pobratimi are, to aſſiſt each other in every caſe of need or danger, to revenge mutual wrongs, and ſuch like. The enthuſiaſm is often carried ſo far as to riſk and even to loſe their life for the Pobratimi, although theſe ſavage friends are not celebrated like a Pylades. If diſcord happens to ariſe between two friends, it is talked of over all the country as a ſcandalous novelty; and there has been ſome examples of it of late years, to the great affliction of the old Morlacchi, who attribute the depravation of their countrymen to their intercourſe with the Italians. Wine and ſtrong liquors, of which the nation is beginning to make daily abuſe, will of courſe produce the ſame bad effects as among others.

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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 ſkirt 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 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. It is the cuſtom in ſome places for the offended party to threaten the criminal, holding all kind of arms to his throat, and, after much intreaty, to conſent at laſt to accept of his ranſom. Theſe pacifications coſt dear in Albania; but the Morlacchi make up matters ſometimes at a ſmall expence; and every-where the buſineſs is concluded with a feaſt at the offender's charge.

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 childrens blood after death, intreat their heirs, and ſometimes oblige them to promiſe, to treat them as vampires when they die.

The boldeſt Haiduk would fly trembling from the apparition of a ſpectre, ghoſt, phantom, or ſuch like goblins as the heated imaginations of credulous and prepoſſeſſed people never fail to ſee. Nor are they aſhamed, when ridiculed for this terror; but anſwer, much in the words of Pindar; "Fear that proceeds from

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from spirits, causes even the sons of the gods to fly." The women, as may be naturally supposed, are a hundred times more timorous and visionary than the men; and some of them, by frequently hearing themselves called *witches*, actually believe they are so.

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 church-yard, 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. Perhaps this particular is carried to an abuse as well as that of public penance, which they pretend to inflict after the manner of the ancient church. They moreover, thro' the silly credulity of those poor mountaineers, draw illicit profits, by selling certain superstitious scrolls and other scandalous merchandise of that kind. They write in a capricious manner on the scrolls called *zapiz*, sacred names which ought not to be trifled with, and sometimes adding others very improperly joined. The virtues attributed to these zapiz are much of the same nature as those which the Basilians attributed to their monstrously cut stones. The Morlacchi use to carry them sewed to their caps, to cure or to prevent diseases; and they also tie them for the same purpose to the horns of their oxen. The composers of this trumpery take every method to maintain the credit of their profitable trade, in spite of its absurdity, and the frequent proofs of its inutility. And so great has their success been, that not only the Morlacchi, but even the Turks near the borders, provide themselves plentifully with zapiz from the Christian priests, which not a little increases their income, as well as the reputation of the commodity. The Morlacchi have also much devotion, and many of the ignorant people in Italy have little less, to certain copper and silver coins of the low empire; or to Venetian cotemporary pieces, which pass among them for medals of St Helen; and they think they cure the epilepsy and such like. They are equally fond of an Hungarian coin called *petizza*, which has the virgin and child on the reverse; and one of these is a most acceptable present to a Morlack.

The bordering Turks not only keep with devotion the superstitious zapiz, but frequently bring presents and cause masses to be celebrated to the images of the Virgin; which is doubtless in contradiction to the alcoran; yet when saluted, in the usual manner in that country, by the name of *Jesus*, they do not answer. Hence, when the Morlacchi, or other travellers, meet them on the confines, they do not say, *Huaglian Issus*, "Jesus be praised;" but, *Huaglian Bog*, "God be praised."

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 malice or immodest thought; and our author has seen all the women and girls, all the young men and old, kissing one another as they came into the church-yard on a holiday; so that they looked as if they had been all belonging to one family. He hath often observed the same thing on the road, and at the fairs in the maritime towns, where the Morlacchi came to sell their commodities. In times of feasting and merriment, besides the kisses, some other little liberties are taken with the hands, which we would not reckon decent, but are not minded among them; and when they are told of it, they answer, It is only toying, and means nothing. From this toying, however, their amours often take their beginning, and frequently end seriously when the two lovers are once agreed. For it very rarely happens, in places far distant from the coast, that a Morlack carries off a girl against her will, or dishonours her: and were such attempts made, the young woman would, no doubt, be able to defend herself; the women in that country being generally very little less robust than the men. But the custom is for the woman herself to appoint the time and place of being carried off; and she does so in order to extricate herself from other suitors, from whom she may have received some love-token, such as a brass ring, a little knife, or such like trifles. The Morlack women keep themselves somewhat neat till they get a husband; but after marriage they abandon themselves totally to a loathsome dirtiness, as if they intended to justify the contempt with which they are treated. Indeed it cannot be said that even the young women have a grateful odour, as they are used to anoint their hair with butter, which soon becoming rancid exhales no agreeable effluvia.

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. Hence half-moons of silver, or of tin, little chains and hearts, false stones and shells, together with all kind of splendid trumpery, are readily admitted into their head-dress. In some districts, they fix tufts of various coloured feathers resembling two horns on their caps; in

Morlachia. in others, tremulous plumes of glaſs; and in others, artificial flowers, which they purchaſe in the ſea-port towns; and in the variety of thoſe capricious and barbarous ornaments, ſometimes a fancy not inelegant is diſplayed. Their holiday-ſhifts are embroidered with red ſilk, and ſometimes with gold, which they work themſelves while they attend their flocks; and it is ſurpriſing to ſee how nicely this work is executed.—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 ankle: 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 ſheeps-ſkin thongs knotted, which they call *apüte*; and theſe they faſten above the ankles, ſomething like the ancient cothurnus.

The unmarried women, even of the richeſt females, 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. An unmarried woman, who falls under the imputation of want of chaſtity, runs the riſk of having her red cap torn off her head publicly in church by the curate, and her hair cut by ſome relation, in token of infamy. Hence, if any of them happen to have fallen into an illicit amour, they commonly of their own accord lay aſide the badge of virginity, and remove into another part of the country.

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. The father of the future bridegroom, or ſome other near relation of mature age, goes to aſk the young woman, or rather a young woman of ſuch a family, not having commonly any determinate choice. Upon this all the girls of the houſe are ſhown to him, and he chooſes which pleaſes him beſt, though generally reſpecting the right of ſeniority. 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. On theſe occaſions, however, the Morlacchi girls enjoy a privilege which ours would alſo wiſh to have, as in juſtice they certainly ought. For he 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. But if ſhe is contented, ſhe returns to her father's houſe, eſcorted by the bridegroom and neareſt relations. There the marriage day is appointed; on which the bridegroom comes to the bride's houſe, attended by all his friends of greateſt note, who on this occaſion are called *ſvati*, and are all armed, and on horſeback, in their holiday-cloaths, with a peacock's feather in their cap, which is the diſtinctive ornament uſed by thoſe who are invited to weddings. The company goes armed, to repulſe any attack or ambuſh that might be intended to diſturb the feaſt; for in old times theſe encounters were not unfrequent, according to the records of many national heroic ſongs. Morlachia.

The bride is conducted to a church veiled, and ſurrounded by the ſvati on horſeback; and the ſacred ceremony is performed amidſt the noiſe of muſkets, piſtols, barbaric ſhouts and acclamations, which continue till ſhe returns to her father's houſe, or to that of her huſband, if not far off. Each of the ſvati has his particular inſpection, as well during the cavalcade as at the marriage-feaſt, which begins immediately on their return from church The parvinaz precedes all the reſt, ſinging ſuch ſongs as he thinks ſuitable to the occaſion. The bariactar brandiſhes a lance with a ſilken banner faſtened to it, and an apple ſtuck on the point; there are two bariactars, and ſometimes four, at the more noble marriages. The ſtari-ſvat is the principal perſonage of the brigade; and the moſt reſpectable relation is commonly inveſted with this dignity. The ſtacheo's duty is to receive and obey the orders of the ſtari-ſvat. The two diveri, who ought to be the bridegroom's brothers when he has any, are appointed to ſerve the bride. The knum correſponds to our ſponſors; and the komorgia, or ſekſana, is deputed to receive and guard the dowery. A ciaous carries the mace, and attends to the order of the march, as maſter of the ceremonies: he goes ſinging aloud, *Breberi*, *Davori*, *Dobrafrichia*, *Jara*, *Pico*; names of ancient propitious deities. Buklia is the cup-bearer of the company, as well on the march as at table; and all theſe offices are doubled, and ſometimes tripled, in proportion to the number of the company.

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 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 happens to be none in the houſe, the child is borrowed from one of the neighbours. When ſhe

 alights,

Morlachia. 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 or 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; but very rarely a Morlacco eats veal, and perhaps never, unleſs he has been perſuaded to do it out of his own country. This abhorrence to calves fleſh is very ancient among the Morlacchi. St Jerom, againſt Jovinian, takes notice of it; and Tomeo Marnavich, a Boſnian writer, who lived in the beginning of the laſt age, ſays, that the Dalmatians, uncorrupted by the vices of ſtrangers, abſtained from eating calves-fleſh, as an unclean food, even to his days. The women relations, if they are invited, never dine at table with the men, it being an eſtabliſhed cuſtom for them to dine by themſelves. After dinner, they paſs the reſt of the day in dancing, ſinging ancient ſongs, and in games of dexterity, or of wit and fancy; and in the evening, at a convenient hour after ſupper, the three ritual healths having firſt gone round, the knum accompanies the bridegroom to the matrimonial apartment, which commonly is the cellar or the ſtable, whither the bride is alſo conducted by the diveri and the ſtacheo; but the three laſt are obliged to retire, and the knum remains alone with the new-married couple. If there happens to be any bed pregared better than ſtraw, he leads them to it: and having untied the bride's girdle, he cauſes them both to undreſs each other reciprocally. It is not long ſince the knum was obliged to undreſs the bride entirely; but that cuſtom is now out of uſe; and, inſtead of it, he has the privilege of kiſſing her as often as he pleaſes, wherever he meets her; which privilege may poſſibly be agreeable for the firſt months, but muſt ſoon become very diſguſtful. When they are both undreſſed, the knum retires, and ſtands liſtening at the door, if there be a door. It is his buſineſs to announce the conſummation of the marriage, which he does by diſcharging a piſtol, and is anſwered by many of the company. The next day the bride, without her veil and virginal cap, dines at table with the ſvati, and is forced to hear the coarſe equivocal jeſts of her indelicate and ſometimes intoxicated company.

Theſe nuptial-feaſts, called *ſdrave* by the ancient Huns, are by our Morlacchi called *ſdravize*, from whence our 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 cloaths 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. The brides are alſo permitted to raiſe other little contributions among the ſvati, by hiding their ſhoes, caps, knives, or ſome other neceſſary part of their equipage, which they are obliged to ranſom by a piece of money, according as the company rates it. And, beſides all theſe voluntary or extorted contributions already mentioned, each gueſt muſt give ſome preſent to the new married wife at taking leave the laſt day of the ſdraviſe; and then ſhe alſo diſtributes ſome trifles in return, which commonly conſiſt in ſhirts, caps, handkerchiefs, and ſuch like. Morlachia.

The nuptial-rites are almoſt preciſely the ſame thro' all the vaſt country inhabited by the Morlacchi; and thoſe in uſe among the peaſants and common people of the ſea-coaſt of Dalmatia, Iſtria, and the iſlands, differ but little from them. Yet among theſe particular varieties, there is one of the iſland Zlarine, near Sebenico, remarkable enough; for there the ſtariſvat (who may naturally be ſuppoſed drunk at that hour) muſt, at one blow with his naked broad ſword, ſtrike the bride's crown of flowers off her head, when ſhe is ready to go to bed. And in the iſland of Pago, in the village of Novoglia (probably the Giſſa of ancient geographers), there is a cuſtom more comical, and leſs dangerous, but equally ſavage and brutal. After the marriage-contract is ſettled, and the bridegroom comes to conduct his bride to church, her father or mother, in delivering her over to him, makes an exaggerated enumeration of her ill qualities: "Know, ſince thou wilt have her, that ſhe is good for nothing, ill-natured, obſtinate, &c." On which the bridegroom, affecting an angry look, turns to the young woman, with an "Ah! ſince it is ſo, I will teach you to behave better;" and at the ſame time regales her with a blow or a kick, or ſome piece of ſimilar gallantry, which is by no means figurative. And it ſeems in general, that the Morlack women, and perhaps the greateſt part of the Dalmatians, the inhabitants of the cities excepted, do not diſlike a beating either from their huſbands or lovers.

In the neighbourhood of Derniſh, the women are obliged, during the firſt year after marriage, to kiſs all their national acquaintances who come to the houſe; but after the firſt year they are diſpenſed from that compliment; and indeed they become ſo intolerably naſty, that they are no longer fit to practiſe it. Perhaps the mortifying manner in which they are treated by their huſbands and relations is, at the ſame time, both

Morlachia, Morley.

both the cause and effect of their shameful neglect of their persons. When a Morlack husband mentions his wife, he always premises, by your leave, or begging your pardon. And when the husband has a bedstead, the wife must sleep on the floor near it. Our author often lodged in Morlack houses, and observed that the female sex is universally treated with contempt: it is true, that the women are by no means amiable in that country; they even deform and spoil the gifts of nature.

The pregnancy and births of those women would be thought very extraordinary among us, where the ladies suffer so much, notwithstanding all the care and circumspection used before and after labour. On the contrary, a Morlack woman neither changes her food nor interrupts her daily fatigue on account of her pregnancy; and is frequently delivered in the fields, or on the road, by herself; and takes the infant, washes it in the first water she finds, carries it home, and returns the day after to her usual labour, or to feed her flock.

The little creatures, thus carelessly treated in their tenderest moments, are afterwards wrapt in miserable rags, where they remain three or four months, under the same ungentle management; and when that term is elapsed, they are set at liberty, and left to crawl about the cottage and before the door, till they learn to walk upright by themselves; and at the same time acquire that singular degree of strength and health with which the Morlacchi are endowed, and are able, without the least inconvenience, to expose their naked breasts to the severest frosts and snow. The infants are allowed to suck their mother's milk while she has any, or till she is with child again; and if that should not happen for three, four, or six years, they continue all that time to receive nourishment from the breast. The prodigious length of the breasts of the Morlacchian women is somewhat extraordinary; for it is very certain, that they can give the teat to their children over their shoulders, or under their arms. They let the boys run about, without breeches, in a shirt that reaches only to the knee, till the age of 13 or 14, following the custom of Bossina, subject to the Porte, where no haraz or capitation-tax is paid for the boys till they wear breeches, they being considered before that time as children, not capable of labouring, or of earning their bread. On the occasion of births, and especially of the first, all the relations and friends send presents of eatables to the woman in childbed, or rather to the woman delivered; and the family makes a supper of all those presents together. The women do not enter the church till 40 days after child-birth.

The Morlacchi pass their youth in the woods, attending their flocks and herds; and in that life of quiet and leisure they often become dexterous in carving with a simple knife: they make wooden cups, and whistles adorned with fanciful basse-reliefs, which are not void of merit, and at least show the genius of the people.

MORLEY (George), bishop of Winchester, was the son of Francis Morley, Esq; and was born at London in 1597. He was educated at Christ-church, Oxford, of which he had the canonry in 1641, and the next year was made doctor of divinity. He had also several church-preferments, of which he was deprived by the parliament visitors in the beginning of the year 1648. After this, king Charles I. sent for him to assist at the treaty of the Isle of Wight. After the king's death he attended the lord Capel at his execution, and then retired to Charles II. at the Hague, on whom he constantly waited till his majesty went to Scotland, when he retired to Antwerp, where he read the service of the church of England, as he afterwards did at Breda. At the Restoration he was first made dean of Christ church, and in 1660 was consecrated bishop of Worcester, and soon after was made dean of the royal chapel. In 1662 he was translated to the bishopric of Winchester, when he bestowed considerable sums on that see, in repairing Farnham-castle and his palace at Westminster, and in purchasing Winchester house at Chelsea. He died at Farnham-castle in 1684. He was a Calvinist, and before the wars was thought a friend to the Puritans; but after his promotion he took care to free himself from all suspicions of that kind. He was a pious and charitable man, of a very exemplary life, but extremely passionate. He published, 1. *Epistola apologetica et parænetica ad theologum quendam Belgam scripta*, in 4to. 2. The sum of a short conference between Father Darcey a Jesuit and Dr Morley at Brussels. 3. An argument drawn from the evidence and certainty of sense against the doctrine of Transubstantiation. 4. A letter to Anne duchess of York. 5. Several sermons, and other pieces.

Mornay.

MORNAY (Philippe de), seigneur du Plessis-Marly, was born at Buhy or Bishuy in Upper Normandy, November 5th, 1549, and 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 Elisabeth 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 them 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, and 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

Mornay. 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 adjuged 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 against 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 11th, 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'Eucharisté*, 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. 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 1784, who is the only person that ever ascended to the top of it, and from whose account, in the Philosophical Transactions, Vol. LXXV. the following is taken.

The mountain in question is situated on the north-west part of the island, and is the highest in it. It is constantly reported to have emitted volcanic eruptions; and the ravins at the bottom seem to corroborate the traditions of the inhabitants in this respect. The structure of it, when viewed at a distance, appears different from that of any other mountain in the island, or that Mr Anderson had seen in the West Indies. He could perceive it divided into many different ridges, separated by deep chasms, and its summit appeared quite destitute of every vegetable production. Several ravins, that run from the bottom a great way up the mountain, were found quite destitute of water, and pieces of pumice-stone, charcoal, and several earths and minerals of a particular quality, found in them, plainly indicated some very great singularity in this mountain. Some very old men also informed our author, that they had heard it related by the captain of a ship, that between this island and St Lucia he saw flames and smoke rising from the top of the mountain, and next morning his decks were covered with ashes and small stones.

Mr Anderson's curiosity was so much excited by these circumstances, that he formed a resolution of going up to the top; but was informed that this was impossible, nor could he find either white man, Caribbee, or negro, who would undertake to show him the way. Having observed the basis as well as he could, with a view to discover the most proper place for attempting an ascent, he found several dry ravins that seemingly ran a great way up, though he could not be certain that they were not intersected by rocks or precipices lying across. Having examined the mountain with a good glass, he thought he perceived two ridges by which there was a possibility of getting up; and though they appeared to be covered for a great way with wood, he hoped by a little cutting to open a way through it.

On the 26th of February 1784 our author began his journey, having been furnished by a Mr Maloune, who lives within a mile of the foot of the mountain, with two stout negroes, and having another boy who waited on himself. They arrived at the bottom of the

Mornegarou.

the mountain a little before ſeven in the morning, having each a good cutlaſs to cut through the woods, or to defend themſelves in caſe of an attack from the Caribbees or runaway negroes. Before they could get at either of the ridges, however, they had a rock to climb upwards of 40 feet high. Having ſcrambled up this with great difficulty, they found themſelves in the bottom of a deep and narrow ravin, which having aſcended a little way, they arrived at the habitation of Mr Gaſco a Frenchman. Mr Anderſon expreſſes his ſurpriſe, that a young and healthy man, and a good mechanic, ſhould ſequeſtrate himſelf from the world among woods and precipices, where he was beſides in continual danger of being ſwept away with his whole habitation by the torrents occaſioned by the rains. He found him, however, an intelligent man, and was hoſpitably entertained by him.

"The difficulty (ſays Mr Anderſon) in going thro' woods in the Weſt Indies, where there are no roads or paths, is far beyond any thing an European can conceive. Beſides tall trees and thick underwood, there are hundreds of different climbing plants twiſted together like ropes, and running together in all directions to a great extent, and even to the tops of the higheſt trees. They cannot be broken by puſhing on; and many of them are not to be cut without difficulty. Beſides theſe, a ſpecies of graſs, the *ſchœnus lithoſpermos*, with ſerrated leaves, cuts and tears the hands and face terribly."

By reaſon of theſe obſtructions, it was upwards of two hours before they got upon the ridge; but here they found their paſſage more difficult than before. They were now ſurrounded by a thick foreſt, rendered more impracticable by the large piles of trees blown down by the hurricanes; which obliged them in many places to creep on their hands and feet to get below them, while in others it was neceſſary to climb to a conſiderable height to get over them; at the ſame time that by the trunks being frequently rotten, they often tumbled headlong from a great height, and could not extricate themſelves without great difficulty.

The fatigue of cutting their way through the woods ſoon became intolerable to the negroes; ſo that about four in the afternoon he could not prevail on them to go any farther. Mr Anderſon therefore perceiving it was impoſſible to get to the ſummit that night, and his water being totally expended, returned to Mr Gaſco's, where he ſpent the night, determining to try another route next morning. The hoſpitable Frenchman entertained him in the beſt manner he could; but though he parted with his own hammock to him, and ſlept on a board himſelf, Mr Anderſon found it impoſſible to ſhut his eyes the whole night by reaſon of the cold. "His hut (ſays he) was built of *roſeaux* or large reeds, between each two of which a dog might creep through, and the top was covered with dry graſs. It is ſituated in the bottom of a deep gully, where the ſun does not ſhine till nine in the morning nor after four in the afternoon. It is ſurrounded by thick wood; and during the night the whole of the mountain is covered with thick clouds, from which it frequently rains, and which makes the night air exceedingly cold."

Early next morning Mr Anderſon ſet out in company with the negro boy, who continued very faithful to him during the whole of the journey. He now determined to take his courſe up the ravin, and proceeded for about a mile and an half without any conſiderable obſtruction. It now, however, began to narrow faſt: there were numbers of rocks and precipices to climb over, with many buſhes and vines which could ſcarcely be got through. At laſt the ravin terminated at the bottom of a very high precipice. It was impoſſible to know the extent of this, as the top was covered with thick wood; but from the bottom upward, as far as he could ſee, was looſe ſand with ferns and tufts of graſs, which as ſoon as he took hold of them came up by the roots. Though the aſcent was plainly at the riſk of his life, Mr Anderſon reſolved to attempt it; and therefore telling the boy to keep at ſome diſtance behind, leſt he ſhould tumble and drive him down, he began to aſcend, digging holes with his cutlaſs to put his feet in, and taking hold of the tufts of graſs as lightly as poſſible. Notwithſtanding all his care, however, he frequently ſlipped down a conſiderable way; but as it was only looſe ſand, he could eaſily puſh his cutlaſs into it up to the handle, and thus by taking hold of it recover himſelf again. At laſt he got up to ſome wild plantains, which continued all the way to the place where the trees began to grow. Here he reſted for ſome time, waiting for the boy, who got up with much leſs difficulty than he had done. On getting up to the top of the precipice, he found himſelf on a very narrow ridge, covered with wood, and bounded by two ravins, the bottoms of which he could not ſee, the deſcent to them appearing to be nearly perpendicular, though all the way covered with thick wood. Proceeding onwards, they found the ridge exceedingly narrow, in many places not ſix feet broad; with a tremendous gulf on each ſide, into which they were every moment in danger of falling; ſo that Mr Anderſon was obliged to lie down on his belly with great caution, in order to ſee through the buſhes how the ridge tended.

Here a ſulphureous ſmell, or rather one like gunpowder, began to be perceived; which, Mr Anderſon knew, muſt proceed from the top of the mountain, as the wind then blew that way; and as it plainly grew ſtronger as he advanced, he was in hopes that the top could not be very far diſtant. Perceiving a riſing before him, he imagined, that, by getting upon it, he might have a view of the top of the mountain; but when this was done, he could only ſee a peak on the north-weſt ſide of the mountain, to which, by appearance, he judged himſelf very little nearer than when at the bottom.

The woods now became very difficult, great quantities of fallen trees lying buried among the graſs; and being rotten, he was frequently buried very deep among them when he thought himſelf walking upon firm ground. About noon he was alarmed with a ruſtling among the buſhes, and ſomething like a human voice behind him; but as he was preparing to defend himſelf againſt Carribbees or run-away negroes, he was agreeably ſurpriſed with the ſight of thoſe who had formerly left him, with three others, ſent by Mr Maloune with plenty of proviſions. Encouraged by this aſſiſtance, after refreſhing themſelves, they renewed their labours with freſh vigour, and Mr Anderſon thought himſelf ſure of reaching the top before night.

In

Morne-garou.

In a little time he had a fair view of the ravin on the left, which was of prodigious depth, and ran from near the top of the mountain to the sea. Its bottom seemed to be a rock nearly resembling lava in colour, and it seemed as if there had been vast torrents of sulphureous matter running upon it for some time.—He now regretted much that he knew not of this ravin before he commenced his excursion, as, by passing a headland in a canoe, and getting into it, he might have gained the summit without all those delays and difficulties he had encountered.

About four in the afternoon he had no prospect of the top of the mountain, but imagined that if he could get into the ravine before night, he might easily reach it next morning. After cutting through wild plantains for a great way, however, he found himself at sunset on the brink of a precipice, over which he prevented himself from falling by catching hold of some shrubs. They were now about half way down, but all the rest of the way seemed a perpendicular precipice, which it was impossible to pass; the top of the mountain was yet a great way off, and there was no other resource than to attempt the ridge they had left. The evening was now so far advanced, that they were obliged to take up their residence where they were; and there was only time to place two or three sticks against the stump of a tree, and slightly to cover them with plantain leaves for a night's habitation. —Their situation, however, was extremely uncomfortable: it began to rain and blow violently, which prevented them from getting a fire made, so that they were almost chilled with cold. As soon as they could see, they renewed their work with great alacrity, and in a short time had the satisfaction to perceive that the woods became thin. About eleven o'clock they obtained a full view of the top, about a mile distant. It seemed to be composed of six or seven ridges, very much broken in the sides, as if they had suffered great convulsions; and they were divided by excessively deep ravins without any water in them. Mr Anderson directed his course towards a high peak that overlooked a large excavation where the ridges met, and which he supposed to be the crater of the volcano. In his way, he found the last wood composed of a most beautiful species of trees. After that he entered into a thick long grass intermixed with fern, which branched and ran in every direction. Thro' this they were obliged to cut their way with almost as much difficulty as they had done through the woods, and it seemed to continue very near to the top of the mountain. The fatigue of this work soon reduced them to such a situation, that they were scarce able to stand; and they were obliged to quench their thirst, which was excessive, by chewing the leaves of the begonia obliqua, there being no water to be had in the place. Two of the negroes returned, and the rest refused to proceed any farther; so that Mr Anderson himself was obliged to abandon the enterprise, and they all began to descend about half an hour after twelve; and as there was now a clear path all the way down, they arrived at Mr Gasco's by sunset; and notwithstanding his extreme weariness, Mr Anderson continued his journey to Mr Malounne's, where he arrived between six and seven at night.

Our traveller having refreshed himself to the 4th of March, in order to sustain the fatigues of his journey the better, set out about four that morning in company with a Mr Fraser, who had resolved to accompany him. They met with little difficulty till they came to the place whence they had formerly returned. Here, however, they were obliged for a quarter of a mile to cut their way through the grass and ferns already mentioned; which being done, they met with no further obstruction. When they came within a quarter of a mile of the top, they found the climate suddenly altered, the air very cold, and the vegetable productions changed, the whole summit of the mountain being barren. On the confines of the grassy and barren regions, however, he found some beautiful plants; and he observes, that this is the only place in the West Indies where he ever found moss: but here it grows in such plenty, that he frequently sunk in it up to the knees. About noon they reached the summit, and were instantly surprised with the sight of a most extraordinary cavity. It is situated in the very centre of the mountain, at the place where all the ridges meet. Its diameter is something more than a mile, and its circumference to appearance a perfect circle. Its depth from the surrounding margin is above a quarter of a mile, and it narrows a little, but very regularly, to the bottom. Its sides are very smooth, and for the most part covered with short moss, except towards the south, where there are a number of small holes and rents. This is the only place where it is possible to go down to the bottom; and the descent is very dangerous on account of the numberless small chasms. On the west side is a section of a red rock like granite, cut very smooth, and having the same declivity with the other parts. All the rest of the surrounding sides seem to be composed of sand, which has undergone the action of an intense fire. It has a crust quite smooth, and about an inch thick, almost as hard as rock; on breaking thro' which we meet with nothing but loose sand. In the centre stands a burning mountain about a mile in circumference, of a conic form, "but quite level." Out of the middle of the summit rises a small eminence eight or ten feet high, and perfectly conical; from the apex of which a column of smoke constantly issues. It is composed of large masses of red granite-like rock, of various shapes and sizes, which appear to have been split into their present form by some terrible convulsion of nature; and are piled up very regular. Great quantities of smoke issue from most parts of the mountain, especially on the north side, which appears to be burning from top to bottom; and the heat is so intense, that it is impossible to ascend it. It is even very dangerous to go round the base, as large masses of rock are constantly splitting with the heat and tumbling down. At the bottom, on the north side, is a very large rock split in two. Each of these halves, which are rent in all directions, are separated to a considerable distance from each other, and the crevices have glossy efflorescences tasting like vitriol. There are also beautiful crystallizations of sulphur; and on all parts of the mountain are great quantities of sulphur, also alum, vitriol, &c.

From the external appearance of this mountain, Mr Anderson conjectures that it had but lately begun to burn; as on several parts of it he saw small shrubs and

and graſs, which looked as if they had been but lately ſcorched and burnt. There were alſo ſeveral holes on the ſouth from which ſmoke iſſued, that appeared to have broken out but lately, the adjacent buſhes being but lately burnt. On two oppoſite ſides, the eaſt and weſt, of the burning mountain, are two lakes of water, about a ſtone's throw in breadth. They appear to be deep in the middle, and have a bottom of a kind of clay. The water is a chalybeate, and has a pleaſant taſte. Theſe lakes probably derive their exiſtence in a great meaſure, if not totally, from the rain-water running down the ſides of the crater. On the north ſide Mr Anderſon obſerved the traces of great torrents, that to appearance had conveyed vaſt quantities of water to theſe lakes; and by the ſtones at the bottom he could perceive that abſorption or evaporation, or both, went on very faſt. The greater part of the bottom of the crater is very level; and on the ſouth ſide are ſome ſhrubs and ſmall trees. Some pieces of pumice-ſtone were met with, and many ſtones about the ſize of a man's fiſt, rough, and blue upon one ſide, are ſcattered all over the mountain.

The motion of the clouds on the top of this mountain was very ſingular. Though there were ſeveral parts higher than the crater, yet the clouds ſeemed always to be attracted by the latter. After entering on its eaſt or windward ſide, they ſunk a conſiderable way into it; then mounting the oppoſite ſide, and whirling round the north-weſt ſide, they ran along a ridge which tended nearly north-eaſt, and afterwards ſunk into a deep ravin dividing this ridge from another on the north-weſt corner of the mountain, and the higheſt on it, lying in a direction nearly north and ſouth. They keep in this ridge to the ſouth end, and then whirl off in their natural direction.

From the ſituation of theſe iſlands to one another, and to the continent of South America, Mr Anderſon conjectures, that there are ſubmarine communications between the volcanoes in each of them, and from them to thoſe in the high mountains of South America. He obſerves, that the crater in this iſland lies nearly in a line with Soufriere in St Lucia and Morne Pelee in Martinico; and probably from thence to a place of the ſame kind in Dominique, and from thence to the other iſlands; there being ſomething of the kind in each, Barbadoes and Tobago excepted.

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. In conſequence of this property, the maroc is never found any where but in thoſe parts where the honey is very plentiful, tho' the Abyſſinians never take any notice of the ravages they commit among their ſtocks of bees.

The moroc reſembles the cuckoo in ſize and ſhape, but differs in other reſpects. Its mouth is very wide, the opening reaching almoſt to his 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. The eyebrows are black; the beak pointed, and very little crooked; the pupil of the eye black, and ſurrounded with an iris of a dull and duſky red: The fore-part of the neck is light yellow, darker on each ſide than in the middle, where it is partly white: the yellow on each ſide reaches near the ſhoulder, or round part of the wing; and from this the whole breaſt and belly is of a dirty white to the under part of the tail; and from this the feathers begin to be tipt with white, as are all thoſe that cover the outſide of the wing. The wing has eight feathers of the largeſt ſize and ſix of the ſecond: the tail conſiſts of twelve feathers, the longeſt three being in the middle: they are placed cloſely together; and the tail is of an equal breadth from top to bottom, the feathers being alſo tipt with white. The thighs are covered with feathers of the ſame colour as thoſe of the belly, reaching more than half way down the legs, which are black, as well as the feet, and marked diſtinctly with ſcales. There are two toes before and behind, each of which has a ſharp and crooked claw. It makes a ſharp ſnapping noiſe when it catches the bees, evidently from cloſing its beak; but Mr Bruce never could diſcover that it had any ſong.

This ſeems to be the creature mentioned by Dr 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, does not take 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. "I cannot (ſays he), for my own part, conceive, in a country where there are ſo many thouſand hives, that there was any uſe for giving to a bird a peculiar inſtinct or faculty of diſcovering honey, when, at the ſame time, nature had deprived him of the power of availing himſelf of any advantage from the diſcovery; for man ſeems in this caſe to be made for the ſervice of the moroc, which is very different from the common and ordinary courſe of things; man certainly needs him not, for on every tree, and on every hillock, he may ſee plenty of honey at his own deliberate diſpoſal. I cannot then but think, with all ſubmiſſion to theſe natural philoſophers, that the whole of this is an improbable fiction; nor did I ever hear a ſingle perſon in Abyſſinia ſuggeſt, that either this or any other bird had ſuch a property. Sparman ſays it was not known to any inhabitant of the Cape, any more than that of the moroc was in Abyſſinia; it was a ſecret of nature, hid from all but theſe two great men; and I moſt willingly leave it among the catalogue of their particular diſcoveries."

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 midday. 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

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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 most narrow places 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 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.

This happened about the year 1516; and since that time, what we have under the name of history is little else than a catalogue of the enormous vices and excesses of the emperors. They have been in general a set of bloody tyrants; though they have had among them some able princes, particularly Muley Moluc, who defeated and killed Don Sebastian king of Portugal. See the article PORTUGAL, n° 26. They have lived in almost a continual state of warfare with the kings of Spain and other Christian princes ever since; nor does the crown of Great Britain sometimes disdain, as in the year 1769, to purchase their friendship with presents.

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 uncontrolable power over the lives and fortunes of his subjects, but in a great measure over their consciences, such as they are; 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 altogether forced; 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 of the same class, yet in other respects, as if to repair the mischief which he committed, he left nothing undone for the encouragement of population.— He introduced, as above-mentioned, 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. In short, whatever revolutions

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revolutions took place in the country, consisted merely in a change of one tyrant for another. Muley Ishmael had discernment enough to see, therefore, 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 frequently threatened to revolt, and support those of his sons who were in opposition, and who promised them the most liberal rewards. They offered to place his eldest son Muley Ali, who is since dead, 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, the late emperor, 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. This important mode of population has therefore been of late years neglected, while no better system has been substituted in its room; for though the late emperor indulged in cruelty much less frequently than his predecessors, yet population has, perhaps, been more completely impeded by the general poverty which he has introduced into the country by his severe exactions, than if he had made a liberal use of the sword or of the bow-string.

5
Despotism of the emperors.

A most flagrant species of despotism, which renders the emperors still 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. To preserve, however, some show or shadow of justice, they allow their mufti a kind of superiority in spirituals, and a sort of liberty to the meanest subject to summon them before his tribunal. But the danger which such an attempt would bring upon a plaintiff, perhaps no less than death and destruction, is of itself sufficient to deter any man from it; especially considering the little probability there is that the judges of it would run the risk of declaring themselves against a monarch whose creatures they are, and on whom their lives and fortunes so absolutely depend. The titles which the emperors of Morocco assume, are those of *Most glorious, mighty, and noble emperor of Afric, king of Fez and Morocco, Taphilet, Suz, Darha, 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
Administration of justice.

The judges or magistrates that act immediately under the emperor are either spiritual or temporal, or rather ecclesiastical and military. The mufti and the kadis 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. Add to this, that those bashaws, governors, &c. are obliged to keep their agents and spies in constant pay at court, to prevent their being supplanted by higher bidders, slanderers, or other underminers. In short, power and weakness, rank and meanness, opulence and indigence, are here equally dependent, equally uncertain. 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. It is surprising that men under these circumstances should be ambitious of rank, or desirous of riches and power. 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
Royal revenues.

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 of corsair vessels out, 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

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very confiderable addition to his revenue, not only as he fells their ranfom at a very high rate, but likewife as he has the profit of all their labour, without allowing them any other maintenance than a little bread and oil, or any other affiftance when fick than what medicines a Spanifh convent, which he tolerates there, gives them gratis; and which, neverthelefs, is forced to pay him an annual prefent for that toleration, befides furnifhing the court with medicines, and the flaves with lodging and diet when they are not able to work. Another branch of his revenue confifts 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 thefe are levied, or rather farmed, by the bafhaws, governors, alcaides, &c. with all poffible feverity. The Jews and Chriftians likewife pay an income or capitation, the former of fix crowns *per* head on all males from 15 years and upwards, befides other arbitrary impofts, fines, &c. That on the Chriftians, for the liberty of trading in his dominions, rifes 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, feeing it difcourages great numbers from fettling there, notwithftanding the artful invitations which the emperors and their minifters make ufe of to invite them to it; for, befides thofe arbitrary exactions, there is ftill another great hardfhip 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, *communibus annis*, no author has yet given us any account of; only conful Hatfield has computed the whole yearly revenue, including ordinaries and extraordinaries, to amount to 500 quintals of filver, each quintal, or 100 lb. weight, valued at fomewhat above 330 l. Sterling: fo that the whole amounts to no more, according to him, than 165,000 l.; a fmall revenue indeed for fo large an empire, if the calculation may be depended upon. But St Olan, though he does not pretend fo much as to guefs at the yearly amount of it, in general reprefents it as fo confiderable, that Muley Ifhmael was reckoned to have amaffed out of it a treafure in gold and filver of about 50 effective millions; but whether of crowns or livres he does not tell us, nor how he came by his knowledge of it; becaufe that politic prince, even by his own confeffion, not only caufed all his riches to be buried in fundry places under-ground, his gold and filver to be melted into great lumps, and laid in the fame privacy underground, but likewife all thofe whom he entrufted with the fecret to be as privately murdered.

8 Climate of Morocco.

The climate of the empire of Morocco is in general fufficiently temperate, healthy, and not fo hot as its fituation might lead us to fuppofe. The chain of mountains which form Atlas, on the eaftern fide, defends it from the eaft winds, that would fcorch up the earth were they frequent. The fummit of thefe mountains is always covered with fnow; and their abundant defcending ftreams fpread verdure through the neighbourhood, make the winter more cold, and temper the heats of fummer. The fea on the weft fide, which extends along the coaft from north to fouth, alfo refrefhes the land with regular breezes, that feldom vary according to their feafons. At a diftance from the fea, within land, the heat is fo great, that the rivulets become dry in fummer; 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 atmofphere is not loaded with clouds as in northern latitudes. Thofe rains which fall by intervals are favourable to the earth, and increafe its fecundity. In January the country is covered with verdure, and enamelled with flowers. Barley is cut in March, but the wheat harveft 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 lefs variation in hot than in northern climates, the firft are neverthelefs expofed to the intemperance of weather: too heavy rains often impede the harveft; and drought has ftill greater inconveniences, for it enfures the propagation of locufts. Thefe fatal infects, which have fo often laid defolate hot countries, fometimes commit the moft dreadful ravages in the empire of Morocco. They come from the fouth, fpread themfelves over the lands, and increafe to infinity when the rains of fpring are not fufficiently heavy to deftroy the eggs they depofit on the earth. The large locufts, which are near three inches long, are not the moft deftructive: as they fly, they yield to the current of wind, which hurries them into the fea, or into fandy deferts, where they perifh with hunger or fatigue. The young locufts, that cannot fly, are the moft ruinous; they creep over the country in fuch multitudes, that they leave not a blade of grafs behind; and the noife of their feeding announces their approach at fome diftance. The devaftations of locufts increafe the price of provifions, and often occafion famines: but the Moors find a kind of compenfation in making food of thefe infects; prodigious quantities of which are brought to market falted and dried like red herrings. They have an oily and rancid tafte, which habit only can render agreeable: they are eat here, however, with pleafure. The winters in Morocco are not fevere, nor is there an abfolute need of fire. In the coldeft weather the thermometer feldom finks to more than five degrees above the freezing point. The longeft days in Morocco are not more than 14 hours, and the fhorteft confequently not lefs than ten.

The foil of Morocco is exceedingly fertile. It is moft fo in the inland provinces. On the weftern coaft it is in general light and ftony, and is better adapted to the vine and olive than the culture of wheat. They annually burn, before the September rains, the ftubble, which is left rather long; and this and the dung of cattle, every day turned to pafture, form the fole manure the land receives. The foil requires but little labour, and the ploughing is fo light that the furrows are fcarcely fix inches deep; for which reafon, in fome provinces, wooden ploughfhares are ufed for cheapnefs. 9 Soil, and

The empire of Morocco might fupply itfelf with all neceffaries, as well from the abundance and nature of its products, as from the few natural or artificial wants of the Moors occafioned by climate or education. Its wealth confifts in the fruitfulnefs of its foil: its corn, fruits, flocks, flax, falt, gums, and wax, would not only fupply its neceffities, but yield a fuperflux, which might

become

Morocco. to Productions.

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 exportation of this corn is burdened by the laws, and by the prejudices of an intolerant religion, which permits them not to ſell their ſuperabundance to infidels. The property of land is beſides entirely precarious; ſo that each individual grows little more than ſufficient for his own wants. Hence it happens, when the harveſt fails from the ravages of locuſts or the intemperance of ſeaſons, theſe people are expoſed to miſery, ſuch as Europeans have no conception of, who enjoy a ſtable adminiſtration, which obviates and provides for all their wants.

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 every where 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 every where found along the coaſt, but particularly to the ſouth. The trees are planted in rows, which form alleys the more agreeable becauſe the trees are large, round, and high in proportion. They take care to water them, the better to preſerve the fruit. Oil of olives might here be plentifully extracted, were taxation fixed and moderate; but ſuch has been the variation it has undergone, that the culture of olives is ſo neglected as ſcarcely to produce oil ſufficient for internal conſumption. In 1768 and 1769 there were near 40,000 quintals of oil exported from Mogodore and Santa-Cruz to Marſeilles, and ten years after it coſt 15 d. per pound. Thus do the vices of government expoſe nations to dearth and famine who live in the very boſom of abundance.

From the province of Duquella to the ſouth of the empire, there are foreſts of the arga tree, which is thorny, irregular in its form, and produces a ſpecies of almond exceedingly hard, with a ſkin as corroſive as that of walnuts. Its fruit conſiſts of two almonds, rough and bitter, from which an oil is produced very excellent for frying. In order to uſe this oil, it muſt be purified by fire, and ſet in a flame, which muſt be ſuffered to die away of itſelf; the moſt greaſy and corroſive particles are conſumed, and its acrid qualities are thus wholly deſtroyed. When the Moors gather theſe fruits, they bring their goats under the trees; and as the fruit falls, the animals carefully nibble off the ſkins. In the ſame province alſo is found the tree which produces gum ſandarac; alſo that which yields the tranſparent gum; but the latter is moſt productive, and affords the beſt gum the farther we proceed ſouthward, where the heat and night-dews may perhaps render the vegetable ſecretion more pure and copious.

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 eat raw and roaſted. This fruit is called *Bellote*, and is ſent to Cadiz. where the Spaniſh ladies hold it in great eſtimation. The empire of Morocco alſo produces much wax: but ſince it has been ſubjected by the emperor to the payment of additional duties, the country people have very much neglected the care of their hives. 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.

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

Morocco. perors will not permit to be worked, left their subjects should thus find means to shake off their yoke. It is not improbable but that the mouotains 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 their deserts abound with lions, tigers, leopards, hyænas, and monstrous serpents. The Barbary horses were formerly very valuable, and thought equal to the Arabian. Though their 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, cameleons, 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. As to mountains, the chief are that 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 Mulvia above-mentioned, which rises in the desarts, 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. The chief capes are Cape Threeforks on the Mediterranean, Cape Spartel at the entrance of the straits, Cape Cantin, Cape None, and Cape Rajador, on the Atlantic Ocean. Of the bays the most considerable are, the bay of Tetuan in the Mediterranean, and the bay of Tangier in the straits of Gibraltar.

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, 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 desarts 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 desarts. And there is still a more dangerous enemy, and that 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. There is no doubt also, but both men and cattle are sometimes surprised by wild beasts, as well as robbers, in those vast desarts; the hot winds also, blowing over a long tract of burning sand, are equal almost to the heat of an oven, and destroy abundance of merchants and pilgrims. If it was not for devotion, and in expectation of very great gains, no man would undertake a journey in these desarts; great are the hazards and fatigues they must of necessity undergo; but those that go to Mecca assure themselves of paradise if they die, and have uncommon honours paid them at home if they survive. People crowd to be taken into the eastern caravans; and the gold that is found in the south make them no less eager to undertake that journey.

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. 16 Foreign commerce.

The land-forces of the emperor of Morocco consist principally of the black troops already mentioned, 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 soldiers have no distinction in dress from the other Moors; and are only marked by their accoutrements, which consist of a sabre, a very long musket, a small red leathern box to hold their balls, which is fixed in front by means of a belt, and a powder-horn flung over their shoulders. The army is under the direction of a commander in chief, four principal bashaws, and alcaides who command distinct divisions. 17 Land-forces.

The black troops are naturally of a very fiery disposition, Morocco. position, 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. Though these troops are supposed to be the strongest support of despotism, yet from their avarice and love of variety they frequently prove the most dangerous enemies to their monarchs; they are often known to excite sedition and rebellion, and their insolence has sometimes proceeded to such excesses as nearly to overturn the government. Their conduct is governed only by the passions. Those who pay them best, and treat them with the greatest attention, they will always be most ready to support. This circumstance, independent of every other, makes it the interest of the monarch to keep his subjects in as complete a state of poverty as possible. The Moors are indeed remarkable for insincerity in their attachments, and for their love of variety; a military force, in this kingdom especially, is therefore the only means which a despotic monarch can employ for securing himself in the possession of the throne. Ignorant of every principle of rational liberty, whatever contests this devoted people may engage in with their tyrants, are merely contests for the succession; and the sole object for which they spend their lives and their property, is to exchange one merciless despot for another.

18 Navy. The emperor's navy consists of about 15 small frigates, a few zebecks, 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 are computed at 6000.

19 Coins. The coins of this empire are a fluce, a blanquil, and ducat. The fluce is a small copper coin, twenty whereof make a blanquil, of the value of two-pence Sterling. The blanquil is of silver, and the ducat of gold, not unlike that of Hungary, and work 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, ten of which make a ducat; but in payments to the government, it is said they will reckon seventeen 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 religon, 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 Mohammedan 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; hanging him upon hooks till he die; crucifying him against a wall; and, indeed, the punishment and condemnation of criminals is in a manner arbitrary. The emperor, or his bashaws, frequently turn executioners; shoot the offender, or cut him to pieces with their own hands, or command others to do it in their presence. 21 Laws.

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 *cafiles* or *cabiles*, from the Arabic word *kobeila*; and they are so numerous, that it is impossible to have a knowledge of them all. In the northern provinces are enumerated Beni-Garir, Beni-Guernid, Beni-Mansor, Beni-Oriegan, Beni-Chelid, Beni-Juseph, Beni-Zaruol, Beni-Razin, Beni-Gebara, Beni-Buseibet, Beni-Gualid, Beni-Yeder, Beni-Gueiaghel, Beni-Guaseval, Beni-Guamud, &c. Toward the east are, Beni-Sayd, Beni-Teusin, Beni-Iessetin, Beni-Buhalel, Beni-Telid, Beni-Soffian, Beni-Becil, Beni-Zequer, &c.—and to the south, those of Beni-Fonsecara, Beni-Aros, Beni-Hassen, Beni Mager, Beni-Basil, Beni-Seba, with an infinite number of others (A). The people 22 Inhabitants of the empire of Morocco.

(A) The word *Ben*, that is to say "Son," is usually employed to signify "family descendants;" thus, *Beni-Hassen*, and *Beni-Juseph*, signify, "the children or descendants of Hassen and of Joseph." The Moors, as a more extensive generic term, call men *Ben-Adam*; that is, "the descendants or sons of Adam."

Morocco. people who depend on Algiers, Tunis, and Tripoli, are in like manner divided into an infinite number of these tribes, who are all so ancient that they themselves have not the least idea of their origin.

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 th. 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.—Mahometanism has not obliterated the customs and ancient prejudices of these people, for they eat the wild boar; and in places where there are vineyards, they drink wine, *provided* (say they) *that it is of our own making*. In order to preserve it in the southern parts of Mount Atlas. they put it in earthen vessels, and in barrels made of the hollowed trunk of a tree, the upper end of which is done over with pitch; and these are deposited in cellars, or even in water. In the northern province of Rif they boil it a little, which renders it less apt to inebriate, and perhaps they think that in this state they may reconcile the use of it with the spirit of their law.

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 cafiles among them who are exceedingly powerful both by their number and courage. Such are those of Gomera on the borders of Rif, of Gayroan toward Fez, of Timoor extending along mount Atlas from Mequinez to Tedla, of Shavoya from Tedla to Duquella, and of Mishboya, from Morocco to the south. The emperor of Morocco keeps the children of the chiefs of these tribes at court as hostages for their fidelity. The Brebes have no distinction of dress; they are always clothed in woollen like the Moors; and, though they inhabit the mountains, they rarely wear any thing on their heads. These mountaineers, as well as their wives, have exceedingly fine teeth; and possess a degree of vigour and intrepidity which distinguishes them from the inhabitants of the plains. It is common for them to hunt lions and tigers; and the mothers have a custom of decorating their children with a tiger's claw or the remnant of a lion's hide on the head, thinking that by this means they will acquire strength and courage; and from a similar superstition, young wives are in use to give their husbands the same as a sort of amulets.

The Brebes and the Shellu having a language common to themselves, and unknown to the Moors, both must have had the same origin, notwithstanding the difference there is in their mode of life. The *Shellu* live on the frontiers of the empire toward the south; their population is by no means so great as that of the Brebes, nor are they so ferocious: they do not marry with other tribes; and though they practise many superstitious rites, they are faithful observers of their religion.

The *Moors* of the plains may be distinguished into those who lead a pastoral life, and those who inhabit the cities.

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 *douhars*, 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 entrance of the douhar is sometimes shut with faggots of thorns; and the only guard is a number of dogs, that bark incessantly at the approach of a stranger. Each douhar has a chief, subordinate to an officer of the highest rank, who has under his administration a number of camps; and several of these subordinate divisions are united under the government of a bacha, who has often 1000 douhars in his department. 24 The Moors of the country.

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.

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 cloathing. 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. 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 coofcoofoo; which is a paste made with their meal in the form of small grains like Italian paste. This coofcoofoo is drest in the vapour of boiling soup, in a hollow dish perforated with many small holes in the bottom, 25 Their simple way of life. 26 Occupations of the women, &c.

Morocco.

tom, and the dish is inclosed in a kettle where meat is boiled; the coofcoofoo, 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. These officers receive strangers in their tents with the same cordiality that Jacob and Laban showed to their guests. Upon their arrival a sheep is killed and immediately dressed; if they are not provided with a spit, they instantly make one of wood; and this mutton roasted at a brisk fire, and served up in a wooden dish, has a very delicate colour and taste.

The women in their tents likewise prepare the wool, spin it, and weave it into cloth on looms suspended the whole length of the tent. Each piece is about five ells long and one and an 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 *Haique*, 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 haique for winter, another for summer, a red cape, 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, grey, or striped, which reaches to the middle of the leg, with great sleeves and a hood; it resembles the habit of the Carthusians.

The womens dress in the country is likewise confined to a haique, 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.

Besides these ornaments, the women, to add to their beauty, imprint on their face, their neck, their breast, and on almost every part of their body, representations of flowers and other figures. The impressions are made with a piece of wood stuck full of needles; with the points of which they gently puncture the skin, and then lay it over with a blue-coloured substance or gunpowder pulverised, and the marks never wear out. This custom, which is very ancient, and which has been practised by a variety of nations, in Turkey, over all Asia, in the southern parts of Europe, and perhaps over the whole globe, is, however, not general among the Moorish tribes.

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, to the shame of humanity, it must be owned, that 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 douhars, 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 suspended in a cloth girt round their bodies. In the more southern parts, the women are likewise employed in the care of the horses, in saddling and bridling them; the husband, who in these climates is always a despot, issues his orders, and seems only made to be obeyed.

The women travel without being veiled; they are accordingly sun-burnt, and have no pretensions to beauty. There are, however, some quarters where they put on a little rouge: they every where stain their hair, their feet, and the ends of their fingers, with an herb called *henna*, which gives them a deep saffron colour; a custom that must be very ancient among the people of Asia. Abu Becre dyed his eye-brows and beard with the same colour, and many of his successors imitated him. The custom may have originally been a religious ceremony, which the women have turned into an ornament; but it is more probable that the custom of painting the beard and hair, and that of shaving the head and using depilatories in other parts of the body, has been at first employed from motives of cleanliness in warm countries.

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 douhars 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. 28 Marriages, &c.

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 douhar 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

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 douhars 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. 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. The ſalts that abound in the vegetables of warm countries give this dung a conſiſtence which it has not perhaps in northern regions. 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 douhars 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 douhar. 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 ſun-ſet are not imputed to them, as they could neither ſee nor prevent them: on this account, people here travel only from ſun-riſing to ſun-ſetting.

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, haiques, 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. The diſſolution of the ſoc is always the preſage of ſome ſeditious ſquabble. The ſkirts of theſe markets are commonly occupied by merry Andrews, ſingers, dancers, and other buffoons, who make apes dance to amuſe the idle. On one ſide are barbers and ſurgeons, to whom the ſick are brought to be cured.

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 church-yard; 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 *verandos*, 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 diſpatched 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. The doors are uſually painted of various colours in a chequered form, and the upper parts of them are frequently ornamented with very curious carved work. 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. In ſome, for inſtance, he will find the walls decorated with looking-glaſſes of different ſizes; in others, watches and clocks in glaſs-caſes; and in ſome the apartments are hung with the ſkins of lions or tigers, or adorned with a diſplay of muſkets and ſabres. In the houſes of thoſe who live in the very firſt ſtyle, an European mahogany bedſtead, with one or two mattreſſes, covered with fine white linen, is ſometimes placed at each end of the room. Theſe, however, are only conſidered as ornaments, as the Moors always ſleep on a mattreſs or a mat placed upon the floor, and covered only with their *haick* or perhaps a quilt.

As the law of Mahomet ſtrictly proſcribes the uſe of pictures of every deſcription, this delightful ſpecies of ornament finds no place in the houſes of the Moors.

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.—Obliged as they are to conceal their riches, the Moors wear no jewels; very few have ſo much as a ring, a watch, or a ſilver ſnuff-box. They frequently carry a roſary

Morocco. rosary in their hand, but without annexing any ideas of devotion to the practice, although they use it to recite the name of God a certain number of times in the day. After these momentary prayers they play with their rosary much the same as the European ladies do with their fans. The Moorish women seldom leave the house, and when they do are always veiled. The old very carefully hide their faces, but the young and handsome are somewhat more indulgent, that is to say toward foreigners, for they are exceedingly cautious with the Moors. Being veiled, their husbands do not know them in the street, and it is even impolite to endeavour to see the faces of the women who pass; so different are the manners and customs of nations. There are very fine women found among the Moors, especially up the country; those of the northern parts by no means possess the same degree of grace and beauty. As females in warm countries sooner arrive at puberty, they are also sooner old; and this perhaps may be the reason why polygamy has been generally adopted in such climates. Women there sooner lose the charms of youth, while men still preserve their passions and the powers of nature. The Moorish women are not in general very reserved. Climate has a vast influence on the temperament of the body; and licentiousness is there more general and less restrained, tho' as in other places its disorderly pleasures incur its attendant pains; not but that the disease attending illicit amours is less poisonous, and slower in its operations, among the Moors than in Europe, because of the heat of the climate, and the great temperance of their mode of living. The women of the south are in general the handsomest, and are said to be so reserved, or so guarded, that their very relations do not enter their houses nor their tents. Yet such is the contradictory custom of nations, that there are tribes in these same provinces among whom it is held to be an act of hospitality to present a woman to a traveller. It may be there are women who dedicate themselves to this species of devotion as to an act of benevolence; for it is impossible to describe all the varieties of opinion among men, or the whims to which the human fancy is subject.

34 Dress of the ladies. The Moorish women who live in cities are, as in other nations, more addicted to shew 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 deshabille 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. The reason of a custom like this may be found in the nature of the climate and the quality of the aliments, which make the people naturally meagre. Our slender waists and fine turned ankles would be imperfections in this part of Africa, and perhaps over all that quarter of the globe; so great is the contrast of taste, and so various the prejudices of nations.

The Moors present their wives with jewels of gold, silver, or pearl, but very few wear precious stones; this is a luxury of which they have little knowledge. They have rings in silver or gold; also ear-rings in the form of a crescent, five inches in circumference, and as thick as the end of the little finger. They first pierce their ears, and introduce a small roll of paper, which they daily increase in thickness, till at length they insert the kernel of the date, which is equal in size to the ear-ring. They wear bracelets in gold and solid silver, and silver rings at the bottom of their legs, some of them considerably heavy. The use of white paint is unknown among the Moorish women, and that of red but little. It is much more common to see them dye their eyebrows and eye-lashes, which dye does not add to the beauty of the countenance, but considerably to the fire of the eyes. They trace regular features with henna, of a saffron colour, on their feet, the palm of the hand, and the tip of their fingers.—On their visiting day they wrap themselves in a clean fine haick, which comes over the head, and surrounds the face so as to let them see without being seen.—When they travel, they wear straw hats to keep off the sun; and in some parts of the empire the women wear hats on their visits; which is a fashion peculiar to the tribes coming from the south, who have preserved their customs; for the Moors do not change modes they have once adopted.

The *Negroes*, who constitute a large proportion of the emperor's subjects, and the occasion of whose introduction to this empire has been already mentioned, are better formed than the Moors; and as they are more lively, daring, and active, they are entrusted 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, em- 35 Negroes.

ploying 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. In their commercial bargains many of them buy up the commodities of the country to ſell again. Some have European correſpondents; and others are mechanics, ſuch as goldſmiths, tailors, gunſmiths, millers, and maſons. More induſtrious, artful, and better informed than the Moors, the Jews are employed by the emperor in receiving the cuſtoms, coining the money, and in all affairs and intercourſe which the monarch has with the European merchants, as well as in all his negociations with the various European governments.

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 this 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 œconomy are written upon ſmall boards. Theſe leſſons being once learned, the ſcholar is ſuppoſed to have obtained ſufficient knowledge to leave ſchool: on this occaſion he rides on horſeback through the city, followed by his comrades, who ſing his praiſes: this to him is a day of triumph; to the ſcholars an incitement to emulation, a feſtival for the maſter, and a day of expence for the parents; for in all countries, wherever there are feſtivals and proceſſions, there alſo are eating and drinking. At Fez there is ſome ſmall degree more of inſtruction to be obtained in the ſchools; and the Moors who are a little wealthy ſend their children thither to have them inſtructed in the Arabic language, and in the religion and laws of their country. Here ſome of them alſo acquire a little taſte for poetry.

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 uſual phyſicians are their talbes, their fakirs, and their ſaints, in whom they place a ſuperſtitious confidence. Aſtronomy is entirely or almoſt unknown to the Moors; for though they likewiſe wander from place to place, there are few if any among them who have a knowledge of the motion of the heavens, or who are capable from principle to direct their own courſe by obſerving the courſe of the ſtars. They are therefore neceſſarily wholly unable to calculate eclipſes, which they always interpret to portend evil.

Superſtitious people, indeed, have every where ſuppoſed eclipſes were ſent to preſage ſome calamity.—The Moors being unable to reaſon on the cauſes of ſuch an appearance, imagine the ſun or the moon are in the power of a dragon that ſwallows them; and they offer up prayers that theſe luminaries may be delivered from an enemy ſo cruel and voracious.

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 deſpite 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

Morocco.

Moorifh credulity with ftrange dreams and ambiguous forebodings and prophefies.

In fhort, arts and fciences feem to be almoft unknown in Morocco; or if at all cultivated, it is only by the Jews, who indeed are the only induftrious and ingenious people in the country. The Moors in general may be confidered as exifting in the paftoral ftate, following only a few mechanical trades, and leaving every thing that requires invention to the Jews, who have likewife the principal management of their commercial and pecuniary matters; and even thofe few of the Moors who are merchants, are obliged to have Jew agents, for the purpofe of tranfacting their bufinefs.

39 Manufactures and trades.

The Moorifh manufactures are—The haick, which, as was before obferved, is a long garment compofed of white wool and cotton, or cotton and filk woven together, and is ufed by the Moors for the purpofe of covering their under drefs when they go abroad, which they do by totally wrapping themfelves in it in a carelefs but eafy manner; filk handkerchiefs of a particular kind, prepared only at Fez; filks chequered with cotton; carpeting, little inferior to that of Turkey; beautiful matting, made of the palmetto or wild palm tree; paper of a coarfe kind; cordovan, commonly called *Morocco leather*; gunpowder of an inferior nature; and long-barrelled mufkets, made of Bifcay iron. The Moors are unacquainted with the mode of cafting cannon; and therefore thofe few which are now in the country are obtained from Europeans.—The manufacture of glafs is likewife unknown to them; as indeed they make great ufe of earthen ware, and have few or no windows to their houfes, this commodity may be of lefs importance to them than many others. They make butter, by putting the milk into a goat-fkin, with its outward coat turned inwards, and fhaking it till the butter collects on the fides, when it is taken out for ufe. From this operation it proves always full of hairs, and has an infipid flavour. Their cheefe confifts merely of curds hardened and dried, and has uniformly a difagreeable tafte. The bread in fome of the principal towns, particularly at Tangier and Salee, is remarkably good, but in many other places it is coarfe, black, and heavy.

The Moors, agreeably to the Jewifh cuftom, cut the throats of all the animals they eat, at the fame time turning their heads towards Mecca, in adoration of their prophet. After fuffering them to bleed freely, they carefully wafh all the remaining blood away, and divide the meat into fmall pieces, of about one or two pounds in weight. As they are unacquainted with the invention of pumps, and have but few fprings, it affords employment to a number of indigent people, who would probably be idle otherwife, to carry water in fkins from the neareft river or refervoir, and fell it to the inhabitants. From their being obliged to tar the fkins to prevent them from leaking, the water is frequently rendered very unpleafant.

Their looms, forges, ploughs, carpenters tools, &c. are much upon the fame conftruction with the unimproved inftruments of the fame kind which are ufed at this time in fome parts of Europe, only ftill more clumfily finifhed. In their work, they attend more to ftrength than neatnefs 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 fince the revolution in their arts and fciences, which took place foon after their expulfion 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 barbarifm; but owing to the weaknefs and tyranny of their princes, they gradually funk into the very oppofite extreme, and may now be confidered as but a few degrees removed from a favage ftate.

They ufe no kind of wheel-carriage; and therefore all their articles of burden are tranfported from one place to another on camels, mules, or affes. Their buildings, though by no means conftructed on any fixed principle of architecture, have at leaft the merit of being very ftrong and durable. The manner of preparing tabby, of which all their beft edifices are formed, is the only remain of their ancient knowledge at prefent exifting. It confifts of a mixture of mortar and very fmall ftones, beaten tight in a wooden cafe, and fuffered to dry, when it forms a cement equal to the folid rock. There are always unaccountable difcrepancies and inconfiftencies in the arts of uncivilized nations. The apartments are, if poffible, even more inconvenient than thofe of their neighbours the Spaniards; but the carved wood-work with which many of them are ornamented, is equal to any in Europe.

Their mofques or places of public worfhip are ufually large fquare buildings, compofed of the fame materials as the houfes. The building confifts of broad and lofty piazzas, opening into a fquare court, in a manner in fome degree fimilar to the Royal Exchange of London. In the centre of the court is a large fountain, and a fmall ftream furrounds the piazzas, where the Moors perform the ceremony of ablution. The court and piazzas are floored with blue and white checquered tiling, and the latter are covered with matting, upon which the Moors kneel while repeating their prayers. In the moft confpicuous part of the mofque, fronting the eaft, ftands a kind of pulpit, where the talbe or prieft occafionally preaches. The Moors always enter this place of worfhip bare-footed, leaving their flippers at the door. On the top of the mofque is a fquare fteeple with a flag-ftaff, whither at ftated hours the talbe afcends, hoifts a white flag, and calls the people to prayers, for they have no bells. From this high fituation the voice is heard at a confiderable diftance; and the talbes have a monotonous mode of enunciation, the voice finking at the end of every fhort fentence, which in fome meafure refembles the found of a bell. The moment the flag is difplayed, every perfon forfakes his employment, and goes to prayers. If they are near a mofque, they perform their devotions within it, otherwife immediately on the fpot where they happen to be, and always with their faces towards the eaft, in honour of their prophet Mahomet, who it is well known was buried at Medina. The prayer which is generally repeated on thefe occafions, is a chapter from the Koran, acknowledging the goodnefs of God and Mahomet; and it is accompanied with various geftures, fuch as lifting the hands above the head, bowing twice, performing two genuflexions,

40 Religious ceremonies.

Morocco. nuflexions, bowing again twice, and kiffing the ground. The whole of this ceremony they repeat three times.

Their fabbath is on our Friday, and commences from fix o'clock the preceding evening. On this day they ufe a blue flag inftead of the white one. As it has been prophefied that they are to be conquered by the Chriftians on the fabbath-day, the gates of all the towns and of the emperor's palaces are fhut when at divine fervice on that day, in order to avoid being furprifed during that period Their talbes are not diftinguifhed by any particular drefs.

The Moors have three folemn devotional periods in the courfe of the year. The firft, which is named *Aid de Cabier*, is held in commemoration of the birth of Mahomet. It continues feven days; during which period, every perfon who can afford the expence kills a fheep as a facrifice, and divides it among his friends. The fecond is the *Ramadam*. This is held at the feafon when Mahomet difappeared in his flight from Mecca to Medina. Every man is obliged at that period to faft (that is, to abftain from animal-food from funrife to fun-fet each day) for 30 days; at the expiration of which time a feaft takes place, and continues a week. The third is named *Llafhore*, and is a day fet apart by Mahomet for every perfon 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 ufes. Although this feaft only lafts a fingle 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 firft, fecond, third, &c. beginning from our Sunday. They ufe a common reed for writing, and begin their manufcripts from right to left.

41 Language of the Moors.

The Moors of the empire of Morocco, as well as thofe to the northern limits of Africa, fpeak Arabic; but this language is corrupted in proportion as we retire farther from Afia, where it firft took birth; the intermixture which has happened among the African nations, and the frequent tranfmigrations of the Moors, during a fucceffion of ages, have occafioned them to lofe the purity of the Arabic language; its pronunciation has been vitiated, the ufe of many words loft, and other foreign words have been introduced without thereby rendering it more copious; the pronounciation of the Africans, however, is fofter to the ear and lefs guttural than that of the Egyptians. The language, when written, is in effect much the fame at Morocco as at Cairo, except that there are letters and expreffions among the Moors which differ from thofe of the Oriental Arabs, who, however, underftand the Moors in converfation, notwithftanding their vitiated manner of pronouncing. They mutually read each others writings with fome difficulty.

There is a very fenfible difference among the Moors between the Arabic of the learned and the courtiers, and that fpoken by the people in general; and this difference is felt ftill more in the provinces of the fouth or of the eaft, and among the Moors who live in the defarts, where the Arabic is yet farther disfigured by a mixture of foreign tribes.

The Brebes and the Shellu, who appear to have had the fame origin, for they have preferved the fame dialect, fpeak a language which the Moors do not underftand, and which feems to have no analogy with that of the latter. It has been conjectured to be the Punic, or the Numidian; but thefe people write it in Arabic characters. The Brebes count the days of the week like the Moors, and both of them employ Arabic words. The Shellu enumerate the days after the fame method, but in their own language. Both the Brebes and the Shellu denote the months of the year in the fame manner as do the Moors and Arabs, and date from the fame æra; that is to fay, from the year of the Hegira.

The Koran and books of prayer of the Brebes and Shellu are in Arabic; as likewife are their acts and title-deeds, which are written by their talbes or learned men.

42 Their temper and difpofition.

The Moors are naturally of a grave and penfive difpofition, fervid in profeffions of friendfhip, but very infincere in their attachments. They have no curiofity, nor 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 fenfation; and they require more than ordinary excitement to render them fenfible of pleafure or of pain. This languor of fentiment is, however, unaccompanied with the fmalleft fpark of courage or fortitude. When in adverfity, they manifeft the moft abject fubmiffion to their fuperiors; and in profperity their tyranny and pride is infupportable. They frequently fmile, but feldom are heard to laugh loud. The moft infallible mark of internal tranquillity and enjoyment is when they amufe themfelves with ftroking or playing with their beard. When roufed by refentment, their difputes rarely proceed further than violently to abufe each other in the moft opprobrious language. They never fight or box with their fifts like our peafantry; but when a quarrel proceeds to great extremities, they collar each other, and fometimes terminate a difpute by affaffination.

43 Mode of living, manners, &c.

Perfonal cleanlinefs has been confidered as one of thofe circumftances which ferve 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 drefs, which fhould be white, is but feldom wafhed; and their whole appearance evinces that they perform this branch of their religious ceremonies in but a flovenly manner. With this degree of negligence as to their perfons, we may be juftly furprifed to find united a moft fcrupulous nicety in their habitations and apartments. They enter their chambers barefooted, and cannot bear the flighteft degree of contamination near the place where they are feated. This delicacy again is much confined to the infides of their houfes. The ftreets receive the whole of their rubbifh and filth; and by thefe means the ground is fo raifed in moft parts of the city of Morocco, that the new buildings always ftand confiderably higher than the old.

When a Moor receives his guefts, he never rifes from his feat, but fhakes hands, inquires after their health, and defires them to fit down, either on a carpet or a cufhion placed on the floor for that purpofe. Whatever be the time of day, tea is then brought in on a tea-board with fhort feet. This is the higheft com-

Morocco. compliment that can be offered by a Moor; for tea is a very expenſive and ſcarce article in Barbary, and is only drank by the rich and luxurious. Their manner of preparing it is by putting ſome green tea, a ſmall quantity of tanſey, the ſame portion of mint, and a large proportion of ſugar (for the Moors drink their tea very ſweet) into the tea-pot at the ſame time, and filling it up with boiling water. When theſe articles are infuſed a proper time, the fluid is then poured into remarkably ſmall cups of the beſt India china, the ſmaller the more genteel, without any milk; and accompanied with ſome cakes or ſweetmeats, it is handed round to the company. From the great eſteem in which this beverage is held by the Moors, it is generally drank by very ſmall and ſlow ſips, that its flavour may be the longer enjoyed; and as they uſually drink a conſiderable quantity whenever it is introduced, this entertainment is ſeldom finiſhed in leſs time than two hours.

The other luxuries of the Moors are ſnuff, of which they are uncommonly fond, and ſmoking tobacco, for which the greater part uſe wooden pipes about four feet in length, with an earthen bowl; but the princes or emperor generally have the bowls made of ſolid gold. Inſtead of the indulgence of opium, which, from the heavy duty impoſed upon that article by the emperor, is too expenſive to be uſed by the Moors, they ſubſtitute the *achicha*, a ſpecies of flax. This they powder and infuſe in water in ſmall quantities. The Moors aſſert, that it produces agreeable ideas; but own, that when it is taken to exceſs it moſt powerfully intoxicates. In order to produce this effect, they likewiſe mix with their tobacco an herb named in this country *khaf*, which by ſmoking occaſions all the inebriating effects of the *achicha*. The uſe of ſpirits as well as wine is ſtrictly forbidden by the Koran; there are, however, very few among the Moors who do not joyfully embrace every private opportunity of drinking both to exceſs.

With reſpect to the hours for eating, the people of this country are remarkably regular. Very ſoon after day-break 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 12 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 ſun-ſet they ſup upon the ſame diſh; and indeed ſupper is their principal meal. Morocco.

Such is the general mode of living among the principal people in towns. There are conſiderable multitudes, however, who do not fare ſo well, but are obliged to content themſelves with a little bread and fruit inſtead of animal food, and to 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 300 or 400 miles at the rate of between 30 or 40 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 diſpatched at a moment's warning to any part of the country their employers may have occaſion to ſend them. They conſtitute in this empire the only mode of conveyance for all public and private diſpatches; and as they are well known in the place to which they belong, they are very punctual in delivering every thing that is put into their hands. From their ſteady pace in travelling, at the rate of about four miles an hour, and from their being able to paſs over parts which from the mountainous ſtate of the country, and from the want of good roads, perſons on horſeback would find inacceſſible, they are indeed by far the moſt expeditious meſſengers that could be employed.

As none but the very vulgar go on foot in this country, for the purpoſe of viſiting mules are conſidered as more genteel than horſes; and the greateſt pride of a Moor is to have ſuch as walk remarkably faſt, and to keep his footmen, of which the number is proportionable to the rank and conſequence of the maſter, on a continued run.

As the Moors are not fond of admitting men into their houſes except upon particular occaſions, if the weather is fine they place a mat, and ſometimes a carpet, on the ground before their 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 drafts, 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

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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.

The manner of ſalutation among the Moors is, when too equals meet, by a quick motion they ſhake hands, and afterwards kiſs each other's hand. When an inferior meets a ſuperior, ſuch as an officer of rank, a judge, or governor, he kiſſes that part of his haick which covers the arm; and ſometimes, as a higher mark of reſpect, he will kiſs his feet. But the compliment due to the emperor, or any of the princes of the blood, is to take off the cap or turban, and to proſtrate the head to the ground. When two particular friends or relations meet, they anxiouſly embrace and kiſs each other's faces and beards for a few minutes, make a number of enquiries about the health of each party, as well as that of their families, but ſeldom allow time for a reply.

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 muſic a part of their amuſements. There are not in Morocco, as in Turkey, public coffee-houſes, where people meet to enquire 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.

Showmen and dancers come often into the towns; round whom the people aſſemble and partake of the amuſement for a very trifle. There are alſo a kind of wandering hiſtorians: the vulgar, who cannot read, and who every where are eager to hear extraordinary relations, are the more aſſiduous in attending theſe narrators, as want of more extenſive information prevents the tale-teller remaining above a week in a place.

A common diverſion in the towns where there are ſoldiers, as well as in the country, is what the Moors call the game of gun-powder; 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 gun-powder 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.

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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 ſun-ſet; 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.

Notwithſtanding the attachment which the Moors manifeſt to their horſes, they moſt certainly uſe them with great cruelty. Their higheſt pleaſure, and one of their firſt accompliſhments, is, by means of long and ſharp ſpurs, to make the horſe go full ſpeed, and then to ſtop him inſtantaneouſly; and in this they certainly manifeſt uncommon dexterity. The iron-work of their bridles is ſo conſtructed, that by its preſſure on the horſe's tongue and lower jaw, with the leaſt exertion of the rider, it fills his mouth full of blood; and if not uſed with the utmoſt caution, throws him inevitably on his back. The bridle has only a ſingle rein, which is ſo very long, that it ſerves the purpoſe of both whip and bridle. The Mooriſh ſaddle is in ſome degree ſimilar to the Spaniſh, but the pummel is ſtill higher and more peaked. Their ſtirrups, in which they ride very ſhort, are ſo formed as to cover the whole of the foot. They either plate or gild them, according to the dignity, opulence, or fancy of the poſſeſſor. Their ſaddles, which are covered with red woollen cloth, or if belonging to a perſon of conſequence with red ſattin or damaſk, are faſtened with a ſtrong girth round the body in the European ſtyle, and another round the ſhoulders.—The Moors frequently amuſe themſelves by riding with the utmoſt apparent violence againſt a wall; and a ſtranger would conceive it impoſſible for them to avoid being daſhed to pieces, when juſt as the horſe's head touches the wall, they ſtop him with the utmoſt accuracy.

46 Love 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. Upon all days of rejoicing, this kind of muſic, repeated volleys of muſketry, either by men on horſeback or on foot, and

Morocco. and in the evening a grand attack upon the coofcoofo, conftitute the principal part of the public entertainments.

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 pleafe; but if we except the very opulent, the people feldom avail themfelves of this indulgence, fince it entails on them a vaft additional expence in houfe-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 fee each other till the ceremony is performed. The marriage-fettlements are made before the cadi, and then the friends of the bride produce her portion, or if not, the hufband agrees to fettle a certain fum upon her in cafe he fhould die, or divorce her on account of barrennefs, or any other caufe. The children of the wives have all an equal claim to the effects of the father and mother, but thofe of the concubines can each only claim half a fhare.

47 Marriage ceremonies.

When the marriage is finally agreed upon, the bride is kept at home eight days, to receive her female friends, who pay congratulatory vifits every day. At the fame time a talbe attends upon her, to converfe with her relative to the folemn engagement on which fhe is about to enter: on thefe occafions he commonly accompanies his admonitions with finging a pious hymn, which is adapted to the folemnity. The bridegroom, on the other hand, receives vifits from his male friends in the morning, and in the evening rides through the town accompanied by them, fome playing on hautboys and drums, while others are employed in firing volleys of mufketry. In all their feftivals, the difcharge of mufketry indeed forms a principal part of the entertainment. Contrary to the European mode, which particularly aims at firing with exactnefs, the Moors difcharge their pieces as irregularly as poffible, fo as to have a continual fucceffion of reports for a few minutes.

On the day of the marriage, the bride in the evening is put into a fquare or octagonal cage about 12 feet in circumference, which is covered with fine white linen, and fometimes with gauzes and filks of various colours. In this vehicle, which is placed on a mule, fhe is paraded round the ftreets, accompanied by her relations and friends, fome carrying lighted torches, others playing on the hautboys, and a third party again firing volleys of mufketry. In this manner fhe is carried to the houfe of her intended hufband, who returns about the fame time from performing fimilar ceremonies. On her arrival, fhe is placed in an apartment by herfelf, and her hufband is introduced to her alone for the firft time, who finds her fitting on a filk or velvet cufhion, fuppofing her to be a perfon of confequence, with a fmall table before her, upon which are two wax candles lighted. Her fhift, or more properly fhirt, hangs down like a train behind her, and over it is a filk or velvet robe with clofe fleeves, which at the breaft and wrifts is embroidered with gold; this drefs reaches fomething lower than the calf of the leg. Round her head is tied a black filk fcarf, which hangs behind as low as the ground. Thus attired, the bride fits with her hands over her eyes, when her hufband appears and receives her as his wife without any further ceremony: for the agreement made by the friends before the cadi is the only fpecific contract which is thought neceffary.

If the hufband fhould have any reafon to fufpect that his wife has not been ftrictly virtuous, he is at liberty to divorce her and take another. For fome time after marriage, the family and the friends are engaged in much feafting, and a variety of amufements, which laft a longer or fhorter time according to the circumftances of the parties. It is ufually cuftomary for the man to remain at home eight days and the woman eight months after they are firft married; and the woman is at liberty to divorce herfelf from her hufband, if fhe can prove that he does not provide her with a proper fubfiftence. If he curfes her, the law obliges him to pay her, for the firft offence eight ducats; for the fecond, a rich drefs of ftill greater value; and the third time fhe may leave him entirely. He is then at liberty to marry again in two months.

Women fuffer but little inconvenience in this country from child-bearing; they are frequently up the next day, and go through all the duties of the houfe with the infant upon their backs. In celebrating the rite of circumcifion, the child is dreffed very fumptuoufly, and carried on a mule, or, if the parents are in poor circumftances, on an afs, accompanied with flags flying and muficians playing on hautboys and beating drums. In this manner they proceed to the mofque, where the ceremony is performed. Children, as foon as they can be made in the leaft degree ufeful, are put to the various kinds of labour adapted to their age and ftrength. Others, whofe parents are in better circumftances, are fometimes fent to fchool; and thofe who are intended for the church, ufually continue their ftudies till they have nearly learnt the Koran by rote. In that cafe they are enrolled among the talbes, or learned men of the law; and upon leaving fchool are paraded round the ftreets on a horfe, accompanied by mufic and a large concourfe of people.

48 Circumcifion.

49 Education of children.

50 Funeral rites.

When any perfon dies, a certain number of women are hired for the purpofe of lamentation; in the performance of which, nothing can be more grating to the ear, or more unpleafant, than their frightful moans, or rather howlings: at the fame time, thefe mercenary mourners beat their heads and breafts, and tear their cheeks with their nails. The bodies are ufually buried a few hours after death. Previous to interment, the corpfe is wafhed very clean, and fewed up in a fhrowd, with the right hand under the head, which is pointed towards Mecca: it is carried on a bier fupported upon mens fhoulders, to the burying place, which is always, with great propriety, on the outfide of the town, for they never bury their dead in the mofques, or within the bounds of an inhabited place. The bier is accompanied by numbers of people, two a-breaft, who walk very faft, calling upon God and Mahomet, and finging hymns adapted to the occafion. The grave is made very wide at the bottom and narrow at the top, and the body is depofited without any other ceremony than finging and praying in the fame manner as on their way to the grave. They have no tombs in this country, but long and plain ftones; and it is frequently cuftomary for the female

Morocco. friends of the departed to weep over their graves for several days after their funeral.

51 Absurd conduct of the European powers towards Morocco.

It has often been thought surprising, that the Christian powers should suffer their marine to be insulted by those barbarians, who take the ships of all nations with whom they are not at peace, or rather who do not pay them a subsidy either in money or commodities. This forbearance has been accounted for no otherwise than by supposing, first, that a breach with them might provoke the Porte, who pretends to be their lord paramount; secondly, that no Christian power would be fond of seeing Algiers, and the rest of that coast, in possession of another; and, thirdly, that nothing could be got by a bombardment of any of their towns, as the inhabitants would instantly carry their effects to their deserts and mountains, so that the benefit resulting from the conquest must be tedious and uncertain.

The first reason is so obviously absurd as to require no answer. In regard to the second and third suppositions, it may be observed, that there is no necessity for taking possession of those coasts by any European power whatever. The object ought to be, not to conquer, but to render impotent, those piratical states; not to profit by plundering them, but to quash their piracies, and prevent them from being longer the nuisances and pests of the Mediterranean. Than which, according to the best informed travellers, there can be nothing more easy. Hardly any force of armament would be necessary for the purpose, would the Europeans merely leave them to their own resources, and with-hold those supplies with which they have been in use to furnish them, contrary as well to good policy as to the interests of humanity. M. Lempriere †, speaking of the emperor of Morocco (1790) observes, that "nothing but gross neglect or inexcusable ignorance could induce the European princes in general to remain in a kind of tributary state to a prince who had neither an army nor a fleet which deserved the name, and a people whose disposition is less suited to enterprise than perhaps any other. What had they to fear from him? His whole fleet consisted only of a few small frigates and row-boats, ill managed and worse manned, the whole of which might have been destroyed in one day by two or three well appointed European frigates. The entrances of those ports where he laid up his shipping, if we except Tangier and Larache, are so continually choaking up with sand, that in a short time they will only admit fishing-boats, or the very smallest craft. The towns are none of them regularly fortified except Mogodore, and that hardly produces half a dozen of men who understand the least of working the guns. And yet this contemptible power gives laws to all the coasts of Portugal and Spain, and may be said in some measure to command the entrance of the Mediterranean.

† *Tour*, p. 233.

"It may be said, he was too trifling a power to notice; if so, why lavish immense presents for the purpose of keeping him in temper? Those who imagined they secured his friendship by these means, were much mistaken; on the contrary, they only added fuel to that flame of avarice which was not to be extinguished. If he was one day presented with a frigate, he asked for two the next; and the more his requests were indulged, the more his inordinate desires were increased. It is well known to those who have been conversant with the Moors, that to secure their friendship, you must first assert your own superiority; and then if you make them a trifling present, its value is trebled in their estimation. The same disposition would have been found in the late emperor as in the common Moor. So far from courting an alliance, it would rather have been good policy at once to quarrel with him; the loss of a few towns, and particularly Mogodore, to which he was much attached, from its being raised under his own auspices, would soon have reduced him to good humour and submission."

Another intelligent traveller, M. Brisson *, observes how extraordinary it is, that a prince so little to be dreaded as the emperor of Morocco should oblige the different powers of Europe to send ambassadors to him, and that he should even dictate laws to them. There is not a single sovereign who dares to send a representative to his court without making him at the same time considerable presents; and what envoy would present himself without having his hands full? How happens it that the consuls have not, by common consent, represented to their respective sovereigns, that the emperor of Morocco becomes every day more and more powerful by the supplies which they themselves furnish him? Twenty years ago this prince was absolutely destitute of resources. He had neither materials nor any place for casting cannons; and he was equally in want of wood for building ships, of ropes, of nails, and even of workmen. It is France and other European powers that assist him, else the emperor of Morocco would be of little consideration. His superb batteries of brass cannons, 24, 36, and 48 pounders, were furnished by Holland, Spain, England, and France. England has done more than other nations, by selling him those beautiful cannons which were taken on the floating batteries. Mogodore is built in an advantageous situation, its batteries are well disposed, and there are cannon at each embrasure; but they are there only in a manner for show, as they have no carriages, and are supported only by brick-work. There are no workmen in the country capable of mounting them on carriages, nor is there wood proper for making them. Did a few vessels only wait for the sailing of those small frigates, which are almost all unfit for sea except only two, nothing would be easier than to prevent them from returning, and to block up the ports of Mogodore, Rabat, and Salee. What would become of his commerce, and above all his marine, did the Christian princes cease to assist him, contrary to the interests of humanity? Would England and Spain unite only for a moment, Tangiers, his most beautiful port, would soon be so far ruined, that it could not afford shelter to his subjects, who, destitute of ships, would soon be obliged to give over their piracies. If the consuls of different nations have never made these observations, and if they have never pointed out the means of curbing the insolence of the emperor of Morocco, it is because they are at the head of the commerce which these different powers carry on in that part of the world. I can positively assert, that these representatives, instead of furnishing their courts with the means of diminishing the power of the emperor, never cease to add to his strength, and to incite him to make new

* *Shipwreck of M. Brisson.*

52 Avarice and intrigues of their consuls.

Morocco. new pretenſions. How much we aſſiſt theſe pirates, to hurt the advantageous trade which we might carry on! Their ſituation renders them very dangerous; but if we leave them only their ſituation, it would be impoſſible for them to profit much by it. Let impartial people pay a viſit to that country, let them ſpeak with the ſame ſincerity as I do; and they will no doubt be convinced, that the emperor of Morocco, of all the princes in the world, would be the leaſt able to do miſchief, did the ſovereigns of Europe ceaſe to furniſh him with ſuccours."

53 Deſcription of the city of Morocco.

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 the 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 aparments opened, was very neatly paved with glazed blue and white tiling, and had in its centre a beautilful fountain. The upper apartments were connected together by a broad gallery, the balluſters 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 wood-work, 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.

* Publiſhed in 1791.

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 an 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 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, incloſed 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

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 purposes 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 mattrass 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 sumac or galls, and coloured of any colour at pleasure; much used in bookbinding, &c. The name is ordinarily 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.

MOROCHTHUS, in natural history, an indurated clay called by us *French chalk*; serving taylors and others to mark with. The ancients esteemed it as an astringent, prescribing it in the colic, hæmorrhagies, and other fluxes.

MORON, a town of Spain, in Andalusia, seated in a pleasant fertile plain, and in the neighbourhood is a mine of precious stones. It is 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 them both. The market-place is conveniently situated near the centre of the town; and an elegant town-house 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 scite 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. Its fairs are on Wednesday, Thursday, and Friday before Whitsunday, and the Wednesday before July 22. It sends two members to parliament.

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, 1643. He learned rhetoric and philosophy at Aix, and divinity at Lyons. At 18 years of age he wrote a small piece, intitled *Le Pays d'Amour*, and a collection of the finest French poems intitled *Doux plaisirs de la Poesie*. He learned Spanish and Italian; and translated out of Spanish into French the book intitled *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 vasa, were a sort of cups or vases made use of by the ancients for drinking out of, and other

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 scymetar.

MORSE, in zoology. See Trichecus.

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 prolificknefs, 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 or 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. 669.) and is the first table of this 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 numbers 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 $3\frac{1}{5}$ to 3.

He that will take the pains to examine the accounts in Phil. Transf. 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 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, ended 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 Struycks, 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-

Mortality.

In all Sweden for nine years, ended 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. Transf. 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

babilities 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 has 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 is an increaſe, it will be greater than this exceſs. If there is 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 50, 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 excepting even 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 (Abridgment, vol. vii. n° 380, 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 be well 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 values of lives come 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 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

Mortality 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 at 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 numnumber living at that given age. And if at 20, and every age above it, this 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,

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 15710. 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 $20\frac{3}{4}$ inhabitants. It was before ſhown, that the number of inhabitants in London could not be ſo great as 25 times $\frac{1}{4}$ the deaths. It now appears (ſince the numbers in the ſecond column of this table are too high) that the number of inhabitants in London cannot be ſo great as even 20 times $\frac{3}{4}$ 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 enquiry 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 ages 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. 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.
0	750	240	12	272	4
1	510	99	13	268	3
2	411	42	14	265	3
3	369	29	15	262	3
4	340	21	16	259	3
5	319	11	17	256	3
6	308	10	18	253	4
7	298	7	19	249	
8	291	6	20	494	
9	285	5	21	487	
10	280	4	&c.	&c.	
11	276	4			

The numbers in the ſecond column to be continued as in the laſt table.

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. 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 ſtill-borns. All the bills alſo give the numbers dying in every period of five years.

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	212	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 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	31	364	6	62	129	6
1	813	107	32	358	5	63	123	7
2	706	61	33	353	6	64	116	7
3	645	46	34	347	7	65	109	8
4	599	33	35	340	8	66	101	8
5	566	30	36	332	8	67	93	8
6	536	20	37	324	8	68	85	7
7	516	11	38	316	9	69	78	7
8	505	9	39	307	9	70	71	6
9	496	7	40	298	8	71	65	5
10	489	6	41	290	7	72	60	5
11	483	5	42	283	6	73	55	4
12	478	5	43	277	6	74	51	4
13	473	6	44	271	7	75	47	5
14	467	6	45	264	8	76	42	5
15	461	6	46	256	9	77	37	5
16	455	7	47	247	9	78	32	5
17	448	6	48	238	9	79	27	4
18	442	6	49	229	9	80	23	3
19	436	6	50	220	8	81	20	2
20	430	5	51	212	7	82	19	2
21	425	5	52	205	7	83	16	2
22	420	5	53	198	7	84	14	2
23	415	6	54	191	7	85	12	2
24	409	6	55	184	8	86	10	2
25	403	6	56	176	8	87	8	2
26	397	6	57	168	9	88	6	2
27	391	7	58	159	8	89	4	1
28	381	7	59	151	8	90	3	1
29	377	7	60	143	7	91	2	1
30	370	6	61	136	7	92	1	1

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. page 37, Tables.

Age	Living.	Decr.	Age.	Living.	Decr.	Age.	Living.	Decr.
0	1427	524	33	361	7	65	112	6
1	903	151	34	354	7	66	106	7
2	752	61	35	347	8	67	99	7
3	691	73	36	339	9	68	92	6
4	618	45	37	330	10	69	86	6
5	573	21	38	320	10	70	80	6
6	552	15	39	310	10	71	74	6
7	536	13	40	300	10	72	68	6
8	523	9	41	290	9	73	62	5
9	514	7	42	281	8	74	57	5
10	507	5	43	274	7	75	52	5
11	502	4	44	266	7	76	47	5
12	498	4	45	259	7	77	42	5
13	494	4	46	252	7	78	37	5
14	490	4	47	245	7	79	32	4
15	486	4	48	238	7	80	28	4
16	482	5	49	231	7	81	24	3
17	477	5	50	224	7	82	21	2
18	472	5	51	217	7	83	19	2
19	467	6	52	210	7	84	17	2
20	461	6	53	203	8	85	15	2
21	455	6	54	195	8	86	13	2
22	449	6	55	187	8	87	11	2
23	443	7	56	179	8	88	9	2
24	436	8	57	171	8	89	7	1
25	428	9	58	163	9	90	6	1
26	421	9	59	154	9	91	5	1
27	412	9	60	145	8	92	4	1
28	403	9	61	137	7	93	3	1
29	394	9	62	130	6	94	2	1
30	385	9	63	124	6			
31	376	8	64	118	6			
32	368	7						

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.

Under the article Cement, we have already given the theory of mortar, as delivered by Mr Anderson; which has now received a farther confirmation by a recent discovery, that if the lime is slaked, and the mortar made up, with lime-water instead of common water, the mortar will be much better. The reason of this is, that in common water, especially such as is drawn from wells, there is always a considerable quantity of fixed air, which, mingling with the mortar previous to its being used, spoils it by reducing the quicklime in part to an inert calcareous earth like chalk; but when it is built up in a perfectly caustic state, it attracts the air so slowly, that it hardens into a kind of stony matter as hard as was the rock from whence the limestone was taken.

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,

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 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 ſoft metal, ſoluble by almoſt all menſtruums, and hurtful to health, good artiſts have ſome time ago proſcribed the uſe of this metal.

One of the principal inconveniences of pulveriſation 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, calxes of lead, cantharides, euphorbium, &c. are ſo noxious, that all theſe precautions ought to be uſed, particularly when a large quantity of them 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 the 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 powder 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 tampion 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 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 $2\frac{1}{2}$ 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, carcaſes, &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, carcaſe, &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 propoſed elevations, Galileo and Torricelli give us the following table, wherein the ſigns of the angles ſought are had by inſpection.

Degrees.

Mortar, Mortgage.

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 mortgagor, ſhall pay the mortgagee the ſaid ſum of 200l. on a certain day mentioned in the deed, that then the mortgagor 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 mortgagor: 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 mortgagor; 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 incumbrances of the mortgage (though that doubt has been long ago over-ruled 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 re-payment 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 alone are entitled in equity

Mortgage.

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 mortgagor 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 mortgagor, 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 mortgagor at any reaſonable time to re-call 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 mortgagors, is called the *equity of redemption*; and this enables a mortgagor 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 mortgagor 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 recall. And alſo, in ſome caſes of fraudulent mortgages, the fraudulent mortgagor 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 mortgagor 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 mortgagor, 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 mortgagor 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

Mortier || Mortmain.

rious conveyances for more private and secret bargains, have well evinced the wisdom of our ancient law.

MORTIER, an ensign of dignity, borne by the chancellor and grand presidents of the parliament of France. That borne by the chancellor is a piece of cloth of gold, edged and turned up with ermine; and that of the first president is a piece of black velvet edged with a double row of gold-lace, while that of the other presidents is only edged with a single row. This they formerly carried on their heads, as they still do in grand ceremonies, such as the entry of the king; but ordinarily they carry them in the hand.

MORTIFICATION, in medicine and surgery, a total extinction of the natural heat of the body, or a part thereof. Some define mortification a disease, wherein the natural juices of any part quite lose their proper motion; and by that means fall into a fermentative one, and corrupt and destroy the texture of the part. See SURGERY.

MORTIFICATION, in religion, any severe penance observed on a religious account. How ancient and how universal the practice of it has been, and for what seasons observed, see FAST.

MORTIMER (John), a late English artist, born in 1743. According to Mr Strutt, "he was endowed with every requisite to make a great painter; his genius fertile, and his imagination lively. There is an originality in his works which add greatly to their value. No man perhaps touched in the heads and other extremities of his figures with more spirit; and few could draw them more correctly. When he failed, it was from his haste to express his thoughts; so that at times he did not attend with that precision which historical painting requires to the proportion of his figures; and they are sometimes heavy. This defect is, however, well repaid by the lightness of his pencil, and the freedom which appears in his works." He died at his house in Norfolk-street in 1779, aged 36.—"King John granting the Magna Charta to the barons," and the "Battle of Agincourt," two of his capital pictures, have been engraved. The first was nearly finished by Mr Ryland, and completed by Mr Bartolozzi. The last, intended as a companion to the former, was published by Mrs Mortimer.

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 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.

* See *Corporation*.

Mortmain.

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 licence 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 licences of mortmain seem to have been necessary among the Saxons above 60 years before the Norman conquest. But, besides this general licence 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 licence also (upon the same feodal principles) for the alienation of the specific land. And if no such licence was obtained, the king or other lord might respectively enter on the lands so alienated in mortmain, as a forfeiture. The necessity of this licence 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 licence 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 Kings 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

Mortmain. 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 Edward 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 lords 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 Edward 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 authorise any kind of alienation in mortmain. And when afterwards the method of obtaining the king's licence by writ of *ad quod damnum* was marked out by the statute 27 Edward I. st. 2. it was farther provided by statute 34 Edward I. st. 3. that no such licence 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 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 licence 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 *church-yards*, 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, chauntries, 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 licence 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 licence 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 licences to alienate or take in mortmain, of whomsoever the tenements may be holden.

After the dissolution of monasteries under H. 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 licence 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 100 l. *per annum* may be augmented by the purchase of lands, without licence 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

Morton, Mortuary.

tute 23 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 kalendar 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.

MORTON (Thomas), a learned English bishop in the 17th century, was bred at St John's college, Cambridge, and was logic-lecturer of the university. After several preferments he was advanced to the see of Chester in 1615, and translated to that of Litchfield and Coventry in 1618; at which time he became acquainted with Antonio de Dominis archbishop of Spalatro, whom he endeavoured to dissuade from returning to Rome. While he was bishop of Litchfield and Coventry, in which see he sat 14 years, he educated, ordained, and presented to a living, a youth of excellent parts and memory, who was born blind; and detected the imposture of the famous boy of Bilson in Staffordshire, who pretended to be possessed with a devil. In 1632 he was translated to the see of Durham, in which he sat with great reputation till the opening of the long parliament, which met in 1640; when he received great insults from the common people, and was committed twice to custody. The parliament, upon the dissolution of bishoprics, voted him 800 l. *per annum*, of which he received but a small part. He died in 1659, in the 95th year of his age and 44th of his episcopal consecration. He published *Apologia Catholica*, and several other works; and was a man of extensive learning, great piety, and temperance.

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.

* See Heriot.

Mortuary.

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 *corse-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 meliori:* the lord must have the best good left him as an heriot; and the church the second best as a mortuary. 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 recompence 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 goods claimed, which bear so near a resemblance to those in the archdeaconary 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

Morus.

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 pound, 3*s.* 4*d.* if above 30 pounds, and under 40 pounds, 6*s.* 8*d.* if above 40 pounds, of what value ſoever they may be, 10*s.* 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.

MORUS, the MULBERRY-TREE: A genus of the tetrandria order, belonging to the monœcia claſs of plants; and in the natural method ranking under the 53d order, *Scabridæ.* The male calyx is quadripartite; and there is no corolla: the female calyx is tetraphyllous; there is no corolla; two ſtyles; the calyx like a berry, with one ſeed. There are ſeven ſpecies, viz.

Species. 1. The *nigra*, or common black-fruited mulberry-tree, riſes with an upright, large, rough trunk, dividing into a branchy and very ſpreading head, riſing 20 feet high, or more. It has large, heart-ſhaped, rough leaves; and monœcious flowers, ſucceeded in the females by large ſucculent black-berries. There is a variety with jagged leaves and ſmaller fruit.—2. The *alba*, or white mulberry tree, riſes with an upright trunk, branching 20 or 30 feet high; garniſhed with large, oblique, heart-ſhaped, ſmooth, light-green, ſhining leaves, and monœcious flowers ſucceeded by pale-whitiſh fruit. There is a variety with purpliſh fruit. 3. The *papyrifera*, or paper mulberry-tree of Japan, grows 20 or 30 feet high; having large palmated leaves, ſome trilobate, others quinquelobed; and monœcious flowers, ſucceeded by ſmall black fruit.—4. The *rubra*, or red Virginia mulberry-tree, grows 30 feet high; is garniſhed with very large, heart-ſhaped, rough leaves, hairy underneath; and has monœcious flowers, ſucceeded by large reddiſh berries. 5. The *tinctoria*, dyer's mulberry, or fuſtic, has oblong leaves more extended on one ſide at the baſe, with axillary thorns. It is a native of Braſil and Jamaica. 6. The *tatarica*, or Tartarian mulberry, has ovate oblong leaves equal on both ſides and equally ſerrated. It abounds on the banks of the Wolga and the Tanais. 7. The *indica*, or Indian mulberry, has ovate oblong leaves, equal on both ſides, but unequally ſerrated.

The laſt three ſpecies are tender plants in this country; but the four firſt are very hardy, and ſucceed in any common ſoil and ſituation. The leaves are generally late before they come out, the buds ſeldom beginning to open till the middle or towards the latter end of May, according to the temperature of the ſeaſon; and when theſe trees in particular begin to expand their foliage, it is a good ſign of the near approach of fine warm ſettled weather; the white mulberry, however, is generally forwarder in leafing than the black. The flowers and fruit come out ſoon after the leaves; the males in amentums, and the females in ſmall roundiſh heads; neither of which are very conſpicuous, nor poſſeſs any beauty, but for obſervation. The female or fruitful flowers always riſe on the extremity of the young ſhoots, on ſhort ſpurs; and with this ſingularity, that the calyxes of the flowers become the fruit, which is of the berry kind, and compoſed of many tuberances, each of them furniſhing one ſeed. The fruit matures here gradually from about the middle of Auguſt until the middle of September. In dry warm ſeaſons, they ripen in great perfection; but when it proves very wet weather, they ripen but indifferently, and prove devoid of flavour.

Uſes, &c. Conſidered as fruit-trees, the nigra is the only proper ſort to cultivate here; the trees being not only the moſt plentiful bearers, but the fruit is larger and much finer-flavoured than that of the white kind, which is the only other ſort that bears in this country. The three next ſpecies are chiefly employed to form variety in our ornamental plantations; tho' abroad they are adapted to more uſeful purpoſes.

The *fruit* of the black mulberry is exceedingly grateful to the taſte, and is conſidered at the ſame time as laxative and cooling. Like the other acid-ſweet fruits, it allays thirſt (as Dr Cullen obſerves), partly by refrigerating, and partly by exciting an excretion of mucus from the mouth and fauces; a ſimilar effect is alſo produced in the ſtomach, where, by correcting putreſcency, a powerful cauſe of thirſt is removed. A ſyrup is made from the berries gathered before they are ripe, which, taken as a gargle, is excellent for allaying inflammations of the throat, and for cleanſing ulcers in the mouth. The *bark* of the *root*, which has an acrid bitter taſte, poſſeſſes a cathartic power; and has been ſucceſsfully uſed as a vermifuge, particularly in caſes of tænia: the doſe is half a dram of the powder, or a dram of the infuſion. The juice of the black mulberry is alſo employed to give a colour to certain liquors and confections. Some make from it a wine which is not diſagreeable; others employ it for giving a high colour to red wine; which it likewiſe contributes to make ſweet.—Although this juice is of no uſe in dyeing, it gives a red colour to the fingers and to linen, which it is very difficult to remove. Verjuice, ſorrel, lemon, and green mulberries, remove ſpots of this kind from the hands: but with reſpect to linen, the beſt way is to wet the part which has been ſtained, and to dry it with the vapour of ſulphur; the vitriolic acid which eſcapes from this ſubſtance during combuſtion, inſtantly takes off the ſtain.—The *wood* of the mulberry tree is yellow, tolerably hard, and may be applied to various uſes in turnery and carving: But in order to ſeparate the bark, which is rough, thick, thready, and fit for being made into ropes, it is proper to ſteep the wood in water.

Mulberry trees are noted for their *leaves* affording the principal food of that valuable inſect the ſilk-worm. The leaves of the *alba*, or white ſpecies, are preferred for this purpoſe in Europe; but in China, where the beſt ſilk is made, the worms are ſaid to be fed with thoſe of the *morus tatarica.* The advantages of *white mulberry* trees are not confined to the nouriſhment of worms: they may be cut every three or four years like ſallows and poplar trees, to make faggots;

and

Morus.

and the ſheep eat their leaves in winter, before they are burnt. This kind of food, of which they are extremely fond, is very nouriſhing; it gives a delicacy to the fleſh, and a fineneſs and beauty to the wool. In ſhort, in every climate and in moſt fields, it might be proper, as is the caſe in Spain, to wait for the firſt hoar-froſt ſhaking off the leaves, which are gathered and placed to dry in ſheds or cart-houſes, taking care always to ſtir them from time to time. In Spain, the ſheep are fed on theſe leaves during the cold and froſts. By this method no injury is done to the mulberries, which produce leaves every year; and it is thought that the beauty and fineneſs of the Spaniſh wool is in a great meaſure owing to the uſe of this kind of food. From theſe conſiderations M. Bourgeois infers, that even in countries where, from the nature of the climate, the ſcarcity of workmen and the high price of labour, or any other particular cauſes, ſilk-worms could not be raiſed to any advantage, the cultivation of mulberry trees ought not be neglected.—The fruit of the white mulberry has a ſweetiſh and very inſipid taſte. Birds, however, are very fond of it; and it is remarked that thoſe which have been fed with ſuch fruit are excellent eating.

The *papyrifera*, or paper-mulberry, is ſo called from the paper chiefly uſed by the Japaneſe being made of the bark of its branches; (ſee the article Paper.) The leaves of this ſpecies alſo ſerve for food to the ſilk worm, and is now cultivated with ſucceſs in France. It thrives beſt in ſandy ſoils, grows faſter than the common mulberry, and at the ſame time is not injured by the cold. M. de la Bouviere affirms that he procured a beautiful vegetable ſilk from the bark of the young branches of this ſpecies of mulberry, which he cut while the tree was in ſap, and afterwards beat and ſteeped. The women of Louiſiana procure the ſame kind of production from the ſhoots which iſſue from the ſtock of the mulberry; and which are four or five feet high. After taking off the bark, they dry it in the ſun, and then beat it that the external part may fall off; and the internal part, which is fine bark, remains entire. This is again beaten, to make it ſtill finer; after which they bleach it with dew. It is then ſpun, and various fabrics are made from it, ſuch as nets and fringes: they even ſometimes weave it and make it into cloth.—The fineſt ſort of cloth among the inhabitants of Otaheite and others of the South Sea Iſlands, is made of the bark of this tree, in the manner particularly deſcribed under the article Bark.

The *tinctoria* is a fine timber-tree, and a principal ingredient in moſt of our yellow dyes, for which it is chiefly imported into Europe. The berries are ſweet and wholeſome; but not much uſed, except by the winged tribe, by whoſe care it is chiefly planted.

Culture of the Mulberry. From the nouriſhment which it affords to the ſilk-worm, that valuable inſect to which we are indebted for the materials of our fineſt ſtuffs, the method of cultivating the mulberry tree muſt be peculiarly intereſting wherever its culture can be undertaken with ſucceſs. In France and Italy, vaſt plantations of the trees are made ſolely for their leaves to feed the little animals we have mentioned, which amply reward the poſſeſſors with the ſupply of ſilk which they ſpin from their bowels. Plantations of the mulberry have at different times been recommended in this country for the ſame purpoſe; though nothing has yet been done in that way to any extent, and even the expediency of any ſuch attempt has been doubted by others, upon the ground of its interfering with other branches of rural economics more productive and more congenial to our climate.

In the European ſilk-countries, a great many varieties of mulberry trees are diſtinguiſhed, ariſing from difference of climate, ſoil, method of culture, and other accidental cauſes. Among the wild mulberries, we meet with ſome whoſe leaves are roundiſh, and reſembling thoſe of a roſe: hence they have been called the *roſe-leaved* mulberry.

Mulberry trees were firſt cultivated in France in the reign of Charles IX. It has been found by experience that this tree is not ſo peculiar to warm countries, ſuch as Spain, Italy, Provence, Languedoc, and Piedmont; but it may alſo thrive very well in colder countries, ſuch as Touraine, Poitou, Maine, Anjou, Angoumois near Rochefoucault, and even in Germany, where it affords very good nouriſhment for ſilk-worms. They grow in all kinds of ſoil: they thrive beſt in ſtrong and wet lands; but it is alleged that their leaves conſtitute too coarſe food, prejudicial to the worms, and unfavourable to the quality of the ſilk.—A good light land is the beſt kind of ſoil for raiſing them. White mulberry trees have been found to grow in ſandy ſoils where heath would ſcarcely vegetate; but their leaves are too dry, and afford not ſufficient nouriſhment for the ſilk-worms.

Mulberry trees may be propagated either from ſhoots which have taken root, or by ſeed, by layers, and by ſlips. To raiſe black mulberry trees, the ſeed muſt be taken from the largeſt and moſt beautiful mulberries: in raiſing white ones, the ſeed is taken from the fineſt mulberries growing on trees with large whitiſh, ſoft and tender leaves, and as little cut as poſſible. The beſt ſeed is commonly got from Piedmont, Languedoc, &c. According to M. Duhamel, that ſeed ſhould be preferred which is gathered in countries where the cold is ſometimes pretty ſevere; becauſe in that caſe the trees are better able to reſiſt the attacks of the froſt. It frequently happens in ſevere winters, as M. Bourgeois obſerves, that the ſtalks of the young mulberry trees, eſpecially during the firſt winter, are deſtroyed by the froſt; but when they are cut cloſe to the earth, they ſend forth as beautiful and vigorous ſtalks as the former. Good ſeed ought to be large, heavy, light coloured, to produce a great deal of oil when it is preſſed, and to crackle when thrown on a red hot ſhovel. This ſeed muſt be ſown in good land.

In the autumn of the ſecond year, all thoſe trees muſt be pulled up which have ſmall leaves of a very deep green, rough, and deeply indented, for they would produce no leaves proper for the ſilk-worms.—In the third year, when the mulberry tree is about the thickneſs of the finger, it muſt be taken up and put in the nurſery. According to M. Bourgeois, mulberries ought to be tranſplanted in the ſpring of the ſecond year, which makes them thrive better, and ſooner attain their growth. Without this tranſplantation, they would put forth only one root like a pivot, and moſt of them would be in danger of periſhing when they are taken up to be put where they are intended

Morus.

tended to remain. Some cultivators of this tree tell us, that all the young trees, whether large or ſmall, ſtraight or crooked, ought to be cut cloſe to the ground in the third year, that they may put forth a greater number of roots. Others never employ this method but with regard to thoſe which are crooked, or in a languiſhing ſtate.

White mulberries may be raiſed for the food of ſilk-worms, either in the form of a copſe, or planted in a [illegible] by letting them grow to their natural ſize. [illegible] ingrafted [illegible] curing fine leaves from mulberries. Mulberries ingrafted on wild ſtocks choſen from a good kind, ſuch as thoſe which are produced from the ſeed of the Italian mulberry, commonly called the *roſe-mulberry*, or of the Spaniſh mulberry, produce, as M. Bourgeois obſerves, much more beautiful leaves, and of a much better quality for ſilk-worms, than thoſe which are ingrafted on the common or prickly ſmall-leafed wild-ſtock. The ſame obſervation has been made by a great many cultivators of mulberries, and in particular by M. Thomé of Lyons, whoſe authority has the greateſt weight in whatever regards the cultivation of mulberries and the rearing of ſilk-worms.

Encyclop. Methodique.

Ingrafted mulberries, it muſt be confeſſed, produce a greater number of leaves, and theſe more nouriſhing for ſilk-worms, than wild mulberries. The latter, however, it has been found by experience, may exiſt for two centuries; whereas the extenſion of leaves produced by ingrafting, occaſions a premature diſſipation of the ſap of the tree, and thereby accelerates its decay. In a memoir inſerted in a treatiſe on the culture of white mulberries by M. Pomier, it is recommended to ingraft white mulberries upon black ones; and there is reaſon to think that by following this plan the trees would exiſt much longer: for it is well known that the white mulberry commonly decays firſt in the root, whereas the black mulberry is not ſubject to any malady. In almoſt all the books on agriculture we find it aſſerted, that mulberries may be ingrafted on elms. "I will not affirm (ſays M. Duhamel), that this method of ingrafting has never been ſucceſsful; but I have frequently tried it in vain, and I have many reaſons for thinking that it cannot be attended with any advantage." In works of the ſame kind, we are likewiſe told, "that mulberries may be ingrafted on fig and lime trees; but in general ſuch ingrafting will not ſucceed, unleſs there is a great analogy betwixt the trees, and particularly unleſs the ſap is ſet in motion at the ſame time."

The greater care we take of mulberries, by dreſſing them, and lopping off the overgrown branches, they produce the greater plenty of good leaves. It is very prejudicial to the mulberries to ſtrip them when too young of their leaves for the purpoſe of feeding the worms, becauſe the leaves are the organs of perſpiration in trees, and likewiſe contribute greatly to nutrition by means of their abſorbing veſſels which imbibe the moiſture of the atmoſphere. Mulberry trees are ſo plentifully ſtored with ſap, that they renew their leaves ſometimes twice or thrice. When the winter is mild, mulberry trees put forth their leaves very early: but it is always dangerous to accelerate the hatching of the worms in expectation of this event; for no leaves can be depended upon till the beginning of May, thoſe which are prior to this period being in danger of being deſtroyed by the froſts.

Morus. Moſa.

In Tuſcany, eſpecially in the neighbourhood of Florence, M. Nollet tells us, that though the inhabitants do not cultivate half ſo many mulberries as the Piedmonteſe, they rear and feed double the quantity, in proportion, of ſilk-worms. For this purpoſe they cauſe the worms hatch only at two different ſeaſons. [illegible] worms which are hatched are fed on the firſt produced their ſilk, other worms are hatched, which are nouriſhed on the ſecond crop of the ſame trees.

We are told by M. Bourgeois, that ſeveral kinds of white mulberries are now cultivated near Bienne in Switzerland. According to this author, the prickly mulberry is the leaſt eſteemed of all the white wild mulberries. Its branches are rough with prickles; its leaves are of a ſmall ſize and few in number; and the reaping of them is difficult and expenſive. The common wild mulberry produces indented leaves, oblong, and very ſlender; but it is worth being attended to, becauſe it thrives very well when planted in a hedge, and in a favourable expoſure: it is alſo earlier in the ſpring than the other ſpecies. The wild mulberry, which is produced from the roſe or Italian ingrafted mulberry, bears a great many leaves, of a roundiſh ſhape and middling ſize, inclining to a light yellow, and of an excellent quality.

Of the white ingrafted mulberry-trees, the roſe, or Italian ingrafted mulberry, which is now the ſpecies moſt cultivated in France, Italy, and Piedmont, produces great abundance of large thick and ſmooth leaves. It has now come into great repute, in conſequence of the recommendation of M. Thomé, who prefers it to all other ſpecies of mulberry-trees for raiſing ſilk-worms. It is extremely delicate, however, and ſuffered greatly in Switzerland from the ſevere winters of 1766 and 1767. The mulberry called *Roman leaf* is diſtinguiſhed from every other ſpecies by its very large leaves, ſome of which are frequently found equal in ſize to thoſe of a gourd. The Spaniſh mulberry greatly reſembles the wild roſe-mulberry, except that its leaves are larger and more pointed. It is by no means delicate, and can reſiſt the ſtrongeſt froſts and the ſevereſt winters in cold climates. The leaves of the mulberry called the *ſmall queen* are oblong, moderately large, and exceedingly ſmooth. This ſpecies is of an excellent quality and much eſteemed.

MOSA, (anc. geog.) 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 no greater diſtance than 80 miles: its mouth, which is large and broad, is that which Pliny calls *Helius*, denoting *Lower*, according to ſome German writers. Now called the *Maeſe*, or *Meuſe*; riſing in Champaign, on the borders of the county of Burgundy, or the Franche Compté, at a village called *Meuſe*, whence the appellation; and running north through Lorrain and Champaign into the Netherlands: it afterwards directs its courſe north-eaſt, and then weſt; and joining the Waal, runs to Dort, and falls

Mofæ, Mofaic Law.

falls into the German fea, a little below the Briel.— According to Baudrand, it twice receives the Waal; by the firft junction forming the ifland Bommel; and again receives it at Worcum, from which place proceeding to Dort, it divides into two branches, which again uniting together form one large mouth difcharging itfelf into the German fea.

MOSÆ Pons (anc. geog.), fuppofed to be Maeftricht, fituated on the Mafe. E. Long. 5. 40. N. Lat. 50. 55.

Wilfon's *Archæol. Dict.*

ancienteft 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 thefe was delivered, may perhaps fuggeft to us a right idea of their different natures. The moral law, or ten commandments, for inftance, was delivered on the top of the mountain, in the face of the whole world, as being of univerfal influence, and obligatory on all mankind. The ceremonial was received by Mofes in private in the tabernacle, as being of peculiar concern, belonging to the Jews only, and deftined to ceafe when the tabernacle was down, and the vail of the temple rent. As to the judicial law, it was neither fo publicly nor fo audibly given as the moral law, nor yet fo privately as the ceremonial; this kind of law being, as it differs with the place and government under which we live. The five books of Mofes called the *Pentateuch*, are frequently ftyled, by way of emphafis, *the Law*. This was held by the Jews in fuch veneration, that they would not allow it to be laid upon the bed of any fick perfon, left it fhould be polluted by touching the dead.

Mofaic Law.

A TABLE or HARMONY of the MOSAIC LAW, digefted into proper Heads, with References to the feveral Parts of the Pentateuch where the refpective 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 *firft table*, which includes				
The firft commandment, - -	20. 23.	—	—	5. 6. 13
The fecond commandment, - -	20. 23. 34.	19. 20. 26.	—	4. 5. 6. 7. 8. 10. 11. 12. 13.
The third commandment, - -	20. 23.	—	—	5.
The fourth commandment, - -	20. 23. 31. 34. 35.	19. 23. 26.	—	—
The *fecond table*, including				
The fifth commandment, - -	20. 22.	19.	—	5.
The fixth commandment, - -	20.	19.	—	5.
The feventh 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 fum 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 ftructure of the tabernacle, -	25. 26. 27. 35.	—	—	—
Of the inftruments of the fame, *viz.*				
The laver of brafs, - - -	30.	—	—	—
The altar of burnt offering, - -	27.	—	—	—
The altar of incenfe, - -	30.	—	—	—
The candleftick of pure gold, - -	25.	—	—	—
The table of fhew-bread, - -	25. 26.	—	—	—
Of the priefts and their veftments for glory and beauty, -	28.	—	—	—
Of the choofing of the Levites, - -	—	—	18. 3. 8.	—
Of the prieft's office in general, - -	—	—	3. 18.	—
Of their office in teaching, - -	—	19. 10.	—	18. 12. 17. 31.
Of their office in bleffing, - - -	—	—	6.	—
Of their office in offering; which function largely fpreading itfelf, is divided into thefe heads, *viz.*				
What the facrifice 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

Mosaic Law.

	Exod. chap.	Levitic. chap.	Numb. chap.	Deut. chap.
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 sacrifice,	—	—	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 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 forbid 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.	—

		Exod. chap.	Levitic. chap.	Numb. chap.	Deut. chap.
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 idolators 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. 34.	—	—	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 the fifth commandment, *viz.*					
Of magistrates and their authority, Of the power of fathers,		18. 30.	—	11.	1. 13. 17. [23.
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. 20.	—	—
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,	Joshua vii.	—	—	—	—
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 stray cattle,		22. 23.	—	—	22.
Of corrupted judgments,		23.	19.	—	16. 24.
Of fire breaking out by chance,		22.	—	—	—
Of man-stealing,		—	—	—	24.
Of the fugitive servant,		—	—	—	23.

Plate CCCXV.


Moschus.
M. Pigmæa.
M. Memina.
M. Moschiferus.
Mordella.
Motacilla.
M Regulus.
M Sutoria
Monoculus.
M. Holona.
Muræna.
M. Siren.
Monodon.
Mutilla.
Mullus.
Mugil.
A. Bell Prin. Wal. Sculptor fecit.

	Exod. chap.	Levitic. chap.	Numb. chap.	Deut. chap.
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 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 musea.*

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 calking, 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 calked. 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 mastic, 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 mastic, composed partly of Burgundy-pitch poured on hot; taking off afterwards what is superfluous with a piece

Mosaic.

piece of soft stone or brick, which, together with water and beaten cement, takes away the mastic, 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, scarce 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 free-stone. The matter with which the stones are joined together is a mastic, 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 vaneering 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 compartiments without any visible joining.

Some make the ground of plaster of Paris, others of free-stone. 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.

Mosaic.

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 calqued. 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 gave 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 no ways 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 call *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,

Mosaic, Mosambique.

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 pincers, 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, 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 was 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 *Mongale*, 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, Moschus.

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, in zoology; a genus of quadrupeds of the order of pecora, having no horns. There are eight small cutting teeth in the lower jaw; in the upper, no cutting or fore teeth; but two long tusks, one on each side, projecting out of the mouth. Plate CCCXV.

1. The moschiferus, or Thibet musk, has a bag or tumour on the belly near the navel, and a very short tail almost hid in the fur. The length of the male is about three feet three inches from the nose to the origin of the tail, and about two feet three inches high at the shoulder; the female is less than the male, has a sharper nose, has no tusks nor musk-bag, and is provided with two teats. The head resembles that of the roe: the fur is coarse like that of the animals of the deer kind; but softer, very smooth, erect, plentiful, thick, and long: the colour varies according to the age of the animal and time of the year; but is chiefly blackish brown on the upper, and hoary, seldom white, on the under parts of the body; the hoofs are long, black, and much divided, and the spurious hoofs of the fore feet are very long: the scrotum is of a bright red colour, and the penis very small. It inhabits the Asiatic Alps, especially the highest rocky mountains from the Altaic chain to that which divides Thibet from India; likewise in China and Tonquin, and in eastern Siberia about lake Baikal and the rivers Jenisea and Argun. It avoids mankind, dwelling solitarily in the most precipitous places of the mountains, among rocks in the small narrow valleys surrounded by these snowy hills, and the pine forests which grow in their interstices. It is a very gentle and timid animal, except in rutting time, when the males fight violently with their tusks for the females; it is exceedingly active in leaping, running, climbing, and swimming, and is very difficultly tamed; the flesh is eatable, and that of the younger animals is reckoned delicate. The

Moschus. chace of them is a trade equally difficult and hazardous; if pursued, they seek the highest tops of the snowy peaks, inaccessible to men or dogs. They take amazing leaps over the tremendous chasms of their alps, or from rock to rock; treading so light on the snow with their true and false hoofs extended, as scarcely to leave a mark; while the dogs which pursue them sink in, and are forced to desist from the chase. They are so fond of liberty as never to be kept alive in captivity. They are mostly taken in snares, or shot by cross-bows placed in their tracks, with a string from the trigger for them to tread on, and discharge. The Tunguli shoot them with bows and arrows. The skins are used for bonnets and winter dresses. The Russians often scrape off the hair, and have a way of preparing them for summer cloathing, so as to become as soft and shining as silk. The noted drug the musk is produced from the male. The bag or follicle that contains it is situated near the prepuce; and is of a somewhat oval figure, flat on one side and rounded on the other, having a small open orifice. In young animals this bag is empty; but in adults it is filled with a clotted, oily, friable matter, of a dark brown colour: this is the true musk, of which each bag contains from a dram and a half to two drams. The best comes from Thibet; that which is produced in Siberia having somewhat of the flavour of castor.

2. The Americanus, or Brasilian musk, of a reddish brown colour, with a black muzzle and white throat, is scarcely so large as a roe-buck. The fur is soft and short; the colour of the head and upper part of the neck is dark brown; the lower part of the neck and throat are white; the body and limbs are reddish brown; the hind legs are longer than the fore. This animal, which inhabits Guiana and Brasil, is exceedingly timid, active, and swift. Numbers are frequently seen swimming the rivers, and at that time are easily taken. The Indians hunt them, and their flesh is esteemed very delicate. The French of Guiana call them *biches* or does, because, notwithstanding their likeness to deer, both sexes are without horns. Gmelin suspects this animal may only be a fawn of the American roe.

3. The Indicus, or Indian musk, has short hair of a tawney colour on the upper and whitish on the under parts of the body; the tail is short, and the feet have spurious hoofs. It inhabits India, and is much of the same size with the moschiferus, but the tail is longer and more perceptible; the legs are very slender; and the head resembles that of a horse, with erect oblong ears.

4. The pigmæus, or pigmy musk, is marked as to colour like the former, but has no spurious hoofs.—The body and head measure only nine inches and a half in length; the tail is about an inch long; and the legs are smaller than a man's finger. It inhabits the East Indies and several of the Indian islands. It is called *kant-chel* by the Malayes, and *poet-jang* by the inhabitants of Java. The natives catch them in great numbers, carry them in cages to market, and sell them for 2½ d. a piece.

5. The meminna, or Ceylon chevrotin, is in length 17 inches from the nose to the rump, and of a cinereous olive colour; the throat, breast, and belly, are white; the sides and haunches spotted, and barred transversely with white; and the ears are large and open: the tail is very short; and the feet have no spurious hoofs. It inhabits Ceylon and Java. Moscow.

6. The javanicus, or Javan musk, is of a ferruginous colour on the upper parts of the body, and white all along the under; the tail is long and hairy, white below and at the tip; its legs are similar to those of the pigmy musk, and furnished with very small spurious hoofs. This and the meminna seem only varieties of the pigmæus.

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, Biela, and Smolensko. It extends about 200 miles in length, and about 100 in breadth; and is watered by the Moska, 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 Nieper, 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 present century the metropolis of all Russia, is situated in a spacious plain on the banks of the river Muskova. 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

Moscow. 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 over-ran 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 splendor, 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 present 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 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 of the empress reside: they here support a larger 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 splendor of the court.

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 late 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 desart, other quarters of a populous town; some of a contemptible village, others of a great capital. Moscow.

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 inclosed 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 tradesmens 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.

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 πρόναος, 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 belfreys 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 ſideways. 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 a-breaſt 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 cieling. In this palace Peter the Great came into the world, in the year 1672. In that part called the treaſury are repoſited 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 engraved the name of the deceaſed ſovereign, and the æra 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 preſent empreſs 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, alſo ſituated in the Khitaigorod, was founded, at the inſtance of Count Shuvalof, by the empreſs Elizabeth, for 600 ſtudents; who are clothed, Moscow. 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 philosophers, 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. As to the retail commerce here, the whole of it 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 interval 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.

Among 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, 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 tenanted and mortoised 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 dispatch 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 reconstructed 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 centinal 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 present empress, and supported by voluntary contributions and legacies, and other charitable gifts. In order to encourage donations, her majesty grants 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 L. 100,000. 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, 3000 foundlings; and, when the whole is completed, will receive 8000. 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 bedsteads are of iron; the sheets are changed every week, and the linen three times a-week. Through the whole rooms the greatest neatness prevails; even the nurseries being uncommonly clean, and without any unwholesome smells. No cradles are allowed, and rocking is particularly forbidden. The infants are not swaddled according to the custom of the country, but loosely dressed.—The foundlings are divided into separate classes, according to their respective ages. 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 14 the foundlings enter into the first class; when they have the liberty of choosing any

Mofelle, Mofes. any particular branch of trade; and for this purpofe there are different fpecies of manufactures eftablifhed in the hofpital, of which the principal are embroidery, filk ftockings, ribbands, lace, gloves, buttons, and cabinet work. A feparate room is appropriated to each trade. Some boys and girls are inftructed in the French and German languages, and a few boys in the Latin tongue; others learn mufic, drawing, and dancing. About the age of 20, the foundlings receive a fum of money, and feveral other advantages, which enable them to follow their trade in any part of the empire; a very confiderable privilege in Ruffia, where the peafants are flaves, and cannot leave their village without the permiffion of their mafter.—The girls and boys eat feparately The dining rooms, which are upon the ground-floor, are large and vaulted, and diftinct from their work-rooms The firft clafs fit at table; the reft ftand: the little children are attended by fervants; but thofe of the firft or fecond clafs alternately wait upon each other. Their victuals are of the moft wholefome and nourifhing kinds. Each foundling has a napkin, pewter plate, a knife, fork, and fpoon: the napkin and table-cloth are clean three times in the week. They rife at fix, dine at eleven, and fup at fix. The little children have bread at feven and at four When they are not employed in their neceffary occupations, the utmoft freedom is allowed, and they are encouraged to be as much in the air as poffible.

MOSELLE, a river of Germany, which rifes in the mountains of Vauge in Lorrain, and, running thro' that duchy and the electorate of Triers, falls into the Rhine at Coblentz.

MOSES, the fon of Amram and Jochebed, was born in the year 1571 before Chrift. Pharaoh king of Egypt, perceiving that the Hebrews were become a formidable nation, iffued forth an edict commanding all the male children to be put to death. Jochebed the mother of Mofes, having, to avoid this cruel edict, concealed her fon for three months, at length made an ark or bafket of bulrufhes, daubed it with pitch, laid the child in it, and expofed him on the banks of the Nile. Thermuthis the king's daughter, who happened to be walking by the river's fide, perceived the floating cradle, commanded it to be brought to her, and, ftruck with the beauty of the child, determined to preferve his life. In three years afterwards the princefs adopted him for her own fon, called his name *Mofes*, and caufed him be diligently inftructed in all the learning of the Egyptians. But his father and mother, to whom he was reftored by a fortunate accident, were at ftill greater pains to teach him the hiftory and religion of his fathers. Many things are related by hiftorians concerning the firft period of Mofes's life, which are not to be found in the Old Teftament. According to Jofephus and Eufebius, 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 fhe 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 fhall therefore confine ourfelves to the narrative of facred writ, which commences at the fortieth year of Mofes's life. He then left the court of Pharaoh, and went to vifit his countrymen the Hebrews, who groaned under the ill-ufage and oppreffion of their unfeeling mafters. Having perceived an Egyptian fmiting an Hebrew, he flew the Egyptian, and buried him in the fand. But he was obliged, in confequence of this murder, to fly into the land of Midian, where he married Zipporah, daughter of the prieft Jethro, by whom he had two fons, Gerfhom 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 midft of a bufh which burned with fire but was not confumed, and commanded him to go and deliver his brethren from their bondage. Mofes at firft refufed to go; but was at length prevailed on by two miracles 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 facrifices in the defert of Arabia. But the impious monarch difregarded this command, and caufed the labour of the Ifraelites to be doubled. The meffengers of the Almighty again returned to the king, and wrought a miracle in his fight, that they might move his heart, and induce him to let the people depart. Aaron having caft down his miraculous rod, it was immediately converted into a ferpent: but the fame thing being performed by the magicians, the king's heart was hardened more and more; and his obftinacy at laft drew down the judgments of the Almighty on his kingdom, which was afflicted with ten dreadful plagues. The firft was the changing of the waters of the Nile and of all the rivers into blood, fo that the Egyptians died of thirft. In confequence of the fecond plague, the land was covered with innumerable fwarms of frogs, which entered even into Pharaoh's palace. By the third plague, the duft was converted into lice, which cruelly tormented both man and beaft. The fourth plague was a multitude of deftructive flies which fpread throughout Egypt, and infefted the whole country. The fifth was a fudden peftilence, which deftroyed all the cattle of the Egyptians, without injuring thofe of the Ifraelites. The fixth produced numberlefs ulcers and fiery biles upon man and upon beaft. The feventh was a dreadful ftorm of hail, accompanied with thunder and lightning, which deftroyed every thing that was in the field, whether man or beaft, and fpared only the land of Gofhen, where the children of Ifrael dwelt. By the eighth plague fwarms of locufts were brought into the country, which devoured every green herb, the fruit of the trees and the produce of the harveft. By the ninth plague thick darknefs covered all the land of Egypt, except the dwellings of the children of Ifrael. The tenth and laft plague was the death of the firft-born in Egypt, who were all in one night cut off by the deftroying angel, from the firft-born of the king to the firft-born of the flaves and of the cattle. This dreadful calamity moved the heart of the hardened Pharaoh, and he at length confented to allow the people of Ifrael to depart from his kingdom.

Profane authors who have fpoken of Mofes, feem to have been in part acquainted with thefe mighty wonders.

Moses.

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 Iſraelites 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, 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, Moſheim.

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 acknowleged 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; tho' 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,

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 university 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, universally lamented, in 1755. 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 his Ecclesiastical History, from the birth of Christ to the beginning of the present 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-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 maratee 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 Albemarle was governor of Jamaica, and the king of the Moskitos received a commission from his grace, under the seal of that island; since which time they have not only been steady in their alliance with the English, but warm in their affections, and very useful to them on many occasions.

When their king dies, the male heir goes to Jamaica, to certify that he is next in blood, and receives a commission in form from the governor of Jamaica to be king of the Moskitos, till which he is not acknowledged as such by his countrymen. So fond are these people of every thing that is English, that the common people are proud of every Christian or surname given them by our seamen, who honour their chief men with the titles of some of our nobility.

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 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 sattin; 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 (Dr Robert), dean of Ely, was eldest son of Mr Robert Moss, a gentleman in good circumstances; and was born at Gillingham in Norfolk in 1666. He was bred at Benet-college, Cambridge; and acquired great reputation both as a disputant and a preacher. He became preacher to the society of Gray's-inn, London, in 1698; and assistant preacher to Dr Wake at St James's, Westminster, 1699. He was sworn chaplain in three succeeding reigns, to King William, Queen Anne, and George I. and being one of the chaplains in waiting when Queen Anne visited the university of Cambridge, April 5. 1705, he was then created D. D. In 1708 he was invited by the parishioners of St Lawrence Jewry, on the resignation of dean Stanhope, to accept of their Tuesday lecture, which he held till 1727, and then resigned it on account

count of his growing infirmities. In 1712, on the death of Dr Roderick, he was nominated by the queen to the deanry of Ely, which was the higheft, but not the laft, promotion he obtained in the church; for in 1714 he was collated, by Robinfon bifhop of London, to Glifton, a fmall rectory on the eaftern fide of Heitfordfhire. The gout deprived him of the ufe of his limbs for fome of the laft years of his life; and he died March 26. 1729, in his 63d year; and was buried in the prefbytery of his own cathedral, under a plain ftone with a fimple infcription. His character may be feen in the preface to the eight volumes of his Sermons, which has ufually been attributed to Dr Snape, the editor of the fermons; but the credit of it has lately been tranferred to Dr Zachary Grey. Dean Mofs is alfo fuppofed to have been the author of a pamphlet printed in 1717, intitled, "The report vindicated from mifreports: being a defence of my lords the bifhops, as well as the clergy of the lower houfe of convocation; in a letter from a member of that houfe to the prolocutor concerning their late confultations about the bifhop of Bangor's writings." He wrote alfo fome poems, both Latin and Englifh.

MOSS, or MOSSES, in botany. See MUSCI.

Moss on Trees, in gardening. The growth of large quantities of mofs on any kind of tree is a diftemper of very bad confequence to its increafe, and much damages the fruit of the trees of our orchards.

The prefent remedy is the fcraping 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 foaking rain. But the moft effectual cure is the taking away the caufe. This is to be done by draining off all the fuperfluous moifture from about the roots of the trees, and may greatly be guarded againft in the firft planting of the trees, by not fetting them too deep.

If trees ftand too thick in a cold ground, they will always be covered with mofs; and the beft way to remedy the fault is to thin them. When the young branches of trees are covered with a long and fhaggy mofs, 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 neceffary; for it will fprout again: and if the caufe be in the mean time removed by thinning the plantation, or draining the land and ftirring the ground well, the young fhoots will continue clear after this.

If the trees are covered with mofs in confequence of the ground's being too dry, as this will happen from either extreme in the foil, 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 fome diftance and depth to let it in; this will not only cool it, and prevent its giving growth to any great quantity of mofs, but it will alfo prevent the other great mifchief which fruit-trees are liable to in dry grounds, which is the falling off of the fruit too early.

The moffes which cover the trunks of trees, as they always are frefheft and moft vigorous on the fide which points to the north, if only produced on that, ferve to preferve the trunk of the tree from the feverity of the north-winds, and direct the traveller in his way, by always plainly pointing out that part of the compafs.

MOSS is alfo a name given by fome to the boggy ground in many parts of England, otherwife called a *fen* and *bog*.

In many of thefe grounds, as well in England and Ireland as in other parts of the world, there are found vaft numbers of trees ftanding with their ftumps erect, and their roots piercing the ground in a natural pofture as when growing. Many of thofe trees are broken or cut off near the roots, and lie along, and this ufually in a north-eaft direction. People who have been willing to account for this, have ufually refolved it into the effect of the deluge in the days of Noah; but this is a very wild conjecture, and is proved falfe by many unanfwerable arguments. The waters of this deluge might indeed have wafhed 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 lengthwife from fouthweft to north-eaft, and the roots all ftand in their natural perpendicular pofture, as clofe as the roots of trees in a foreft.

Befide, thefe trees are not all in their natural ftate, but many of them have the evident marks of human workmanfhip upon them, fome being cut down with an ax, fome fplit, and the wedges ftill remaining in them; fome burnt in different parts, and fome bored through with holes. Thefe things are alfo proved to be of a later date than the deluge, by other matters found among them, fuch as utenfils of ancient people, and coins of the Roman emperors.

It appears from the whole, that all the trees which we find in this foffile ftate, originally grew in the very places where we now find them, and have only been thrown down and buried there, not brought from elfewhere. It may appear indeed an objection to this opinion, that moft of thefe foffile trees are of the fir-kind; and that Cæfar fays exprefsly, that no firs grew in Britain in his time: but this is eafily anfwered by obferving, that thefe trees, though of the fir-kind, yet are not the fpecies ufually called the *fir*, but pitch-tree; and Cæfar has no where faid that pitch-trees did not grow in England. Norway and Sweden yet abound with thefe trees; and there are at this time whole forefts of them in many parts of Scotland, and a large number of them wild upon a hill at Wareton in Staffordfhire to this day.

In Hatfield marfh, where fuch vaft numbers of the foffile trees are now found, there has evidently once been a whole foreft of them growing. The laft of thefe was found alive, and growing in that place within 70 years laft paft, and cut down for fome common ufe.

It is alfo objected by fome to the fyftem of the firs growing where they are found foffile, that thefe countries are all bogs and moors, whereas thefe forts of trees grow only in mountainous places. But this is founded on an error; for though in Norway and Sweden, and fome 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 weft parts of New

Moss. 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 expresly says this; and observes, that Cassibelan 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 expresly says, that in the time of the Romans pushing their 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 histories all join in telling us, 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 ran 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. Transf. N° 275.

By this system it is also easily explained why the moor-

moor foil in the country is in fome places two or three yards thicker than in others, or higher than it was formerly, fince the growing up of peat-earth or bog-ground is well known, and the foil added by overflowing of waters is not a little.

As the Romans were the deftroyers of this great and noble foreft, fo they were probably alfo of the feveral other ancient forefts; the ruins of which furnifhes us with the bog-wood of Staffordfhire, Lancafhire, Yorkfhire, and other counties. But as the Romans were not much in Wales, in the Ifle of Man, or in Ireland, it is not to be fuppofed that forefts cut down by thefe people gave origin to the foffile wood found there; but though they did not cut down thefe forefts, others did; and the orgin of the bog-wood is the fame with them and with us. Holingfhead informs us, that Edward I. being not able to get at the Welch becaufe of their hiding themfelves in boggy woods, gave orders at length that they fhould all be deftroyed by fire and by the axe; and doubtlefs the roots and bodies of trees found in Pembrokefhire under ground, are the remains of the execution of this order. The foffile wood in the bogs of the ifland of Man is doubtlefs of the fame origin, though we have not any accounts extant of the time or occafion of the forefts there being deftroyed; but as to the foffile trees of the bogs of Ireland, we are exprefsly 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 fecure his conquefts, by cutting away the places of refort of rebels.

Moving-MOSS. We have an account in the Philofophical Tranfactions of a moving mofs near Churchtown in Lancafhire, which greatly alarmed the neighbourhood as miraculous. The mofs was obferved to rife to a furprifing height, and foon after funk as much below the level, and moved flowly towards the fouth.

A very furprifing inftance of a moving mofs is that of Solway in Scotland, which happened in the year 1771, after fevere rains which had produced terrible inundations of the rivers in many places. For the better underftanding of this event, we fhall give the following defcription of the fpot of ground where it happened. Along the fide of the river Efk there is a vale, about a mile broad, lefs or more in different places. It is bounded on the fouth-eaft by the river Efk, and on the north-weft by a fteep bank 30 feet in height above the level of the vale. From the top of the bank the ground rifes in an eafy afcent for about a quarter of a mile, where it is terminated by the mofs; which extends about two miles north and fouth, and about a mile and an half eaft and weft, and is bounded on the north-weft by the river Sark. It is probable that the folid ground from the top of the bank above the vale was continued in the fame direction under the mofs, before its eruption, for a confiderable fpace; for the mofs at the place where the eruption happened, was inclined towards the floping ground. From the edge of the mofs there was a gully or hollow, called by the country people *the gap*, and faid to be 30 yards deep where it entered the vale; down which ran a fmall rill of water, which was often dry in fummer, having no fupply but what filtered from the mofs. The eruption happened at the head of this gap, on Saturday November 16th 1771, about ten or eleven at night, when all the neighbouring rivers and brooks were prodigioufly fwelled by the rains. A large body of the mofs was forced, partly by the great fall of rain, and partly by fome fprings below it, into a fmall beck or burn, which runs within a few yards of its border to the fouth-eaft. By the united preffure 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 fpacious plain, over part of which it fpread with great rapidity. The mofs continued for fome time to fend off confiderable quantities; which, being borne along by the torrent on the back of the firft great body, kept it for many hours in perpetual motion, and drove it ftill farther on. This night at leaft 400 acres of fine arable land were covered with mofs from 3 to 12 or 15 feet deep. Several houfes were deftroyed, a good deal of corn loft, &c. but all the inhabitants efcaped. When the waters fubfided, the mofs alfo ceafed to flow; but two pretty confiderable ftreams continued to run from the heart of it, and carried off fome pieces of moffy matter to the place where it burft. There they joined the beck already mentioned; which, with this addition, refumed its former channel; and, with a little affiftance from the people of the neighbourhood, made its way to the Efk, through the midft of that great body of mofs which obftructed its courfe. Thus, in a great meafure drained, the new mofs fell feveral feet, when the fair weather came in the end of November, and fettled in a firmer and more folid body on the lands it had over-run. By this inundation about 800 acres of arable ground were overflowed before the mofs ftopped, and the habitations of 27 families deftroyed. Tradition has preferved the memory of a fimilar inundation in Monteith in Scotland. A mofs there altered its courfe in one night, and covered a great extent of ground.

MOSS *of* Kincardine: A remarkable tract of ground in the fhire of Perth in Scotland, which deferves particular notice, not merely as a topographical curiofity, or as a fubject of natural hiftory; but for the information, equally uncommon and important, which it affords, refpecting agricultural improvement, and the promotion of induftry and population.

The mofs of Kincardine is fituated in the parifh of the fame name, comprehended between the rivers Forth and Teith, and in that diftrict of Perthfhire called *Monteith*. The mofs begins about a mile above the confluence of thefe rivers; from thence it extends in length about four miles, and from one to two in breadth; and before the commencement of the operations (an account of which is to be given), comprehended near 2000 Scotch acres, of which about 1500 belong to the eftate of Blair Drummond, the property of Lord Kames by his marriage with Mrs Drummond of Blair Drummond.

As moffes are extremely various in their nature; before entering upon the improvements made in Kincardine mofs, it will be proper to give a fhort defcription of that mofs, and of the fubjacent foil which is the object of thofe improvements.

The mofs lies upon a field of clay, which is a continuation of thefe rich, extenfive flats in the neighbourhood

bourhood of Falkirk and Stirling, diftinguifhed by the name of *carfes*. This clay, which is one uniform homogeneous mafs finking to a great depth, is found near the furface, confifts of different colours, and is difpofed in layers. The uppermoft is grey; the next is reddifh; and the loweft, which is the moft fertile, is blue. Through the whole mafs not a pebble is to be found. The only extraneous bodies it contains are fea-fhells, which occur in all the varieties peculiar to the eaftern coaft of Scotland. They are difpofed fometimes in beds, fometimes fcattered irregularly at different depths. By attending to thefe circumftances, it cannot be doubted that the fea has been the means of the whole accumulation, and that it was carried on in a gradual manner by the ordinary ebb and flow of the tide. Upon any other fuppofition, why fhould there not have been a congeries of all the different materials that compofe the furface of the furrounding heights? But to whatever caufe the origin of this accumulation may be afcribed, certain it is that no foil whatever is more favourable to vegetation, or carries more abundant crops of every kind.

The furface of the clay, which, upon the retreat of the fea, had been left in an almoft level plane, is every where thickly covered with trees, chiefly oak and birch, many of them of a great fize. Thefe trees feem to have been the firft remarkable produce of the carfe; and it is probable they were propagated by diffemination from the furrounding eminences. They are found lying in all directions befide their roots, which ftill continue firm in the ground in their natural pofition; and from impreffions ftill vifible, it is evident they have been cut with an axe or fome fimilar inftrument. For the cutting of wood, the two common purpofes are, either to apply it to its proper ufe, or that the ground it occupies may be cultivated. In the prefent cafe, however, neither of thefe ends had been propofed, fince the trees, by being left juft as they were cut, were not only entirely loft, but the ground was rendered totally unfit for cultivation. Hence it is evident, that the downfal of this wood muft be afcribed to fome more extraordinary caufe; and to none more probably than to that expedient, which, as we learn from Dion Caffius and other hiftorians, the Romans put fo extenfively in practice to diflodge from their forefts the ancient inhabitants of the Britifh iflands.

This hypothefis acquires no fmall degree of force from a circumftance that occurred in May 1768, when a large round veffel of thin brafs and curious workmanfhip, 25 inches in diameter and 16 inches in height, was difcovered upon the furface of the clay buried under the mofs. This veffel, found upon the eftate of John Ramfay, Efq; of Ochtertyre, was by that gentleman prefented to the Antiquarian Society of Edinburgh; in whofe mufeum it remains depofited for prefervation. And in a lift of the various donations prefented to that fociety, publifhed by them in 1782, it is there denominated a *Roman camp-kettle*.

Between the clay and the mofs is found a ftratum nine inches thick, partly dark brown and partly of a colour approaching to black. This is a vegetable mould, accumulated probably by the plants that covered the ground previous to the growth of the wood, and by leaves from the trees thereafter. The difference of colour muft be owing to a difference in the vegetable fubftances that compofe it. The brown mould is highly fertile; the other, efpecially in a dry feafon, is very unproductive. The crop that had occupied this mould when the trees were felled is found ftill entire. It confifts chiefly of heath; but feveral other fmaller plants are alfo very diftinguifhable.

Immediately above this ftratum lies the mofs, to the height, upon an average, of feven feet. It is compofed of different vegetables arranged in three diftinct ftrata. Of thefe the firft is three feet thick. It is black and heavy, and preferable to the others for the purpofe of fuel. It confifts of bent-grafs (*agroftis*), which feems to have grown up luxuriantly among the trees after they were felled. The fecond ftratum alfo is three feet thick. It is compofed of various kinds of moffes, but principally of bog-mofs (*fphagnum*). It is of a fallow or iron colour, and remarkably elaftic. It is commonly called *white-peat*; and for fuel is confidered as much inferior to that above mentioned. The third ftratum is compofed of heath and a little bent-grafs, but chiefly of the deciduous parts of the former. It is about a foot thick, and black.

Three ftrata of different vegetables lying above each other, the limits of each diftinctly marked, and each diftinguifhed by a different colour, is certainly a curious natural phenomenon.

An inquiry will here occur, What has occafioned this fucceffion in the vegetables of which the mofs is compofed?

Every vegetable has a particular foil, more or lefs moift, peculiarly adapted to its nature. Let a piece of ground be in a moift ftate, rufhes will introduce themfelves; drain the ground fufficiently, the rufhes will difappear, and finer vegetables will fucceed. It feems reafonable to account for the fucceffion of the different plants that compofe the mofs on fimilar principles.

Let us imagine an extenfive plain covered with trees lying in all directions, full of branches, and poffibly loaded with leaves. This it is evident would produce a great ftagnation of water, which, as the crops of bent-grafs accumulated, would ftill increafe: and the probability is, that at length it had fo increafed, as to be the caufe why the bent-grafs and other congenial plants of the firft ftratum ceafed to grow. But it is evident that a plant was to be found that could live in fuch a fituation. Accordingly we fee that bog-mofs had eftablifhed itfelf; a plant that loves even to fwim in water.

When the accumulations of bent-grafs and the moffes had, in procefs of time, arifen to the height of fix feet above the furrounding *carfe* ground, the water that fell upon the furface had by that means an opportunity to difcharge itfelf. It has accordingly formed many channels, which are often three feet deep; and the intermediate furface being wholly turned into little hillocks has become dry and firm. By this means it became unfit for moffes, and heath fucceeded.

Such feems to have been the procefs in the formation of what is now called *a mofs*.

By far the greateft part of the mofs in queftion is, upon an average, full feven feet deep, and has in all probability lain undifturbed fince its formation: this is called the *High Mofs*. The remainder, called the *Low Mofs*, lies to a confiderable breadth around the extremities of the high; and is, upon an average, not above three feet in depth,

depth, to which it has been reduced by the digging of peats. Thefe are formed of that ftratum of the mofs only that lies four feet below the furface and downwards; the reft is improper for the purpofe, and is thrown afide.

Before the introduction of the plan which is now purfued, two methods chiefly were employed to gain land from the mofs. 1ft, The furrounding farmers marked off yearly a portion of the Low Mofs next to their arable land, about 15 feet broad. This they removed with carts and fpread upon their fields, fome acres of which they for that end left unfown. Here it lay till May or June; when, being thoroughly dry, it was burnt to afhes to ferve as a manure. By this means they added to their farms about half a rood of land yearly. But this plan proved unfuccefsful; for by the repeated application of thefe afhes, the foil was rendered fo loofe that the crops generally failed. 2dly, Many farmers were wont to *trench down* the low mofs, and to cover it *furrow deep* with clay taken out of the trench. This, though commendable as an attempt to improve, proved likewife an unavailing method; becaufe in a dry feafon the fuperficial covering of clay retains fo little moifture that the crop commonly fails.

It has been attempted to cover the mofs with clay brought from the adjacent grounds. But what from the neceffary impoverifhment of the ground from which the clay was carried, and the foftnefs of the mofs, this was foon found to be impracticable.

Draining has alfo been propofed as another mode of improvement; and it muft be acknowledged, that, by means of draining, many moffes have been converted both into arable and meadow grounds, which in the end became interefting improvements. But in a mofs, fuch as that of Kincardine, this method would be ineffectual; as for feveral feet deep it is of fuch a nature, that upon being dry and divided into parts, it would blow with the wind like chaff; and when thrown afide in the operation of digging peats, it lies for years without producing a fingle vegetable, except only a few plants of forrel.

Hence it is evident, that all attempts to *improve* this mofs muft ever prove abortive; and that the object to be had in view is the acquifition of the valuable foil lying underneath; to which end nothing lefs is requifite than the total abolition of the mofs.

By the methods above defcribed from 100 to 200 acres of mofs had been removed. When the prefent plan was introduced, there ftill remained covered with mofs from 1300 to 1400 acres of carfe clay—a treafure for which it muft be ever interefting to dig.

In the year 1766 Lord Kames entered into poffeffion of the eftate of Blair Drummond. Long before that period he was well acquainted with the mofs, and often lamented that no attempt had ever been made to turn it to advantage. Many different plans were now propofed; at length it was refolved to attempt, by means of water as the moft powerful agent, entirely to fweep off the whole body of mofs.

That mofs might be floated in water, was abundantly obvious; but to find water in fufficient quantity was difficult, the only ftream at hand being employed to turn a corn-mill. Convinced of the fuperior confequence of dedicating this ftream to the purpofe of floating off the mofs, Lord Kames having made an agreement with the tenant who farmed the mill, and the tenants thirled confenting to pay the rent, he immediately threw down the mill, and applied the water to the above purpofe.

In order to determine the beft manner of conducting the operation, workmen were now employed for a confiderable time upon the Low Mofs both by the day and by the piece, to afcertain the expence for which a given quantity of mofs could be removed. It was then agreed to operate at a certain rate per acre; and in this manner feveral acres were removed.

But this was to be a very expenfive procefs. The ground gained might, indeed, be afterwards let to tenants; but every acre would require an expenditure from 12 l. to 15 l. before it could be ready for fowing; fo that the acquifition of the whole, computing it at a medium to be 1350 acres, would fink a capital of nearly 20,000 l. Sterling.

One other method ftill remained; namely, to attempt letting portions of the mofs, as it lay, for a term of years fufficient to indemnify tenants for the expences incurred in removing it. For fome time both thefe plans were adopted; but feveral reafons made the latter preferable. 1. The quantity of water to be had was fmall; and being alfo uncertain, it was very inconvenient for an undertaker; neither were there any houfes near the fpot, which occafioned a great lofs of time in going and coming: but when a man fhould live upon the fpot, then he could be ready to feize every opportunity. 2. The mofs was an ufelefs wafte. To let it to tenants would increafe the population of the eftate, and afford to a number of induftrious people the means of making to themfelves a comfortable livelihood.

In the mean time it was determined, till as many tenants fhould be got as could occupy the whole water, to carry on the work by means of undertakers.

But before proceeding farther, it will be neceffary to defcribe the manner of applying water to the purpofe of floating the mofs.

A ftream of water fufficient to turn a common cornmill will carry off as much mofs as 20 men can throw into it, provided they be ftationed at the diftance of 100 yards from each other. The firft ftep is to make in the clay, along-fide of the mofs, a drain to convey the water: and for this operation the carfe-clay below the mofs is peculiarly favourable, being perfectly free from ftones and all other extraneous fubftances, and at the fame time, when moift, flippery as foap; fo that not only is it eafily dug, but its lubricity greatly facilitates the progrefs of the water when loaded with mofs. The dimenfions proper for the drain are found to be two feet for the breadth and the fame for the depth. If fmaller, it could not conveniently receive the fpadefuls of mofs; if larger, the water would efcape, leaving the mofs behind. The drain has an inclination of one foot in 100 yards: the more regularly this inclination is obferved throughout, the lefs will the mofs be liable to obftructions in its progrefs with the water. The drain being formed, the operator marks off to a convenient extent along-fide of it a fection of mofs 10 feet broad; the greateft diftance from which he can heave his fpadeful into the drain. This he repeatedly does till the entire mafs be removed down to the clay. He then digs a new drain at the foot of the

Moss. the moſs-bank, turns the water into it, and proceeds as before, leaving the moſs to purſue its courſe into the river Forth, a receptacle equally convenient and capacious; upon the fortunate ſituation of which, happily forming for ſeveral miles the ſouthern boundary of the eſtate, without the interpoſition of any neighbouring proprietor, depended the very exiſtence of the whole operations.

When the moſs is entirely removed, the clay is found to be encumbered with the roots of different kinds of trees ſtanding in it as they grew, often very large: their trunks alſo are frequently found lying beſide them. All theſe the tenants remove often with great labour. In the courſe of their operations they purpoſely leave upon the clay a ſtratum of moſs ſix inches thick. This, in ſpring, when the ſeaſon offers, they reduce to aſhes, which in a great meaſure enſures the firſt crop. The ground thus cleared is turned over, where the dryneſs admits, with a plough, and, where too ſoft, with a ſpade. A month's expoſure to the ſun, wind, and froſt, reduces the clay to a powder fitting it for the ſeed in March and April. A crop of oats is the firſt, which ſeldom fails of being plentiful, yielding from eight to ten bolls after one.

In the year 1767 an agreement was made with one tenant for a portion of the Low Moſs. This, as being the firſt ſtep towards the intended plan, was then viewed as a conſiderable acquiſition. The ſame terms agreed upon with this tenant have ever ſince been obſerved with all the reſt. They are as follow:

The tenant holds eight acres of moſs by a tack of 38 years; he is allowed a proper quantity of timber, and two bolls of oatmeal to ſupport him while employed in rearing a houſe; the firſt ſeven years he pays no rent; the eighth year he pays one merk Scots; the ninth year two merks; and ſo on with the addition of one merk yearly till the end of the firſt 19 years; during the laſt five years of which he alſo pays a hen yearly. Upon the commencement of the ſecond 19 years, he begins to pay a yearly rent of 12s. for each acre of land cleared from moſs, and 2s. 6d. for each acre not cleared, alſo two hens yearly: A low rent indeed for ſo fine a ſoil; but no more than a proper reward for his laborious exertions in acquiring it.

In the year 1768 another tenant was ſettled. Theſe two were tradeſmen; to whom the preference was always given, as having this great advantage to recommend them, that even when deprived of water they need never want employment. The motives that induced theſe people to become ſettlers were, 1*ſt*, The proſpect of an independent eſtabliſhment for a number of years. 2*dly*, The moſs afforded them great abundance of excellent fuel; to which was added the comfortable conſideration, that, while buſied in providing that neceſſary article, they had the double advantage of promoting, at the ſame time, the principal object of their ſettlement.

Notwithſtanding theſe inducements, ſtill ſettlers offered ſlowly; to which two circumſtances chiefly contributed: 1*ſt*, The whole farmers ſurrounding the moſs threw every poſſible obſtruction in their way. 2*dly*, By people of all denominations the ſcheme was viewed as a chimerical project, and became a common topic of ridicule. The plan, however, ſupported itſelf; and in the year 1769 five more tenants agreed for eight acres each; and thus 56 acres of Low Moſs were diſpoſed of. From the progreſs made by the firſt ſettlers, and the addition of theſe, the obloquy of becoming a moſs-tenant gradually became leſs regarded; ſo that in the year 1772 two more were added; in 1773, three; and in 1774, one; in all 13: which diſpoſed of 104 acres; all the Low Moſs to which water could then be conveyed. As water is the main ſpring of the operation, every tenant, beſide the attention neceſſary to his ſhare of the principal ſtream, collected water by every poſſible means, making ditches round his portion of the moſs, and a reſervoir therein to retain it till wanted. Moſs.

The tenants in the Low Moſs having now begun to raiſe good crops, in the year 1774 ſeveral perſons offered to take poſſeſſions in the High Moſs, upon condition that acceſs to it ſhould be rendered practicable. The High Moſs wanted many advantages that the Low poſſeſſed. To the Low Moſs, lying contiguous to the ſurrounding arable lands, the acceſs was tolerably good; but from the arable lands the High Moſs was ſeparated by 300 or 400 yards of the Low, which, even to a man, affords but indifferent footing, and to horſes is altogether impracticable. The Low Moſs is in general only three feet deep; the High Moſs is from ſix to twelve feet in depth.

It will appear at firſt ſight, that without a road of communication the High Moſs muſt for ever have proved unconquerable. Without delay, therefore, a road was opened to the breadth of twelve feet, for ſeveral hundred yards in length, by floating off the moſs down to the clay.

This being effected, and at the ſame time an opening given to admit water, in the year 1775 twelve tenants agreed for eight acres of high moſs each. In conſideration of the greater depth of this part of the moſs, it was agreed, that during the firſt 19 years they ſhould pay no rent; but for the ſecond 19 years the terms of agreement were the ſame as thoſe made with the tenants in the Low Moſs. To the above mentioned tenants every degree of encouragement was given; as upon their ſucceſs depended, in a great meaſure, the diſpoſal of the great quantity of moſs ſtill remaining. But their ſucceſs, however problematical, was ſuch, that next year,

1776, 6 more took 8 acres each,
1777, 1
1778, 4
1779, 3
1780, 1
1781, 1
1782, 1

In all, including thoſe upon the Low Moſs, 42 tenants, occupying 336 acres.

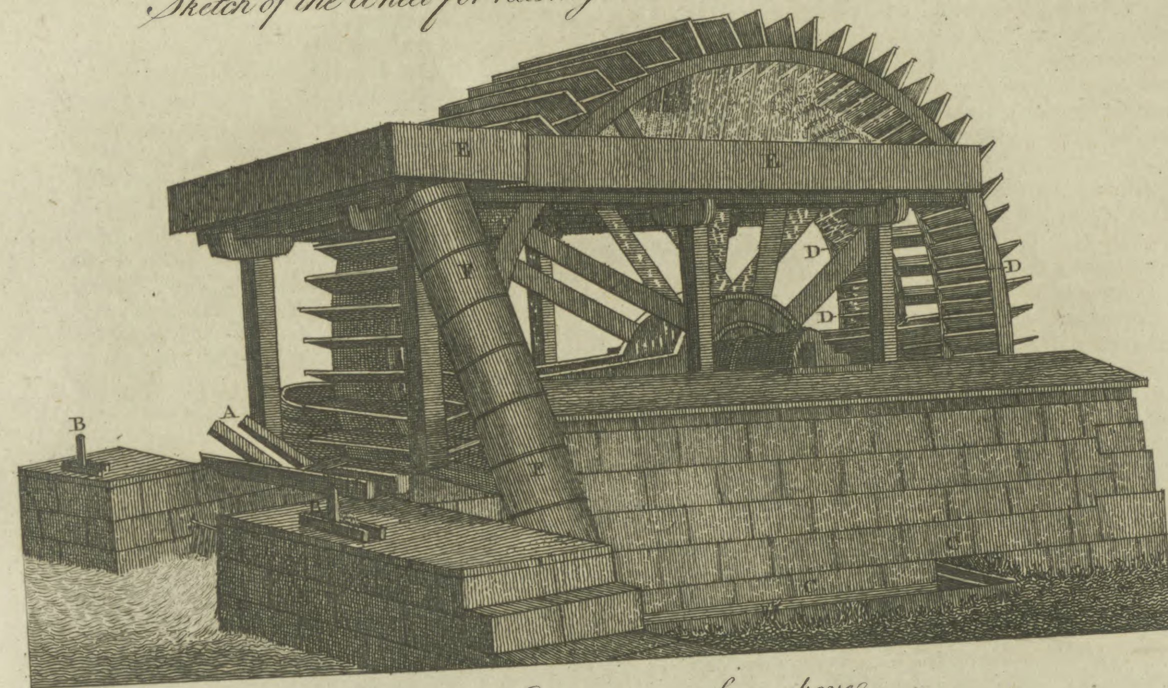
Though for ſome time the diſpoſal of the Hgh Moſs went but ſlowly on, it was not for want of tenants; but the number of operators was already ſufficient for the quantity of water; to have added more would evidently have been imprudent.

In the year 1783 Mr Drummond entered into poſſeſſion of the eſtate of Blair-Drummond, and went fully into the plan adopted by his predeceſſor for ſubduing the moſs. At this time there ſtill remained undiſpoſed of about 1000 acres of High Moſs. As water was the great deſideratum, it was determined, that

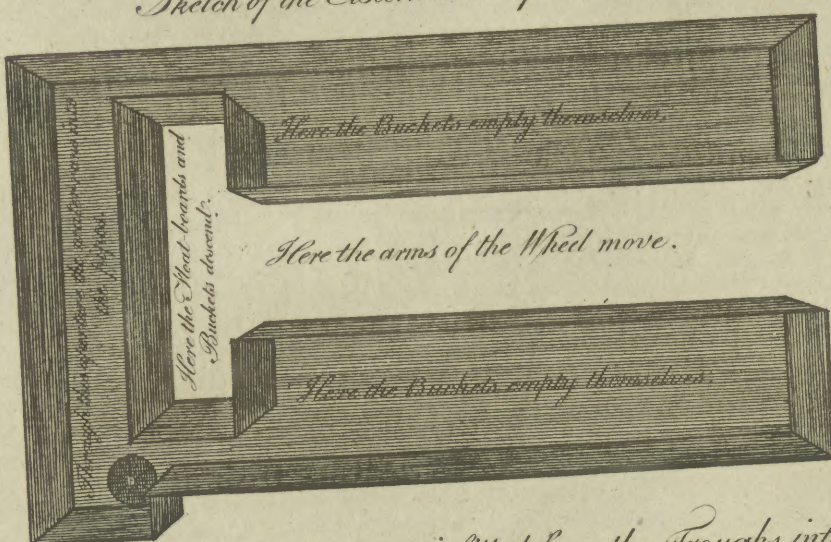
Plate CCCXVI.

Moss or Bog.

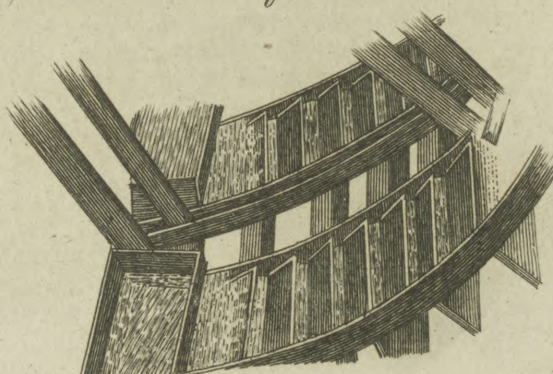
Sketch of the Wheel for raising Water at Blair Drummond.



Sketch of the Cistern as seen from above.



Sketch of the manner in which the water is filled from the Troughs into the Buckets.



A. Bell Prin. Wal. Sculptor fecit.

Mofs.

that to obtain that neceffary article neither pains nor expence fhould be wanting. Steps were accordingly taken to afcertain in what manner it might be procured to moft advantage.

Meanwhile, to prepare for new tenants a fecond road parallel to the former, at the diftance of half a mile, was immediately begun and cut, with what water could be got, down to the clay, 12 feet broad and 2670 yards long, quite acrofs the mofs. This opening was previoufly neceffary, that operators might get a drain formed in the clay to direct the water; and it was to remain as a road that was abfolutely neceffary, and which relieved fettlers from an expence they were unable to fupport. Thefe preparations, the progrefs of the former tenants, and the profpect of a farther fupply of water, induced 10 more to take poffeffions in the year 1783; in the year 1784, 18 more took poffeffions; and in 1785 no fewer than 27;—in all, 55 tenants in three years, which difpofed of 440 acres more of the High Mofs.

As the introduction of an additional ftream to the mofs was to be a work both of nicety and expence, it was neceffary to proceed with caution. For this reafon feveral engineers were employed to make furveys and plans of the different modes by which it might be procured. In one point they all agreed, that the proper fource for furnifhing that fupply was the river Teith; a large and copious ftream that paffes within a mile of the mofs: but various modes were propofed for effecting that purpofe.

To carry a ftream from the river by a cut or canal into the mofs was found to be impracticable; and Mr Whitworth (A) gave in a plan of a pumping machine, which he was of opinion would anfwer the purpofe extremely well.

Soon after this Mr George Meikle of Alloa, a very fkilful and ingenious mill-wright, gave in a model of a wheel for raifing water entirely of a new conftruction, of his own and his father's invention jointly. This machine is fo exceedingly fimple, and acts in a manner fo eafy, natural, and uniform, that a common obferver is apt to undervalue the invention: But perfons fkilled in mechanics view machinery with a very different eye; for to them fimplicity is the firft recommendation a machine can poffefs. Accordingly, upon feeing the model fet to work, Mr Whitworth, with that candour and liberality of mind that generally accompany genius and knowledge, not only gave it the greateft praife, but declared that, for the purpofe required, it was fuperior to the machine recommended by himfelf, and advifed it to be adopted without hefitation.

The better to explain this machine, two fketches are annexed, to the firft of which the following letters refer. The explanation of the fecond will be found upon the fketch.

Plate CCCXVI.

a. Sluice through which is admitted the water that moves the wheel.

b, *b*. Two fluices through which is admitted the water raifed by the wheel.

c, *c*. A part of one of two wooden troughs and an aperture in the wall, through which the above water is conveyed into the buckets. [The other trough is hid by two ftone walls that fupport the wheel.]

d, *d*, *d*. Buckets, of which 80 are arranged on each fide of the arms of the wheel = 160.

e, *e*, *e*. A ciftern, into which the water raifed by the buckets is difcharged.

f, *f*, *f*. Wooden barrel-pipes, through which the water defcends from the ciftern underground, to avoid the high road from Stirling and the private approach to the houfe.

Sketch fecond contains a plan of the ciftern, and exhibits the manner in which the water is filled into the buckets.

The diameter of the wheel to the extremities of the float-boards is 28 feet; the length of the float-boards, 10 feet. The wheel makes nearly four revolutions *per* minute; in which time it difcharges into the ciftern 40 hogfheads of water. But this is not all the wheel is capable of performing; for by feveral accurate trials by Meffrs Whitworth and Meikle, in the refult of which, though made feparately, they perfectly agreed, it was found that the wheel was able to lift no lefs than 60 hogfheads *per* minute; but that the diameter of the pipes through which the water defcends from the ciftern would not admit a greater quantity than what they already receive.

To a perfon at all converfant in hydraulics, the refemblance of this to the Perfian wheel muft be obvious: and indeed it is probable, that from the Perfian wheel the firft idea of this machine was derived. But admitting this, ftill the fuperiority of the prefent wheel is, in moft refpects, fo confpicuous, as to entitle it to little lefs praife than the firft invention. For, 1ft, In the Perfian wheel, the buckets being all moveable, muft be conftantly going out of order: In this wheel they are all immoveable, confequently never can be out of order. 2dly, Inftead of lifting the water from the bottom of the fall as in the Perfian wheel, this wheel lifts it from the top of the fall, being from four to five feet higher; by which means fome additional power is gained. 3dly, By means of the three fluices (*a*, and *b*, *b*, fig. 1.) in whatever fituation the river may be, the quantity of the water to be raifed is fo nicely adjufted to that of the moving power, as conftantly to preferve the wheel in a fteady and equable motion. In fhort, as a regulator is to a watch, fo are thefe fluices to this wheel, whofe movements would otherwife be fo various, as fometimes to carry the water clear over the ciftern, fometimes to drop it entirely behind, but feldom fo as fully to difcharge the whole contents of the buckets into the ciftern.

It is however but candid to remark, that this machine labours under a fmall defect, which did not efcape the obfervation of Mr Whitworth; namely, that by raifing the water about 3½ feet higher than the ciftern where it is ultimately delivered, a fmall degree of power is loft. To this indeed he propofed a remedy; but candidly confeffed, that, as it would render the machine fome-

(A) This gentleman is fuperintendant of the London water-works, and an engineer of great reputation in England. He was feveral years employed in Scotland in completing the great canal.

Mofs.

fomewhat more complex, and would alfo increafe the friction, he thought it more advifable to keep it in its prefent ftate. At the fame time he juftly obferved, that as the ftream by which the wheel is moved is at all times copious and powerful, the fmall lofs of power occafioned by the above circumftances was of little or no avail.

This ftream is detached from the Teith at the place where that river approaches neareft to the mofs. The furface of the latter is about 15 feet higher than that of the former; the ciftern is therefore placed 17 feet above the furface of the ftream, fo as to leave a declivity fufficient to deliver the water upon the furface of the mofs.

The pipes through which the water defcends from the ciftern are compofed of wooden barrels hooped with iron 4 feet long and 18 inches in diameter within.

In thefe pipes, having been conveyed under ground for 354 yards from the ciftern, the water at once emerges into an open aqueduct. This aqueduct, which was formed according to a plan by Mr Whitworth, is conftructed wholly of earth or clay; and in order to keep the water on a level with the furface of the mofs, it is for nearly two-thirds of its courfe elevated from 8 to 10 feet above the level of the adjacent grounds; the bafe being 40 feet broad, the fummit 18 feet, and the water-courfe 10 feet broad. It commences at the termination of the pipes; from whence extending above 1400 yards, it difcharges the water into a canal formed for its reception on the furface of the mofs.

For raifing the water to this height there were two reafons. 1ft, That not only where it was delivered on the mofs, but even after being conveyed to the moft diftant corners, it might ftill retain fufficient power to tranfport the mofs to the river Forth. 2dly, That refervoirs of a fufficient height might be formed in the mofs to retain the water delivered during night.

In confequence of Mr Whitworth's advice, a contract was entered into with Mr Meikle in fpring 1787; and by the end of October in that year, the wheel, pipes, and aqueduct, were all completely finifhed: and what, in fo complex and extenfive an undertaking, is by no means common, the different branches of the work were fo completely executed, and fo happily adjufted to each other, that upon trial the effect anfwered the moft fanguine expectations. The total expence exceeded L. 1000 Sterling.

To induce the proprietor to embark in this undertaking, the mofs tenants had of their own accord previoufly come under a formal engagement to pay the intereft of any fum that might be expended in procuring a fupply of water. But he was determined they fhould not enjoy by halves the fweets of this long-wifhed-for acquifition. With a view, therefore, not only to reward their paft induftry, but to roufe them to future exertions, he at once fet them free from their engagement; nor has any intereft ever been demanded.

This new fupply was a moft acceptable boon to the mofs tenants.—In order to make an equitable diftribution, the water raifed through the day was allotted to one divifion of operators; that raifed during the night to another. To retain the latter, a canal was formed, extending almoft three miles through the centre of the mofs. From place to place along the fides are inferted fluices to admit water to the refervoirs of the poffeffors; each fluice having an aperture proportioned to the number of operators to be fupplied from the refervoir which it fills. For the water raifed through the day no refervoirs are neceffary; as it is immediately ufed by the divifion to which it is allotted.

This additional ftream, though highly beneficial, yet is not more than fufficient to keep 40 men at conftant work. But fuch a quantity as would give conftant work is not neceffary; the operators muft be often employed in making and repairing their drains, grubbing up roots of trees, &c.; fo that a quantity fufficient to give five or fix hours work *per* day to the whole inhabitants is as much as would be wanted. But as the quantity procured was ftill infufficient for this purpofe, a fmall ftream that defcended from the higher grounds was diverted from its courfe and brought into the mofs. From want of level this ftream could not be delivered to the greateft advantage; namely, upon the furface of the mofs. Yet by making, at a confiderable expence, a drain half a mile long, and a refervoir for the night-water, it was rendered of much importance. And during the whole winter months, as well as in fummer, after every fall of rain, it keeps 15 perfons fully employed.

In the year 1787 two more tenants agreed for eight acres each; in 1788, four; in 1789, eight; in 1790, four tenants, all agreed for the fame number of acres.

The whole mofs was now difpofed of, except that part called *Flow-mofs*, which comprehended about 400 acres. Here it is twice the ufual breadth, fo fluid that a pole may be thruft with one hand to the bottom; and the interior part, for near a mile broad, is three feet above the level of all the reft of the mofs. Hitherto the many and various difficulties that prefented themfelves had been overcome by perfeverance and expence. But here the extraordinary elevation of the morafs, joined to its great fluidity, feemed to exclude all poffibility of admitting a ftream of water; and it was the general opinion that the mofs-operations had now arrived at their *ne plus ultra*, and that this morafs was doomed to remain a nuifance for ages to come.

But the proprietor had now advanced fo far that he could not fubmit to retreat; and he confidered himfelf as, in fome meafure, pledged to the country for the completion of this undertaking. To detail the various methods practifed to introduce a ftream of water into that morafs, would prove tedious. It is fufficient to fay, that after a thoufand unfuccefsful efforts, attended with much trouble and confiderable expence, the point at laft was gained, and a ftream of water was brought in, and carried fairly acrofs the centre of the morafs.

The greateft obftacle was now indeed overcome; but ftill another remained of no fmall moment, namely, the difcouragement given to fettlers from the total impoffiblity of erecting habitations upon the furface of this morafs. To find a remedy for this evil was difficult. Happily a refource at laft occurred. This was to bargain with a certain number of the old tenants whofe habitations were neareft, to take leafes of portions of the morafs. But as fome additional aid was here neceffary, it was agreed that L. 12 Sterling fhould be gradually advanced to each tenant till he fhould accomplifh the clearing of an acre, for which he or his fucceffor is bound to pay 12s. of yearly rent, equal

equal to five *per cent.* upon the ſum advanced. When this point ſhall be gained, they are bound to diſpoſe, as moſt agreeable to themſelves, either of their old or of their new poſſeſſion; for which, when once an acre is cleared, purchaſers will not be wanting.

In conſequence of the above arrangement, during the year 1791 no fewer than 35 of the old tenants agreed, upon the foreſaid conditions, for eight acres each of the Flow-moſs. Thus 1200 acres are now diſpoſed of to 115 tenants. But when theſe 35 tenants ſhall each have cleared their acre, then, according to agreement, 35 additional tenants will ſpeedily be acquired; and the moſs will then contain in all 150 families.

To the leaſes already granted to the tenants in the High Moſs, it is now determined to add a further period of 19 years (making in all 57 years), during which they are to pay one guinea per acre; a rent not greater than the land is worth even at preſent, but greatly below its probable value at that diſtant period. This, it is hoped, will prove to the tenants a ſufficient incitement to continue their operations till their poſſeſſions are completely cleared from moſs.

Having now gone through, in detail, the whole progreſs of the colony ſince its firſt ſettlement in the year 1767, it ſtill remains to take a general view of the effects produced by that eſtabliſhment.

For ſeveral years, at firſt, the water was uſed chiefly to carry off moſs, in the forming of new roads, and preparing reſervoirs; which conſiderably retarded the principal object of gaining land. Nevertheleſs there have been cleared full 300 acres of excellent land, producing wheat, barley, oats, and clover, yielding from ſix to twelve bolls after one.

From the nature of the undertaking, there is good reaſon to ſuppoſe that the operations will yearly advance with greater rapidity; eſpecially as the greater number of the ſettlers have only of late begun to operate. Many, beſides maintaining their families otherwiſe by occaſional employments, have in the High Moſs cleared in a year one rood of land; ſome have cleared two, ſome three roods, and in the Low Moſs an acre.

It was a remark often made, even by perſons of ſome obſervation, that by collecting together ſuch a number of people, Kincardine would be over-ſtocked; and the conſequence would be their becoming a burthen on the pariſh: for as the bulk of them were labourers not bred to any trade, and poſſeſſed of little ſtock, it was foreſeen that, for ſome time, they could not afford to confine themſelves ſolely to the moſs, from which the return muſt be ſlow; but behoved, for immediate ſubſiſtence, to work for daily hire. Happily theſe predictions have proved entirely groundleſs; for ſuch is the growing demand for hands in this country, that not only do the whole of theſe people find employment whenever they chooſe to look for it, but their wages have been yearly increaſing from the time of their firſt eſtabliſhment. In ſhort, they have proved to the corner where they are ſet down a moſt uſeful nurſery of labourers; and thoſe very farmers who, at firſt, ſo ſtrongly oppoſed their ſettlement, now fly to them as a ſure reſource for every purpoſe of agriculture. Still they conſider the moſs-operations as their principal buſineſs; none pay them ſo well; and when they do leave it to earn a little money, they return with cheerfulneſs to their proper employment. Many of them already raiſe from 10 to 60 bolls of grain, and have no occaſion to go off to other work; which will ſoon be the caſe with the whole. Their original ſtock, indeed, did not often exceed L.25, and ſome had not even L.10; but what was wanting in ſtock is compenſated by induſtry.

Of the whole inhabitants full nine-tenths are Highlanders, from the neighbouring pariſhes of Callander, Balquhidder, &c.; a ſober, frugal, and induſtrious people, who, inured to hardſhips in their own country, are peculiarly qualified to encounter ſo arduous an undertaking. From this circumſtance, too, ariſes a very happy conſequence; that wearing a different garb and ſpeaking a different language from the people amongſt whom they are ſettled, they conſider themſelves in a manner as one family tranſported to a foreign land. And hence upon all occaſions of difficulty, they fly with alacrity to each others relief. Neither ought it to be forgotten, that, from their firſt ſettlement to the preſent day, not a ſingle inſtance has occurred amongſt them of theft, bad neighbourhood, or of any other miſdemeanour, that required the interpoſition of the civil magiſtrate. Nor, however poor in circumſtances, has any one of them ever ſtooped to ſolicit aſſiſtance from the funds of the pariſh appropriated to that purpoſe.

Though few of the tenants entered with a large ſtock, one only has been obliged to leave the moſs from incapacity to proceed. Many indeed have ſpent their ſmall ſtocks, and even run a little in debt: but in this caſe they have been permitted to ſell their tacks upon the following conditions: *1ſt*, That the purchaſer ſhall be a good man; *2d*, That the ſeller ſhall take another poſſeſſion. By this manœuvre a new inhabitant is gained; while the old one, relieved from debt, and aided by paſt experience, recommences his operations with double ſpirit upon a new poſſeſſion. The monied man, again, has at once a houſe and a piece of ground; the want of which, chiefly, ſtartled new beginners.

Some have even made a kind of trade of ſelling; inſomuch, that from the year 1774 to the preſent year 1792, no fewer than fifty ſales have taken place, producing in all the ſum of L.849 Sterling. This proved from time to time a moſt ſeaſonable recruit to the colony, and gave new vigour and ſpirits to the whole.

The number of the ſettlers is productive of an excellent effect; that although ſome are generally abſent, enough ſtill remain to occupy the water conſtantly. In a favourable day there may be ſeen hundreds, men, women, and children, labouring with the utmoſt aſſiduity. The women declare they can make more by working at the moſs than at their wheel; and ſuch is the general attachment to that employment, that they have frequently been diſcovered working by moon-light.

Another happy conſequence ariſing from their numbers is the great quantity of moſs they conſume for fuel. There are in all 115 families. Each family requires at an average 10 dargues (B) of peats yearly.

(B) A dargue (or darg) of peats, is the quantity that one man can caſt and two can wheel in a day to the field where they are ſpread out to dry.

Mofs.

Each darg uncovers a ſpace equal to 10 ſquare yards of clay: ſo that by caſting peats, the moſs tenants gain yearly about 6 roods of land.

The advantage, too, of providing their fuel with ſo little trouble, is very great. They require yearly 1150 dargs of peats; which, as each darg when dried and ſtacked is valued at five ſhillings, are worth 287l. 10s. Sterling; a ſum which otherwiſe muſt have been expended on the prime coſt and carriage of coals. Many of them caſt peats for ſale; and L. 100 worth are yearly diſpoſed of in the town of Stirling, the village of Down, &c.

Though moſs-work be laborious, it is at the ſame time amuſing. The operator moves the moſs five feet only at a medium; and the water, like carts in other caſes, carrying it off as faſt as it is thrown in, excites him to activity. Still he muſt ſubmit to be wet from morning to night. But habit reconciles him to this inconvenience; while his houſe and arable land fill his eye and cheer his mind. Nor is it found that the health of the inhabitants is in the ſmalleſt degree injured either by the nature of the work or the vicinity of the moſs.

The quantity of moſs that one man can move in a day is ſurpriſing; when he meets with no interruption, ſeldom leſs than 48 cubic yards, each weighing 90 ſtones. The weight, then, of moſs moved per day is no leſs than 4320 ſtones. A cubic yard is moved into the water, and of courſe carried into the river Forth for one farthing. It follows, that the expence of moving 48 cubic yards is one ſhilling. But the ſame quantity moved to the ſame diſtance by carts would coſt 24 ſhillings. Hence the advantage derived from the poſſibility of floating moſs in water, and the great importance of having water for that purpoſe.

The moſs, when contraſted with the rich lands ſurrounding, appeared, eſpecially before the improvements, a very dreary ſpot; one wide unvaried wild, totally unproductive, unfit even to furniſh ſuſtenance to any animal, except here and there a few wretched ſtraggling ſheep. Beſides, it entirely cut off all connection betwixt the farms on either ſide; amongſt which no intercourſe was practicable but by a circuit of ſeveral miles.

The ſcene is already greatly changed. The following are the numbers of the inhabitants now reſiding in the moſs; alſo of their cows and horſes, and of the acres gained by them from the moſs, together with their produce.

Men - - -	115
Women - -	113
Boys - - -	199
Girls -	193
Total	620

Number of cows, at leaſt, -	115
Ditto of horſes and carts, -	34
Ditto of acres cleared from moſs, -	300

The produce in bolls cannot be exactly aſcertained: but, conſidering the goodneſs of the ſoil, may be fairly ſtated at 8 bolls per acre, *inde* 2400 bolls.

As oats are the ſtaple commodity, the calculation ſhall be confined to that grain. According to the fiars of Stirlingſhire, crop 1790 (the laſt crop for which they have been ſtruck), carſe oats are valued at 14s. per boll. *Inde* 2400 bolls at 14s. is L. 1680.

Moſs.

A track of ground ſo conſiderable, formerly a nuiſance to the country, thus converted into a fertile field, filled with inhabitants, comfortable and happy, cannot ſurely be ſurveyed with an eye of indifference by any perſon whoſe mind is at all ſuſceptible of feeling or of public ſpirit.

An excellent gravelled road 20 feet wide and a mile and a half long, is now carried quite acroſs the moſs. By this means, in the firſt place, a ſhort and eaſy intercourſe is eſtabliſhed between two conſiderable parts of the eſtate, formerly as little connected as if ſeparated by a lake or an arm of the ſea. Secondly, the inhabitants of the Moſs, to whom, hitherto, all paſſage with carts or horſes was impracticable for at leaſt one half of the year, have now obtained the eſſential advantage of being able, with eaſe, to tranſport all their different commodities at every ſeaſon of the year. This road was entirely formed by the hands of the moſs-tenants, and gravelled by their own carts and horſes: a work which, it will not be doubted, they performed with much alacrity; when it is conſidered that, to the proſpect of procuring a laſting and material benefit to themſelves, there was joined the additional inducement of receiving an immediate ſupply of money, the whole being done at the proprietor's expence.

The poſſeſſions are laid off in the manner beſt fitted for the operations; and are divided by lanes running in ſtraight lines parallel to each other. Parallel to theſe again the drains are carried; and this ſtraight direction greatly facilitates the progreſs of the water with its load of moſs. Upon the bank of moſs fronting the lanes, the operation of floating is begun; and twenty or thirty people are ſometimes ſeen heaving moſs into the ſame drain. That the water may be the more conveniently applied, the lanes include between them the breadth of two poſſeſſions only. The new houſes are erected upon each ſide of theſe lanes at the diſtance of 100 yards from each other.

Before the formation of lanes and roads, and while yet no ground was cleared, the firſt ſettlers were obliged to erect their houſes upon the ſurface of the moſs. Its ſoftneſs denied all acceſs to ſtones; which, at any rate, are at ſuch a diſtance as would render them too expenſive. Settlers, therefore, were obliged to conſtruct their houſes of other materials. Upon the Low Moſs there is found for this purpoſe great plenty of ſod or turf, which accordingly the tenants uſe for the walls of their houſes. For the rudeneſs of the fabric nature in ſome meaſure compenſates, by overſpreading the outſide with a luxuriant coating of heath and other mooriſh plants, which has a very pictureſque appearance.

But upon the High Moſs there is no ſod to be found. There the tenant muſt go differently to work. Having choſen a proper ſituation for his houſe, he firſt digs four trenches down to the clay, ſo as to ſeparate from the reſt of the moſs a ſolid maſs, containing an oblong, rectangular area, ſufficiently large for his intended houſe. This being done, he then ſcoops out the middle of the maſs, leaving on all ſides the thickneſs of three feet for walls; over which he throws a roof,

roof, ſuch as that by which other cottages are commonly covered.

Upon the ſofteſt parts of the moſs, even theſe walls cannot be obtained. In ſuch places the houſes are built with peat dug out of the moſs, and cloſely compreſſed together while in a humid ſtate (c). It is neceſſary even to lay upon the ſurface a platform of boards to prevent the walls from ſinking; which they have frequently done when that precaution was neglected. After all, to ſtamp with the foot will ſhake the whole fabric as well as the moſs for fifty yards around. This, at firſt, ſtartled the people a good deal; but cuſtom ſoon rendered it familiar.

The coloniſts have now made conſiderable advancement in rearing better habitations for their comfort and convenience. Their huts of turf are but temporary lodgings. As ſoon as they have cleared a little ground, they build houſes of brick; when the proprietor a ſecond time furniſhes them with timber gratis. It has alſo been found neceſſary to relieve them entirely from the payment of the burdenſome tax upon bricks; a tax which ſurely was never intended to fall on ſuch poor induſtrious adventurers; and which, without this aſſiſtance, would have proved a moſt effectual bar to the employment of theſe materials.

There are now erected in the moſs 69 brick-houſes, ſubſtantially built with lime. The total expence amounted to 1033 l. Sterling. And it is a very comfortable circumſtance, that the money expended upon theſe houſes is moſtly kept in circulation among the inhabitants themſelves: for as a number of them have learned not only to manufacture but alſo to build bricks, and as others who have horſes and carts furniſh the carriage of lime and coals, they thus interchange ſervices with each other.

With a view to excite the exertion of the coloniſts, the following premiums have lately been offered: 1. To the perſon who ſhall in the ſpace of one year remove the greateſt quantity of moſs down to the clay, a plough of the beſt conſtruction. 2. To the perſon who ſhall remove the next greateſt quantity, a pair of harrows of the beſt kind. 3. For the next greateſt quantity, a ſpade of the beſt kind, and 10 lb. of red clover-ſeed. But as theſe premiums, if conteſted for by the whole inhabitants, could reach but a very few of the number, they have therefore been divided into ſix diſtricts according to their ſituation, and the above premiums have been offered to each diſtrict.

The eſtabliſhment of this colony has no doubt been attended with a very conſiderable ſhare of expence and difficulty; for the undertaking was altogether new, and there were many prejudices againſt it, which it was neceſſary to overcome. At the ſame time it was noble and intereſting: it was to make a valuable addition to private property: it was to increaſe the population of the country, and to give bread to a number of people; many of whom having been turned out of their farms and cottaries in the Highlands, might otherwiſe, by emigration, have been loſt to their country; and that too at a time when, owing to the great enlargement of farms, depopulation prevails but too much even in the low countries. And it was to add to the arable lands of the kingdom, making many thouſand bolls of grain to grow where none ever grew before.

Theſe conſiderations have hitherto preponderated with the proprietors againſt the various obſtacles that preſent themſelves to the execution of ſo extenſive an undertaking. Should their example tend in any degree to ſtimulate others, who both in Scotland and in England poſſeſs much ground equally uſeleſs to the country, to commence ſimilar improvements, it would be a moſt grateful conſideration ſuperadded to the pleaſure already ariſing from the progreſs of the infant colony.

Moss-Troopers, a rebellious ſort of people in the north of England, that lived by robbery and rapine, not unlike the tories in Ireland, the bucaneers in Jamaica, or banditti of Italy. The counties of Northumberland and Cumberland were charged with an 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, in ornithology, the WAGTAIL and WARBLER: A genus of birds of the order of paſſeres; diſtinguiſhed by a ſtraight weak bill of a ſubulated figure, a tongue lacerated at the end, and very ſlender legs. Plate CCCXV.

1. The alba, or white wagtail, frequents the ſides of ponds and ſmall ſtreams, and feeds on inſects and worms. The head, back, and upper and lower ſide of the neck, as far as the breaſt, are black; in ſome the chin is white, and the throat marked with a black creſcent: the breaſt and belly are white; the quill-feathers are duſky; the coverts black, tipt and edged with white. The tail is very long, and always in motion. Mr Willoughby obſerves, that this ſpecies ſhifts its quarters in the winter; moving from the north to the ſouth of England during that ſeaſon. In ſpring and autumn it is a conſtant attendant on the plough, for the ſake of the worms thrown up by that inſtrument. Theſe birds make their neſt on the ground, compoſed of dry graſs, fine fibres of roots, and moſs lined within with hair or feathers. The eggs are five in number, white, ſpotted with brown; and for the moſt part there is only one brood in a year.

2. The flava, or yellow wagtail, migrates in the north of England, but in Hampſhire continues the whole year. The male is a bird of great beauty: the breaſt, belly, thighs, and vent-feathers, being of a moſt vivid and lovely yellow: the throat is marked with ſome large black ſpots; above the eye is a bright yellow

(c) This does not apply to the *moraſs*, upon the ſurface of which, it has already been obſerved, it is impoſſible to erect houſes in any ſhape.

Motacilla.

yellow line: beneath that, from the bill, cross the eye, is another of a dusky hue; and beneath the eye is a third of the same colour: the head and upper part of the body is of an olive-green, which brightens in the coverts of the tail; the quill-feathers are dusky; the coverts of the wings olive-coloured; but the lower rows dusky, tipt with yellowish white; the two outmost feathers of the tail half white; the others black, as in the former. The colours of the female are far more obscure than those of the male: it wants also those black spots on the throat. It makes its nest on the ground, in corn-fields: the outside is composed of decayed stems of plants, and small fibrous roots; the inside is lined with hair: it lays five eggs.

3. The regulus, or gold-crested wren, is a native of Europe, and of the correspondent latitudes of Asia and America. It is the least of all the European birds, weighing only a single drachm. Its length is about four inches and an half; and the wings, when spread out, measure little more than six inches. On the top of its head is a beautiful orange-coloured spot called its *crest*, which it can hide at pleasure; the margins of the crest are yellow, and it ends in a pretty broad black line; the sides of the neck are of a beautiful yellowish green; the eyes surrounded with a white circle; the neck and back of a dark green mixed with yellow; the breast of a dirty white; the tail composed of 12 feathers of a brown colour, an inch and an half long, but not forked. In America it associates with the titmice, running up and down the bark of lofty oaks with them, and collecting its food in their company, as if they were all of one brood. It feeds on insects lodged in their winter dormitories in a torpid state. It is said to sing very melodiously.

4. The sialis, or blue-bird, is a native of most parts of North America; and is about the bigness of a sparrow. The eyes are large; the head and upper part of the body, tail, and wings, are of a bright blue, excepting that the ends of the feathers are brown. The throat and breast are of a dirty red. The belly is white. It flies swiftly, having very long wings; so that the hawk generally pursues it in vain. It make its nest in holes of trees; resembles our robin-red breast in its disposition, and feeds only on insects.

5. The sutoria, or taylor-bird, is a native of the East-Indies. It is remarkable for the art with which it makes its nest, seemingly in order to secure itself and its young in the most perfect manner possible against all danger from voracious animals. It picks up a dead leaf, and sews it to the side of a living one: its slender bill is the needle, and its thread is formed of some fine fibres; the lining is composed of feathers, gossamer, and down. The colour of the bird is light-yellow; its length three inches; and its weight only three-sixteenths of an ounce: so that the materials of the nest and its own size are not likely to draw down a habitation depending on so slight a tenure.

6. The lucinia, or nightingale, exceeds in size the hedge-sparrow. The bill is brown: the irides are hazel: the head and back pale tawny, dashed with olive: the tail is of a deep tawny red; the under parts pale ash-colour, growing white towards the vent: the quills are cinereous brown, with the outer margins reddish brown: the legs cinereous brown. The male and female are very similar. This bird, the most famed of the feathered tribe for the variety, length, and sweetness of its notes, is migratory, and supposed to be an inhabitant of the Asiatic regions during such times as it is not to be found in Europe. It is met with in Siberia, Sweden, Germany, France, Italy, and Greece; but in all those places it is migratory, as in England. Hasselquist speaks of it as being in Palestine; and Fryer ascertains its being found about Chulminor in Persia: it is also spoken of as a bird of China, Kamtschatka, and Japan; at which last place they are much esteemed, and sell dear; as they are also at Aleppo, where they are "in great abundance kept tame in houses, and let out at a small rate to such as choose it in the city, so that no entertainment is made in the spring without a concert of these birds." They are not found in America, though several of their birds improperly bear that name; and it is uncertain whether they are found in Africa. This bird visits Britain in the beginning of April, and leaves us in August; and during its continuance with us its range is confined to but a part of the island: it is not found in Scotland, Ireland, or North Wales, nor in any of the northern counties except Yorkshire; and it does not migrate so far to the west as Devonshire and Cornwall. They are solitary birds, never uniting into even small flocks; and in respect to the nests, it is very seldom that two are found near each other. The female builds in some low bush or quickset hedge well covered with foliage, for such only this bird frequents; and lays four or five eggs of a greenish brown. The nest is composed of dry leaves on the outside, mixed with grass and fibres, lined with hair or down within, though not always alike. The female alone sits on and hatches the eggs, while the male not far off regales her with his delightful song; but as soon as the young are hatched, he commonly leaves off singing, and joins with the female in the task of providing for and feeding them. After the young can provide for themselves, the old female provides for a second brood, and the song of the male recommences. They have been known to have three broods in a year, and in the hot countries even four. These birds are often brought up from the nest for the sake of their song. They are likewise caught at their first coming over; and though old birds, yet by management can be made to bear confinement, and to sing equally with those brought up from the nest. None but the vilest epicure, as Mr Latham remarks, would think of eating these charming songsters; yet we are told that their flesh is equal to that of the ortolan, and they are fatted in Gascony for the table. Every school-boy must have read of Heliogabalus eating of nightingales tongues; and that famed dish of the Roman tragedian Æsop, which was composed of those of every singing or talking bird, and is said to have cost about L. 6843 of our money.

7. The hippolais, or pettychaps, is somewhat less than a linnet. The bill is short; the upper mandible black, the under bluish: above and below the eye there is a yellowish line: the head, neck, and upper parts are of a greenish ash-colour; the quills and tail of a mouse-colour, with greenish edges and black shafts; and the under wing-coverts are yellow: the belly is of a silvery white; the breast darker, and tinged with yellow: the legs are bluish or lead-coloured. This species is frequent in several parts of England, and makes a nest of

Motacilla.

of an arched form, composed of dry bents, mixed with a little moss, and thickly lined with feathers: it is placed on the ground under a tuft of grass or at the bottom of a bush. The eggs are five in number, white, sprinkled all over with small red spots, most so at the largest end. In Dorsetshire it is known by the name of *hay-bird.* In Yorkshire is is called the *beam-bird,* from its nestling under beams in outbuildings.

8. The atricapilla, or blackcap, is smaller than the pettichaps. The bill is brown: the top of the head is black; and the upper parts of the body are of a greenish ash-colour: the sides of the head and under parts are grey, changing to very light grey, or almost white, towards the vent: the quills and tail are cinereous brown, margined with the same colour as the upper parts: legs are lead-coloured, and the claws black. This bird is pretty common in England, and elsewhere in Europe, as far as Italy; in all which places it is known to breed; coming in spring, and retiring in September. In Italy it builds twice in the year; with us only once. The nest, which is generally placed in some low bush not far from the ground, is composed of dried stalks, mixed with a little wool and green moss round the verge; the inside lined with the fibres of roots, thinly covered with black horse-hair. The eggs are five in number; of a pale reddish brown, mottled with a deeper colour, and sprinkled with a few dark spots. The male and female sit by turns during incubation; and the young very early leap out of the nest, especially if any one approaches it, and forsake it for ever. The food is chiefly insects; but in defect of these they will eat the fruits of spurge laurel, service, and ivy; and seems to be even fond of the last, as they much frequent such trees as are overgrown with it. The song is much esteemed, and in many things almost equalling the nightingale itself; scarcely deficient, except in the delightful variety of note of the last named bird. Hence by many it has been named the *mock nightingale.*

9. The modularis, or hedge-sparrow, a well-known bird, has the back and wing coverts of a dusky hue edged with reddish brown; rump of a greenish brown; throat and breast of a dull ash colour; the belly a dirty white; and the legs of a dull flesh-colour. This bird frequents hedges in England; where it makes its nest of moss and wool, lining it with hair; and lays four or five eggs of a fine pale blue. With us and the more northern regions it is seen at all seasons; but in France it is migratory, coming in October and departing northward in spring. The note of this bird would be thought pleasant, did it not remind us of the approach of winter; beginning with the first frosts, and continuing till a little time in spring. Its often repeating the words *tit, tit, tit,* has occasioned its being called *titling;* a name it is known by in many places.

10. The phœnicurus, or red start, is somewhat less than the red-breast: the forehead is white; the crown of the head, hind part of the neck, and back, are deep blue grey; the cheeks and throat black; the breast, rump, and sides, red; and the belly is white: the two middle tail-feathers are brown; the rest red; and the legs are black. The female has the top of the head and back cinereous grey; chin white. The same parts are red in this sex as in the male, but not so bright. The wings are brown in both sexes. This bird is migratory; coming hither in spring, and departing in autumn about October. It is not so shy as many birds in respect to itself; for it approaches habitations, and frequently makes its nest in some hole of a wall where numbers of people pass by frequently: yet it is content, if no one meddles with the nest; for the least derangement of the eggs, or almost looking at them, especially if the female is disturbed thereby, causes her to forsake the nest altogether. It frequently builds also in some hole of a tree. The nest is composed chiefly of moss, lined with hair and feathers. The eggs are blue, and four or five in number. This bird frequently wags its tail; but does it sideways like a dog when he is pleased, and not up and down like the wagtail. It is with difficulty that these birds are kept in a cage; nor will they submit to it by any means if caught old. Their song has no great strength: yet it is agreeable enough; and they will, if taught young, imitate the note of other birds, and sing by night frequently as well as in the day-time.

11. The salicaria, or sedge-bird, is about the size of the blackcap, but more slender. The head is brown, marked with dusky streaks: the cheeks are brown; with a white line over each eye, and above that a black one: the upper parts of the neck and back are of a reddish brown; and the wing-coverts and quills dusky: the under parts are white; but the breast and belly have a yellow tinge: the tail is brown, and much rounded; and the legs are dusky. This bird is common in England, and frequents places where reeds and sedges grow, among which it is said to make the nest, though it has been known to do this on the lowest branches of trees. The nest is composed of straw and dried fibres of plants, lined with hair; and the eggs five in number, of a dirty white, marbled with brown. It is observed to imitate the note of the swallow, sky-lark, house-sparrow, and other birds, in a pleasing but hurrying manner, and sings all night.

12. The ficedula, or epicurean warbler, is in length five inches: the upper parts are grey brown; the under parts greyish white, with a tinge of brown on the breast; and the legs are blackish. This is a bird much esteemed on the continent for the delicate flavour of its flesh. Their chief food is insects; except in autumn, when they make great havock among the figs and grapes; whence it is supposed their great delicacy in some measure arises. It is not found in England, but met with in most of the intermediate parts between Sweden and Greece; where, however, it is only a summer-inhabitant, probably retiring still more south at the approach of winter. In the isle of Cyprus and Candy they abound greatly, insomuch as to be an article of commerce. They transport them in vessels filled with vinegar and sweet herbs: the isle of Cyprus alone collects 1000 or 1200 of these pots every year.

13. The rubecula, or red-breast, is universally known: the upper parts are of a greenish ash-colour; the forehead, throat, neck, and breast, a rufous orange; the belly and vent whitish; the bill, legs, and sides of the body, dusky. It is a constant inhabitant of these kingdoms, as well as the whole European continent from Sweden to Italy. It abounds in Burgundy and Lorraine, where numbers are taken for the table, and thought

Motacilla. thought excellent. It builds not far from the ground if in a bush; though sometimes it fixes on an out-house, or retired part of some old building. The nest is composed of dried leaves, mixed with hair and moss, and lined with feathers. The eggs are of a dusky white, marked with irregular reddish spots; and are from five to seven in number. The young, when full feathered, may be taken for a different bird, being spotted all over. The first rudiments of the red break forth on the breast about the end of August; but it is quite the end of September before they come to the full colour. Insects are their general food; but in defect of these they will eat many other things. No bird is so tame and familiar as this; closely attending the heels of the gardener when he is using his spade, for the sake of worms; and frequently in winter entering houses where windows are open, when they will pick up the crumbs from the table while the family is at dinner. Its familiarity has caused a petty name to be given it in several countries. The people about Bornholm call it *Tommi-liden*; in Norway, *Peter Ronsmad*; the Germans, *Thomas Gierdet*; and we, the *Robin Red-breast*.

14. The rubicola, or stone-chatter, is in length about four inches and three quarters. The male has the upper parts of the body mixed blackish and pale rufous: on each side the neck there is a transverse streak of white: the breast is of a reddish yellow; the belly paler: and the legs are black. The female has the colours much less vivid. This bird inhabits dry places, such as heaths and commons; living on insects of all kinds. It makes its nest early, at the foot of some low bush, or under a stone; and lays five or six eggs of a bluish green, sparingly marked with faint rufous spots. It is so very crafty as not to betray the place of the nest, never alighting but at some distance, and creeping on the ground to it by the greatest stealth. It is a restless bird, incessantly flying from bush to bush; and seems to have received its English name from its note, resembling the clicking of two stones together.

15. The rubetra, or whin-chat, is somewhat bigger than the stone-chatter. The upper parts are blackish, edged with rufous: from the bill arises a streak of white, which passes over the eye on each side, almost to the hind head: beneath this the cheeks are blackish; the chin is white; the rest of the under parts rufous-white: on the wing, near the shoulder, is a transverse white mark, and another smaller near the bastard wing, on the outer edge: the legs are black. The female differs in being paler, and the spots on the wings and the white trace over the eye being far less conspicuous. This is not uncommon in Britain, and is seen along with the stone-chatter on the heaths during the summer months; where it breeds, making the nest much after the manner of that bird. It lays five dirty white eggs, dotted with black. This species is common also on the continent of Europe, in France, Italy, Germany, and the more temperate parts of Russia; but it is said to be less common than the stone-chatter there, as it is also in England. Its food is chiefly insects; and is said to be as good as the ortolan, when fat and in good condition.

16. The œnanthe, or wheat-ear, is in length five inches and a half. The top of the head, hind part of the neck, and back, are of a bluish grey; and over the eye a streak of white: the under parts of the body yellowish white, changing to pure white at the vent: the breast is tinged with red; and the legs are black. This bird is met with in most parts of Europe, even as far as Greenland; and specimens have also been received from the East Indies. It visits England annually in the middle of March, and leaves us in September. It chiefly frequents heaths. The nest is usually placed under shelter of some turf, clod, stone, or the like, always on the ground, and not unfrequently in some deserted rabbit-burrow. It is composed of dry grass or moss, mixed with wool, fur of the rabbit, &c. or lined with hair and feathers. The eggs are from five to eight in number, of a light blue, with a deeper blue circle at the large end. The young are hatched the middle of May. In some parts of England these birds are in vast plenty. About Eastbourn in Sussex they are taken in snares made of horse-hair placed beneath a long turf: Being very timid birds, the motion of a cloud or the appearance of an hawk will drive them for shelter into these traps, and so they are taken. The numbers annually ensnared in that district alone amount to about 1840 dozen, which usually sell at sixpence per dozen. Quantities of these are eaten on the spot by the neighbouring inhabitants; others are picked, and sent up to the London poulterers; and many are potted, being as much esteemed in England as the ortolan on the continent. Their food is insects only; though in rainy summers they feed much on earth-worms, whence they are fattest in such seasons.

17. The cyanea, or superb warbler, a most beautiful species, is five inches and a half long. The bill is black: the feathers of the head are long, and stand erect like a full crest; from the forehead to the crown they are of a bright blue; from thence to the nape, black like velvet: through the eyes from the bill there runs a line of black; and beneath the eye springs a tuft of the same blue feathers; beneath which, and on the chin, it is of a deep blue almost black, and feeling like velvet: on the ears is another patch of blue, and across the back part of the head a band of the same; the whole giving the head a greater appearance of bulk than is natural: the hind part of the neck, and upper parts of the body and tail, are of a deep blue black; the under, pure white: the wings are dusky; the shafts of the quills chesnut: the legs are dusky brown; the claws black. It inhabits Van Diemen's Land, the most southern part of New Holland. The female of this species, of which a figure is given in Phillip's Voyage to Botany Bay, is discovered to be entirely destitute of all the fine blue colours, both pale and dark, by which the male is adorned, except that there is a very narrow circle of azure round each eye, apparently on the skin only: all the upper feathers consist of shades of brown, and the whole throat and belly is pure white. Except from the shape and size, this bird would not be suspected at first sight to belong to the same species as the male: the epithet of *superb* applies very ill to the female.

18. The troglodytes, or wren, is a very small species, in length only three inches three quarters, though some have measured four inches. The bill is very slender, and of a dusky brown colour: the head, neck, and back, are of a reddish brown; and over each eye a

Mote ‖ Mothe.

a pale reddiſh white ſtreak: the under parts, as far as the breaſt, are of this laſt colour; the reſt more inclined to brown, croſſed with brown lines: the legs are pale brown. It generally carries the tail erect. The neſt is of a curious conſtruction, in ſhape almoſt oval, and has only one ſmall entrance: it is chiefly compoſed of moſs, well lined with feathers. In this the female lays from 10 to 16 or even 18 eggs, which are almoſt white, with reddiſh markings at the large end. She builds twice in a year, in April and June. The neſt is frequently found in ſome corner of an outhouſe, ſtack of wood, hole in a wall, or ſuch like, if near habitations; but in the woods often in a buſh near the ground, in a ſtump of a tree, or on the ground itſelf. This minute bird is found throughout Europe; and in England it defies our ſevereſt winters. Its ſong is much eſteemed, being, though ſhort, a pleaſing warble, and much louder than could be expected from the ſize of the bird: it continues throughout the year.

Above 150 other ſpecies, beſides varieties, are enumerated by ornithologiſts.

MOTE, in law-books, ſignifies court or convention; as a 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, in zoology. See Phalæna.

MOTHE LE VAYER (Francis de la), counſellor of ſtate, and preceptor to the duke of Anjou only brother to Louis XIV. was born at Paris in the year 1588. He was well educated by a learned father, whoſe merits and employment rendered him of conſequence; and he became ſo eminently learned himſelf, and diſtinguiſhed by his writings, that he was conſidered as one of the beſt members of the French academy, into which he was admitted in the year 1639. He was loved and conſidered by the two cardinals Richelieu and Mazarine, who governed France ſucceſſively. Splendid titles and honourable poſts were beſtowed upon him. He was appointed preceptor to the duke of Anjou, as we have ſaid, and would have been preceptor alſo to the king his brother, if the queen had not taken a particular fancy not to have that place beſtowed on a married man: though Moreri in his Dictionary, and Peliſſon in his Hiſtory of the French Academy, both affirm that he was preceptor to his majeſty for the ſpace of one year. He was a man of a very regular conduct, and a true philoſopher in his manners; yet was ſuſpected of having no religion. As great a philoſopher as he was, however, he was extremely afflicted at the loſs of his only ſon, who died when about 35 years of age; and his grief diſordered him ſo much that in three months after he married again, although he was above 75 years old. Le Vayer lived a long time after his ſecond marriage, and died in the year 1672. His works, collected into a body by his ſon, were dedicated to cardinal Mazarine in 1653: but the beſt and completeſt collection of them was that of Paris 1669, dedicated to Louis XIV. and conſiſting of 15 volumes in 12mo.

Mother, Motion.

"There is no ſmall advantage (ſays Bayle) to be made of reading this writer: and we have no French author that approaches nearer to Plutarch than he. We find beautiful thoughts and ſolid arguments interwoven and diſperſed through all he wrote; wit and learning go hand in hand. His treatiſe concerning the education of the dauphin, and that of pagan philoſophy, are the beſt which he hath written."

MOTHER, a term of relation, denoting a woman who hath born a child.

Mother of Pearl. See Mytilus.

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 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*.

2 Several definitions of.

* See *An Eſſay on the Powers and Mechaniſm of Nature*, by Robert Young.

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

‡ See Dr Reid's account of Ariſtotle's logic, in Lord Kames's *Sketches of Man*.

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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 thoſe 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 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, 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 *ather*, 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

6 A ſubtle æther the probable cauſe of attraction and repulſion.

† *Siris*, n° 153, &c.

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it constantly sends forth and resorbs. So quick in its motions, so subtile and penetrating in its nature, so extensive in its effects, it seemeth no other than the vegetative soul or vital spirit of the world.

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.

† *Essay on the First Principles of Natural Philosophy.*

"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, 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 axis, 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 aerial 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

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thor 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 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 phænomena 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 Platonics (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."

‡ *Siris*, n° 277.

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; 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, 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 plac

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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. In other terms, body is to be conſidered as 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,

Motion.

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.

"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
16 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.

The manner in which it is ſuppoſed to operate,

"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.

"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. 17

produce impulſe,

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 cauſe 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

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 round 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

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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 philoſophiſing 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 ætherial 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.

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 analyſes 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

20 Other theories more ancient and rational.

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.

* *Pſal.* 104.

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 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 loſt 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

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

23 By Newton

ways 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.

25 proved by Sir Iſaac Newton's doctrine of the compoſition and reſolution of motion. Plate CCCXIV.

Under the article MECHANICS, it has been ſhown, that when motion is compounded of two powers acting obliquely upon one another, more motion is loſt than the two powers taken together could ſpare. Thus, if the two powers AB and AC move a body through the diagonal of the ſquare AD; ſuppoſing each of theſe powers to be $=5$, the diagonal through which they paſs will be 7 (A); but from an inſpection of the figure, it is manifeſt, that by the ſeparation of the two powers, a quantity of motion BC, equal to the length of the other diagonal, is loſt; for in as far as the two act oppoſite to each other, they muſt deſtroy motion. The quantity of motion produced therefore being 7, and the quantity loſt the ſame, the whole quantity originally exiſting in the two powers AB and BC ought to have been 14, when it is only 10. To make up for the deficiency, therefore, we muſt ſearch for the origin of the two powers AB and BC, and this we ſhall find in the lines A*a*, A*c*, and A*d*; each of which is $3\frac{1}{2}$, altogether making 14; whence deducting 7 the motion loſt, we have 7 remaining for the motion produced. Let us now find out the origins of theſe powers, and we ſhall find thoſe of A*a* in the lines A*e* and A*f*; the origins of A*c* in A*f* and A*g*. The ſources of A*d* we find in the lines A*g* and A*h*. Thus we have now eight ſources of the four powers which generated the two firſt ones; and thus we find that the power $AD=7$, requires two of 5 each $=10$ for its generation; theſe two require four of $3\frac{1}{2}$ each for their production; and theſe again require eight of 2 45 each for their production. Hence, in order to generate the two original powers AB and AC, we ſee that there is required at a very few ſteps no leſs than 20; and in like manner, to generate theſe eight powers, we muſt have recourſe to 16 others; ſo that the ultimate ſource of motion increaſes beyond all calculation.

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 phe-

(A) It will be ſomething more than 7; but the fractional part is omitted, as being of no importance in the illuſtration of the fact before us.

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 just now 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.

26 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.

To find a perpetual motion, or to construct an engine, &c. which shall have such a motion, is a famous problem that has employed the mathematicians of 2000 years; though none perhaps have prosecuted it with attention and earnestness equal to those of the present age.

Infinite are the schemes, designs, plans, engines, wheels, &c. to which this longed-for perpetual motion has given birth: it were as endless as impertinent to give a detail of them all.

In effect, there seems but little in nature to countenance all this assiduity and expectation; among all the laws of matter and motion, we know of none yet which seems to furnish any principle or foundation for such an effect.

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 remarkably, 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 gre-hound 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 vermin, 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 to have a kind of medium fwiftnefs between both.—This very remarkable circumftance feems not even to depend on the range which animals are obliged to take in order to procure food for themfelves: the motion of a fnail is flower than that of an earth-worm; while that of many caterpillars is much quicker than either; though we can fcarce determine which of the three has the greateft or the leaft extenfive range for its food.

Of all animals the fhell-fifh move the floweft, infomuch that fome have fuppofed them to be entirely deftitute of loco-motive powers; and mufcles particularly are denied to have any faculty of this kind. Every one knows that thefe animals can open and fhut their fhells at pleafure; and it cannot efcape obfervation, that in every mufcle there is a flefhy protuberance of a much redder colour than the reft. This has been thought to be a tongue or probofcis, by which the animal takes in its food; but is in reality the inftrument of its motion from place to place. This protuberance is divided into two lobes, which perform the office of feet. When the river mufcle is inclined to remove from its ftation, it opens its fhell, thrufts out this protuberance, and digs a furrow in the fand; and into this furrow, by the action of the fame protuberance, the fhell is made to fall in a vertical pofition. It is recovered out of this into the former horizontal one, by pufhing back the fand with the fame tentacula, lengthens the furrow, and thus the animal continues its journey by a continual turning topfy-turvy.—Marine mufcles perform their motions in the fame manner, and by fimilar inftruments. In general they are firmly attached to rocks or fmall ftones by threads about two inches long, which are fpun from a glutinous fubftance in the protuberances already mentioned; thefe are called, in Scotland, the *beards* of mufcles, and are thought to be the caufe of the fatal diforders which fometimes attend the eating of mufcles. See Mytulus.

Other animals which dwell in bivalved fhells, perform their motions by a kind of leg or foot; which, however, they can alter into almoft any figure they pleafe. By means of this leg they can not only fink into the mud, or rife out of it at pleafure, 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 moft fluggifh animals in nature.—When this creature is about to make a fpring, it fets its fhell on edge, as if to diminifh friction; then, ftretching out the leg as far as poffible, it makes it embrace a portion of the fhell, and by a fudden movement, fimilar to that of a fpring let loofe, it ftrikes the earth with its leg, and actually leaps to a confiderable diftance.

The fpout, or razor-fifh, is faid to be incapable of moving forward horizontally on the furface; but it digs a hole fometimes two feet deep in the fand, in which it can afcend or defcend at pleafure. The leg, by which it performs all its movements, is flefhy, cylindrical, and pretty long; and the animal can at pleafure make it affume the form of a ball. When lying on the furface of the fand, and about to fink into it, the leg is extended from the inferior end of the fhell, and makes the extremity of it take on the form of a fhovel, fharp on each fide, and terminating in a point. With this inftrument the animal makes a hole in the fand; after which it advances the leg ftill farther into it, makes it affume the form of a hook, and with this, as a fulcrum, it obliges the fhell to defcend into the hole. This operation is continued until the whole fhell be covered; and when the animal wifhes to regain the furface, it makes the extremity of the leg to affume the form of a ball, and makes an effort to extend it. The ball, however, prevents any farther defcent, and the reaction of the mufcular effort raifes up the whole fhell, which operation is continued until it reaches the furface; and it is furprifing with what facility thefe motions are accomplifhed by an animal feemingly fo little qualified to move at all. Another particularity in this fifh is, that though it lives among falt water, it abhors falt fo much that when a little is thrown into its hole it inftantly leaves it. But it is ftill more remarkable, that if you once take hold of the fpout fifh, and then allow it to retire into its hole, it cannot then be driven out by falt; though unlefs it be taken hold of by the hand, the application of falt will make it come to the furface as often as you pleafe. See Solen.

All other fhell-fifh, even thofe apparently the moft fluggifh and deftitute of any apparatus for motion, are found to be furnifhed with fuch inftruments as enable them to perform all thofe movements for which they have any occafion. Thus the fcallop, a well-known animal inhabiting a bivalved fhell, can both fwim upon the furface of water and move upon land. When it happens to be deferted by the tide, it opens its fhell to the full extent, and fhutting it again with a fudden jerk, the reaction of the ground gives fuch an impulfe to the whole, that it fometimes fprings five or fix inches from the ground; and by a continued repetition of this action, it gradually tumbles forward until it regains the water. Its method of failing is ftill more curious. Having attained the furface of the water by means unknown to us, it opens the fhell, 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 feen failing in company with their fhells fticking up above water when the weather is fine, and the wind acting upon them as fails; but on the leaft alarm they inftantly fhut their fhells, and all fink to the bottom together. See Pecten.

The oyfter has generally been fuppofed one of the moft fluggifh animals in nature, and totally incapable of voluntary motion; but from the refearches of the Abbé Dicquemarre, this opinion feems to be erroneous. The oyfter, like many other bivalved fhell-fifh, has a power of fquirting water out from its body; and this property may eafily be obferved by putting fome of them into a plate with as much fea-water as will cover them. The water is ejected with fo much force, as not only to repel the approach of ordinary enemies, but to move the whole animal backwards or fideways, in a direction contrary to that in which the water was ejected. It has been alfo fuppofed, that oyfters are deftitute of fenfation; but M. Dicquemarre has fhown, that they not only poffefs fenfation, but that they are capable of deriving knowledge from experience. When removed from fuch places as are entirely covered with the fea, when deftitute of experience, they open their fhells and die in a few days; but if they happen to efcape this danger, and the water covers them again, they will not open their fhells

 again,

Motion.

again, but keep them ſhut, as if warned by experience to avoid a danger ſimilar to what they formerly underwent. See OSTREA.

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 hedge-hog*. The 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 turing round like a wheel. Thus, ſays Mr Smellie ‡, the ſea-urchin furniſhes an example of an animal employing many thouſand limbs in its various movements. The reader may try to conceive the number of muſcles, fibres, and other apparatus which are requiſite to the progreſſive motion of this little animal.

‡ *Phil. of Nat. Hiſt.*

Thoſe 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 neverthefs 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.

* See *Actinia*.

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 locomotion 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,

contains, but to the oppofition of new matter; whence the increafe of fize muft always take place in the direction from whence the nourifhment proceeds. On this principle alfo may we explain the reafon why the roots of a tree, after having arrived at the edge of a ditch, inftead of fhooting out into the air, will creep down the one fide, along the bottom, and up the other.

In their other movements the vegetables difcover nothing like fenfation or defign. They will, indeed, uniformly bend towards light, or towards water; but in the one cafe we muft attribute the phenomenon to the action of the elements of light and air upon them; and in the latter the property feems to be the fame with what in other cafes we call attraction. Thus, if a root be uncovered, and a wet fpunge placed near it in a direction different from that in which the root was proceeding, it will foon alter its pofition, and turn towards the fpunge; and thus we may vary the direction of the root as often as we pleafe. The efforts of a plant to turn from darknefs or fhade into funfhine are very remarkable; as, in order to accomplifh this, not only the leaves will be inclined, but even the ftems and branches twifted. When a wet fpunge is held under the leaves of a tree, they bend down in order to touch it. If a veffel of water be put within fix inches of a growing cucumber, in lefs than 24 hours the latter will alter its direction; the branches will bend towards the water, and never alter their courfe until they come in contact with it. The moft remarkable inftance of this kind of motion, however, is, that when a pole is brought near a vine, the latter will turn towards it, and never ceafe extending its branches till it lays hold of the fupport.

The motions of the fenfitive plant, and others of the fame kind, have been confidered as very wonderful; but it is doubtful if any of them be really more fo than that of the vine juft mentioned. None of thefe fhow any kind of propenfity to move without an actual touch. A very flight one, indeed, makes the fenfitive plant contract, and the whole branch, together with the leaves, bend down towards the earth.—This is fo fimilar to fome phenomena of electricity, that very few will hefitate at afcribing both to the fame caufe. Even the motions of the hedyfarum gyrans, which at firft fight feem fo much more furprifing than thofe of the fenfitive plant, may be explained upon the fame principle. There is a fpecimen of this plant in the botanic garden of Edinburgh. It is a native of the Eaft Indies, and its motions are occafioned by the fun-beams. The leaves are the only moveable parts. They are fupported by long foot-ftalks; and when the fun fhines upon them they move brifkly in every direction. Their moft ufual motion is upward and downward; but not unfrequently they turn almoft quite round, and then the foot-ftalks are evidently twifted. Thefe motions continue only while the light and heat of the fun continues, ceafing when at night, or when the weather becomes cloudy and cold. The American plant called *Dionæa mufcipula*, or *Venus's fly trap*, is another example of very wonderful mechanifm in vegetables, though even this does not argue any degree of fenfation in this plant more than in others. The leaves of the dionæa are jointed, and furnifhed with two rows of prickles. A number of fmall glands upon the furface fecrete a fweet juice, which entices flies to come and fettle upon it; but the moment thefe infects touch the fatal fpot, the leaves fold up, and fqueeze them to death between the prickles. The leaves fold up in the fame manner when the plant is touched with a ftraw or pin.

The folding up of the leaves of certain plants in the abfence of the fun's light, called their *fleep*, affords another very curious inftance of vegetable motion.—Almoft all vegetables, indeed, undergo fuch a remarkable change in the night, that it is difficult to know exactly how many kinds do really fleep. They fold up their leaves in many different ways; but all agree in difpofing of them in fuch a manner as to afford the beft protection to the young ftems, flower-buds, or fruit. The leaves of the tamarind-tree contract round the young fruit, in order to protect it from nocturnal cold; and thofe of fenna, glycina, and many other papilionaceous plants, difpofe of their leaves in the fame manner. The leaves of the chickweed, afclepias, atriplex, &c. are difpofed in oppofite pairs. In the night-time they rife perpendicularly, and join fo clofe at the top that the flowers are concealed by them. In like manner do the leaves protect the flowers of the fida, or althæa theophrafti, the aycnia, and œnothira, the folanum, and the Egyptian vetch. All thefe are erected during the night; but thofe of the white lupine, in time of fleep, hang down.

The flowers of plants alfo have motions peculiar to themfelves. Many of them during the night are inclofed in their calyxes. Some, particularly thofe of the German fpurge, geranium ftriatum, and common Whitlow-grafs, when afleep bend towards the earth; by which means the noxious effects of rain or dew are prevented. All thefe motions have been commonly afcribed to the fun's rays; and Mr Smellie informs us, that in fome of the examples above-mentioned the effects were evidently to be afcribed to heat: but plants kept in an hot-houfe, where the temperature of the day and night are alike, contract their leaves, and fleep in the fame manner as if they were expofed to the open air; "whence it appears (fays he), that the fleep of plants is owing rather to a peculiar law, than to a quicker or flower motion of the juices." He fufpects, therefore, that as the fleep of plants is not owing to the mere abfence of heat, it may be occafioned by the want of light; and to afcertain this he propofes an experiment of throwing upon them a ftrong artificial light. "If, notwithftanding this light (fays he), the plants are not roufed, but continue to fleep as ufual, then it may be prefumed that their organs, like thofe of animals, are not only irritable, but require the reparation of fome invigorating influence which they have loft while awake, by the agitations of the air and of the fun's rays, by the act of growing, or by fome other latent caufe." On this, however, we muft remark, that the throwing of artificial light upon plants cannot be attended with the fame confequences as that of the light of the fun, unlefs the former were as ftrong as the latter, which is impoffible; and even granting that we could procure an artificial light as ftrong as that of the fun, a difference might be occafioned by the different directions of the rays, thofe of the fun being very nearly parallel, while the rays of all artificial light diverge very greatly. If, therefore, w 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 diaphraghm, are the moſt 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 prepetuate the ſpecies. Thoſe parts alone ſeem ſenſible to ſtimuli; the bark, leaves, ſtalks, and roots ſhowing no ſigns of irritability.

"The vital motions in plants are ſlow, and entirely determined by circumſtances, which are always repeated and equally diffuſed over all the parts. In animals, on the contrary, almoſt all the vital motions are very ſenſible; ſuch as the pulſations of the heart and arteries, the dilatation of the thorax, &c.: theſe being abſolutely neceſſary to the preſervation of the individual, are always reproduced in a ſimilar manner in thoſe of the ſame ſpecies, and in the ſame direction; and this takes place in like manner in plants. The twining plants, for inſtance, ſuch as the hop, follow conſtantly, as they twiſt themſelves round a pole, the direction of the ſouth towards the weſt. If vegetables are obſtructed in exerciſing theſe motions, they ſoon periſh: if, for example, we untwiſt a twining plant which had taken its direction round a branch from the right to the left, and place it in a contrary direction, it withers in a ſhort time; eſpecially if it has not vigour enough to regain its natural ſituation. We bring death in the ſame manner on an animal, if we interrupt any of its vital motions. The law by which plants are forced to move in a particular manner is very powerful: When two twining plants, one of which is weaker than the other, for example two plants of woodbine, happen to encounter, they twiſt round each other, the one directing itſelf to the right and the other to the left: this laſt is always the weakeſt; it is forced to take a direction contrary to that which it would have done if it had not met with the other: but if, by any accident, theſe two twigs of woodbine ſhould come afterwards to be ſeparated, they both reſume their natural direction, that is, from right to left.

"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 will 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* (sundew). 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 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.

MOTTE (Anthony Houdart de la), an ingenious Frenchman, greatly distinguished by his writings in prose and verse, and by his literary contests with many eminent persons, was born at Paris in 1672. He wrote with very different success, no man having been more praised or more criticised than he was; his literary paradoxes, Motoualis. radoxes, his singular systems, in all branches of polite learning, and above all his judgment upon the ancients, which, like those of Perrault, were thought disrespectful and detracting, raised him up formidable adversaries. Racine, Boileau, Rousseau, and Madam Dacier, were among the number of those who made it their business to avenge antiquity on a man who, with more wit than genius or learning, assumed a kind of dictatorial authority in the province of belles lettres. He became blind in the latter years of his life, and died in 1731. He wrote a great deal in epic poetry, tragedy, comedy, lyric, pastoral, and fables; besides a vast variety of discourses, critical and academical, in prose. A complete edition of all his works was published in 11 vols 8vo, in 1754; though, as has been said of our Swift, his reputation had been better consulted by reducing them to three or four.

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 Mr Volney in his Travels, vol. ii. p. 84.

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 Hejira arose among the Arabs, respecting the successors of Mahomet, is the cause of an irreconcileable 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:

"Those 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. Motoualis.

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 present century; it is not even to be found in the maps of Donville: 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 Balbek 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 fantly laboured to deftroy them. His perfecution forced them in 1784 to a reconciliation with the Drufes, and to enter into an alliance with the Emir Youfef. Though reduced to lefs than 700 armed men, they did more in that campaign than 15,000 or 20,000 Druzes and Maronites affembled at Dair-el-Kamar. They alone took the ftrong fortrefs of Mar-Djebaa, and put to the fword 50 or 60 Epirots who defended it. But the mifunderftanding which prevailed among the chiefs of the Druzes having rendered abortive all their operations, the pacha has obtained poffeffion of the whole valley, and the city of Balbek itfelf. 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 foil, it is probable they will be totally annihilated, and even their very name become extinct.

MOTTEUX (Peter), a French gentleman, born and educated at Rouen in Normandy. Coming over to England on account of the perfecution of the Proteftants, he became a confiderable trader in London, kept an Eaft-India warehoufe in Leadenhall-ftreet, and had a genteel place in the general poft-office, relating to foreign letters, being mafter of feveral languages. He was a man of wit and humour; and acquired fo perfect a maftery of the Englifh language, that he not only was qualified to oblige the world with a very good tranflation of Don Quixote, but alfo wrote feveral fongs, prologues, epilogues, &c. and what was ftill more extraordinary, became a very eminent dramatic writer in a language to which he was not a native. He was at laft, in the year 1718, found dead in a diforderly houfe, on his birth-day, when he completed his 58th year.

MOTTO, in armoury, a fhort fentence or phrafe, carried in a fcroll, generally under, but fometimes over, the arms; fometimes alluding to the bearing, fometimes to the name of the bearer, and fometimes containing whatever pleafes the fancy of the devifer.

MOUCHO MORE. See AGARICUS.

MOVEABLE, in general, denotes any thing capable of being moved.

MOVEABLE-Feafts, are fuch as are not always held on the fame day of the year or month; though they be on the fame day of the week. See FEASTS.

Thus, Eafter is a moveable feaft, being always held on the Sunday which falls upon or next after the firft full moon following the 21ft of March.

All the other moveable feafts follow Eafter, *i.e.* they keep their diftance from it; fo that they are fixed with refpect thereto.

Such are Septuagefima, Sexagefima, Afh-Wednefday, Afcenfion-day, Pentecoft, Trinity-Sunday, &c. which fee under their proper articles, SEPTUAGESIMA, &c.

MOVEABLE-Subject, in law, any thing that moves itfelf, or can be moved; in contradiftinction to immoveable or heritable fubjects, as lands, houfes, &c.

MOVEMENT, MOTION, a term frequently ufed in the fame fenfe with automaton.

The moft ufual movements for keeping time are watches and clocks: the firft are fuch as fhow the parts of time, and are portable in the pocket; the fecond, fuch as publifh it by founds, and are fixed as furniture. See HOROLOGY.

MOVEMENT, in its popular ufe among us, fignifies all the inner work of a watch, clock, or other engine, which move, and by that motion carry on the defign of the inftrument.

The movement of a clock or watch is the infide, or that part which meafures the time, ftrikes, &c. exclufive of the frame, cafe, dial-plate, &c.

The parts common to both of thefe movements are, the main-fpring, with its appurtenances; lying in the fpring box, and in the middle thereof lapping about the fpring-arbor, to which one end of it is faftened. A-top of the fpring arbor is the endlefs-fcrew and its wheel; but in fpring-clocks, this is a ratchet-wheel with its click, that ftops it. That which the main-fpring draws, and round which the chain or ftring is wrapped, is called the *fufy*; this is ordinarily taper; in large works, going with weights, it is cylindrical, and called the *barrel*. The fmall teeth at the bottom of the fufy or barrel, which ftop it in winding up, is called the *ratchet*; and that which ftops it when wound up, and is for that end driven up by the fpring, the *garde-gut*. The wheels are various: the parts of a wheel are, the hoop or rim; the teeth, the crofs, and the collet or piece of brafs foldered on the arbor or fpindle 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 fpindle are called *pivots*; and the guttered wheel, with iron fpikes at bottom, wherein the line of ordinary clocks runs, the *pulley*. We need not fay any thing of the hand, fcrews, wedges, ftops, &c. See WHEEL, FUSY, &c.

Perpetual MOVEMENT. Many have attempted to find a perpetual movement, but without fuccefs; and there is reafon to think, from the principles of mechanics, that fuch a movement is impoffible: for though, in many cafes of bodies acting upon one another, there is a gain of abfolute motion, yet the gain is always equal in oppofite directions; fo that the quantity of direct motion is never increafed.

To make a perpetual movement, it appears neceffary that a certain fyftem of bodies, of a determined number and quantity, fhould move in a certain fpace for ever, and in a certain way and manner; and for this there muft be a feries of actions returning in a circle, otherwife the movement will not be perpetual; fo that any action by which the abfolute quantity of force is increafed, of which there are feveral forts, muft have its correfponding counter-action, by which the gain is deftroyed, and the quantity of force reftored to its firft ftate.

Thus by thefe actions there will never be any gain of direct force to overcome the friction and refiftance of the medium; fo that every motion being diminifhed by thefe refiftances, they muft at length languifh and ceafe.

MOUFET (Thomas), a celebrated Englifh phyfician, was born at London, and practifed medicine with great reputation. Towards the latter end of his life he retired to the country, and died about the year 1600. This phyfician is known by a work which was begun by Edward Wotton, and printed at London in 1634, 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 mantains 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 *Lii-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.—Near the gates are two magnificent tombs of the first emperors of the reigning family, built in the Chinese manner, and surrounded by a thick wall furnished with battlements; the care of them is entrusted to several Mantchew mandarins, who at stated times are obliged to perform certain usual ceremonies; a duty which they acquit themselves of with the same marks of respect and veneration as if their masters were still living.

MOVING PLANTS. See HEDYSARUM, TREMELLA, and MIMOSA.

MOULD, or MOLD, in the mechanic arts, &c. a cavity artfully cut, with 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 glebe dug out of mines, have each 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 merchandizes 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 cap 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 beat 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 to 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-

Mould. holes by which counterfeit coins and medals 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, whereof the mould is composed, are rejoined, the melted brass is run.

Moulds of letter-founders are partly of steel and partly 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 silver 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 called *caliber*.

Moulds, among plumbers, are the tables whereon they cast their 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. Mould, Mouldiness.

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 caddles, 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 guts 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 contain 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, however, far from being an homogeneous substance; being compounded of decayed animal and vegetable matters, calcareous, argillaceous, and siliceous earths, all mixed together in various proportions, and with the different degrees of moisture, constituting all the varieties of soil throughout the world. All kinds of mould contain some inflammable substance, which remains in them from the decayed animals and vegetables; and they are more or less black in proportion to the quantity of phlogiston they contain. The black mould yields by distillation a volatile alkali and oil.

MOULDINESS, a term applied to bodies which corrupt in the air, from some hidden principle of humidity therein; and whose corruption shows itself by a certain white down or lanugo on their surface, which viewed through a microscope appears like a kind of meadow, out of which arise herbs and flowers, some only in the bud, others full-blown, and others decayed; each having its root, stalk, and other parts. See Mucor.

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 ax.

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.

MOULIN (Charles du), a celebrated civilian, and one of the moſt learned men of the 16th century, was born of a conſiderable family at Paris in 1500, and acquired great reputation by his ſkill in the law. He publiſhed many works, which have been collected together, and printed in five volumes folio; and are juſtly conſidered as the moſt excellent works that France has produced on the ſubject of civil law. He died at Paris in 1566.

Moulin (Peter du), a Proteſtant divine, believed to be of the ſame family with the former, was born in 1568. He taught philoſophy at Leyden; and afterwards became chaplain to the princeſs of Navarre. At the king of England's deſire he came hither in 1615, and prepared a plan for the union of the Proteſtant churches. The univerſity of Leyden offered him a profeſſorſhip of divinity in 1619: but he refuſed it, and preſided at the ſynod held by the Calviniſts at Alais in 1620. Some time after, being informed by Mr Drelincourt that the French king reſolved to have him thrown into priſon, he retired to Sedan, where the duke de Bouillon made him profeſſor of divinity, and miniſter in ordinary. He was employed by the Calviniſts in the moſt important affairs; and died at Sedan in 1658. His principal works are, 1. The anatomy of Arminianiſm. 2. A treatiſe on repentance, and the keys of the church. 3. The Capuchine, or the hiſtory of thoſe monks. 4. The buckler of faith, or a defence of the reformed churches. 5. The judge of controverſies and traditions. 6. The anatomy of the maſs. 7. The novelty of Popery.

Peter du Moulin, his eldeſt ſon, was chaplain to Charles II. of England, and prebendary of Canterbury, where he died in 1684, aged 84. He wrote, 1. The peace of the ſoul, in French. 2. *Clamor regii ſanguinis;* which Milton, by miſtake, attributed to Alexander Morus. 3. A defence of the Proteſtant religion, in Engliſh.

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, and 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, and capital of Bourbonnois. The houſes of the Chartreux, and that of the Viſitation, are magnificent. It carries on 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, and the north ſide of South Moulton, of whoſe hundred it is a member, and anciently gave name to it, as the latter does now. It has two fairs, on Tueſday after May 11. and on Nov. 12.

Moulton (South), on the ſame ſtream, 182 miles from London. This, as well as the former, was anciently royal demeſne. This corporation, which once 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. Here is a market on Saturdays; and fairs are held the firſt Tueſday after May 11. and Nov. 12. Their chief manufactures are ſerges, ſhalloons, and felts; and great quantities of wool brought from the country are bought up here every Saturday. In the year 1684, a merchant of London, a native of this town, built and endowed a free ſchool here; beſides which, here is a charity-ſchool.

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 their 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 every thing adjoining to it, and commanding all the ſurrounding places: It is commonly full of inequalities, cavities more or leſs expoſed, and ſtrata half laid open.

This name is likewiſe given to a chain of mountains; as when we ſpeak of Mount Atlas in Africa; Mount Caucaſus, which begins above Colchis and ends at the Caſpian ſea; the Pyrenean mountains, which ſeparate France from Italy; and the Apennine mountains, which run through the whole of Italy.

Thoſe who have ſurveyed the earth in general, and ſtudied

ſtudied nature on a grand ſcale, have conſtantly been ſtruck with admiration and aſtoniſhment at the ſight of ſuch majeſtic eminences, which extending in different ways, ſeem to rule over the reſt of the globe, and which preſent to the beholder a ſpectacle equally magnificent and intereſting. In them it has been ſuppoſed we muſt ſearch for a ſolution of the important problem regarding the creation of the world.

Naturaliſts reckon ſeveral kinds of mountains: we ſhall find that theſe elevations of the earth have not all the ſame origin, nor date their commencement from the ſame era.

1. Thoſe mountains which form a chain, and which are covered with ſnow, may be conſidered as *primitive* or antediluvian. They are like majeſtic bulwarks ſcattered on the ſurface of the globe, and greatly exceed the other mountains in height. In general, their elevation is very ſudden, and their aſcent very ſteep and difficult. Their ſhape is that of a pyramid crowned with ſharp and prominent rocks, on which no verdure is to be ſeen, but which are dry, naked, and as it were ſtripped of their ſoil, which has been waſhed away by the rains, and which preſent an awful and horrible aſpect, ſufficient to impreſs the coldeſt imagination with terror. Theſe primitive mountains, which aſtoniſh the eye, and where wind only reigns, are condemned by nature to perpetual ſterility. At the foot of them we frequently find paths leſs ſteep and winding than when we aſcend to a greater height. They every where preſent thundering caſcades, frightful precipices, and deep valleys. The depreſſions and excavations correſpond with the quantity of water, the motion of which is accelerated in its fall, and which ſometimes produces a total ſinking or an inclination of the mountain. The wrecks to be found at the foot of moſt peaks, ſhow how much they have ſuffered from the hand of time. Nothing meets the eye but enormous rocks, heaped in confuſion on one another, which prevent the approach of the human race. On the ſummits of theſe mountains or high eminences, which are only a ſeries of peaks frequently detached from one another, the prominent rocks are covered with eternal ſnow and ice, and ſurrounded with floating clouds which are diſperſed into dew. In a word, the rugged cliffs oppoſe an inacceſſible rampart to the intrepidity of man; and nature exhibits a picture of diſorder and decay (A). No ſhells or other organized marine bodies are to be found in the internal part of theſe primitive mountains; and though ſearch has been made, by digging, on the tops of the Alps and the Pyrenees, no ſubſtances of this nature have yet been diſcovered except on the ſides near the baſe. Nothing is to be met with but continued rocks, caverns dug by the hand of nature, and abounding in cryſtallizations of great beauty, with various minerals. The ſtone of which they conſiſt is an immenſe maſs of quartz, ſomewhat varied, which penetrates into the bowels of the earth in a direction almoſt perpendicular to the horizon. We find no calcareous ſpar but in the fiſſures or rents which have ſome extent and an evident direction; and at great depths we find new parts as it were, or, in other words, the primitive ſtate of things. All primitive mountains furniſh proofs of theſe aſſertions. Of this kind in Europe are the Pyrenees, the Alps, the Apennines, the mountains of Tirol, the mountain of the giants in Sileſia, the Carpathian mountains, the mountains of Saxony, thoſe of Norway, &c. In Aſia we find the Riphean mountains, Mount Caucaſus, Mount Taurus, and Mount Libanus; in Africa, the mountains of the moon; and in America the Apalachian mountains, and the Andes or Cordilleras. Many of the latter have been the ſeats of volcanoes.

2. Another kind of mountains are thoſe which are either detached, or ſurrounded with groups of little hills, the ſoil of which is heaped up in diſorder, and the cruſt gravelly and confuſedly arranged together. Theſe are truncated or have a wide mouth in the ſhape of a funnel towards the ſummit, and which are compoſed of, or ſurrounded with, heaps of calcined and half vitrified bodies, lava, &c. This claſs of mountains appear to have been formed by different ſtrata raiſed up and diſcharged into the air, upon occaſion of the eruption of ſome ſubterraneous fire. The iſles of Santorin, Monte-Nuovo, Mount Etna, Adam's Peak in the iſland of Ceylon, the peak of Teneriffe in the Canary Iſlands, and many others, have been formed in this manner. When very high mountains of this kind are covered with ſea-ſhells, we may conſider their ſummits as having once conſtituted a part of the bottom of the ocean. A number of theſe mountains have been formed in the memory of man; and preſent nothing to the view but diſordered ruins, confuſed maſſes, parts heaped together in the greateſt irregularity, and productions formed by eruptions or by the falling in of the earth. When a mountain of this

(A) It is obſerved, ſays the Abbé Palaſſou, that at the foot of the Pyrenean mountains, the ſoil of ſeveral countries conſiſts wholly of the mud and rubbiſh depoſited by the rivers which deſcend from them. According to Herodotus, a great part of Egypt was in like manner formed by the different ſubſtances brought thither by the Nile: Ariſtotle calls it the work of the Nile; and on this account the Ethiopians boaſted that Egypt was indebted to them for its orign. The inhabitants of the Pyrenees might ſay the ſame thing of almoſt the whole tract of country ſituated along the northern chain from the ocean to the Mediterranean, forming that kind of iſthmus which ſeparates the two ſeas. The ſurface of our globe is thus in a ſtate of perpetual change; the plains are elevated, the mountains are levelled, and water is the principal agent employed by nature in theſe great revolutions. Time alone is wanting to verify the ſaying of Louis XIV. to his grandſon: Poſterity will one day be able to ſay, "The Pyrenees are no more." The period, however, muſt neceſſarily be very diſtant. M. Genſanne, from obſervations which he thinks well-founded, concludes, that theſe mountains are lowered about ten inches every century. Suppoſing them therefore to be 1500 toiſes above the level of the ſea, and always ſuſceptible of being lowered in the ſame degree, a million of years would elapſe before their total deſtruction.

Mountain. this kind is connected with the land, and advances farther into the sea than the adjoining country, it is then termed a *Cape, Head*, or *Promontory;* such as the Cape of Good Hope at the southern extremity of Africa. Mountains of the second rank are commonly more easy of access. Dr Haller observes, that the angle formed between their base and their declivity is larger; that they have fewer springs; and that their plants are different from those of the Alps. The peasants in Swisserland, he tells us, are acquainted with the difference betwixt these two kinds of mountains.

3. Those mountains, whether arranged in a group or not, the earth or stone of which is disposed in strata more or less regular, and consisting of one or more colours and substances, are produced by the substances deposited slowly and gradually by the waters, or by soil gained at the time of great floods. We daily see little hills formed in this manner, which are always of a small height compared with those of the first order, and round in the top, or covered with soil frequently forming a pretty flat and extensive surface. We there find likewise sand and heaps of round pebbles like such as have been worn by the waters. The internal part of these mountains consists of a heap of strata almost horizontal, and containing a prodigious quantity of shells, marine bodies, and fish-bones. Although these mountains formed by strata sometimes degenerate into little hills, and even become almost flat, they always consist of an immense collection of fossils of different kinds, in great preservation, and which are pretty easily detached from their earthy bed whether harder or softer. These fossils, consisting of marine shells intermixed and confounded with heaps of organised bodies of another species, present a picture of astonishing disorder, and give indubitable indications that some extraordinary and violent current has confounded and accumulated in the greatest disorder and precipitation foreign substances and shells of various kinds. These, removed from their natural and original place, by their union form an elevation and a mountain, which are in fact nothing but a composition of the wrecks of bodies formerly organised. All these phenomena seem to prove, that most of these mountains chiefly owe their origin to the sea, which once covered some parts of our continent, now left dry by its retreat. (According to the principles of this system, Anaxarchus explained the formation of the mountains of Lampsacus). In these mountains we likewise find wood, prints of plants, strata of clay, marl, and chalk, different beds of stone succeeding one another, such as slate, marble which is often full of sea shells, lime-stone which appears to be wholly formed from the wreck of shells, plaster-stone, entire strata of ochre, and beds of bitumen, mineral salt, and alum.

The strata of mountains which are lower and of a recent date, or formed by recent accidents, sometimes appear to rest upon, or to take their rise from, the sides of primitive mountains which they surround, and of which they in some measure form the first steps in the ascent; and they end by being insensibly lost in the plains. With respect to the irregularity of some strata in recent mountains, it is owing to violent and sudden inundations, to torrents, and to local revolutions which have produced angles, leaps, and sinkings down of the strata. It is generally observed, Mountain. however, that the strata in mountains are exactly parallel to each other throughout all their different windings. M. Desmarest remarks, that in two mountains which by their brows form the hollow of a valley, we find strata of earth or stone of the same kind, and disposed and arranged in the same manner. We have already shown, under the article Earth, why the strata of recent mountains are not every where the same in number and thickness. Some strata are only a quarter of an inch thick, others are more than ten feet: in some places we find 30 or 40 beds succeeding each other, in others only three or four. In recent mountains composed of strata, M. Lehmann observes, the lowest stratum is always pit-coal; and this rests on a coarse and ferruginous gravel or sand. Above the pit-coal we find strata of slate, schistus, &c. and the upper part of the strata is constantly occupied by limestone and salt-springs. It is easy to perceive the utility of these observations, when we intend to work for these minerals; and by attending to the distinction which has been made of the different mountains of the same kind, we may know the nature of those substances which upon search we may expect to find in them. The specimens which appear without, indicate what substances are concealed within.

In general, it has been observed, that when two or more mountains run parallel to each other, the salient angles correspond with the receding ones; and these angles are sharper and more striking in deep and narrow valleys. Dr Haller observes, that there are many places in the Alps and in mountains, where two chains are prolonged contrary to the axis of the valley, and join so as only to leave as much space as is necessary for the discharge of the water. In other places the mountain is continued, for instance, to the north, and discontinued to the south, where it opens into a valley. In others, the two chains retire and form a bend on each side, the concavity of which fronts the axis: hence arise valleys almost round and completely united.

It is likewise worthy of observation, that primitive mountains which form vast chains are commonly connected together; that they succeed one another for a space of several hundred leagues; and cover with their principal branches, and their various collateral ramifications, the surface of continents. Father Kircher and many others have observed, that the principal chain generally runs from south to north, and from east to west. The Cordilleras in the New world, Dr Haller observes, extend from north to south; the Pyrenees have nearly the same direction; the Alps run from east to west; and there must be a chain of this kind in Africa, for the great rivers in that quarter of the world run to the east on the one side and to the west on the other. The chain of Thibet appears to be parallel to the Alps; and, from the great length of the road through the snows, it may be inferred that the mountains of Thibet have a very great elevation. Those mountains which, strictly speaking, are the principal roots, and the capital point of elevation and division, present very considerable masses, both with regard to their height and their size or extent: they commonly occupy and traverse the centre of continents.

Those

Mountain. Those which have a smaller elevation arise from these principal chains; they gradually diminish in proportion to their distance from their root, and at length wholly disappear either on the sea-coast or in the plains. Others are continued along the shore of the sea; their chain is interrupted only to make room for the waters of the ocean, under the bed of which the base of these mountains extends; and it again occurs in islands, which perpetuate their continuation till the whole chain re-appears. The highest mountains and the greatest number of islands are generally found between or near the tropics, and in the middle of the temperate zones; while the lowest are adjacent to the poles; though this does not always hold good without exception. M. Buache, a member of the Academy of Sciences at Paris, has laid down a system of physical geography concerning the structure of the terraqueous globe, considered with respect to the great chains of mountains which cross the continents and seas from pole to pole, and from east to west. According to this system, there is an uninterrupted series of mountains and high grounds which divide the earth into four declivities, from which the rivers descend. These chains of mountains are continued from one continent to another under the ocean; and the islands which are observed in it, are as it were the summits of the mountains. M. Buache's work is entitled *Tables et Cartes de la Geographie physique*. But that this system, with regard to the islands, must be erroneous, will appear evident from our article EARTH.

In the *Journal de Physique* for May 1779 we are informed, that Dr Pallas, who has travelled through Siberia, and almost all the Russian empire in the north of Asia, thinks he has discovered the insufficiency of the principal systems hitherto proposed to account for the formation of mountains. This accurate observer has prosecuted the study of mountains by traversing immense regions, and visiting as it were the secret work-shops of nature in almost the fourth part of our hemisphere. He has not trusted to the vague reports of others, but from observations which he himself had occasion to make for the space of ten years. He has, in a work entitled *Observations on Mountains*, explained both the direction of the northern chains, and the particular composition of each. He is thence led to make an ingenious conjecture concerning the formation of the principal groups of mountains, and concerning the irregular distribution and the figure of the old continent. Under the article EARTH an account is given of the different systems which have been formed concerning the formation and configuration of our globe. To establish a general system, it would perhaps be necessary to have travelled over the whole earth; and to have studied all the chains of mountains, their direction, and particular composition, for a long series of years. Thus very little attention is required to perceive, in the different systems mentioned under the article EARTH, the influence of climate and local situation. Burnet, Whiston, and Woodward, who were acquainted only with England, where very few great chains of mountains are to be seen, where they are almost all insulated or detached, and where the soil of extensive plains is formed by horizontal and pretty regular strata, naturally thought that these general and concentric strata were to be found all around the globe, and considered mountains as nothing but the wrecks of these strata, either raised or swallowed up by the violence of the waters. Scheuchzer, who studied among the steep mountains of Switzerland, amid rocks of granite, petrosilex, jasper, and hard stones, and who found nothing on the most elevated plains of the Alps but strata of similar substances, had recourse to the power of the Almighty, who broke in pieces these strata, and elevated their splinters into the form of mountains. Ray, Morro, and Stenon, who saw nothing all around them but burning mountains and traces of volcanic productions—deceived by the constitution of the hills of Italy, which are almost all formed of lava, pozzolana, and basaltic substances, and by the origin of the Monte Nuovo, which rose up almost before their eyes, have considered great mountains as formed by a cause which undoubtedly has a secondary, but to which they have ascribed a primary and principal, influence. M. de Buffon, who delineated nature at the foot of the utmost extremity of the French Alps, and who perceived them gradually attain a greater elevation as they advanced towards the southern parts of France and towards Savoy, concluded from his theory, and in support of the same theory, that the highest mountains were near the equator; that they became lower towards the poles; and that, being produced by the flux and reflux of the sea, they were formed of the substances which it deposited.

We shall now lay before our readers the geographical description of the directions of the principal mountains, and of that kind of connection which subsists betwixt them. This description differs from that of M. Buache, and may be read with a map of the world before us.

M. Buache places the most elevated points of the great chains of mountains under the equatorial line: but, according to the author whom we follow in this place, the fullest and most continuous lands, and perhaps likewise the most elevated, are to be found at a distance from the equator, and towards the temperate zones. If, in fact, we survey the globe's surface, we will not be able to perceive that chain of mountains, which running from east to west, and dividing the earth into two portions, ought again to meet. On the contrary, extensive plains seem to accompany the line through almost its whole extent. In Africa, the deserts of Nigritia and those of Upper Ethiopia, are on the one side of the line; and on the other are the sandy plains of Nicoco, Caffraria, Monoemugi, and Zanguebar. From the eastern shores of Africa to the Sunda islands, is a space of 1500 leagues of sea with almost no islands, except the Laccadive and Maldive islands; most part of which have little elevation, and which run from north to south. From the Molucca islands and New Guinea, to the western borders of America, the sea occupies a space of 3000 leagues. Though Chimboraço and Pichincha in America, the two highest mountains which have been measured, are near and even under the line, yet from this no conclusion can be drawn; because on one side these mountains run in a direction not parallel to the equator; the Andes or Cordilleras attain a greater elevation as they remove from the equator towards the poles; and a vast plain is found exactly under the line, between the Oroonoko and the river of the Amazons. Besides, the latter river, which

Mountain. which takes its rise in the province of Lima about the 11th degree of south latitude, after crossing the whole of South America from west to east, falls into the ocean exactly under the equator. This shows that there is a descent for the space of 12 degrees or 300 leagues. From the mouth of the river of the Amazons, to the western shores of Africa, the sea forms another plain of more than 50 degrees.

From the few certain facts and accurate observations which we have received from well informed travellers, we might almost affirm that the most elevated land on our globe is situated without the tropics in the northern and southern hemispheres. By examining the course of the great rivers, we in fact find that they are in general discharged into three great reservoirs, the one under the line, and the other two towards the poles. This, however, we do not mean to lay down as a thing universally true; for it is allowed, that, besides the two elevated belts, the whole surface of the earth is covered with innumerable mountains, either detached from one another or in a continued chain. In America, the Oronooko and the river of the Amazons run towards the line, while the river St Lawrence runs towards the 50th degree of north latitude, and the river de la Plata towards the 40th degree of south latitude. We are still too little acquainted with Africa, which is almost all contained within the tropics, to form any accurate conclusions concerning this subject. Europe and Asia, which form only one great mass, appear to be divided by a more elevated belt, which extends from the most westerly shores of France to the most easterly of China, and to the island of Sagaleen or Anga-hata, following pretty nearly the 50th degree of north latitude. In the new continent, therefore, we may consider that chain where the Mississippi, the river St Lawrence, the Ohio, and the river de los Estrechos, take their rise, as the most elevated situation in North America: whence the Mississippi flows towards the equator, the river St Lawrence towards the north-east, and the rest towards the north-west. In the old continent, the belt formerly mentioned, and to which we may assign about 10 degrees in breadth, may be reckoned from the 45th to the 55th degree of north latitude: for in Europe the Tagus, the Danube, the Dnieper, the Don, and the Volga, and in Asia the Indus, the Ganges, the Meran, the Mecon, the Hoang-ho, and the Yantg-tse-Kiang, descending as it were from this elevation, fall into the great reservoir between the tropics; whilst towards the north the Rhine, the Elbe, the Oder, the Vistula, the Obi, the Jenisei, the Lena, the Indigirka, and the Kowyma, are discharged into the northern reservoir.

Judging from those mountains the height of which has been calculated, and from the immense chains with which we are acquainted, we may infer that the highest mountains are to be found in this elevated belt. The Alps of Swisserland and Savoy extend through the 45th, the 46th, and the 47th degrees. Among them we find St Gothard, Furca, Bruning, Russ, Whiggis, Scheideck, Gunggels, Galanda, and lastly that branch of the Swiss Alps which reaches Tirol by the name of Arlenberg and Arula. In Savoy, we meet with Mount Blanc, the Peak of Argentiere, Cornero, Great and Little St Bernard, Great and Little Cenis, Coupeline, Servin, and that branch of the Savoyard Alps which proceeds towards Italy through the duchy of Aost and Montferrat. In this vast heap of elevated peaks, Mont Blanc and St Gothard are particularly distinguished. The Alps, leaving Swisserland and Savoy, and passing through Tirol and Carniola, traverse Saltzbourg, Stiria, and Austria, and extend their branches through Moravia and Bohemia, as far as Poland and Prussia.—Between the 47th and 48th degrees, we meet with Grimming the highest mountain of Stiria, and Priel which is the highest in Austria. Between the 46th and 47th degrees, the der Bacher and the der Reinschnicken, form two remarkable chains. The upper one, which traverses the counties of Trencsin, Arrava, Scepus, and the Kreyna, separates Upper Hungary from Silesia, Little Poland, and Red Russia; the inferior one traverses Upper Croatia, Bosnia, Servia, and Transilvania, separates Lower Hungary from Turkey in Europe, and meets the upper chain behind Moldavia, on the confines of Little Tartary. In these mountains are situated the rich mines of Schemnitz.

To form a general idea of the great height of this Alpine belt, it is necessary only to remark, that the greatest depth of the wells at Schemnitz is 200 toises; and yet it appears, from the barometrical calculations of the learned M. Noda, that the greatest depth of these mines is 286 toises higher than the city of Vienna. The granito-argillous mountains of Schemnitz, and of the whole of this metallic district, are inferior, however, to the Carpathian mountains. Mount Krivany in the county of Arrava, and the Carpathian mountains between Red Russia and the Kreyna, appear by their great elevation to rule over the whole of the upper Alpine chain. In the inferior chain we likewise meet with mountains of an extraordinary height; among others, Mount Mediednik, which gives its name to a chain extending far into Bosnia; and Mount Hemus, celebrated even among the ancients. In short, this extensive chain reaches into Asia, and is there confounded with another chain no less famous, which, following exactly the 50th degree of latitude, runs through the whole of Asia. This chain of mountains is described by Dr Pallas in the work above-mentioned; and we shall now trace its course in company with this intelligent observer.

This author places the head of the mountains of Oural, between the sources of the Taik and the Bielaïa, about the 53d degree of latitude, and the 47th of longitude. Here the European Alps, after having traversed Europe, and sent off various branches which we shall afterwards examine, lose their name, which is changed into that of the Ouralic or Uralian mountains, and begin their course in Asia. This lofty chain, which separates Great Bulgaria from the desarts of Ischimska, proceeds through the country of the Eleuths, follows the course of the river Irtis, approaches the lake Teleskaia, and afterwards forms a part of the same system of mountains with the Altaic chain. There they give rise to the Oby, the Irtis, and the Jenisei, which begin their course about the 50th degree of north latitude, and fall into the Frozen Ocean.

The Altaic chain, after having embraced and united all the rivers which supply the Jenisei, is continued under

Mountain. under the name of *Saianes*, without the ſmalleſt interruption, as far as the Baikal lake. The extenſion of this chain to the ſouth forms that immenſe and elevated plain which is loſt in Chineſe Tartary, which may be compared with the only plain in Quito, and which is called *Gobi* or *Chamo*. The Altai afterwards interpoſing between the ſource of the Tchikoi and of the rivers which ſupply the Amur or Sagaleen, riſes towards the Lena, approaches the city Jakuck beyond the 60th degree of latitude, runs from that to the ſea of Kamtſchatka, turns round the Ochockoi and Penſink gulphs. joins the great marine chain of the Kurile iſles near Japan, and forms the ſteep ſhores of Kamtſchatka, between the 55th and 60th degrees of latitude. Such is the direct courſe of the high mountains conſtituting the belt which, we imagine, is to be found in the northern hemiſphere, and which, after becoming lower, paſſing under the ſea, and forming by means of their elevated peaks that archipelago of iſlands which derives its name from the unfortunate Bhering, again riſe and enter North America, on the weſtern ſide, about the Straits of Anian. After running in the ſame parallel, and giving riſe to the Ohio, the Riviere-Longue, the river St Lawrence, and the Miſſiſſippi, they are loſt in Canada. From the eaſtern ſhores of America to the weſtern ſhores of Europe, we find a vaſt interruption. Perhaps the chain was at firſt continued completely round the globe; but extraordinary revolutions, by ſeparating the old and new continents, may have occaſioned this diviſion, and left nothing but the Azores and ſome detached points as a monument of what formerly exiſted, till we come to the Britiſh iſles.

Before we proceed to inquire whether a belt of a ſimilar elevation exiſts in the ſouthern hemiſphere, we may remark thoſe branches and ramifications which the great northern Alpine belt ſends forth both towards the equator and the antarctic pole. Theſe new chains, which gradually become lower as they approach the boundary towards which they tend, appear a ſufficient proof that the equator is not the moſt elevated part of the earth.

The European Alps produce three principal chains, which run towards the equator, and ſome ſmaller ones running towards the pole. The firſt ſouthern chain is ſent out through Dauphiné; traverſes Vivarais, Lyonnois, Auvergne, Cevennes, and Languedoc; and, after joining the Pyrenees, enters Spain. There it divides into two or three ramifications, one of which runs through Navarre, Biſcay, Arragon, Caſtile, Marche, and Sierra Morena, and extends into Portugal. The other, after traverſing Andaluſia and the kingdom of Granada, and there forming a number of ſierras, again makes its appearance, beyond the Straits of Gibraltar, in Africa, and coaſts along its northern ſhores under the name of *Mount Atlas*.—The ſecond principal chain of the Alps paſſes out through Savoy and Piedmont; ſpreads its roughneſſes over the ſtates of Genoa and Parma; forms the belt of the Apennines; and after frequently changing its name, and dividing Italy into two parts, terminates in the kingdom of Naples and in Sicily, producing volcanoes in every part of its courſe. The third chain is ſent off from Hungary, and ſcatters innumerable mountains over all Turkey in Europe, as far as the Morea and the Archipelago at the bottom of the Mediterranean ſea. The northern branches, though ſmaller at firſt, are no leſs clearly defined; and ſome of them even extend their ramifications as far as the Frozen Ocean. An Alpine branch, iſſuing from Savoy thro' the country of Gex, proceeds through Franche Comte, Suntgaw, Alſace, the Palatinate, and Veterabia.—Another iſſues from the territory of Saltzbourg, paſſes along Bohemia, enters Poland, ſends off a ramification into Pruſſia towards the deſerts of Waldow, and after having paſſed through Ruſſia is loſt in the government of Archangel.

The Aſiatic Alps ſend forth in like manner ſeveral branches both to the ſouth and north. The Ouralic mountains, between the ſources of the Bielaïa and the Jaik, produce three principal branches; the firſt of which, including the Caſpian Sea in one of its diviſions, enters Circaſſia through the government of Aſtracan, paſſes through Georgia under the name of *Caucaſus*, ſends a vaſt number of ramifications to the weſt into Aſiatic Turkey, and there produces the mountains Tſchilder, Ararat, Taurus, Argée, and many others in the three Arabias; while the other diviſion, paſſing between the Caſpian Sea and the lake Aral, penetrates through Choraſan into Perſia. The ſecond branch, taking a more eaſterly direction, leaves the country of the Eleuths; reaches Little Bucharia; and forms the ramparts of Gog and Magog, and the celebrated mountains formerly known by the name of *Caf*, which M. Bailly has made the ſeat of the war between the Dives and the Peris*. It traverſes the kingdoms of Caſgar and Turkeſtan, enters through that of Lahor into the Mogul territory, and, after giving riſe to the elevated deſert of Chamo forms the weſtern peninſula of India. While theſe two branches run towards the ſouth, the third branch of the Ouralic chain riſes towards the north, following almoſt the 79th degree of longitude, and forms a natural boundary between Europe and Aſia; without, however, bounding the immenſe empire of Ruſſia. This chain, after coming oppoſite to Nova Zembla, divides into two conſiderable branches. The one, running to the north-eaſt, paſſes along the Arctic ſhores; the other, proceeding towards the north-weſt, meets the northern European chain, traverſes Scandinavia in the ſhape of a horſeſhoe, covers the low-lands of Finland with rocks; and, as is obſerved by Dr Pallas, appears to be continued from the North Cape of Norway through the marine chain of Spitzbergen, ſcattering iſlands and ſhelves perhaps throughout the northern ocean, that, paſſing through the pole, it may join the northern and eaſtern points of Aſia and North America.

* *Lettres ſur les Atlantides*, let. 16.

The Ouralic, which in the country of the Mongols becomes the Altaic chain, proceeds towards the equator. After forming the mountains and caverns wherein, as we are told, the aſhes of the Mongol emperors of the race of Ghengis-Kan are depoſited, together with the vaſt plain of Chamo, conſiſting of arid ſand, and the frightful rocks and precipices of Thibet, which form the myſterious and deſert retreats of the Grand Lama, it croſſes the rivers Ava and Menan; contains in its ſubdiviſions the kingdoms of Ava, Pegu, Laos, Tonquin, Cochinchina, and Siam; ſupports the peninſula of Malacca; and overſpreads the Indian ocean with the iſles of Sonda, the Moluccas, and the Philippines. From the borders of the Baikal lake and of the province of Selinginſkoy, Mountain. ginſkoy, a branch is detached, which ſpreads over Chineſe Tartary and China, is continued into Corea, and gives riſe to the iſlands of Japan.

The great chain having extended to the north, near the city of Jakuck, upon the banks of the Lena, ſends off one of its branches to the north-weſt, which paſſing between the two Tunguſta, is loſt in marſhy grounds lying in the northern parts of the province of Jenniſſeiſkoy. The ſame chain, after it has reached the eaſtern part of Aſia, is loſt in the icy regions of the north about Nos-Tſchalatſkoy or the icy Promontory, and Cap Czuczenſkoy.

It will be more difficult, perhaps, to trace the elevated belt in the ſouthern hemiſphere beyond the tropic of Capricorn, than it has been to diſtinguiſh that towards the north. An immenſe extent of ocean ſeems to occupy the whole Antarctic part of the globe. The greateſt ſouth latitude of the old continent is not more than 34 degrees, and South America ſcarcely extends to the 55th degree. In vain has the enterpriſing Cook attempted to diſcover regions towards the pole: his progreſs was conſtantly interrupted by tremendous mountains and fields of ice. Beyond the 50th degree no land and no habitation is to be found. The iſlands of New Zealand are the fartheſt land in theſe deſert ſeas; and yet the ſouth cape of Taral-Poenamoo extends only to the 48th degree: We do not mention Sandwich-land, which is ſituated in the 58th degree, becauſe it is too ſmall and too low. It muſt be recollected, however, that according to the declarations of travellers, the Cordilleras become higher as they advance ſouthward to the Straits of Magellan; and that the Terra del Fuego, which lies in the latitude of 55, is nothing but a maſs of rocks of prodigious elevation. America, however, exhibits to our view elevated points, whence chains of mountains are diſtributed in different directions over the whole ſurface of the new continent. There muſt likewiſe be great reſervoirs, where the moſt remarkable rivers take their riſe, and from which they neceſſarily deſcend towards their mouth. In the ſouthern hemiſphere, this elevated belt is nearer the equator; and though it does not extend to the 50th degree, it is evidently to be met with and may be accurately traced between the 20th and 30th degrees. The high mountains of Tucuman and of Paraguay, which interſect South America about the 25th degree of latitude, may be conſidered as the American Alps. If we look into the map of the world, we will be able to diſtinguiſh an elevated belt all along this parallel. In Africa, Monomotapa and Caffraria are covered with very high mountains, from which pretty large rivers deſcend. In the Pacific Ocean, we find New Holland, New Caledonia, the New Hebrides, and the Friendly and the Society iſlands, under the ſame parallel. We may, therefore, with ſufficient propriety, diſtinguiſh this parallel by the name of the *Southern Alps*, as we have already diſtinguiſhed the elevated belt of the 50th degree of north latitude by that of the *Northern Alps*. In America, the Rio de la Plata, which after a courſe of 500 leagues falls into the ocean at the 3_th degree of ſouth latitude; the Pavana, which riſes from the mountains of the Arapes, and falls into the Plata at Corriente; the great number of rivers which flow into that of the Amazons, ſuch as the Paraba, which receives in its courſe the tribute of more than 30 other rivers; the Madera, the Cuchirara, the Ucayal, &c. &c. all deſcend from theſe ſouthern Alps. From theſe Alps likewiſe three conſiderable branches of mountains are detached, which go by the common name of *Andes* or *Cordilleras*.—The firſt branch, which extends towards the ſouth, and paſſes out from Paraguay through Tucuman, ſeparates Chili from theſe provinces and from Chimito, and is continued through the Terra Magellanica as far as Terra del Fuego. The ſecond branch, directing its courſe towards the equator, traverſes Peru, in vain endeavouring to conceal treaſures which the avarice of men has taught them to diſcover in its bowels; bounds the Spaniſh Miſſions; enters Terra Firma thro' Popayan; and unites South and North America by the iſthmus of Panama The third diviſion, iſſuing from Paraguay through Guayra and the territory of Saint-Vincent, traverſes Brazil, diſtributes ramifications into Portugueſe, French, and Dutch Guiana, croſſes the Oroonoko, forms the mountains of Venezuela, and near Carthagena meets the ſecond branch coming from Popayan.

We have already ſuppoſed, that the elevated belt of North America was ſituated about the 45th degree of north latitude; and there we imagined we recognized the continuation of the northern Alps of the old continent. This chain likewiſe ſends forth conſiderable branches on both ſides. One of them is detached acroſs the ſources of the Miſſiſſippi, the Belle-Riviere, and the Miſſouri, and at the entrance of New Mexico divides, in order to form California to the weſt, and the Apalachian mountains to the eaſt.—Thence proceeding through New Biſcay, the audience of Guadalaxara, Old Mexico, and Guatimala, it meets at Panama the ſouthern branch, which is part of the Alps of Paraguay. The ſecond branch, following the courſe of the Miſſiſſippi, ſeparates Louiſiana from Virginia; ſerves as a bulwark to the United States of America; forms the Apalachian mountains in Carolina; and at laſt, traverſing Eaſt Florida, incloſes the Gulph of Mexico with the Great and Little Antilles. In the north, we can trace the branches of the elevated belt; on one ſide obſerve them proceeding towards Canada, directing their courſe through Labrador to Hudſon's Straits, and at length confounded with the rocks of Greenland, which are covered with eternal ſnow and ice. On the other ſide, we ſee them riſing through the country of the Aſſinipoels and the Kriſtinos, as far as Michinipis and the northern Archipelago.

We have thus traced the directions of the great chains of mountains. There are certain projecting and pretty ſenſible points on the globe, which appear to ſupply every region with great rivers and high mountains. The Alps of Switzerland and Savoy in Europe, the union of the Ouralic mountains in Aſia, (B) the Andes of Tucuman and Paraguay in South America, and the high countries, whence the Miſſiſſippi,

(B) Theſe M. Bailly conſiders as the moſt elevated art of the globe. *Lettres ſur les Atlantides*, p. 236

Mountain. ſippi, the river Saint Lawrence, and the Belle Riviere deſcend, may be conſidered as ſome of theſe; though M. Buache places them much nearer the equator, and even under the line. But his object was to form a ſyſtem to ſupport his own, and to confirm another; ours is merely to ſtate what we have obſerved, and what indeed muſt occur to every one who ſurveys the ſurface of the globe as it is delineated by our beſt geographers.

So many obſervations fully ſhow that the primitive mountains may be conſidered as the foundation of our globe. By their ſhape, elevation, direction, and continuity, they give riſe to the greateſt part of winds, or produce that variety which prevails among them. Primitive mountains, as we have already ſaid, are diſtinguiſhed likewiſe by their internal ſtructure, by the nature of the ſtones of which they are compoſed, and by the minerals which they contain. The higheſt mountains are, properly ſpeaking, nothing but peaks or cones conſiſting of ſolid rock. This pyramidal form has been ſuppoſed to be at firſt owing to a kind of cryſtallization; and the late M. Rouelle was of opinion, that the ſubſtances of which our globe is compoſed originally ſwam in a fluid. The ſimilar parts of which the great mountains conſiſt, according to this philoſopher, approached one another and formed a cryſtallization, ſometimes in a group, and at other times detached at the bottom of the waters. Upon this ſuppoſition, we might analyſe different portions or blocks of rock taken from primitive mountains; and by making them cryſtalliſe, we would then have in miniature a part of the ſame economy or connection of mountains, a figurative portion, in ſhort, of the ſkeleton of the earth.—We may farther preſume, that thoſe ſteep rocks which it now ſeems almoſt impoſſible to ſurmount even in imagination, are co-eval with the exiſtence of the world.

Mountains with flat ſummits ſometimes reſt on the baſe of primitive mountains; and contain marble, foſſils, and limeſtone. When mountains of the ſame kind poſſeſs a round and more regular ſhape, they conſiſt of chalk and other calcareous and friable ſubſtances arranged in ſtrata. Granite-argillous mountains, like thoſe of Shemnitz, generally form metallic diſtricts. Hills compoſed of brown free-ſtone every where preſent irregular points, indicating broken ſtrata and heaps of rubbiſh.

Dr Pallas (in the ſyſtematic part of the Memoir above mentioned, concerning the ſubſtances of which the higheſt mountains are compoſed) lays it down as an axiom, that the higheſt mountains of the globe forming continued chains, are compoſed of that rock which is called *granite*, the baſe of which is always a quartz, with a greater or ſmaller mixture of felt-ſpar, mica, and ſmall ſchoerls, ſcattered without order, and in irregular fragments of different ſizes. This old rock, and the ſand ariſing from its decompoſition, form the baſe of all continents. Granite is found below mountains compoſed of ſtrata (this obſervation is not applicable to the courſes of mountains formed by ſtrata); it conſtitutes the large protuberances, and as it were the heart, of the greateſt Alps in the known world: hence we may with the greateſt probability infer, that this rock forms the principal ingredient in the internal compoſition of our globe. It is never found in regular ſtrata, but in huge maſſes and in ſhapeleſs blocks; its origin is prior to that of all animated beings; it exhibits not the ſmalleſt traces of petrifaction, and ſeems not to have received the leaſt impreſſion from any organiſed ſubſtance. High eminences, whether in continued chains or in the form of ſteep peaks, are never covered with clayey or calcareous ſtrata, deriving their origin from the ſea; but appear to have been from their very firſt formation elevated above the level of the ocean. The ſides of theſe great chains are for the moſt part covered with ſchiſtous belts, and ſurrounded with mountains of the ſecond and third orders. This is proved by the Ouralic and Altaic chains, which have been traced by Dr Pallas. Such is the ſyſtem propoſed by this author. The high or primitive and ancient mountains, which have exiſted from the beginning of time, are granitous; the ſchiſtous mountains, to which he gives the name of *ſecondary*, have ariſen from the ſides of the primitive by the decompoſition of the granite; and thoſe which he calls *tertiary* mountains, or mountains of the third order, are nothing but ſubſtances depoſited by the ſea, and raiſed up by volcanoes, or ſwept away by a violent irruption, a powerful inundation, or an univerſal deluge. This hypotheſis concerning the formation of mountains is borrowed from nature itſelf, and appears to be confirmed by many facts in natural hiſtory.

We ſhall now proceed to ſtate the height of moſt of the primitive mountains; an object no leſs worthy of attention than their ſtructure and variety.

According to M. Pontoppidan, the higheſt mountains in Norway are 3000 toiſes in height. According to M. Brovallius, the higheſt mountains in Sweden are 2333 toiſes. It is ſuppoſed, however, that both theſe calculations are erroneous.

From the Memoirs of the Academy of Sciences at Paris, it appears, that the mountains in France moſt elevated above the ſurface of the Mediterranean are the Puy-de-Dome, which is 817 toiſes, and the Mont d'Or, which is 1048 toiſes. Theſe two mountains are in Auvergne, and are ſuppoſed to be extinguiſhed volcanoes. Mount Cantal is 993 toiſes high: Mount Ventoux is 1036: the ſouth peak of Canigou in the Pyrenees, according to M. de Rocheblave, is 1442; and according to M. de Plantade, 1453: and Saint Barthelemi is 1184.

M. Needham obſerves, that the higheſt Alps in Savoy are the convent of the great Saint Bernard, at the point of the rock to the ſouth-weſt of that mountain, which is 1274 toiſes; Mount Séréné, which is 1283; and Mount Tourné, which is 1683. According to the meaſurement of the Engliſh obſerver, the peak or needle of Argentiere is 2094 toiſes high. M. Facio de Duiller and M. Duluc make the ridge of Mont Blanc 2213 toiſes; but according to the obſervation of M. Shuckburgh, its elevation is 2447 toiſes one foot (by M. de Sauſſure's meaſurement 2426 toiſes) above the level of the Mediterranean.

The principal mountains of the Alps are among the moſt elevated in the world; and particularly Mont-Blanc, that enormous maſs of granite, which is ſituated in the centre of the Alps, and the acceſs to which is rendered ſo difficult by the ſharp peaks, walls of ice, and everlaſting ſnows wherewith it is covered, is the

Mountain. highest mountain which has been measured either in Europe, Asia, or Africa. The altitude of the Alps of Switzerland has been ascertained by different philosophers: We shall content ourselves with mentioning the most remarkable of those mountains covered with snow, which in Switzerland are called *Gletschers* or *Glaciers*. St Gothard, according to Scheuchzer, is 1650 toises; and Lignon, near the lake of Como, north-east, is, according to Pini, 1486 toises in height. M. Pasumot, engineer to the king of the French, justly observes, that the heights assigned by Mikheli to the mountains of Switzerland appear rather to be ideal computations than founded on observations. An opinion of them may be formed from the following: According to this author, Mount Pilate or Frakmont, in the district of Lucerne, is 1403 toises in height; Mount Cenis, 1445; Raukhstok, 1760; the Nolle ridge of Titlisberg, 2001; Ghemi, 2421; Grimselberg, in the canton of Berne, 2539; the Cornera, part of Loukmanier, 2654; Fourke, 2669; Schrekhorn, 2724; and St Gothard, at its most elevated point, 2750. Mikheli likewise reckons 20 other mountains, the height of which exceeds 2000 toises. The reader may consult the *Table comparative des hauteurs des principales montagnes*, by M. Pasumot (*Journal de Physique*, September 1783.)

Throughout the globe we will not perhaps meet with higher mountains than those of Peru, which go by the name of *Cordilleras de los Andos*. According to the observations of the academicians sent to South America in 1735 by the Spanish and French courts to measure a degree of the meridian and to ascertain the true figure of the earth, the principal summits of these extraordinary mountains, which are situated near Quito, and which are constantly covered with snow though they lie under the equator, have the following geometrical elevations above the level of the sea: Quito-Capilate, 1707 toises; El Corason, 2470 (C); Cotacatche, 2570; Ek-Atlas, 2730; and Noyamble-orcu, under the line, 3030. All the other mountains have been, or still are, volcanoes. The following is an enumeration of them, together with their several heights: Pichincha, 2430; Cargavi-raso, 2450; Sinchonalagon or Sinchoulagoa, 2570; Sangai, 2680; Illinika 2717, Kotopaxi, 2950; Antisana, 3020; Cagambeorcon, situated under the line, 3030; Cimboraso or Chimboraço, 3220. The last mentioned mountain, which forms part of the Cordilleras in Peru, is one of the largest and probably the highest in the world. It is seen at sea from the gulph of Guayaquil, which is more than 60 leagues distant. Mountains.

Other very elevated mountains are Mount Sinai in Japan; Mount Caucasus in Asia; the southern peak of the Pyrenees; the peak of Teneriffe in one of the Canary islands, which according to M. Bouguer is 2100 toises (according to later observations, made by M. M. de Verdun, de Borda, and Pingré, French academicians, in 1754, the peak of Teyde, more commonly known by the name of the *peak of Teneriffe*, is only 1904 toises perpendicular height above the level of the sea); Mount Gibel or Etna in Sicily is 1672 toises; St George's peak in the Azores; Adam's peak in Ceylon; the mountains of the Moon; Mounts Athos, Olympus, Taurus, and Emaus; Mount Cenis in the Alps on the road from France to Italy, is 1460 toises; the Great and Little Atlas; and many others, on the top of which we feel, even in the middle of summer, a more piercing cold than that of the severest frosts of our climates. After this, it cannot appear wonderful that the vapours which reach so great heights are there congealed; and that the summits of these mountains, even in the warmest climates, are constantly covered with snow, while the inhabitants of the plain enjoy a temperate atmosphere, or are subject to extreme heat. The height of these mountains, added to their being placed on the most elevated parts of the globe, is the chief cause of the phenomena peculiar to them. In that part of Asia which is separated by the chain of mountains called the *Ghauts*, there are two very different seasons at one and the same time. While it is winter on the Malabar coast, for instance, the Coromandel coast, which has the same degree of elevation, and in some places is only 20 leagues distant, enjoys an agreeable spring or the temperature of autumn. The traveller in the Alps generally experiences, even in summer, the four seasons of the year. In the Andes we meet with a change of temperature no less curious; for as we descend from their summit to their base, we experience all the varieties of heat and cold which are felt in every climate of the earth, at whatever season (D). There are many other mountainous countries in which we pass at once from a serene sky to dreadful

(C) This is the greatest height to which any person is known to have ascended in America: the greatest elevation which has been reached in the Alps is the top of Mont-Blanc, which is 2426 toises, and which Dr Paccard ascended on the 8th of August 1786. M. de Saussure arrived there likewise on the 3d of August 1787, accompanied by 17 persons.

(D) The more we are elevated above the surface of the earth, it becomes the colder; and accordingly the tops of the highest mountains are always covered with snow. At the height of about 2300 toises above the level of the sea no plant whatever is found to grow: and it appears from the observations of MM. de la Condamine, Bouguer, Godin, Dom George Juan, and Dom Antonio de Ulloa, the academicians sent to Quito in 1735, that at the height of 2434 the snow is perpetual, and never melts at any time of the year even under the equator. The congelation begins and continues in all the mountains of the Cordilleras at the same height above the level of the sea, which is determined by an equal elevation of the mercury in the barometer. But from experiments which have been made, Sir Isaac Newton concludes, that the density of the atmosphere at any height is as the weight of the incumbent air, that is, as the height of the mercury in the barometer; and consequently the density of the air is the same in the whole region of the atmosphere, where the congelation is continual, and where that perpetual cold commences which is felt on all mountains. Above this constant height the density of the air continues to diminish, and the cold becomes greater and greater till we dreadful ftorms and tempefts. It cannot therefore be doubted, that mountains have a great influence on the temperature of the countries to which they belong, by ftopping the courfe of certain winds, by forming barriers to the clouds, by reflecting the fun's rays, and by ferving as elevated conductors to the electricity of the atmofphere. It was formerly faid by travellers, that on the peak of Teneriffe they found that brandy loft its ftrength; that fpirit of wine became almoft infipid; that pepper, ginger, and falt, had little or no tafte when applied to the tongue; but, it was alleged, that Canary wines ftill retained their tafte on that mountain. Thefe ftories appeared too marvellous not to require new experiments; and M M. de Lamanon and Mongez, who vifited this peak in 1785, tell us, that the flavour and tafte of liquors appeared to have fuftained no lofs at that height: (See the experiments made on the Pic du Midi in the Pyrenees by M. Darcet, in the *Journal de Phyfique* for November 1776; and a journey to the peak of Teneriffe, in the fame *Journal* for Auguft 1785). At the foot, and fometimes at the middle, of thofe lofty mountains, the tops of which are always covered with fnow, we frequently find fprings which begin to run in May and dry up in September. When the fun approaches near enough to the tropic to warm the fummits of thefe mountains, the fnow with which they are covered melts, filtrates through their interior part, and iffues forth at their bafe. The only trees which grow on mountains of this kind are firs, pines, and other refinous trees; and the grafs becomes fhorter towards their fummit.

Mountains were not formed to be an ufelefs load upon the earth, but evidently anfwer very important purpofes; and we cannot enough admire their form and that kind of harmony which is difcernible in their arrangement. Some of them, vomiting out fire or fmoke, lava, and fulphur, indicate that they in fome meafure anfwer the purpofe of a chimney to fomething within the earth, which, if confined, would burft it in pieces: (See VOLCANO.) Of this kind are Mount Hecla in Iceland, Mount Etna in Sicily, Mount Vefuvius in the kingdom of Naples, Pichincha and Cotopaxi in America, &c. Others, the fummits of which reach into the clouds, attract and abforb the vapours of the fea, &c. which float in the air. It is obferved by M. l'Abbé Palaffon, that ftorms are moft frequent at the foot of thofe high mountains which form extenfive chains. Their enormous maffes, which feem to fupport the heavens on their fhoulders, arreft and fix the different meteors as they are formed. The clouds, in like manner, driven by the winds from different points of the horizon, there meet with impenetrable barriers, are there accumulated in great quantity, and remain fufpended on thefe bulwarks of the globe's furface, till the agitation of the atmofphere fucceeding the calm, produces ftorms, which are fo much the more terrible that they cannot expand and be difperfed but with great difficulty. They are commonly repelled from the mountains; and are then obferved to fpread over whole countries, to diffolve with peals of thunder, and to fall down in deftructive hail-fhowers fatal to the harveft and to the whole produce of the fields. This fcourge is peculiarly dreadful during the feafons of fpring and fummer, when a fufficient quantity of fnow remains on the mountains to cool the atmofphere.

Some chains of mountains have openings; in others they are wanting: of the former kind are the ftraits of Thermopylæ, the Cafpian ftraits, the pafs of the Cordilleras, &c.

Thofe fpaces which feparate the tops of mountains are fo many bafons deftined for the reception of the condenfed mifts, and of the clouds precipitated into rain. The bowels of mountains appear to be great and inexhauftible refervoirs, and to contain fubterraneous canals and lateral openings formed by the hand of nature, that the feveral fpecies of animals may be fupplied with drink, that the earth may be fertilifed, and that nourifhment may be afforded for the growth of vegetables. The ftreams and rivers defcend from the ridges of mountains, the declivities of which form fo many inclined plains: Thus we find the Alps give rife to the Rhine, the Danube, the Rhone, and the Po. With regard to the wonderful ftructure, by means of which fo many advantages are obtained, fee the articles EARTH, SPRINGS, &c.

Mountains of the firft order form vaft folitudes and horrid deferts, where the habitations of men are not to be feen, and their footfteps are feldom to be traced. By their grandeur, their elevation, the variety of their pofitions, the fublime and awful exhibition of wonders which they contain, they elevate the mind and fire the imagination of the obferver. But thefe majeftic eminences have other advantages which deferve our attention. They form the common retreat of a multitude of wild beafts, which are fubfervient to our ufe: there the bear, the lynx, the ermine, the martin, the fox, and many other animals, the fkin of which we employ for furs, take up their abode; and thither the eagle and the vulture refort in fafety. Mountains likewife afford nourifhment to rein-deer, buffaloes, fallow-deer, roe-deer, and chamois; and they are vifited by birds of paffage which, under the guidance of inftinct, follow the fhorteft road to the place of their deftination. They produce medicinal plants, which almoft never grow elfewhere. In Swifferland they are alfo covered with deep forefts, which, by the great height of the trees, announce their antiquity. They afford both timber and fuel, and fupply the inhabitants with abundance of excellent pafture for their beftial during the whole fummer. The moft precious ftones, both for brilliancy and hardnefs, acquire their forms and colours in the fiffures of the rocks: the internal rents of mountains are filled and in a manner cemented by different metallic fubftances; while the grottos are furnifhed with numerous congelations, fhining

we reach the fummits of the mountains, which prefent to our view all the horrors of winter as they are felt in the polar regions. But below this height, as the denfity of the air becomes greater in confequence of being conftantly preffed upon by a great fuperincumbent weight, the fun's heat increafes, fo that thofe who inhabit the plains at the foot of the mountain are expofed to all the inconveniences of the torrid zone.

Mountain. shining cryſtals, and ſubſtances of an extraordinary nature and figure. In ſhort, every thing concurs to ſhow, that the exiſtence of mountains is abſolutely neceſſary; and that in order to acquire a proper knowledge of them, they muſt be conſidered in many different points of view. Their poſition, their direction, their elevation, the extent of their baſe, their figure, their various external windings, their internal ſtructure; in a word, every thing relating to the theory of the globe, and to the different temperatures of the atmoſphere, muſt engage the obſerver's attention; and by ſtudying and carefully examining the general conſtitution of mountains, the particular facts which they preſent to our view, their influence, their action on the atmoſphere, the different ſubſtances of which they are compoſed, together with the arrangement and mixture of theſe ſubſtances, we may at length diſcover the true mechaniſm of the earth. The reader may conſult the *Eſſais Sur l'etude des Montagnes; Journal de M. l'Abbé Rozier*, November 1773.

The difficulty and danger of aſcending to the tops of mountains proceeds not from the thinneſs of the air, as has been commonly reported; but the reaſon is, that they riſe with ſuch a rugged and precipitate aſcent, that they are utterly inacceſſible. In ſome places they appear like a great wall of 600 or 700 feet high; in others, there ſtick out enormous rocks, that hang upon the brow of the ſteep, and every moment threaten deſtruction to the traveller below.

In this manner almoſt all the tops of the higheſt mountains are bare and pointed: and this naturally proceeds from their being ſo continually aſſaulted by thunders and tempeſts. All the earthy ſubſtances with which they might have been once covered, have for ages been waſhed away from their ſummits; and nothing is left remaining but immenſe rocks, which no tempeſt has hitherto been able to deſtroy.

Nevertheleſs, time is every day and every hour making depredations; and huge fragments are ſeen tumbling down the precipice, either looſened from the ſummit by the froſt or rains, or ſtruck down by lightning. Nothing can exhibit a more terrible picture than one of theſe enormous rocks, commonly larger than an houſe, falling from its height with a noiſe louder than thunder, and rolling down the ſide of the mountain. Dr Plot tells us of one in particular, which being looſened from its bed, tumbled down the precipice, and was partly ſhattered into a thouſand pieces. Notwithſtanding, one of the largeſt fragments of the ſame, ſtill preſerving its motion, travelled over the plain below, croſſed a rivulet in the midſt, and at laſt ſtopped on the other ſide of the bank! Theſe fragments, as was ſaid, are often ſtruck off by lightning and ſometimes undermined by rains; but the moſt uſual manner in which they are diſunited from the mountain is by froſt: the rains inſinuating between the interſtices of the mountain, continue there until there comes a froſt; and then, when converted into ice, the water ſwells with an irreſiſtible force, and produces the ſame effect as gun-powder, ſplitting the moſt ſolid rocks, and thus ſhattering the ſummits of the mountain.

But not rocks alone, but whole mountains, are, by various cauſes, diſunited from each other. We ſee, in many parts of the Alps, amazing clefts, the ſides of which ſo exactly correſpond with the oppoſite, that no doubt can be entertained of their having been once joined together. At Cajeta in Italy, a mountain was ſplit in this manner by an earthquake; and there is a paſſage opened through it, that appears as if elaborately done by the induſtry of man. In the Andes theſe breaches are frequently ſeen. That at Thermopylæ in Greece has been long famous. The mountain of the Troglodytes in Arabia has thus a paſſage through it; and that in Savoy, which nature began and which Victor Amadeus completed, is an inſtance of the ſame kind.

We have accounts of ſome of theſe diſruptions immediately after their happening. "In the month of June, in the year 1714, a part of the mountain of Diableret, in the diſtrict of Valais in France, ſuddenly fell down, between two and three o'clock in the afternoon, the weather being very calm and ſerene. It was of a conical figure, and deſtroyed 55 cottages in the fall. Fifteen perſons, together with about 100 beaſts, were alſo cruſhed beneath its ruins, which covered an extent of a good league ſquare. The duſt it occaſioned inſtantly covered all the neighbourhood in darkneſs. The heaps of rubbiſh were more than 300 feet high. They ſtopped the current of a river that ran along the plain, which now is formed into ſeveral new and deep lakes. There appeared, through the whole of this rubbiſh, none of thoſe ſubſtances that ſeemed to indicate that this diſruption had been made by means of ſubterraneous fires. Moſt probably, the baſe of this rocky mountain was rotted and decayed; and thus fell, without any extraneous violence." In the ſame manner, in the year 1618, the town of Pleurs in France was buried beneath a rocky mountain, at the foot of which it was ſituated.

Theſe accidents, and many more that might be enumerated of the ſame kind, have been produced by various cauſes: by earthquakes, as in the mountain at Cajeta; or by being decayed at the bottom, as at Diableret. But the moſt general way is, by the foundation of one part of the mountain being hollowed by waters, and, thus wanting a ſupport, breaking from the other. Thus it generally has been found in the great chaſms in the Alps; and thns it almoſt always is known in thoſe diſruptions of hills which are known by the name of *land-ſlips*. Theſe are nothing more than the ſliding down of an higher piece of ground, diſrooted from its ſituation by ſubterraneous inundations, and ſettling itſelf upon the plain below.

There is not an appearance in all nature that ſo much aſtoniſhed our anceſtors as theſe land-ſlips. In fact, to behold a large upland, with its houſes, its corn, and cattle, at once looſened from its place, and floating as it were upon the ſubjacent water; to behold it quitting its ancient ſituation, and travelling forward like a ſhip, in queſt of new adventures; this is certainly one of the moſt extraordinary appearances that can be imagined; and, to a people ignorant of the powers of nature, might well be conſidered as a prodigy. Accordingly, we find all our old hiſtorians mentioning it as an omen of approaching calamities. In this more enlightened age, however, its cauſe is very well known; and, inſtead of exciting ominous apprehenſions in the populace, it only gives riſe to ſome

Mountain. some very ridiculous law-suits among them, about whose the property shall be; whether the land which has thus slipt shall belong to the original possessor or to him upon whose grounds it has encroached and settled. What has been the determination of the judges is not so well known; but the circumstances of the slips themselves have been minutely enough and exactly described.

In the lands of Slatberg, in the kingdom of Ireland, there stood a declivity gradually ascending for near half a mile. In the year 1713, and on the 10th of March, the inhabitants perceived a crack on its side, somewhat like a furrow made with a plough, which they imputed to the effects of lightning, as there had been thunder the night before. However, on the evening of the same day, they were surprised to hear an hideous confused noise issuing all round from the side of the hill; and their curiosity being raised, they resorted to the place. There, to their amazement, they found the earth for near five acres all in gentle motion, and sliding down the hill upon the subjacent plain. This motion continued the remaining part of the day and the whole night: nor did the noise cease during the whole time; proceeding, probably, from the attrition of the ground beneath. The day following, however, this strange journey down the hill ceased entirely; and above an acre of the meadow below was found covered with what before composed a part of the declivity.

However, these slips, when a whole mountain's side seems to descend, happen but very rarely. There are some of another kind, however, much more common; and, as they are always sudden, much more dangerous. These are snow-slips, well-known, and greatly dreaded by travellers. It often happens, that when snow has long been accumulated on the tops and on the sides of mountains, it is borne down the precipice either by means of tempests or its own melting. At first, when loosened, the volume in motion is but small: but it gathers as it continues to roll; and by the time it has reached the habitable parts of the mountain, it is generally grown of enormous bulk. Wherever it rolls, it levels all things in its way, or buries them in unavoidable destruction. Instead of rolling, it sometimes is found to slide along from the top; yet even thus it is generally as fatal as before. Nevertheless, we have had an instance, a few years ago, of a small family in Germany that lived for above a fortnight beneath one of these snow-slips. Although they were buried during that whole time in utter darkness, and under a bed of some hundred feet deep, yet they were luckily taken out alive, the weight of the snow being supported by a beam that kept up the roof, and nourishment supplied them by the milk of a she-goat that was buried under the same ruin.

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. Mountain.

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 Chimboraço, 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 Chimboraço 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 contrarywise at 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

(E) By a very easy calculation it is found that such a mountain would attract the plumb-line 1′ 18″ from the perpendicular.

take place, in confequence of the attraction of the hill, now to the fouthward of it. The apparent zenith diftances of the ftars would be affected contrarywife; thofe being increafed at the one ftation which were diminifhed at the other: and the correfpondent quantities of the deflection of the plumb-lime would give the obferver the fum of the contrary attractions of the hill, acting on the plummet at the two ftations; the half of which will of courfe indicate the attractive power of the hill.

The various operations requifite for this experiment lafted about four months; and from them it appears, that the fum of the two contrary attractions of the mountain Schehallien, in the two temporary obfervations which were fucceffively fixed half-way up the hill (where the effect of its attraction would be greateft), was equal to 11″. 6.—From a rough computation, founded on the known law of gravitation, and on an affumption that the denfity of the hill is equal to the mean denfity of the earth, it appears that the attraction of the hill fhould amount to about the double of this quantity. From thence it was inferred, that the denfity of the hill is only about half the mean denfity of the earth. It does not appear, however, that the mountain Schehallien has ever been a volcano, or is hollow; as it is extremely folid and denfe, and feemingly compofed of an entire rock.

The inference drawn from thefe experiments may be reduced to the following:

" 1. It appears, that the mountain Schehallien exerts a fenfible attraction; therefore, from the rules of philofophifing, we are to conclude, that every mountain, and indeed every particle of the earth, is endued with the fame property, in proportion to its quantity of matter.

" 2. The law of the variation of this force, in the inverfe ratio of the fquares of the diftances, as laid down by Sir Ifaac Newton, is alfo 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 increafed by the near approach to its centre, the attraction thereof muft have been wholly infenfible. But now, by only fuppofing the mean denfity of the earth to be double to that of the hill, which feems very probable from other confiderations, the attraction of the hill will be reconciled to the general law of the variation of attraction in the inverfe duplicate ratio of the diftances, as deduced by Sir Ifaac Newton from the comparifon of the motion of the heavenly bodies with the force of gravity at the furface of the earth; and the analogy of nature will be preferved.

" 3. We may now, therefore, be allowed to admit this law, and to acknowledge, that the mean denfity of the earth is at leaft double of that at the furface; and confequently that the denfity of the internal parts of the earth is much greater than near the furface. Hence alfo, the whole quantity of matter in the earth will be at leaft as great again as if it had been all compofed of matter of the fame denfity with that at the furface; or will be about four or five times as great as if it were all compofed of water.—This conclufion, Mr Mafkelyne adds, is totally contrary to the hypothefis of fome naturalifts, who ' fuppofe the earth to be only a great hollow fhell of matter; fupporting itfelf from the property of an arch, with an immenfe vacuity in the midft of it.' But, were that the cafe, the attraction of mountains, and even fmaller inequalities in the earth's furface, would be very great, contrary to experiment, and would affect the meafures 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 fo regular as it has been found by experiment to be.

" 4. As mountains are by thefe experiments found capable of producing fenfible deflections of the plumb-lines of aftronomical inftruments; it becomes a matter of great importance, in the menfuration of degrees in the meridian, either to choofe places where the irregular attractions of the elevated parts may be fmall; or where, by their fituation, they may compenfate or counteract the effects of each other."

For meafuring the heights of mountains, fee the article BAROMETER.

Burning MOUNTAINS. See ÆTNA, HECLA, VESUVIUS, and VOLCANO.

Marble MOUNTAINS. Of thefe there are great numbers in Egypt, from which, though immenfe quantities have been carried off for the multitude of great works erected by the ancient Egyptians; yet, in the opinion of Mr Bruce who paffed by them in his journey to Abyffinia, there is ftill fuch an abundant fupply, that it would be fufficient to build Rome, Athens, Corinth, Syracufe, Memphis, Alexandria, and half a dozen more of fuch cities.

The firft mountain of this kind mentioned by Mr Bruce is one oppofite to Terfowey, confifting partly of green marble, partly of granite, with a red blufh upon a grey ground, and fquare oblong fpots. Here he faw a monftrous obelifk of marble, very nearly fquare, broken at the end, and nearly 30 feet long and 19 feet in the face. Throughout the plain there were fcattered fmall pieces of jafper, with green, white, and red fpots, called in Italy *diafpro fanguineo;* and all the mountains upon that fide feemed to confift of the fame materials. Here alfo were quantities of fmall pieces of granite of various kinds, as well as porphyry, which had been carried down by a torrent, probably from the ancient quarries. Thefe pieces were white mixed with black fpots, and red with green veins and black fpots. All the other mountains on the right hand were of red marble, but no great beauty; thofe on the oppofite fide being green marble, probably of the ferpentine kind. This, he fays, was one of the moft extraordinary fights he ever faw. The former mountains were of a confiderable height, without a tree, fhrub, or blade of grafs upon them; and this looked exactly as if it had been covered over with Havannah and Brazil fnuff. Proceeding farther on, he entered another defile with mountains of green marble on every fide. The higheft he faw appeared to be compofed of ferpentine marble; having a large vein of green jafper fpotted with red running through about one-third of its thicknefs. It was extremely hard; fo that it did not yield to the blows of a hammer, though it was evident that it had formerly been quarried; and there were channels for bringing water, which terminated

nated in this quarry of jaſper; "a proof (ſays Mr Bruce) that water was one of the means uſed in cutting thoſe hard ſtones."

On theſe mountains, our author obſerves, that "the porphyry ſhows itſelf by a fine purple ſand without any gloſs upon it, though the colour is very agreeable to the eye. It is mixed with the white ſand and fixed marble of the plains. Green and unvariegated marble is alſo found in the ſame mountain with the porphyry. The marble is brittle for ſome inches where the two veins meet; but the porphyry is as hard as in other places. The granite appears like a dirty brown ſtone covered with ſand; but this is only the change made upon it by the ſun and weather; for on breaking it, the colour appears to be grey with black ſpots, and a reddiſh caſt on the ſurface. The reddiſh colour appears to be impaired by expoſure to the atmoſphere; but is recovered upon poliſhing it anew. It is in greater quantity than the porphyry, and nearer to the Red Sea. The granite is next to the porphyry, but never joined with it in the ſame mountain. Being covered with a reddiſh ſand, it looks as if the whole mountain were covered with brick-duſt." There is likewiſe a kind of red marble with white veins, which our author has ſeen at Rome and likewiſe in Britain. The common green, called *ſerpentine*, looks as if it were covered with Brazil ſnuff. Along with this green he ſaw two ſamples of the beautiful kind called *Iſabella;* one of them with the yellowiſh caſt of Quaker-colour, the other of that bluiſh caſt called *dove-colour;* and theſe two ſeemed to divide the mountains with the ſerpentine. Here alſo he ſaw the vein of jaſper; but had not time to determine whether it was the ſame with that called bloody-jaſper or blood-ſtone or not.

The marble of greateſt value, however, is that called *Verde Antico*, which is of a dark-green colour with white ſpots. It is found, like the jaſper, in the mountains of the plain green ſerpentine, and is not diſcoverable by the duſt or any particular colour upon it. "Firſt (ſays Mr Bruce) there is a blue flaky ſtone exceedingly even and ſmooth in the grain, ſolid, and without ſparks and colour. When broken it is ſomething lighter than a ſlate, and more beautiful than moſt kinds of marble; it is like the lava of volcanoes when poliſhed. After lifting this we come to the beds of verde antico; and here the quarrying is very obvious; for it has been uncovered in patches not above 20 feet ſquare. Then, in another part, the green ſtone has been removed and another pit wrought." In other places of the plain he ſaw pieces of African marble, but no rocks or mountains of it. He ſuppoſes it to be found in the heart of ſome other coloured marble, and in ſtrata like the jaſper and verde antico; and, as he ſuſpects, in the mountains of Iſabella marble, eſpecially of the yelloweſt ſort. This vaſt ſtore of marble is placed on a ridge, whence there is a deſcent to the eaſt and weſt, ſo that it could be conveyed either to the Nile or the Red Sea. The level ground and hard fixed gravel are proper for the heavieſt carriages; ſo that any weight whatever might eaſily be conveyed to the place of embarkation. In the more diſtant mountains alſo he obſerved the ſame care taken to facilitate the carriage: for the defiles between thoſe mountains he ſuppoſes not to be natural but artificial openings; and he obſerved the roads from them to the Nile to be cut with a deſcent of about one foot in 50 at moſt; ſo that, all the way down, the carriages muſt have moved with as little draught as poſſible, at the ſame time that the vaſt friction would prevent any undue acceleration; to which alſo ſome other means muſt have contributed: But thus, he thinks, it may be explained how ſuch immenſe blocks might have been removed as were employed in the ancient Egyptian works.

Mountains of marble and porphyry are not peculiar to Egypt, for they are likewiſe to be met with in the north of Scotland; and in the Weſtern Iſles there are likewiſe ſuch quantities of theſe materials to be met with, as, in the opinion of Mr Williams, would be ſufficient to ſerve all Europe.

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; notwithſtanding which, there is ſtill a very great uncertainty even of the *exiſtence* of ſuch mountain or mountains. The vaſt number of theſe inſcriptions, the deſart place in which they are found, and the length of time requiſite for executing the taſk, has 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, but conſiſt merely of the names of travellers and the dates of their journeys.

M. Niebuhr, who viſited this country about 30 years ago, 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 deſart. 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 Jebel-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

Mountain. 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 M. Niebuhr arrived at last at the mountain to which the sheik had promised to conduct him, he did not find there any inscriptions; but on climbing up to the top, he found nothing there but 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. Thro' 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 desart.

The translator of Volney's travels ascribes these inscriptions to the pilgrims which 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 L. 500 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. Mountains.

White Mountains. See New Hampshire.

Mountains *of the Moon*, a chain of mountains in Africa, extending themselves between Abyssinia and Monomotapa, and receiving the above denomination 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 Abbe 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 precipice, we could advance only by dragging one foot after the other; so that had the smallest fragment given way under us, we should have been hurried to the bottom of this frightful abyss.

"Proceeding a little farther, we found a second grotto, the entrance of which was about nine feet in breadth. It would be of considerable size, were not about two-thirds of it filled up by part of the roof, which had tumbled down. This grotto conducts to another, which we had the curiosity to enter, but we were almost stifled by the great number of bats which were fluttering up and down in it. Being desirous of retreating almost as soon as we had entered, they flew in such numbers around us, that they in a manner covered our whole bodies; but they luckily made a passage for themselves, and suffered us to breathe with freedom. By the glimmering light which reached this grotto, we perceived that the bottom of it was covered to the height of a hand-breadth with the excrements of these animals; and we remarked some niches in the sides of it, which gave us reason to conclude, that it had once served as a sepulchre to the ancient anchorets. This is the more probable, as the other grotto appears by the remains of an altar and of some Greek paintings to have been formerly a church. In the right corner there is a large cistern, the plaster of which retains its original solidity, though broken

Mountain, Mourning.

broken in a few places. In the left corner there is a ſmall ſtair which conducts to a third grotto. This is much longer and broader than any of the former, and its walls are ornamented alſo with Greek paintings, which repreſent the twelve apoſtles in their natural ſize. Their figures, however, are ſo much changed, that one could ſcarcely diſtinguiſh who they are, were it not that their names are written in Greek characters upon the glory which ſurrounds their heads.—At the farther end of this grotto ſtands a ſquare altar a little damaged; above which is an oval painting of the Annunciation, in perfect preſervation. The chiſel has been employed to render theſe grottos regular and ſmooth; and it appears that they were inhabited by a certain number of hermits, who devoted themſelves to a life of contemplation. No writer has been able to tell us who the founder of this hermitage was.—Nicephorus and Euſebius, who have deſcribed all the churches and religious places of Paleſtine and Judea, do not ſpeak of theſe chapels.

"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.* bare-foot, 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: tho' 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 ολοφυρμοι ιαλεμοι, Λινοι and Αιλινοι. 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.

As to the tokens of private grief among the Romans, they were the ſame as thoſe already obſerved as cuſtomary amongſt 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 at Cannæ, the commonwealth decreed that mourning ſhould not be worn for more than 30 days, that the loſs might be forgot 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 among the Jews as well as the Greeks and Romans, (Jerem. ix. 17.)

MOUSE, in zoology. See Mus.

Mouse-Ear, in botany. See Hierachium.

Mouse-Tail. See Myosurus.

Dor-Mouse. See Myoxus.

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 foot-ſtalk 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'. 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 over againſt it is exceedingly fruitful, and yields very 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 was 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 ſcarce 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 theſe parts 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 ſplendor 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 that are planted in boxes. Some of the mou-tan have been ſeen eight or ten feet in height. The reaſon why few are raiſed at preſent to this ſize is, becauſe their flowers are leſs beautiful, and their branches being too weak, cannot ſuſtain their weight. The root of the mou-tan is long and fibrous, of a pale yellow colour, and covered with a greyiſh or reddiſh rind. Its leaves are deeply indented, and of a much darker green above than below. Its flowers, which are compoſed of numberleſs

Mou-tan, Mouth. berless petals, blow like a rose, and are supported by a calyx composed of four leaves. From the bottoms of the petals arise several stamina without any order, which bear on their tops small antheræ, of a beautiful golden colour. The fruit bend downwards like those of common peony, burst when they become dry, and shed their seeds.

Grosier's Hist. of China. There are three kinds of mou-tan; common mou-tan, dwarf mou-tan, and the mou-tan tree. The last species seems at present to be lost; some of them were formerly seen which were 25 feet in height. Dwarf mou-tan is little esteemed: a few plants of this kind are only cultivated to preserve the species. Common mou-tan, which has always been highly prized by florists, is more generally dispersed. It is raised like an espalier in form of a fan, bush, or orange-tree. Some of them flower in spring, others in summer, and some in autumn. These different species must each be cultivated in a different manner.

The vernal and summer mou-tan are those that are cultivated in greatest number; those of autumn require too slavish an attention during the great heat of the dog-days. The mou-tan of each season are divided into single and double; the former are subdivided into those of 100 leaves and 1000 leaves; the second have a large calyx filled with stamina, that bear on their tops gold-coloured antheræ. These are the only kind that produce seed. The flowers of both appear under the different forms of a bason, pomegranate, marigold, &c. Some of the mou-tan are red, others violet, purple, yellow, white, black, and blue; and these colours, varied by as many shades, produce a prodigious number of different kinds. We are assured, that the Chinese florists have the secret of changing the colour of their mou-tan, and of giving them whatever tints they please; but they cannot effect this change but upon those plants which have never produced flowers.

A mou-tan, to please the eye of a Chinese florist, must have a rough crooked stalk, full of knots, and of a blackish green colour; its branches must cross one another, and be twisted in a thousand fantastical figures; the shoots that proceed from them must be of a delicate green shaded with red; the leaves must be large, of a beautiful green, very thick, and supported by reddish stalks; its flowers must blow at different times, in form of a tuft, be all of the same colour, and stand erect upon their stems; they must also be seven or eight inches in diameter, and exhale a sweet and agreeable odour.

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.

Mouvans. MOUVANS (Paul Richard), surnamed the *Brave*, a Protestant officer, was born at Castellane in Provence of a respectable family, and made a considerable figure in the civil wars of France during the 16th century. His brother, who was likewise a Protestant, having been killed in a popular tumult excited by the Romish priests at Draguignan, he took up arms to avenge his death; and, having assembled 2000 men, committed great devastations in Provence. Being pursued by the Count de Tende at the head of 6000 men, and finding himself too weak to keep the field, he took post in a convent strongly fortified by nature, and there resolved to defend himself to the last extremity. That the war might be terminated amicably, the Count de Tende proposed an interview; to which Mouvans agreed, on condition that his brother's murderers should be punished, and that those who had taken up arms with him should not be molested. These terms being accepted, he dismissed his troops, reserving only a guard of 50 men for the security of his person. This precaution was not unnecessary; for the parliament of Aix had received orders from court to punish him capitally for being concerned in the conspiracy of Amboise. The baron de la Garde made an attempt to apprehend him; but he was worsted and repulsed with considerable loss. Mouvans at length resolved to retire to Geneva, where his life would not be in danger; and there he lived for some time in tranquillity, nobly rejecting the splendid offers made him by the duke of Guise if he would join the Catholic party. He returned to France at the recommencement of the troubles, in consequence of the massacre of Vassy in 1562, and continued to distinguish himself in the Protestant armies. His conduct at Sisteron, where he commanded together with Captain Senas when that city was besieged by the Count de Sommerive, is particularly deserving of admiration. After sustaining an assault of seven hours, in which the besiegers were repulsed with considerable loss, Mouvans, perceiving that he was too weak to wait a second, determined to abandon the city, and left it during the night with his troops and those of the inhabitants who chose to accompany him, by a pass which the enemy had neglected to guard. The number of the inhabitants amounted to 4000 of every age and sex, men, women, children, and mothers with their infants at their breast. This body, in which there was not 1000 men fit to bear arms, directed their course towards Grenoble. Musketeers were placed in the front and rear, while the defenceless and unarmed occupied the centre. To add to the difficulty of the march, they were frequently obliged to go out of the way, and to cross steep and rugged mountains, in order to avoid the ambuscades which the enemy had laid for them on the road. They stopped some days to refresh themselves in the valleys of Angrone and Pragelas, where they were cordially received and supplied with provisions by the Vaudois. After a march of 21 or 22 days, and being exposed to the greatest fatigue and famine, the wretched fugitives at length arrived at Grenoble. The baron des Adrets sent them under an escort to Lyons, where they remained till the treaty of pacification. In 1568 Mouvans was defeated at Mésignae in Perigord, and lost his life in the engagement. Upon this occasion he commanded, together with Peter Gourde, the advanced guard of the Protestant army. It is alleged, that in despair he dashed out his brains against a tree.

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 an exceeding great height, and may be seen at the distance of more than 30 leagues. The northern shores, like those of Owyhee, afford no soundings, and the country presents the same appearance of verdure and fertility. Near the west point of the smaller peninsula is a spacious bay, with a sandy beach shaded with cocoa-nut trees. The country behind has a most romantic appearance, the hills rising almost perpendicularly in a great variety of peaked forms; and their steep sides and deep chasms between them are covered with trees. The tops of these hills are entirely bare, and of a reddish brown colour. The number of inhabitants are computed at about 65,000. E. Long. 204. 4. N. Lat. 20. 50.

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. do as well as moxa.

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. See ARTEMISIA.

MOYLE (Walter), a learned English writer in the 18th century, descended of a good family in Cornwall, where he was born in 1672. He was sent to Oxford, and thence removed to the temple; where he applied himself chiefly to the general and more noble parts of the law, such as led him to the knowledge of the constitution of the English government. In 1697 he had a share with Mr Trenchard in writing a pamphlet, intitled, "An Argument showing that a Standing Army is inconsistent with a Free Government, and absolutely destructive to the Constitution of the English Monarchy." He translated Xenophon's Discourse upon Improving the State of Athens. He was for some time member of parliament, in which he always acted an honourable part; applying himself to the improvement and regulation of trade, and the employment of the poor, which has so near a connection with trade. He afterwards retired to his seat at Bake in Cornwall, where he applied himself with vigour to his studies, and died in 1721. In 1726, his works were printed at London, in 2 vols 8vo.

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. The fungus has vesicular heads supported by foot-stalks.—There are 12 species; the most remarkable of which are, 1. The spærocephalus, or grey round-headed mucor, growing upon rotten wood, and sometimes upon decayed plants and mosses. The stalks of this are generally black, about a line in height; bearing each at the top a spherical ball about the size of a pin's head; its coat or rind is covered with a grey powder, and containing within a black or fuscous spongy down. The coat bursts with a ragged, irregular margin. 2. The lichenoides, or little, black, pin-headed mucor. This species grows in groups near to each other, in chasms of the barks of old trees, and upon old park-pales. The stalks are black, about two lines in height; bearing each a single head, sometimes a double or treble one, of the size of mustard or poppy seeds, of a roundish figure at first, but when burst often flattish or truncated, and of a black colour. The internal powdered down is black, with a tinge of green. 3. The mucedo, or common grey mould, grows on bread, fruits, plants, and other substances in a putrid state. It grows in clusters; the stalks a quarter of an inch high, pellucid, hollow, and cylindrical; supporting each a single globular head, at first transparent, afterwards dark grey; which bursts with elastic force, and ejects small round seeds discoverable by the microscope. 4. The glaucus, or grey cluster-headed mould, is found on rotten apples, melons, and other fruits; as also upon decayed wood, and the stalks of wheat. These are of a pellucid grey colour; the stalks generally single, supporting a spherical ball, which, when magnified, appears to be compounded of numerous, fine, moniliform, necklace-like radii. 5. The crustaceus, or fingered mould, is frequent upon corrupted food of various kinds. It is of a white aqueous colour; the stalks single, each supporting at the top four or five necklace-like radii, diverging from the same point or centre. 6. The septicus, or yellow frothy mucor, is found on the leaves of plants, such as ivy and beech, &c. sometimes upon dry sticks, and frequently upon the tan or bark in hot-houses. It is of no certain size or figure, but of a fine yellow colour, and a substance resembling at first cream beat up into froth. In the space of 24 hours it acquires a thin filmy coat, becomes dry, and full of a sooty powder adhering to downy threads. The seeds under the microscope appear to be globular. Haller ranks it under a new genus, which he terms *fuligo*; the characters of which are, that the plants contained under it are soft, and like butter at first, but soon change into a black sooty powder.

MUCUS, a mucilaginous liquor secreted by certain glands,

glands, and ferving to lubricate many of the internal cavities of the body. In its natural ftate it is generally limpid and colourlefs; but, from certain caufes, will often affume a thick confidence and whitifh colour like pus. As it is fometimes of very great importance in medicine to diftinguifh thefe two fluids from each other, this was lately propofed as the fubject of a prize difputation by the Æfculapian Society of Edinburgh. The prize was gained by Mr Charles Darwin ftudent of medicine from Litchfield. The conclufions drawn from his experiments were,

1. Pus and mucus are both foluble in the vitriolic acid, though in very different proportions, pus being by far leaft foluble.

2. The addition of water to either of thefe compounds decompofes it. The mucus thus feparated either fwims in the mixture or forms large flocculi in it; whereas the pus falls to the bottom, and forms, on agitation, an uniform turbid mixture.

3. Pus is diffufible through a diluted vitriolic acid, though mucus is not. The fame alfo occurs with water, or with a folution of fea-falt.

4. Nitrous acid diffolves both pus and mucus. Water added to the folution of pus produces a precipitate, and the fluid above becomes clear and green, while water and the folution of mucus form a turbid dirty-coloured fluid.

5. Alkaline lixivium diffolves, though fometimes with difficulty, mucus, and generally pus.

6. Water precipitates pus from fuch a mixture, but does not mucus.

7. Where alkaline lixivium does not diffolve pus, it ftill diftinguifhes it from mucus, as it then prevents its diffufion through water.

8. Coagulable lymph is neither foluble in concentrated nor diluted vitriolic acid.

9. Water produces no change on a folution of ferum in alkaline lixivium, until after long ftanding, and then only a very flight fediment appears.

10. Corrofive fublimate coagulates mucus, but does not pus.

From the above experiments it appears, that ftrong vitriolic acid and water, diluted vitriolic acid, and cauftic alkaline lixivium and water, will ferve to diftinguifh pus from mucus; that the vitriolic acid can feparate it from coagulable lymph, and alkaline lixivium from ferum.

Hence, when a perfon has any expectorated matter, the decompofition of which he wifhes to afcertain, let him diffolve it in vitriolic acid, and in cauftic alkaline lixivium; and let him add pure water to both folutions. If there be a fair precipitation in each, he may be affured that fome pus is prefent. But if there be a precipitation in neither, it is a certain teft that the mixture is entirely mucus. If the matter cannot be made to diffolve in alkaline lixivium by time and trituration, we have alfo reafon to believe that it is pus.

MUCK, or RUNNING A MUCK, is a practice that has prevailed time immemorial in Batavia. To run a muck, in the original fenfe of the word, is to get intoxicated with opium, and then rufh into the ftreet with a drawn weapon, and kill any one that comes in the way, till the party is himfelf either killed or taken prifoner. If the officer takes one of thefe *amocks* or *mohawks* (as they have been called by an eafy corruption) alive, he has a confiderable reward; and the unhappy wretches are always broken alive on the wheel: but fuch is the fury of their defperation, that three out of four are neceffarily deftroyed in attempting to fecure them.

MUD-IGUANA. See MURÆNA.

MUFFLE, in chemiftry, a veffel much ufed in fome metallurgic operations. In figure it reprefents an oblong arch or vault, the hinder part of which is clofed by a femicircular plane, and the lower part or floor of which is a rectangular plane. It is a little oven that is placed horizontally in affay and enamelling furnaces, fo that its open fide correfponds with the door of the fire-place of the furnace. Under this arched oven fmall cupels or crucibles are placed; and the fubftances contained are thus expofed to heat without contact of fuel, fmoke, or afhes.

MUFTI, the chief of the ecclefiaftical order, or primate of the muffulman religion. The authority of the mufti is very great in the Ottoman empire; for even the fultan himfelf, if he would preferve any appearance of religion, cannot, without hearing his opinion, put any perfon to death, or fo much as inflict any corporal punifhment. In all actions, efpecially criminal ones, his opinion is required, by giving him a writing in which the cafe is ftated under feigned names; which he fubfcribes with the words, *He fhall*, or *Shall not be, punifhed.* Such outward honour is paid to the mufti, that the grand fignior himfelf rifes up to him, and advances feven fteps to meet him when he comes into his prefence. He alone has the honour of kiffing the fultan's left fhoulder, whilft the prime vizier kiffes only the hem of his garment. When the grand fignior addreffes any writing to the mufti, he gives him the following titles: *To the efad, the wifeft of the wife, inftructed in all knowledge, the moft excellent of excellents, abftaining from things unlawful, the fpring of virtue and of true fcience, heir of the prophetic doctrines, refolver of the problems of faith, revealer of the orthodox articles, key of the treafures of truth, the light to the doubtful allegories, ftrengthened with the grace of the fupreme Legiflator of mankind, may the Moft High God perpetuate thy virtues!* The election of the mufti is folely in the grand fignior, who prefents him with a veft of rich fables, &c. If he is convicted of treafon, or any great crime, he is put into a mortar kept for that purpofe in the Seven Towers at Conftantinople, and pounded to death.

MUGGLETONIANS, a religious fect which arofe in England about the year 1657; fo denominated from their leader Lodowick Muggleton, a journeyman taylor, who, with his affociate Reeves, fet up for great prophets, pretending, as it is faid, to have an abfolute power of faving and damning whom they pleafed; and giving out that they were the two laft witneffes of God that fhould appear before the end of the world.

MUGIL, the MULLET; in ichthyology, a genus of fifhes belonging to the order of abdominales. The lips are membranaceous, the inferior one being carinated inwards; they have no teeth; the branchioftege membrane has feven crooked rays; the opercula are fmooth and round; and the body is of a whitifh colour. There are two fpecies, diftinguifhed by the number of rays in the back-fin.

The mullet is juftly ranked by Ariftotle among the *pifces littorales*, or thofe that prefer the fhores to the

Mugil || Mulberry.

full sea; they are found in great plenty on several of the sandy coasts of our island, and haunt in particular those small bays that have influxes of fresh water. They come in great shoals, and keep rooting like hogs in the sand or mud, leaving their traces in form of large round holes. They are very cunning; and when surrounded with a net, the whole shoal frequently escapes by leaping over it; for when one takes the lead, the others are sure to follow. This circumstance is observed by Oppian; who also informs us, that if these fishes fail to get over at the first leap, they never attempt a second, but lie without motion as if they resigned themselves to their fate. Mr Pennant says he is uncertain whether this last observation holds good or not: however, Oppian had good opportunity of examining those fish, as they sometimes swarm on the coasts of the Mediterranean. Near Martegues, in the south of France, abundance of mullets are taken in weres made of reeds placed in the shallows. Of the milts of the males, which are there called *alletants*, and of the roes of females, which are called *botar*, is made botargo. The materials are taken out entire, covered with salt for four or five hours, then pressed a little between two boards or stones, washed, and at last dried in the sun for 13 or 14 days.

This fish was sometimes made the instrument of a horrible punishment for unfortunate gallants. It was used both at Athens and Rome; but it is very doubtful whether it was a legal punishment or not. By Horace it is mentioned in the following lines:

Discincta tunica fugiendum est, ac pede nudo;
Ne nummi pereant, aut PYGA, *aut denique fama.*
SAT. II. lib. i. 132.

The mullet is an excellent fish for the table, but at present not a fashionable one. The albula * is caught in great quantities about the Bahama islands at the times they go in shoals to spawn; and is there esteemed very good eating.

* Plate CCCXV.

MUGWORT, in botany; a species of ARTEMISIA. An infusion of this plant in white wine, or a bath made of it, has been always esteemed an emmenagogue, and useful in difficult parturition. The leaves, when young and tender, are frequently made use of by the Highlanders of Scotland as a pot herb. The country-people in Sweden drink a decoction of them for the ague.

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 woman, or by an Indian man on a negro woman.

MULBERRY, in botany. See MORUS.

MULBERRY-Cyder, a name given by the people of Devonshire, and some other parts of England, to a 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, Mule.

MULCT, a fine of money laid upon a man who has committed some fault or misdemeanour.

MULE, in zoology, 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. There are two kinds of these animals; one from the he-ass and mare, the other from the horse and the she-ass. We call them indifferently *mules*, but the Romans distinguished them by proper appellations. The first kind are the best and most esteemed; as being larger, stronger, and having least of the ass in their disposition. The largest and stoutest asses, and the fairest and finest mares, are chosen in those countries where these creatures are most in use; as in Spain, Italy, and Flanders. In the last especially, they succeeded in having very stately mules from the size of their mares, some of them 16 and some 17 hands high, which are very serviceable as sumpter-mules in the army. But since the Low Countries are no longer under the dominion of Spain, they breed fewer mules. These creatures are very much commended for their being stronger, surer footed, going easier, being more cheaply maintained, and lasting longer than horses. They are commonly of a black-brown, or quite black, with that shining list along the back and cross the shoulders which distinguishes asses. In former times they were much more common in this country than at present; being often brought over in the days of Popery by the Italian prelates. They continued longest in the service of millers; and are yet in use among them in some places, on account of the great loads they carry on their back. As they are capable of being trained for riding, bearing burdens, and for draught, there is no doubt that they might be usefully employed in many different services. But they are commonly found to be vicious, stubborn, and obstinate to a proverb; which whether it occasions or is produced by the ill usage they meet with, is a point not easily settled. Whatever may be the case of asses, it is allowed that mules are larger, fairer, and more serviceable in mild than in warm climates. In the British American colonies, both on the continent and in the islands, but especially in the latter, they are much used and esteemed; so that they are frequently sent to them from hence, suffer less in the passage, and die much seldomer than horses, and commonly yield, when they arrive, no inconsiderable profit.

It has commonly been asserted, that animals produced by the mixture of two heterogeneous species are incapable of generating, and thus perpetuating the monstrous breed; but this, we are informed by M. Buffon, is now discovered to be a mistake. Aristotle, says he, tells us, that the mule engenders with the mare, and that the junction produces an animal which the Greeks call *hinnus*, or *ginnus*. He likewise wife remarks, that the fhe-mule eafily conceives, but feldom brings the fœtus to perfection. But the moft remarkable and well attefted inftance of this fact, is mentioned in a letter read by M. d'Alembert before the academy of fciences, which informed him that a fhe-mule in the ifland of St Domingo had brought forth a foal. The fact was attefted by perfons of the moft unqueftionable veracity; and other inftances, though not fo well authenticated, are adduced by our author. We may therefore, continues M. Buffon, confider it as an eftablifhed fact, that the he-mule can generate and the fhe-mule produce. Like other animals, they have a feminal liquor, and all the organs neceffary to generation. But mongrel animals are always lefs fertile and more tardy than thofe of a pure fpecies. Befides, mules have never produced in cold climates, feldom in warm regions, and ftill more feldom in temperate countries. Hence their barennefs, without being abfolute, may be regarded as pofitive; fince their productions are fo rare, that a few examples can be only collected.

The tranflator of Buffon's works, in a note on the paffage above-quoted, has given a remarkable and well authenticated inftance of the prolific powers of a fhe-mule in the north of Scotland. Having heard that a mule, belonging to Mr David Tullo farmer in Auchtertyre, in the county of Forfar, had fome years ago brought forth a foal, he tranfmitted a few queries to be put to Mr Tullo; and requefted that his anfwers might be legally attefted before a magiftrate. This requeft was cheerfully complied with; and the following is an exact copy of the queries, anfwers, and atteftations.

Interrogatories to be put to Mr Tullo tenant in Auchtertyre, parifh of Newtyle, and county of Forfar, with his anfwers thereto.

1mo, Had you ever a fhe-mule? At what period? Is it true that the mule had a foal? At what time was fhe covered; and when did fhe foal?—Anfwered by Mr Tullo: That he bought a fhe-mule about 20 years ago: That fhe was conftantly in feafon for a horfe: That, about fome years thereafter, he gave her a horfe; and that fhe thereafter gave him a foal, about the 10th of June. The mule's price was L. 4, 5 s. Sterling.

2do, What was the colour of the foal? Was there any thing particular in its figure?—Anfwer: The foal was exactly the colour of its mother, inclined to black, with a very large head, big ears, and fmall tail; and the declarant thinks, had its head been weighed when foaled, it would have weighed nearly as much as its body.

3tio, How long was the animal allowed to live?—Anfwer: The next day after the mule foaled, it was fent, with its mother, to the Loch of Lundie, in order to let the foal die, as the declarant could not want the mule's work, and the mother feemed not fond of the foal: That it was accordingly left, and next day came to Auchtertyre, about two miles diftance, over a hill, with the cattle of Auchtertyre, that had been grazing near to that place, and was drowned in a ditch the day following.

4to, Was its fkin preferved, or the head, or any other bones of the fkeleton? Could any part thereof be ftill found?—Anfwered: Neither the fkin nor any part of the fkeleton was preferved, nor can be now had; though the declarant has often regretted the not preferving the foal, as its mother always performed any work that a horfe of 15 l. value could do.

5to, Is the mother ftill alive? What is her age?—Anfwer: The mother died about eight years ago, of an epidemic cold that was raging among the horfes in this country: The mule had little or no milk after foaling, and the foal got fome cow's milk: And this is all that he remembers of the matter. David Tullo.

Auchtertyre, 4th Feb. 1780. We James Small tenant in Burmouth, and Robert Ramfay tenant in Newtyle, hereby certify, That we have often feen the mule above-defcribed; and we know that fhe had a foal, as is narrated by David Tullo.

James Small. Rob. Ramsay.

Ballantyne houfe, 4th Feb. 1780. The within interrogatories were put to David Tullo tenant in Auchtertyre, anent the mule he had, and the foal fhe produced; to which he gave the anfwers fubjoined to each query, and figned them; as did James Small and Robert Ramfay, attefting the truth thereof, in prefence of George Watson, J. P.

The original atteftation is in the poffeffion of the tranflator; and he lately tranfmitted notorial or authenticated copies of it to the count de Buffon, and to Thomas Pennant, Efq; of Downing, in Flintfhire.

Mules, among gardeners, denote a fort of vegetable monfters produced by putting the farina fœcundans of one fpecies of plant into the piftil or utricle of another.

The carnation and fweet-william being fomewhat alike in their parts, particularly their flowers, the farina of the one will impregnate the other, and the feed fo enlivened will produce a plant differing from either. An inftance of this we firft had in Mr Fairchild's garden at Hoxton; where a plant is feen neither fweet-william nor carnation, but refembling both equally: this was raifed from the feed of a carnation that had been impregnated by the farina of the fweet-william. Thefe couplings being not unlike thofe of the mare with the afs, which produce the mule, the fame name is given them; and they are, like the others, incapable of multiplying their fpecies.

This furnifhes a hint for altering the property and tafte of any fruit, by impregnating one tree with the farina of another of the fame clafs; *e. gr.* a codlin with a pear-main, which will occafion the codlin fo impregnated to laft a longer time than ufual, and to be of a fharper tafte. Or if the winter-fruits be fecundated with the duft of the fummer kinds, they will ripen before their ufual time. And from this accidental coupling of the farina of one with another, it may poffibly be, that an orchard where there is variety of apples, even the fruit gathered from the fame tree differ in their flavour, and in the feafon of maturity. It is alfo from the fame accidental coupling that the numberlefs varieties of fruits and flowers raifed every day from feed proceed.

Wild or Fecund Mule. See Equus, p. 712.

MULHAUSEN, an imperial and Hanfeatic town of Germany, in Upper Saxony, and in Thuringia, under the protection of the elector of Saxony; feated in 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 elder 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.

* See the article *Bastard*.

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 lately erected. The island was originally part of the dominions of the Lords of the Isles; but in after-times it became part of the possessions of the ancient and valiant family of Macleans, who still retain one-half. The other is the litigated property of the duke of Argyle, whose ancestor possessed himself of it in 1674, on account of a debt; but after the courts of law had made an adjudication in his favour, he was obliged to support their decree by force of arms. The ruins of several ancient castles are seen on this island.

Mull of Cantyre. See CANTYRE.

Mull of Galloway. See GALLOWAY.

MULLEIN. See VERBASCUM.

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 abridgment 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 translations of George de Trebizond, that translator's son assassinated him in a second journey he made to Rome in 1476, where Pope Sextus 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 (John), a noted engraver, who flourished about the year 1600, and had been bred under Henry Goltzius, whose style he closely imitated. The facility with which he handled the graver (for he worked with that instrument only) cannot be sufficiently expressed; his works must be seen, to convey a proper idea of it to the mind. His engravings are valuable, as productions of a very extraordinary nature; exclusive of which they have a prodigious share of merit. Among his most estimable performances, may be mentioned, 1. The hand writing on the wall, a middling-sized plate lengthwise, from his own composition. 2. The adoration of the wise men, the same, from the same. Fine impressions of both these prints are very rare. 3. The resurrection of Lazarus, a large plate lengthwise, from Abraham Bloemart. He engraved also several much esteemed portraits.

MULLER, or *Mullar*, denotes a stone flat and even at bottom, but round atop; 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 concave in a sphere or bowl.—The muller is ordinarily about six inches long, turned round: the cement they use 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, in ichthyology. See MUGIL.

MULLET, or *Mollet*, in heraldry, a bearing in form of the rowel of a spur, which it originally represented.

MULLINGAR, a borough or manor in the county of Westmeath, and province of Leinster, in Ireland, 38 miles from Dublin. It is the shire town of that county, and has a barrack for two troops of horse. It returns two members to parliament; patron the earl of Granard. This is a post town. N. Lat. 53. 30. W. Long. 7. 50. Within a few miles of it are the ruins of a 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 here for friars of the order of St Francis, but it was never completed. Fairs are held here 6th April, 4th and 5th July, 29th August, and 11th November.

MULLUS, the SURMULLET, in ichthyology, a genus of fishes belonging to the order of thoracici. See Plate CCCXV. This fish was highly esteemed by the Romans, and bore an exceeding high price. The capricious epicures of Horace's days valued it in proportion to its size; not that the larger were more delicious, but that they were more difficult to be got. The price that was given for one in the time of Juvenal

venal and Pliny is a ftriking evidence of the luxury and extravagance of the age :

M. llum *fex millibus emit*
Æquantem fane paribus feftertia libris *. Juv, Sat. IV.
The lavifh flave
Six thoufand pieces for a mullet gave,
A fefterce for each pound. Dryden.

* L. 48, 8 s. 9 d.

Pennant. But Afinius Celer, a man of confular dignity, gave a ftill more unconfcionable fum ; for he did not fcruple beftowing 8000 *nummi*, or 64 l. 11 s. 8 d. for a fifh of fo fmall a fize as the mullet : for, according to Horace, a *mullus trilibris*, or one of three lb. was a great rarity; fo that Juvenal's fpark muft have had a great bargain in comparifon of what Celer had. But Seneca fays, that it was not worth a farthing except it died in the very hand of your gueft ; that fuch was the luxury of the times, that there were ftews even in the eating-rooms, fo that the fifh could at once be brought from under the table, and placed on it ; and that they put the mullets in tranfparent vafes, that they might be entertained with the various changes of its rich colour while it lay expiring. Apicius, a wonderful genius for luxurious inventions, firft hit upon the method of fuffocating them in the exquifite Carthaginian pickle, and afterwards procured a rich fauce from their livers. — This is the fame gentleman whom Pliny, in another place, honours with the title of *Nepotum omnium altiffimus gurges* ; an expreffion too forcible to be rendered in our language. The body of this fifh is very thick, and covered with large fcales ; beneath them the colour is a moft beautiful rofy red, the changes of which under the thin fcales gave that entertainment to the Roman epicures as above-mentioned : the fcales on the back and fides are of a dirty orange ; thofe on the nofe a bright yellow ; the tail a reddifh yellow.

MULTIPLE, in arithmetic, a number which comprehends fome other feveral times : thus 6 is a multiple of 2, and 12 is a multiple of 6, 4, and 3 ; comprehending the firft twice, the fecond 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 increafing the number of any thing.

Multiplication, in arithmetic, is a rule by which any given number may be fpeedily increafed, according to any propofed number of times. See Arithmetic.

Multiplication, in algebra. See Algebra, p. 401.

MULTIPLICATOR, or Multiplier, in arithmetic, the number by which any other is multiplied, or the number of times it is fuppofed to be taken.

MULTIPLICATUS flos, a luxuriant flower, whofe petals are multiplied fo as to exclude a part of the ftamina.

A multiplied luxuriant flower differs from a full one, the higheft degree of luxuriance, in that the petals of the latter are fo multiplied as to exclude all the ftamina : whereas thofe of the former are only repeated or multiplied, two, three, or four times, as to the exclufion of only a fmall part of the effential organs.

MULTIPLYING-glass, in optics, a glafs wherewith objects appear increafed in number. See (the *Index* fubjoined to) Optics.

MULTURE, in Scots law, a certain ftipulated quantity of meal given as payment to the proprietor or tackfman 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 elfewhere.

MULVIA, a river of Barbary in Africa, which rifes in the mountains of Atlas, and divides the empire of Morocco from that of Algiers, and then falls into the Mediterranean, to the weftward of Marfalquiver.

MUM, a kind of malt-liquor much drank in Germany, and chiefly brought from Brunfwick, which is the place of moft note for making it. The procefs of brewing mum, as recorded in the town-houfe of that city, is as follows. Take 63 gallons of water that has been boiled till one-third part is confumed, and brew it with feven bufhels of wheaten malt, one bufhel of oat-meal, and one bufhel of ground beans. When it is tunned, the hogfhead muft not be filled too full at firft : as foon 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 rofa folis : add burnet, betony, marjoram, avens, pennyroyal, and wild thyme, of each an handful and an half ; of elder-flowers, two handfuls or more ; feeds of cardamum bruifed, 30 ounces ; barberries bruifed, one ounce : when the liquor has worked a while, put the herbs and feeds into the veffel ; and, after they are added, let it work over as little as poffible ; then fill it up : laftly, when it is ftopped, put into the hogfhead ten new-laid eggs unbroken ; ftop it up clofe, and ufe it at two years end. The Englifh brewers, inftead of the inner rind of fir, ufe cardamum, ginger, and fafafras ; and alfo add elicampane, madder, and red fanders.

MUMIA. See Pissaphaltum.

MUMMIUS (L.), a Roman conful fent againft the Achæans, whom he conquered B. C. 147. He deftroyed Corinth, Thebes, and Chalcis, by order of the fenate, and obtained the furname of *Achaicus* from his victories. He did not enrich himfelf with the fpoils of the enemy, but returned home without any increafe of fortune. He was fo unacquainted with the value of the paintings and works of the moft celebrated artifts of Greece which were found in the plunder of Corinth, that he faid to thofe who conveyed them to Rome, that if they loft them or injured them, they fhould make others in their ftead.

MUMMY, a body embalmed or dried, in the manner ufed by the ancient Egyptians ; or the compofition with which it is embalmed. There are two kinds of bodies denominated *mummies*. The firft are only carcafes dried by the heat of the fun, and by that means kept from putrefaction : thefe are frequently found in the fands of Libya. Some imagine, that thefe are the bodies of deceafed people buried there on purpofe to keep them entire without embalming ; others think they are the carcafes of travellers who have been overwhelmed by the clouds of fand raifed by the hurricanes frequent in thofe defarts. The fecond kind of mummies are bodies taken out of the catacombs near Cairo, in which the Egyptians depofited their dead after embalming. See Embalming.

We have two different fubftances preferved for medicinal ufe under the name of *mummy*, though both in fome degree of the fame origin. The one is the dried and preferved flefh of human bodies, embalmed with myrrh and fpices; the other is the liquor running from fuch mummies, when newly prepared, or when affected by great heat or damps. The latter is fometimes in a liquid, fometimes of a folid form, as it is preferved in vials well ftopped, or fuffered to dry and harden in the air. The firft kind of mummy is brought to us in large pieces, of a lax and friable texture, light and fpungy, of a blackifh brown colour, and often damp and clammy on the furface: it is of a ftrong but difagreeable fmell. The fecond kind of mummy, in its liquid ftate, is a thick, opaque, and vifcous fluid, of a blackifh colour, but not difagreeable fmell. In its indurated ftate, it is a dry folid fubftance, of a fine fhining black colour, and clofe texture, eafily broken, and of a good fmell; very inflammable, and yielding a fcent of myrrh and aromatic ingredients while burning. This, if we cannot be content without medicines from our own bodies, ought to be the mummy ufed in the fhops; but it is very fcarce and dear; while the other is fo cheap, that it will always be moft in ufe.

All thefe kinds of mummies are brought from Egypt. But we are not to imagine, that any body breaks up the real Egyptian mummies, to fell them in pieces to the druggifts, as they make a much better market of them in Europe whole, when they can contrive to get them. What our druggifts are fupplied with, is the flefh of executed criminals, or of any other bodies the Jews can get, who fill them with the common bitumen, fo plentiful in that part of the world; and adding a little aloes, and two or three other cheap ingredients, fend them to be baked in an oven, till the juices are exhaled, and the embalming matter has penetrated fo thoroughly that the flefh will keep and bear tranfporting into Europe. Mummy has been efteemed refolvent and balfamic: but whatever virtues have been attributed to it, feem to be fuch as depend more upon the ingredients ufed in preparing the flefh than in the flefh itfelf; and it would furely be better to give thofe ingredients without fo fhocking an addition.'

There are found in Poland a kind of natural mummies, or human bodies preferved without the affiftance of art. Thefe lie in confiderable numbers in fome of the vaft caverns in that country. They are dried with the flefh and fkin fhrunk up almoft clofe to the bones, and are of a blackifh colour. In the wars which feveral ages ago laid wafte that country, it was common for parties of the weaker fide to retire into thefe caves, where their enemies, if they found them out, fuffocated them by burning ftraw, &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 fince.

Mineral Mummy. See Pissaphaltum.

Mummy, among gardeners, a kind of wax ufed 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 fet them on fire in the open air, holding fomething 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 compofition is then to be fet by for ufe.

MUMPS. See Medicine-*Index*.

MUNDA, an ancient town of Spain, in the kingdom of Granada, feated 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 Cæfar over the two fons of Pompey, who had collected an army in Spain after the defeat of their father at Pharfalia. See *(Hiftory of)* Rome.

The Pompeys pofted their army advantageoufly on a rifing ground, whereof one fide was defended by the city of Munda, and the other by a fmall river which watered the plain, and by a marfh; fo that the enemy could not attack them but in front. Cæfar likewife 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 poft, and come to meet him. But as they did not ftir, Cæfar made as if he intended to fortify himfelf in that poft; which induced the young general, who looked upon this as a fign of fear, to advance into the plain, and attack the enemy before they could fecure themfelves with any works. Pompey's army was by far the moft numerous; for it confifted of 13 legions, 6000 horfe, and an incredible number of auxiliaries, among whom were all the forces of Bocchus king of Mauritania, commanded by his two fons, both youths of great valour and bravery. Cæfar had 80 cohorts, three legions, to wit, the third, the fifth, and the tenth, and a body of 8000 horfe. As the enemy drew near, Cæfar betrayed a great deal of uneafinefs and concern, as if he were doubtful of the fuccefs, knowing he was to engage men no way inferior in valour and experience to his own, and commanded by officers who had on many occafions given fignal 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, efteemed fcarce inferior to himfelf.

However, the dictator, defirous to put an end to the civil war, either by his own death or that of his rivals, gave the fignal for the battle, and fell upon the enemy with his ufual vigour and refolution. At the firft onfet, which was dreadful, the auxiliaries on both fides betook themfelves to flight, leaving the Romans to decide their quarrel by themfelves. Then the legionaries engaged with a fury hardly to be expreffed; Cæfar's men being encouraged by the hopes of putting an end to all their labours by this battle, and thofe of Pompey exerting themfelves out of neceffity and defpair, fince moft of them expected no quarter, as having been formerly pardoned. Never was victory more obftinately difputed. Cæfar's men, who had been always ufed to conquer, found themfelves fo vigoroufly charged by the enemy's legionaries, that they began to give ground; and though they did not turn their backs, yet it was manifeft that fhame alone kept them in their pofts. All authors agree, that Cæfar had never been in fo great danger; and he himfelf, when he came back to his camp, told his friends, that he had often fought for victory, but this was the firft time he had ever fought for life. Thinking himfelf 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 Cæsarians 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. See Marcasite.

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 Verde 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 out 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 stair-case 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 also 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 engraven 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.

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 Eliſabeth 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 intereſt of cities, to maintain their right 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.

MUNICPIUM, 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 *municipium 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 them by the admiral.

MUNSTER (Sebaſtion), a learned writer, was born at Ingleheim, and became a Cordelier; but having embraced Luther's ſentiments, he quitted that order in 1529, and retired to Heidelberg, and afterwards to Baſil, where he taught with reputation. He was a man of great candour, and void of ambition; and was ſo well ſkilled in geography, the mathematics, and the Hebrew tongue, that he was ſurnamed the *Eſdras* and the *Strabo of Germany.* His Latin tranſlation of the bible is eſteemed. He was the firſt who wrote a Chaldee grammar and lexicon: he alſo publiſhed a treatiſe on coſmography, and ſeveral other works. He died of the plague at Baſil in 1552, aged 63.

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 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. to 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 Oſnaburg 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 a 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, how-

7 ever,

ever, 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 usurpation 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 *Munychius Portus*, (anc. geog.), a village and port of Athens, nearer to the city, less than, and fortified in the same manner with 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 ἀμφιφῶντες.

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, in ichthyology; a genus of fishes, belonging to the order of apodes. The head is smooth; there are ten rays in the membrane of the gills; the eyes are covered with a common skin; and the body is cylindrical and slimy. There are seven species, distinguished by their fins, tails, &c. The most remarkable are,

1. The *anguilla*, or common eel, is very frequent in all our fresh waters, ponds, ditches, and rivers: according to Mr Pennant, it is the most universal of fish; yet is scarce ever found in the Danube, though very common in the lakes and rivers of Upper Austria.

The eel is very singular in many things relating to its natural history, and in some respects borders on the nature of the reptile tribe. It is known to quit its element, and during night to wander along the meadows, not only in order to change its habitation, but also for the sake of prey, feeding on snails as it passes along. During winter it beds itself deep in the mud, and continues in a state like the serpent-kind. It is very impatient of cold, and will eagerly take shelter in a wisp of straw flung into a pond in severe weather, which has sometimes been practised as a method of taking them. Albertus affirms, that he has known eels to take shelter in a hay-rick; yet all perished through excess of cold. It has been observed in a river of England called the *Nyne*, there is a variety of small eel, with a lesser head and narrower mouth than the common kind, that is found in clusters in the bottom of the river, and is called the *bed-eel*: these are sometimes roused up by the violent floods, and are never found at that time with meat in their stomach.

Eels are extremely voracious, and destructive to the fry of others. No fish lives so long out of water as the eel; and it is so extremely tenacious of life, that its parts will move a considerable time after they are flayed and cut in pieces. They vary much in their colours, from a footy hue to a light olive green; and those which are called *silver eels* have their bellies white, and a remarkable clearness throughout. Besides these, there is a variety of this fish known in the river Thames by the name of *grigs*, and about Oxford by that of *grigs* or *gluts*. These are scarce ever seen near Oxford in the winter; but appear in spring, and bite readily at the hook, which common eels in that neighbourhood will not. They have a larger head, a blunter nose, thicker skin, and less fat, than the common sort; neither are they so much esteemed, nor do they often exceed three or four pounds in weight.—Common eels grow to a large size, sometimes weighing 15 or 20 pounds; but that is extremely rare. Mr Dale indeed, in the Philosophical Transactions, and some others, bring instances of eels much exceeding that size; but Mr Pennant suspects them to have been congers, since the enormous fish they describe have all been taken at the mouths of the Thames or Medway. The Romans held eels very cheap, probably on account of their likeness to snakes. On the contrary, the luxurious Sybarites were so fond of these fish, as to exempt from tribute of every kind those persons who sold them.

There is scarce any animal the generation of which has puzzled the learned more than this. Aristotle first broached an opinion that eels were of no sex, nor did propagate their species like other animals, but were equivocally gendered of the mud; and as wild and absurd a system as this is, there have not been wanting many, even in these latter and more enlightened times, who have given into it. But there is now no room to doubt that all animals are produced by the copulation of parents like themselves; and the finding of eels in new ponds is easily accounted for from the above mentioned circumstance of their migration. Dr Plot, and many others, have given accounts of whole droves of them leaving one ditch or pond to go to another.

Though the learned world at this time generally allows that eels are produced like other animals, by parents of their own kind, yet there remain many doubts about the manner in which the generation is performed. Some allow the eels to be, like the generality of other animals, of different sexes in the different individuals; and others affirm that they are all hermaphrodites, each having the parts of generation of both sexes. Rondeletius affirms that they are of both sexes; and Mr Allan, who has given a very curious paper concerning them in the Philosophical Transactions, is of the same opinion; and both say, that the parts of the sexes may be discovered on a careful inspection; and some are found to be males, and others females; but these parts are, in both sexes, they say, buried in a large quantity of fat; and they are of opinion, that hence proceeded the mistake of Aristotle and his followers, who, not being able to find those parts, concluded that they did not exist at all. Among those who allow the eel to be produced, like other animals, from animal-parents which have the sexes, some are of opinion that they are viviparous,

and

Muræna. and others that they are oviparous: but Mr Chartwynd seems to have determined this controversy by observing, that if the aperture under the belly of the eel, which looks red in the month of May, be cut open at that time, the young eels will be seen to come forth alive after the operation. Mr Lewenhoeck says, that he found an uterus in every eel he examined; and therefore concludes, that they are hermaphrodites: and he supposes that they have no male parts of generation like those of other animals; but that the office of these is performed by a liquor analogous to the male seed of animals, which is contained in certain glands, situated in the inside of the uterus itself.

Eels have sometimes been met with in recent ponds, made at such a distance from any other water that we cannot reasonably suppose them to have migrated thither over land. But in these cases there is reason to believe, that the ponds have been supplied with them by the aquatic fowl of prey, in the same manner as vegetation is spread by many of the land-birds, either by being dropped, as they carry them to feed their young, or by passing quick through their bodies, as is the case with herons.

2. The *conger*, or conger-eel, grows to a vast size. Dr Borlase informs us, that they are sometimes taken near Mount's-bay of 100 lb. weight; and Mr Pennant assures us, that he has heard of some taken near Scarborough that were 10 feet and a half long, and 18 inches in circumference in the thickest part. They differ from the common eel in the following particulars: 1. Their colour in general is more dark. 2 Their eyes much larger in proportion.—3. The irides of a bright silvery colour. 4. The lower jaw is rather shorter than the upper. 5. The inside-line is broad, whitish, and marked with a row of small spots. 6. The edges of the dorsal and anal fins are black. 7. They have more bones than the common eel, especially along the back quite to the head. 8. They grow to a much larger size.

Congers are extremely voracious, preying on other fish, and on crabs at the time they have lost their shell and are in a soft state. They and eels in general are also particularly fond of carcases of any kind, being frequently found lodged in such as are accidentally taken up.

The conger eels probably generate like the fresh-water species. Innumerable quantities of what are supposed to be their fry come up the Severn about the month of April, preceding the shads, which it is conjectured migrate into that river to feed on them: they are called *elvers*. They swarm during their season, and are taken in a kind of sieve made of hair-cloth fixed to a long pole; the fisherman standing on the edge of the water during the tide, puts in his net as far as he can reach, and drawing it out again, takes multitudes at every sweep, and will take as many during one tide as will fill a bushel. They are dressed, and reckoned very delicate.

These fish are an article of commerce in Cornwall; numbers are taken on that coast, and exported to Spain and Portugal, particularly to Barcelona.—Some are taken by a single hook and line, but (because that way is tedious, and does not answer the expence of time and labour) they are chiefly caught by *bulters*, which are strong lines 500 feet long, with 60 hooks, each eight feet asunder, baited with pilchards or mackarel; the bulters are sunk to the ground by a stone fastened to them: sometimes such a number of these are tied together as to reach a mile. The fishermen are very fearful of a large conger, lest it should endanger their legs by clinging round them; they therefore kill them as soon as possible by striking them on the navel. They are afterwards cured in this manner: They are slit, and hung on a frame till they dry, having a considerable quantity of fat, which it is necessary should exsude before they are fit for use. It is remarkable that a conger of 100 weight will waste by drying to 24 lb.; the people therefore prefer the smallest, possibly because they are soonest cured. During the process there is a considerable stench; and it is said, that in the fishing villages the poultry are fed with the maggots that drop from the fish. The Portuguese and Spaniards use those dried congers after they have been ground into a powder, to thicken and give a relish to their soups. They are sold for about 40 shillings the quintal, which weighs 126 lb. A fishery of congers, says Mr Pennant, would be of great advantage to the inhabitants of the Hebrides. Perhaps they would at first undertake it with repugnancy, from their absurd aversion to the eel kind.

3. The *siren*, or mud-iguana, a singular animal, first observed by Dr Garden of Charlestown, and afterwards described by Mr Ellis in the Philosophical Transactions for 1766. It has gills, fins, and two feet; and is in length from 31 to 40 inches. It is an inhabitant of South Carolina, where it is found in swampy and muddy places, by the sides of pools, and under the trunks of old trees that hang over the water, and feeds on serpents. The feet appear like little arms and hands, each furnished with four fingers, and each finger with a claw. "The head is something like an eel, but more compressed; the eyes are small, and placed as those of the eel are. This smallness of the eye best suits an animal that lives so much in mud. The nostrils are very plainly to be distinguished; these, with the gills, and remarkable length of the lungs, show it to be a true amphibious animal.—The mouth is small in proportion to the length of the body; but its palate and inside of the lower jaw are well provided with many rows of pointed teeth: with this provision of nature, added to the sharp exterior bony edges of both the upper and under jaw, the animal seems capable of biting and grinding the hardest kind of food. The skin, which is black and full of small scales, resembles shagreen. These scales are of different sizes and shapes, according to their situation; but all appear sunk into its gelatinous surface: those along the back and belly are of an oblong oval form, and close set together; in the other parts they are round, and more distinct. Both the parts are mottled with small white spots, and have two distinct lines composed of small white streaks continued along from the feet to the tail. The fin of the tail has no rays, and is no more than an adipose membrane like that of the eel."

Dr Garden, in a letter to Mr Ellis, mentions a remarkable property of this animal, which is, that his servant endeavouring to kill one of them by dashing it

Plate CCCXV.

it against the stones, it broke into three or four pieces. Linnæus, from the descriptions sent him, made it a new genus named *Syren*, of a new order *Meantes*, of the class amphibia. But from this class both the order *Meantes* and that of *Nantes* have been lately expunged; and Gmelin has reduced the syren to a species of the present genus. Its place here, however, seems still of doubtful propriety; as Gmelin himself acknowledges in the Preface to his edition of the Systema Naturæ. For Campfer, having lately * had an opportunity to dissect the syren, has discovered, that on each side of the head it is furnished with three true gills, separated from each other by membranes having tooth-like appendages; that the mouth is armed with strong and firmly planted teeth; that the heart has only one ventricle; and that the abdomen is filled with very long and capacious intestines: From all these circumstances, he concludes, that this animal ought to be considered as a fish of the order *Branchiostegi*;—while in other respects it is more nearly allied to the genus *Muræna*, of the order *Apodes*; although it differs materially from the other species of that genus, by having only three notched bones in the gills, and from the pectoral fins being each divided into four finger-like appendages.

* *Kerr's Translation.*

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.

MURALT (N— de), a native of Switzerland, travelled through a great part of Europe with the views of a philosopher. He published a collection of *Lettres sur les François et sur les Anglois*, 12mo, 2 vols. 1726, which met with great success, though they are written in a vague and superficial manner. Some other works which he published are below mediocrity. He died about the year 1750.

MURANT (Emanuel), a much-admired landscape painter, was born at Amsterdam in 1622. He had the happiness to be a disciple of Philip Wouwermans, from whom he acquired that warmth and brilliancy of colouring, and that exquisite pencil, which have rendered him deservedly eminent. His subjects were views in Holland, villages, towns, cities, ruins of houses, and decayed castles; all of them exactly sketched after nature, and so exquisitely finished, that every minute part of a building was perfectly discernible, and even every particular stone or brick might be counted by the assistance of a convex glass. But this demanded so much patience and time, that it was impossible for him to paint many pictures; and on that account they are exceedingly scarce, and sold for such prices as must place them out of the reach of all ordinary purchasers. He died in 1700.

MURANUM, (anc. geog.), a town on the confines of Lucania. Now *Morano*; a citadel in the 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 scarce 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. He acquired the esteem of the learned throughout Europe, who had recourse to him for the lights they wanted. He became an associate to the Academies of the Arcades of Rome, Della Crusca, and Colomberia of Florence, the Academy of Etrusca at Cortona, the Royal Society of London, and of the Imperial Academy of Olmutz; and died in 1750. He wrote a great number of learned works; the principal of which 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 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, Murder.

top, either on horseback or in a coach. It is situated in a pleasant plain, which abounds in fine gardens about the city, in which are the best fruits in Spain. It is seated on the river Segura, in W. Long. 0. 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 *mordrum*.

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 murther; for a bare assault, with intent to kill, is only a great misdemesnor, 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 witness 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, does such an act, of which the probable consequence may be, and eventually is, death; such killing may be murder, although no stroke be

Blackst. Comment.

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 it, and killed it. So too, if a man hath 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 had 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 a dog to worry them. If a physician or surgeon gives 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 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 a faire un male 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

Murder.

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 hath 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 gives 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 judgement; 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 judge, 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.

MURENGERS, two officers of great antiquity in the city of Chester, annually chosen out of the aldermen, to see that the walls are kept in repair, and to receive a certain toll and custom for the maintenance thereof.

MURET (Mark Anthony Francis), in Latin *Muretus*, was born at Muret, near Limoges, in 1526. He acquired a perfect knowledge of the Greek and Latin tongues without any instructor, and became one of the most learned men of his time. After having taught some time in Provence, he was made a professor at Paris in the same college with Turnebus and Buchanan. In 1554 he went into Italy; and in 1565 was professor of law, philosophy, and history, at Rome, where he died in 1585. His principal works are, 1. Excellent notes on Terence, Horace, Catullus, Tacitus, Cicero, Sallust, Aristotle, Xenophon, &c. 2. *Orationes*. 3. *Variæ Lectiones*, *Poemata*, *Hymni Sacri*. 4. *Disputationes in Lib. I. Pandectorum*, *de Origine Juris &c*. 5. *Epistolæ*, *Juvenilia Carmina*, *&c*. Most of Muret's works have been printed in the Venice edition of 1737, in 5 vols 8vo.

MUREX, in zoology, a genus of insects belonging to the order of vermes testacea. This animal is of the snail-kind: the shell consists of one spiral valve, rough, with membranaceous furrows; and the aperture terminates in an entire canal, either straight, or somewhat ascending. There are 60 species, particularly distinguished by peculiarities in their shells, &c.

From a species of murex was obtained the famous Tyrian dye so much valued by the ancients. This, however, has long been superseded by the use of the cochineal. One of the shells producing the dye was a kind of buccinum; but the finest, or Tyrian purple, was got from the murex. These species of shells are found in various parts of the Mediterranean. Immense heaps of them are to be seen about Tarentum to this day, evincing one place where this precious liquor was extracted. See Plate CCCXXII.

In the accounts of a Spanish philosopher it is mentioned, that on the coasts of Guayaquil and Guatimala in Peru the murex is also found. The shell which contains it adheres to the rocks that are washed by the sea: it is of the size of a large walnut. The liquor may be extracted two ways: some kill the animal after they have drawn it out of the shell; then press it with a knife from head to tail; separate from the body the part where the liquor is collected, and throw away the rest. When this operation, after being repeated on several snails, has afforded a certain quantity of fluid, the thread intended to be dyed is dipped in it, and the process is finished. The colour, which is at first of the whiteness of milk, becomes afterwards green, and is not purple till the thread is dry. Those who disapprove of this method, draw the fish partly out of the shell, and, squeezing it, make it yield a fluid which serves for dyeing: they repeat this operation four times at different intervals, but always with less success. If they continue it, the fish dies. No colour at present known, says the Abbé Raynal, can be compared to this, either as to lustre, liveliness, or duration. It succeeds better on cotton than wool, linen, or silk.

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. It was so called, probably, because the points bore some resemblance to the spines and tubercles with which the shell of the fish murex is surrounded.

MURGI, or MURGIS (anc. geog.), the last town of Baetica, 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, alimentary salt. See SALT.

MURINA, or MURINES, a delicious sweet wine, medicated with spices, and the usual drink of the ladies of antiquity.

MURILLO (Bartholomew-Stephen), a celebrated painter, was born at Pilas near Seville, in 1613. Having shown a very early inclination to painting, he was instructed by his uncle John del Castillo, an artist of some note, whose subjects were fairs and markets; in which style Murillo painted several pictures while he continued with that master: but his principal knowledge in the art was derived from Velasquez, who directed his studies, and frequently retouched his designs. Many writers assert, that he studied at Rome, and improved himself excessively in that city. But Velasco, a Spanish author, affirms that he never was in Italy; but arrived at the excellence he possessed by copying the works of Titian, Rubens, and Vandyck, which were at Madrid, and the Escurial; and also by studying after the antique statues, which are in the Royal collections. However, he became an excellent painter, and was employed by the king of Spain to execute several historical pictures, which raised his reputation through every province of his own country. Those paintings being afterwards sent to Rome as a present to the pope, the Italians were so much pleased with his performances, that they called him a second Paul Veronese. In Spain he designed and finished several grand altar-pieces, for the churches and convents at Madrid, Seville, Cordova, Cadiz, and Granada; and some of his compositions are in the churches of Flanders. But notwithstanding his genius, taste, and abilities, qualified him to execute subjects of history with general applause; yet his favourite subjects were beggar-boys, as large as life, in different actions and amusements; which he usually designed after nature, and gave them a strong and good expression. His original pictures of those subjects have true merit, and are much esteemed, many of them being admitted into the most capital collections of the English nobility; but of those, there are abundance of copies, which, to the dishonour of the artist, are sold as originals to injudicious purchasers. He died in 1685.

MURRAIN, or GARGLE, a contagious disease among cattle. The symptoms are, a hanging down, and

and ſwelling of the head, abundance of gum in the eyes, rattling in the throat, a ſhort breath, palpitation at the heart, ſtaggering, a hot breath, and a ſhining tongue. In order to prevent this diſeaſe, the cattle ſhould ſtand cool in ſummer, and have plenty of good water: all carrion ſhould be ſpeedily buried; and as the feeding of cattle in wet places, on rotten graſs and hay, often occaſions this diſeaſe, dry and ſweet fodder ſhould be given them.

MURRAY, a county of Scotland, extending by the coaſt from the river Spey on the eaſt to Beauly on the weſt, which is the boundary of the province of Roſs. It ſends two members to parliament, and is an earldom in a branch of the Stuart family.

According to the account of the reverend Mr Shaw miniſter of Elgin, in anſwer to ſome queries of Mr Pennant, the country produces wheat, barely, oats, rye, peaſe, and beans. Of theſe, in plentiful years, upwards of 20,000 bolls are exported, beſides ſerving the county itſelf and ſome of the Highland counties. Some hemp is alſo cultivated, and a great deal of flax; of which linen is made, not only for home-conſumption, but a conſiderable quantity of linen-yarn is exported. Great quantities of potatoes are alſo cultivated. Several hundreds of black cattle are alſo exported from the Highlands of Murray, but few or none from the Lowlands. Peculiar to this province is a kind of wood, called *red ſaugh*, or *ſallow;* which is no leſs beautiful than mahogany. It is much more firm and tough than mahogany, and reſembles the lighter-coloured kind of that wood. It receives a fine poliſh, but is very ſcarce, growing on rocks. But there are great foreſts of firs and birches, which our author thinks are the remains of the Sylva Caledonia. Here alſo is found a remarkable root, called by the natives *carnee:* it grows in heaths and birch-woods to the bigneſs of a large nut; and ſometimes there are four or five roots joined together by fibres. It has a green ſtalk and ſmall red flowers. Dido, ſpeaking of the Caledonians, ſays, *Certum cibi genus parant ad omnia, quem ſi ceperint quantum eſt unius fabæ magnitudo, minime eſurire aut ſitire ſolent.* Cæſar alſo tells us of a root called *chara*, which his ſoldiers mixed with milk and made into bread when in want of proviſion, which greatly relieved them. This root, Mr Shaw thinks, is the ſame with the *carmele* or *ſweet root* of Murray. He informs us, that he hath often ſeen it dried, and kept for journeys through hills where no proviſion was to be had: he has likewiſe ſeen it pounded and infuſed; the liquor makes a more agreeable and wholeſome liquor than mead. It grows in ſuch plenty, that a cart-load of it can eaſily be gathered.

Murray is interſected by the rivers Spey, Loſſey, Findern, Nairn, Neſs, and Beauly. The river of Spey, riſing on the borders of Lochaber, is more than 60 Scots, or 100 Engliſh miles long, but too rapid to be navigable. Upon this river great floats of fir and birch-wood are carried down to the Frith; the float is guided by a man ſitting on a *courach*. This veſſel is of an oval ſhape, about four feet long and three broad; a ſmall keel from head to ſtern; a few ribs croſs the keel, and a ring of pliable wood round the lip of it; the whole covered with the rough hide of an ox or horſe. The rower ſits on a tranſverſe ſeat in the middle, and holds in his hand a rope, the end of which is tied to the float, and with the other hand he manages a paddle keeps the float in deep water, and brings it to ſhore when he pleaſes. In this province, alſo, is Loch Neſs, remarkable for its never freezing. There are many other lakes in this country, of which one called *Dundelchack* is remarkable in that it is never covered with ice before the month of January; but after that time one night's ſtrong froſt covers it all over. On the eaſt ſide of Loch Neſs, a large mile above the loch, is the waterfall of Foher, where the river *Feach-Len* falls over a ſteep rock about 80 feet high; and a thick fog riſes from the place where it falls, occaſioned by the violent daſhing of the water. There is a conſiderable ſalmon-fiſhery on the rivers Spey, Findern, Neſs, and Beauly, which ſerves the towns and country, beſides exporting to the value of 12,000l. annually.

There are many natural caves in the hills of this country, which formerly were the receptacles of thieves and robbers, and now afford ſhelter to hunters and ſhepherds in ſtormy weather. The moſt remarkable mountain is Carngern in Strathſpey. In it are found a particular kind of ſtones well known to the lapidaries. They are of blue, green, yellow, and amber colours; ſome ſo large as to make ſnuff-boxes, or ſmall cups; ſome of hexagonal or pentagonal figures, and tapering to a point at each end. The mountain of Benalar, in Badenoch is by Mr Shaw reckoned to be the higheſt land in Scotland, as waters flowing from it fall into the ſea at Dundee, Inverlochy, and Garmoch in Murray.

MURRHINE, MURRHINUS, Μορριvος, 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 ſplendor 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 hold 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 κρυσαλλος for cryſtal, and σμυρνε for myrrh, very common among them; and therefore, if theſe veſſels had been made of either of

Mus. of theſe ſubſtances, they would in ſome places have called them ſmyrna or cryſtallina. 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, in zoology: A genus of quadrupeds belonging to the order of *Glires*; the characters of which are theſe: The upper foreteeth are wedge-ſhaped; there are three grinders, ſometimes (though rarely) only two, on each ſide of the jaws; and the clavicles or collar-bones are complete. In the new edition of the *Syſtema Naturæ*, by Dr Gmelin, the numerous ſpecies of this genus have been diſtributed into different groupes or diviſions, diſtinguiſhed by ſome particular character common to the individuals of each.—The firſt diviſion conſiſts of,

I. Myocastores, or *Beaver-rats*, the individuals of which have the tail *flattened* laterally at the end.

1. The coypus, or webbed beaver-rat, has a thick hairy tail of a moderate length, and the hind-feet webbed. It is an inhabitant of Chili, where it frequents the water. It has a ſtrong reſemblance, both in colour and ſhape, to the otter; but is allied to the murine tribe by the number and arrangement of its teeth.

2. The zibethicus, or muſquaſh, with a long ſharp-pointed tail, and the feet not webbed. This has been already deſcribed under the article Castor, of which it was ranked as a ſpecies in the former editions of Linnæus. In fact, it does reſemble the beaver in the form of the body and flat ſcaly tail, as well as in its manners and economy. In ſize, however, and length of tail, it comes nearer to the brown rat; but in its general appearance, and in the ſhort hairy ears, it reſembles the water-rat.

II. Mures, or *Rats* and *Mice*; having *round* tails, ſome naked and ſome hairy.

1. The piloris, or muſk cavy, with a naked tail blunt at the end, and covered with ſcales. There are two varieties: one with the body of an uniform whitiſh colour; the other with the upper parts tawny, and the under parts white. The former inhabits Ceylon, and the latter the Weſt Indies. They are nearly of the ſize of a rabbit: they both burrow in the ground; ſometimes infeſt houſes like the rat; and have a ſtrong flavour of muſk.

2. The caraco has a naked tail, long, ſcaly, and ſomewhat blunt; the body is of a brown grey colour, and the hind feet are very ſlightly webbed. It inhabits the eaſtern parts of Siberia, and probably Chineſe Tartary and the northern provinces of China; burrowing like the rabbit, near the banks of rivers.—It ſwims remarkably well, and even infeſts houſes.—The body and head are ſix inches in length, and the tail four and a half. Mus. Plate CCCXIX. fig. 10.

3. The americanus, or American rat, has a long, naked, and ſcaly tail; the head is long-ſhaped, with a narrow pointed noſe, the upper jaw being much longer than the lower; the ears are large and naked. It is larger than the black, and ſmaller than the brown rat; its colour is of a deep brown, inclining to aſh on the belly, and the fur is coarſe and harſh. It is probably this ſpecies which is ſaid (Kalm's Trav. ii. 48.) to live among the ſtones and clefts of rocks, in the blue mountains of Virginia, at a diſtance from the peopled part of the country, which comes out only at night, and makes a terrible noiſe.

4. The decumanus, or brown rat, has a long, naked, ſcaly tail; the upper parts of the body are of a light brown, mixed with tawny and aſh colour, the lower parts dirty white. The head and body meaſure about nine inches; and the length of the tail, which conſiſts of 200 rings, is ſeven and a half. The whiſkers are larger than the head; and the eyes are large, black, and prominent. The fore-feet have four toes, with a ſmall claw in place of the fifth or thumb. It inhabits India and Perſia, and has only been known in Europe in the preſent century. They dwell in burrows which they dig in the banks of rivers; and frequent towns, aqueducts, drains, neceſſaries, ſtables, barns, gardens, fields, and houſes. They ſwim and dive with great dexterity; feed on vegetables, grain, fruits, and even deſtroy poultry; and are hunted eagerly by cats, dogs, and ferrets. They lay up ſtores of acorns, beech-maſt, and other proviſions, in their holes; in which the males remain during winter, except in fine weather, without hybernating; but the females and their young live moſtly in barns and out-houſes in that ſeaſon. They often emigrate from one place to another in great companies. The female produces three times in the year, having 12 or 15, even 18 or 19, at a litter. The bite of this creature is not only ſevere but dangerous, the wound being immediately attended with great ſwelling, and is a long time in healing. Theſe animals are ſo bold as to turn upon thoſe who purſue them, and faſten on the ſtick or hand of ſuch as offer to ſtrike them. This ſpecies is ſuppoſed to be the mus caſpicus of Ælian †, which he ſays was nearly as large as the ichneumon, and made periodical viſits in vaſt multitudes to the countries which border on the Caſpian, ſwimming boldly over the rivers, holding by each others tails. Plate CCCXVIII fig. 5.

† *Hiſt.* c. 17.

5. The rattus, black or common rat, has an almoſt naked ſcaly tail, which is very ſmall, has 250 diſtinct rings, and is eight inches long. The head and body meaſure ſeven inches in length; the upper parts are deep black grey, and the under parts aſh coloured. There are four toes, and a ſmall claw in place of the fifth, on each fore foot, and five on the hind feet. This ſpecies inhabits India, Perſia, and Europe except its moſt northern parts; from hence it has been carried Fig. 11.

Mus. to Africa and America; and is frequent in Otaheite, though lefs common in the other iſlands of the ſouthern ocean. Of late years it has greatly diminiſhed in Europe, and is even in many places extirpated, in conſequence of the introduction of the brown ſpecies, which deſtroy the black rats; though little is gained by the exchange, the brown having the ſame diſpoſitions, with greater ſtrength and abilities for doing miſchief. It is the moſt pernicious of any of our ſmaller quadrupeds. Meat, corn, paper, cloaths, furniture, in ſhort every convenience of life, is a prey to this deſtructive creature. Nor are its devaſtations confined to theſe: for it will make equal havock among poultry, rabbits, or young game; nay, it has been known to gnaw the extremities of infants when aſleep. It is a domeſtic animal, reſiding very frequently in houſes, barns, or granaries; and it is furniſhed with fore teeth of ſuch ſtrength as enable it to force its way through the hardeſt wood or the oldeſt mortar. It makes a lodge either for its days reſidence, or a neſt for its young, near a chimney; and improves the warmth of it, by forming there a magazine of wool, bits of cloth, hay, or ſtraw. It lodges alſo in cielings, and in the void ſpaces between the wall and the wainſcotting. From theſe lurking-places the rats iſſue in queſt of food, and tranſport thither every ſubſtance they can drag, forming conſiderable magazines, eſpecially when they have young to provide for. The female has ten teats, and brings forth ſeveral times in a year, but always in the ſummer ſeaſon. The litter generally conſiſts of five or ſix; and in ſpite of poiſon, traps, and cats, they thus multiply to ſuch a degree as ſometimes to do a great deal of damage. In old country-houſes where grain is kept, and where the vicinity of barns and magazines facilitates their retreats, they often increaſe ſo prodigiouſly, that the poſſeſſors are obliged to remove and deſert their habitations, unleſs the rats happen to deſtroy each other; an event which frequently takes place, for theſe creatures when pinched for food devour each other. When a famine happens by reaſon of too many being crowded into one place, the ſtrong kill the weak, open their heads, and firſt eat the brain and then the reſt of the body. Next day the war is renewed, and continues in the ſame manner till moſt of them are deſtroyed; which is the reaſon why theſe animals, after being extremely troubleſome for ſome time, diſappear all of a ſudden, and do not return for a long time. Rats are extremely laſcivious; they ſqueak during their amours, and cry when they fight. They ſoon learn their young to eat; and when they begin to iſſue from the hole, their mother watches, defends, and even fights with the cats, in order to ſave them. A large rat is more miſchievous than a young cat, and nearly as ſtrong: the rat uſes her fore-teeth; and the cat makes moſt uſe of her claws; ſo that the latter requires both to be vigorous, and accuſtomed to fight, in order to deſtroy her adverſary. The weaſel, though ſmaller, is a much more dangerous and formidable enemy to the rat, becauſe he can follow it into its retreat. Their ſtrength being nearly equal, the combat often continues for a long time, but the method of uſing their arms is very different. The rat wounds only by reiterated ſtrokes with his fore teeth, which are better formed for gnawing than biting; and being ſituated at the extremity of the lever or jaw, they have not much force. But the weaſel bites cruelly with the whole jaw; and inſtead of letting go its hold, ſucks the blood from the wounded part, ſo that the rat is always killed.—The rat was firſt introduced into America by the Europeans in 1544, and is now the peſt of all that continent. In the neighbourhood of the lower parts of the river Volga, there is a ſmall variety of this ſpecies found in the deſerts, which does not weigh above ſix or ſeven drams.

6. The muſculus, or common mouſe, has a very long, ſcaly, and almoſt naked tail: the fore feet have each four toes; the hind feet five, the fifth or thumb having no claw: the head and body meaſure three inches and a half in length; the upper parts are tawny, and the lower parts whitiſh or aſh-coloured. This little animal, which inhabits all parts of the world, lives almoſt entirely in houſes, and follows mankind for the ſake of their proviſions. It feeds on almoſt every thing, ſuch as grain, bread, cheeſe, butter, oil, and every kind of food uſed by mankind, and drinks little: it is of mild and gentle manners, exceedingly timid, and very quick in all its motions. The mouſe never iſſues from his hole but in queſt of food, and runs in again upon the leaſt alarm. It goes not, like the rat, from houſe to houſe, unleſs forced, and is not near ſo deſtructive. It is alſo capable of being tamed to a certain degree, though not ſo perfectly as other animals. It has many enemies, from whom it can eſcape only by its agility and minuteneſs. Owls, birds of prey, cats, weaſels, hedge-hogs, and even rats, make war upon the mice, ſo that they are deſtroyed by millions; yet the ſpecies ſtill ſubſiſts by its amazing fecundity. They bring forth at all ſeaſons, and ſeveral times in the year: the litter generally conſiſts of five or ſix; and in leſs than 15 days the young diſperſe, and are able to provide for themſelves. Ariſtotle tells us, that having ſhut up a pregnant mouſe in a veſſel, along with plenty of grain, he found in a ſhort time after 120 mice, all ſprung from the ſame mother. Plate CCCXVIII fig. 2.

Several varieties of mice as to colour are found, ſome being altogether black, ſome yellowiſh, ſome ſpotted with white, ſome of a white colour with aſh-coloured ſpots, and the moſt beautiful of all, and the leaſt common, are entirely white, with red eyes: but as theſe agree in every other circumſtance, it is unneceſſary to deſcribe them more at large.

7. The ſylvaticus, or long-tailed field-mouſe, is larger than the common mouſe, meaſuring from the end of the noſe to the ſetting on of the tail four inches and an half, the tail four inches; the upper parts of the body are of a yellowiſh brown; the breaſt is yellow, and the belly white; the tail is covered with ſhort hair. The fore feet have four toes each; the hind feet five. Theſe animals are found in fields, gardens, and ſhrubberies. In ſome places they are called *bean mice*, from the havock they make among beans when firſt ſown. They feed alſo on nuts, acorns, and grain, of which they amaſs quantities, not proportioned to their wants, but to the capacity of the place where it is depoſited, inſomuch that a ſingle animal will collect more than a buſhel. Thus they provide for other animals as well as themſelves: the hog comes in for a ſhare; and the great damage done Fig. 6.

to

Mus. to the fields by these creatures, in rooting up the ground, is chiefly owing to their search after the concealed hoards of the field-mice. M. Buffon informs us, that he has often seen great damage done to the plantations by the field-mice. They carry off the new sown acorns; by following the furrow of the plough, they dig up one after another, not leaving a single seed. This happens chiefly in those seasons when the acorns are scarce: not finding a sufficient quantity in the woods, they come in quest of them in the cultivated fields, and often carry off such quantities that they corrupt in their magazines. These creatures, according to the same author, do more mischief in a nursery of trees than all the birds and other animals put together. The only way to prevent this damage is to lay traps at ten paces asunder, through the extent of the sown field. No other apparatus is necessary than a roasted walnut placed under a flat stone, supported by a stick. The animals come to eat the walnut, which they prefer to acorns; and as it is fixed to the stick, whenever they touch it, the stone falls down and crushes them to death. The same expedient M. Buffon also made use of with success against the short-tailed field-mouse, which also destroys acorns. In this way he found that upwards of 100 were taken each day, from a piece of ground consisting only of about 40 French arpents. From the 15th of November to the 8th of December, above 2000 were caught in this manner. Their numbers gradually diminished till the frost became severe, which is the time they retire into their holes to feed on their magazines. In autumn they are most numerous; for if provisions fail during the winter they devour one another. The long-tailed mice eat also the short tailed species, and even thrushes, blackbirds, &c. which they find entangled in snares. They first eat the brain, and then the rest of the body. M. Buffon once kept a dozen of these mice in a cage, and furnished them with food every morning at eight o'clock. One day they were neglected for about a quarter of an hour, when one of their number was eaten up by the rest; next day another suffered the same fate; and in a few days only one remained: all the others had been killed, and partly devoured; and even the survivor himself had his feet and tail mutilated. These animals are very prolific, producing more than once a-year, and bringing nine or ten at a birth. They generally make the nest for their young very near the surface, and often in a thick tuft of grass. During winter they frequent barns, stables, and out-houses.

8. The messorius, harvest mouse, or less long-tailed field mouse, is a very small species, or perhaps rather a variety of the former; and inhabits Hampshire, where it is very numerous, particularly during harvest. They form their nest above the ground, between the straws of the standing corn, and sometimes in thistles: it is of a round shape, and composed of the blades of corn. They bring about eight young ones at a time. These never enter houses; but are often carried, in the sheaves of corn, into ricks: and 100 of them have frequently been found in a single rick on pulling it down to be housed. Those that are not thus carried away in the sheaves, shelter themselves during winter under ground, and burrow deep, forming a warm bed for themselves of dead grass. They are the smallest of the British quadrupeds: the length from nose to tail is only two inches and a half; their tail two inches, and the weight one-sixth of an ounce. They are more slender than the other long-tailed field-mouse; and their back of a fuller red, inclining to the colour of a dormouse.

9. The agrarius, or rustic mouse, is about three inches long, and scarcely weighs half an ounce; the tail is only about half the length of the body and head; the upper part of the body is of a yellowish colour, with a dark line along the back; the belly and the legs are white; the head is oblong, with a sharp nose, and small ears lined with fur; the hind legs have each a dusky circle just above the foot. It inhabits Russia, and is found in Silesia, rarely in Germany. This species is migratory; and wanders about often in vast multitudes, doing immense injury to the corn: It burrows in the ground, forming a long gallery just below the surface, and a little elevated, leading to a larger chamber, in which considerable quantities of grain and seeds are stored up for winter provision. Plate CCCXIX. fig. 5.

10. The minutus, or minute mouse, has the upper parts of the body of a deep tawny or ferruginous colour, and the under parts whitish. It is about half the size of the common mouse, the tail being scarcely two inches long; the female is smaller than the male, and less elegant in her colours: the nose is somewhat sharp; the face is dusky, with some whiteness at the corners of the mouth; the ears are small, and almost hid in the fur; the feet are grey. This species inhabits Russia; where it is found in the corn-fields and in barns, and is plentiful in birch woods: it seems to wander about without any fixed places for its nest; and much greater numbers of males are found than of females. Fig. 1.

11. The vagus, or wandering mouse, is between two and three inches long: the colour of the upper parts of the body is a pale ash, waved with black, and having a black line along the middle of the back; the ears are large, oval, naked, and plaited. The legs are very slender, and the feet whitish, having four toes and a conical excrescence before, and five behind, all armed with long claws; the tail is longer than the body, very slender, prehensile at the end, of an ash colour above and whitish below; the head is oblong, with a blunt nose reddish at the tip, having yellow fore-teeth, and only two grinders on each side in the upper jaw. The female has eight teats.—This species inhabits the deserts of Tartary and Siberia, as high as the Ural, Irtish, Oby, and Jenisei. Is frequent in the birch woods, and lives in fissures of rocks, under stones, and in hollows of trees; feeding chiefly on seeds, and likewise on small animals of the same genus. It wanders about in great flocks, migrating from one place to another in the night; hybernates during winter, and is of a very chilly nature, so as even to become torpid and fall asleep, in a round form, in the cold nights of the month of June. It has carnivorous inclinations. Fig. 9.

12. The betulinus, or beech-mouse, has a considerable resemblance to the wandering mouse, but is somewhat smaller. The upper parts of the body are tawny, with a black line along the back, the under parts whitish or pale ash-colour; the nose is sharp, with Fig. 15.

Mus.

with a red tip; the ears are ſmall, oval, plaited, brown, and briſtly at the ends; the limbs are very ſlender, with long and very ſeparable toes; the tail is ſlender and much longer than the body. This ſpecies inhabits the birch woods in the deſert plains of Iſchim and Baraba, and between the Oby and Jeniſei. It lives ſolitary, frequenting the hollows of decayed trees. It runs up trees readily, and faſtens on their branches with its tail; and by means of its ſlender fingers or toes, it can faſten even to a very ſmooth ſurface. It is a very tender animal, ſoon growing torpid in cold weather; and its voice is very weak.

Plate CCCXVIII fig. 15.

13. The pumilio, or dwarf mouſe, is of a browniſh aſh colour, with the fore-head and nape of the neck black, and having four black lines along the back meeting at the tail. It is ſcarcely two inches long, the tail is about two-thirds of the length of the body, and the whole animal, even when ſteeped many months in ſpirits, hardly weighs four ſcruples. The body is ſomewhat flattened; the regions of the eyes, the ears, and the noſe, are of a paler colour than the reſt of the body; all the feet have five toes, the thumb or inner toe of the fore feet being very ſmall, but diſtinctly furniſhed with a claw; the legs and feet are ſtrongly made; the tail is almoſt naked, and of a pale aſh-colour. This ſpecies, which was firſt deſcribed by Dr Sparrman, inhabits the foreſts of Sitſicamma near Ilangen river, 200 hours journey from the Cape of Good Hope.

Plate CCCXIX. fig. 16.

14. The ſaxatilis, or rock mouſe, is about four inches long, and weighs nearly nine drams; the tail is hairy, an inch and a half in length, of a brown colour above, and white beneath; the head is oblong, with a longiſh noſe, and oval downy ears, brown at the edges: the limbs are ſtrong; and the tail is thinly covered with hair; the upper parts of the body are of a brown colour, ſlightly mixed with yellowiſh or grey; the ſides are rather inclined to the latter colour; the belly is of a light aſh or whitiſh; the feet and legs are blackiſh; the ſnout is duſky, and ſurrounded with a ſlender white ring. This ſpecies is an inhabitant of the eaſtern parts of Siberia beyond lake Baikal, and of the deſerts of Mongul Tartary.—It burrows in the fiſſures of rocks, forming a winding oblique paſſage, which afterwards branches out into ſeveral others pointing downwards, and ending in a chamber, in which is a bed or neſt of ſoft herbs. It feeds chiefly on the ſeeds of the aſtragalus.

Plate CCCXVIII fig. 13.

15. The amphibious, or water-rat, with a long tail; the upper parts of the body being covered with black hair mixed with yellowiſh, and the under parts aſh-coloured; the ears ſcarcely appear above the fur; the feet have three toes on each, and the rudiments of a fourth. This ſpecies, of which there are ſeveral varieties, differing in the toes and in the colour, inhabits the whole of Europe, the northern parts of Aſia as far as the icy ſea, and North America.—They dwell chiefly near waters, forming burrows in their ſteep banks; about ponds and wet ditches; likewiſe in marſhy places, meadows, and gardens; feeding on roots, herbs, and ſhrubs; and on frogs, craw-fiſh, inſects, ſmall fiſh, and the fry of larger ones. They ſwim and dive with great facility, and live much in the water. They are very fierce, and bite bitterly. The fleſh of theſe animals is reckoned very delicate by ſome of the more ſavage inhabitants of the Ruſſian empire; and is eaten by the French along with that of the otter during lent. The female is ſmaller than the male, and has a greater yellowneſs of colour; ſhe has eight teats, four of which are placed on the breaſt and four on the belly. They procreate about the end of winter, at which time they ſmell ſtrongly of muſk, and produce as far as eight young ones in the month of April.

Plate CCCXIX. fig. 2.

16. The alliarius, or garlic mouſe, has a ſhort tail; the ears rather large, and ſomewhat hairy; the body aſh coloured on its upper parts, and whitiſh underneath. The head and body meaſure ſomewhat more than four inches, the tail ſcarcely an inch and a half. This ſpecies inhabits Siberia, about the rivers Jeniſei, Kan, Lena, and Angara; and feeds on the roots of garlic, of which it lays up large ſtores in ſubterraneous burrows.

Fig. 8.

17. The rutilus, or red mouſe, has a ſhort tail; the ears are longer than the fur, which is tawny red on the back, light grey and yellow on the ſides, and whitiſh on the belly. The head and body meaſure about four inches, and the tail one.—This ſpecies inhabits Siberia, from the Oby as far as Kamtſchatka, and within the Arctic circle. It lives in holes and in hollows of trees; feeding on grain, and ſometimes on animals of the ſame genus. It comes often into houſes and barns, eating almoſt of every thing which comes in its way, but is particularly fond of fleſh. It is very lively, and runs about even on the ſnow the whole winter.

Plate CCCXVIII fig. 8.

18. The arvalis, or meadow-mouſe, is from three to ſix inches long, the female being much longer than the male, and the tail is little more than an inch: the head is large, with a blunt noſe, ſhort ears almoſt hid in the fur, and prominent eyes; the upper parts of the body are of a mixed ferruginous and black colour; the belly is deep aſh, and the legs and feet duſky;—the tail is terminated by a ſmall tuft of hair. There is a variety which is almoſt black.—This ſpecies inhabits all Europe, Siberia, Hircania, and Newfoundland; dwelling in buſhy places, corn-fields, meadows, and gardens, chiefly near waters; living on grain, nuts, acorns, and walnuts, which it collects into ſubterraneous burrows: but it appears to prefer corn to every other food. When the grain is ripe, they aſſemble from all quarters, and often do great damage by cutting the ſtalks of corn in order to come at the ears. They follow the reapers, and eat up all the fallen and neglected grain. When the gleanings are devoured, they flock to the new-ſown fields, and deſtroy the crop of the enſuing year. In winter moſt of them retire into the woods, where they feed upon filberts, acorns, and the ſeeds of trees. In particular years they appear in numbers ſo immenſe, that they would deſtroy every thing if they continued long: but they always kill and eat one another during a ſcarcity of proviſions. They beſides are devoured by the long-tailed field-mice, by foxes, wild-cats, and weaſels. Theſe creatures are often carried home in the ſheaves of corn, and 100 of them have been found in houſing a rick. In ſuch caſes it has been obſerved, that the dogs devoured all the mice of this ſort they could find, rejecting the common kind; and, on the contrary, the cats would touch none but the laſt. The female produces ſeveral

Mus.

ſeveral times a year, and brings from eight to twelve young at a birth: it has a ſtrong affection for them; one that was ſeduced into a wire-trap by placing its brood in it, was ſo intent on foſtering them, that it appeared quite regardleſs of its captivity. In Newfoundland, theſe mice are very deſtructive to gardens; but ſeldom do much damage in this way in Britain.

Plate CCCXIX. fig. 13. 19. The ſocialis, or ſocial mouſe, with a very ſhort ſlender tail, and naked, rounded, and very ſhort ears; the fore feet have each three toes and the rudiments of a fourth; the upper parts of the body are light-grey; the ſides, ſhoulders, and belly, are white. The head and body are ſomewhat more than three inches long, the tail half an inch. This ſpecies inhabits the ſandy deſerts between the Volga and Ural, near the Caſpian ſea, and in the mountains of Hircania.—They live in pairs, or in families, conſiſting of a male and a female with their young ones; and of theſe families vaſt numbers live together, the whole country being covered with little hills of earth thrown out of their burrows. They feed moſtly on tulip roots; and are preyed on by weaſels, polecats, crows, and otters. They ſwarm chiefly in ſpring, and rarely appear in autumn, at which ſeaſon it is ſuppoſed they migrate, or take ſhelter among the buſhes.

Fig. 12. 20. The œconomous, or economic mouſe, in its general form, reſembles the meadow-mouſe; but the body is rather longer and the belly larger. The ears are naked and hid in the fur; the colour is tawny; and the fore-feet have each three toes with the rudiments of a fourth. The head and body meaſure four inches and a quarter, the tail ſomewhat more than an inch. This ſpecies inhabits Siberia, from the river Irtiſh eaſtwards, in Kamtſchatka, and under the Arctic circle. They are called by Dr Pallas *mures œconomi*, from their curious way of living. They dwell moſtly in damp ſoils, forming burrows, with many chambers and numerous entrances, immediately under the turf. In theſe they lay up magazines of various vegetable food, chiefly bulbous roots; which they ſpread out in ſunny days to dry, and never touch them but in winter, living all ſummer on berries and other vegetables. The Kamtſchatkans hold theſe animals in great regard, and never deſtroy their hoards; they take away only part, and leave ſome caviare or other ſubſtance to ſupport them in its ſtead. This ſpecies ſometimes emigrates in vaſt multitudes, keeping a ſtraight courſe, like the lemmus, even over rivers; and are much infeſted on their march by birds, fiſh, wild hogs, foxes, and other wild beaſts. They begin their march from about the river Pengin in ſpring, and about the middle of July reach Ochotſka and Judoma, at a vaſt diſtance; and return in October. The Kamtſchatkans are much alarmed at their migrations, which portend rainy weather and a bad chace; and when they find them lying weak and ſpent with fatigue after croſſing a river, give them every aſſiſtance in their power. The Tſchutſki are not ſo much attached to this animal, and make uſe both of their winter ſtores and of their carcaſes as food.

21. The gregalis, or gregarious mouſe, has a ſhort tail; the ears are longer than the fur; the fore-feet have each three toes and the rudiments of a fourth; the fur is dark aſh-coloured on the upper parts, and whitiſh below. This ſpecies is leſs than the economic mouſe, and longer than the ſocial; the female being five inches long and the male four. It inhabits the eaſtern parts of Siberia, where it dwells in arid places, forming burrows with numerous openings directly under the ſod; theſe lead to chambers in which it lays up large ſtores of roots, eſpecially thoſe of the lilium pomponii and garlic: It eats ſitting up. Mus.

22. The lauiger, or woolly mouſe, with woolly fur of an aſh-colour, inhabits Peru and the north parts of Chili. It burrows in the earth, is very docile and cleanly, and is eaſily tamed; it lives on bulbous roots, eſpecially onions; the female breeds twice a-year, and brings five or ſix young ones at each litter. It is about ſix inches long, with a ſhort noſe, and ſmall ſharp-pointed ears; the fur is very long and exceedingly fine, almoſt like the threads of a ſpider's web, and was formerly employed as the very fineſt ſpecies of wool by the Peruvians.

23. The lagurus or rambling mouſe, has hardly any tail; the ears are ſhorter than the fur; the fore-feet have each three toes, and the rudiments of a fourth; the upper parts of the body are aſh-coloured mixed with duſky, and having a black line along the back. The head is long, with rough and ſwelling lips; the limbs are ſhort and ſlender; and the length of the body and head is between three and four inches. This ſpecies inhabits the deſarts near the rivers Ural, Irtiſh, and Jeniſei.—Each individual forms a round neſt of dried graſs in a burrow, having an oblique and a perpendicular entrance. They feed chiefly on the dwarf iris; but eat all kinds of grain, and devour other ſpecies of this genus, as well as one another. They ſleep very much, in a rolled-up form, and are very ſlow in their motions, like the marmot; but do not become torpid in winter. This ſpecies is very ſalacious; the males fight together for the females, and the conqueror generally devours the vanquiſhed. The female ſmells of muſk when in ſeaſon, produces ſeveral times in the year, and brings five or ſix young ones at a birth. They migrate in great troops; whence the name of rambling mice, which is given them by the Tartars. Fig. 17.

24. The torquatus, collared or ringed mouſe, has a very ſhort tail, with a tuft of hard briſtles at the end, which is blunt: the ears are ſhorter than the fur; the feet have each five toes; the fur is ferruginous, varied with grey, yellow, and duſky, having a whitiſh collar round the neck, and a dark line along the back. The head and body are ſomewhat more than three inches long, the tail ſcarcely one inch. It inhabits the northern parts of the Uralian mountains, and the marſhes near the frozen ocean; feeding chiefly on the lichen rangiferinus, lichen nivalis, and polygonus viviparus; theſe articles of food are ſtored up in burrows having numerous paſſages, which it digs under the turfy ſoil. This ſpecies is migratory, and reſembles the lemmus in its manners. Fig. 4.

25. The lemmus, or lemming, has a very ſhort tail: The head is pointed, having very long whiſkers, ſix of the hairs on each ſide being longer and ſtronger than the reſt; the mouth is ſmall, having two very long fore-teeth in each jaw, and the upper lip is divided; the eyes are ſmall and black; the ears are ſhorter than the fur, rounded, and reclined backwards; the fore-legs are very ſhort, having four ſlender hairy toes Plate CCCXVII. fig. 2.

Mus. toes on each, and a long ſharp claw like a cock's ſpur in place of the fifth or thumb; the hind-feet have five toes; the ſkin is very thin, and the upper parts of the body are black and tawny, diſpoſed in irregular blotches; the belly is white tinged with yellow. The length from noſe to tail is about five inches; of the tail, half an inch. This ſingular animal inhabits the mountains of Norway and Lapland. They feed on graſs, the catkins of the dwarf birch, the lichen rangiferinus, or rein-deer liverwort, and other ſuch vegetable productions: in ſummer they form ſhallow burrows under the turf, and in winter they make ſimilar long paſſages under the ſnow in queſt of food; for as they do not lay up magazines, and do not hybernate, they are obliged to ſearch for proviſions in the rigorous winter of theſe northern climes. When they foreſee, by ſome wonderful inſtinct of nature, the approach of a very ſevere winter, they leave their northern haunts in autumn, and emigrate in immenſe multitudes into the lower parts of Norway and Sweden, keeping a ſtraight line in ſpite of every obſtacle, moving moſtly in the night-time, and making prodigious havock of every vegetable they are able to reach. In this journey, which takes place at uncertain intervals, though generally about every ten years, they are deſtroyed by eagles, hawks, foxes, and other animals of prey, and numbers are drowned in paſſing rivers or lakes, which never interrupt their courſe, even proceeding on into the ſea: from all theſe concurring cauſes very few live to return to their native mountains, and thus a check is put to their ravages, as it takes years to repair their numbers ſufficiently for another invaſion. They are bold and fierce, ſo as even to attack men and animals, if they meet them in their courſe; and bite ſo hard as to allow themſelves to be carried a conſiderable way, hanging by their teeth to a ſtick, before they will quit their hold. The female breeds ſeveral times in the year, producing five or ſix young at a birth: ſometimes they bring forth during their migration, when they carry their young in their mouth or on their back.

There is a variety, the Sibiricus, or Siberian lemming, of a ſmaller ſize, and more uniform tawny colour, than the above. It inhabits the northern parts of the Uralian chain of mountains, and on the river Oby. It differs greatly in manners from the former: for it lays up in its burrows large ſtores of proviſions to ſerve during winter; whence it is probable that it does not migrate like the Norwegian kind.

There are nine or ten other ſpecies belonging to this diviſion.

III. Criceti, or *Hamſters;* having pouches on the cheeks, and ſhort hairy tails.

Plate CCCXIX. fig. 10. 1. The acredula, or Siberian hamſter, has large oblong oval furrowed ears: the upper parts of the body are of a yellowiſh and brown aſh-colour, the under parts hoary. The head and body meaſure four inches, and the tail near one. This ſpecies inhabits the diſtrict of Orenburgh in Siberia, near the Yaik or Ural. It lives in burrows, which it quits only in the night to ſeek for food: The Coſſacks ſay that it migrates out of the deſarts in vaſt multitudes; but Dr Pallas ſuſpects this to be a miſtake.

Plate CCCXVIII fig. 1. 2. The M. cricetus Germanicus, or German hamſter, is the moſt deſtructive of the whole rat-tribe. The males are about ten inches long, and the tail about three, but the females are ſcarcely more than half ſo large: the former weigh from 12 to 16 ounces, while the latter ſeldom exceed from four to ſix ounces: The head is thick, with a blunt noſe, and numerous whiſkers, large full black eyes, and large rounded open ears; uſually the head and back are of a reddiſh brown colour, with red cheeks; the ſides are paler, with three white ſpots; the breaſt, upper part of the fore-legs, and belly, are black; the feet are large and white, having four toes, and a claw inſtead of a fifth toe on the fore-feet, and five toes on each hind foot: The colour varies; ſometimes, though rarely, they are found entirely white or yellowiſh, or white with black ſpots on the back; ſometimes the ſnout is white, and the forehead aſh-coloured, or the lower jaw of a white colour.—There is a variety (the black German hamſter) which is entirely black, excepting the tip of the noſe, edges of the ears, and the feet, which are white. Fig. 4. This ſpecies inhabits Siberia, the ſouth of Ruſſia, Poland, Sclavonia, Hungary, Sileſia, Bohemia, and Germany beyond the Rhine, eſpecially in Thuringia.—Each individual forms a ſubterraneous burrow, conſiſting of ſeveral chambers, with two holes or entrances leading from the ſurface; one of theſe is perpendicular, and the other, in which the excrements are lodged, is oblique; the holes of the females have ſeveral perpendicular openings, and each young one of her family is lodged in a ſeparate chamber: The chambers which are ſet apart for the lodging of themſelves and young are lined with ſtraw or graſs; the reſt are larger, and are appropriated for containing magazines of grain, beans, peaſe, lintſeed, vetches, and other ſuch ſeeds, each in a ſeparate cell. The chambers of the older animals are dug ſeveral feet deep, while thoſe of the younger ones ſeldom exceed a foot under the ſurface. The hamſter ſleeps during the winter like the marmots; when in a torpid ſtate, neither reſpiration nor any kind of feeling can be perceived. The heart, however, beats 15 times in a minute, which has been diſcovered by opening the cheſt. The blood continues to be fluid, but the inteſtines are not irritable; even an electrical ſhock does not awake him; but in the open air he never becomes torpid. When dug up in his ſtate of torpidity, the hamſter is found with his head bent under his belly between the two fore-legs, and thoſe behind reſt upon his muzzle. The eyes are ſhut; and when the eye-lids are forced open, they inſtantly cloſe again. The members are ſtiff, like thoſe of a dead animal, and the whole body feels as cold as ice. When diſſected during this ſtate, he ſeems to feel very little; ſometimes indeed he opens his mouth as if he wanted to reſpire; but his lethargy is too ſtrong to admit of his awakening entirely. This lethargy hath been aſcribed ſolely to a certain degree of cold; which indeed may be true with regard to dormice, bats, &c. But experience ſhows, that, in order to render the hamſter torpid, he muſt alſo be excluded from all communication with the external air: for when he is ſhut up in a cage filled with earth and ſtraw, and expoſed in winter to a degree of cold ſufficient to freeze the water, he never becomes torpid: but when the cage is ſunk four or five feet under ground, and well ſecured againſt the acceſs of the air, at the end of eight or ten days he is equally torpid as if if he had been in his own burrow. If the cage is brought up to the ſurface, the hamſter will awake in a few hours, and reſume his torpid ſtate when put below the earth. The experiment may be repeated with the ſame ſucceſs as long as the froſt continues. We have a farther proof that the abſence of the air is one of the cauſes of torpidity in the hamſter; for when brought up from his hole in the coldeſt weather, and expoſed to the air, he infallibly awakes in a few hours. This experiment ſucceeds as well in the night as in the day; which ſhows that light has no ſhare in producing the effect. It is curious to obſerve the hamſter paſſing from a torpid to an active ſtate. He firſt loſes the rigidity of his members, and then makes a profound reſpiration, but at long intervals. His legs begin to move, he opens his mouth, and utters diſagreeable and rattling ſounds. After continuing theſe operations for ſome time, he opens his eyes, and endeavours to raiſe himſelf on his legs. But all theſe movements are ſtill reeling and unſteady, like thoſe of a man intoxicated with liquor. He, however, reiterates his efforts till he is enabled to ſtand on his legs. In this attitude he remains fixed, as if he meant to reconnoitre and repoſe himſelf after his fatigue; but he gradually begins to walk, eat, and act in his uſual manner. This paſſage from a torpid to an active ſtate requires more or leſs time, according to the temperature of the air. When expoſed to a cold air, he ſometimes requires more than two hours to awake; and in a more temperate air he accompliſhes his purpoſe in leſs than one hour. It is probable that, when the hamſter is in his hole, this change is performed imperceptibly, and that he feels none of the inconveniences which ariſe from a ſudden and forced reviviſcence.

The hamſter is a very miſchievous animal; and ſo exceedingly fierce, that he ſeems to have no other paſſion but rage. In conſequence of this, he attacks every other animal that comes in his way, without regarding the ſuperior ſize or ſtrength of his antagoniſt; nay, as if he was ignorant of the method of ſaving himſelf by flight, he allows himſelf to be beat to pieces with a ſtick rather than yield. If he ſeizes a man's hand, he muſt be killed before he quits his hold. When the hamſter perceives a dog at a diſtance, he begins with emptying his cheek-pouches if they happen to be filled with grain, and which are ſo capacious as to hold a quarter of a pint Engliſh. He then blows them up ſo prodigiouſly, that the ſize of the head and neck greatly exceeds that of the body. Laſtly, he raiſes himſelf on his hind-legs, and in this attitude darts on his enemy. If he catches hold, he never quits it but with the loſs of life. But the dog generally ſeizes him behind, and ſtrangles him. This ferocious temper prevents the hamſter from being at peace with any other animal. He even makes war againſt his own ſpecies, not excepting the females. When two hamſters encounter, they never fail to attack each other, and the ſtronger always devours the weaker. A combat between a male and a female laſts longer than between two males. They begin by purſuing and biting each other; then each of them retires to a ſide as if to take breath; a little after, they renew the combat, and continue to fly and fight till one of them falls. The vanquiſhed uniformly ſerves for a repaſt to the conqueror.

The hamſters copulate about the end of April; when the males enter the apartments of the females, where they remain only a few days. If two males happen to meet in the ſame hole, a furious combat enſues, which generally terminates in the death of the weakeſt. The conqueror takes poſſeſſion of the female; and both, though at every other period they perſecute and kill each other, lay aſide their natural ferocity during the few days their amours continue. They even mutually defend each other againſt agreſſors; and if a hole is opened about this time, the female defends her huſband with the utmoſt fury. The females bring forth twice or thrice every year. Their litter is never fewer than ſix, and more frequently from 16 to 18. Their growth is very rapid. At the age of 15 days they begin to dig the earth; and ſoon after, the mother baniſhes them from her habitation; ſo that at the age of about three weeks they are abandoned to their own management. The mother in general diſcovers little affection for her offſpring; and when her hole is opened, flies in the moſt daſtardly manner, leaving her young ones to periſh. Her only ſolicitude at that time is to provide for her own defence. With this view ſhe digs deeper into the earth, which ſhe performs with amazing quickneſs. The young would willingly follow her; but ſhe is deaf to their cries, and even ſhuts the hole which ſhe has made.

The hamſters feed upon all kinds of herbs, roots, and grains, which the different ſeaſons produce, and even eat the fleſh of ſuch animals as they can conquer. They are particularly fond of places where liquorice grows, and feed much on its ſeeds. Their pace is very ſlow, and they do not climb; but they dig with vaſt quickneſs, and will gnaw through a piece of wood an inch and a half thick in a very ſhort time. As they are not adapted for long journeys, their magazines are firſt ſtocked with the proviſions which are neareſt their abode. This is the reaſon why ſome of the chambers are frequently filled with one kind of grain only. When the harveſt is reaped, they go to a greater diſtance in queſt of proviſions, and carry every article they can find, without diſtinction, to their granary. To facilitate the tranſportation of their food, nature has furniſhed them with two pouches in the inſide of each cheek. On the outſide, theſe pouches are membranous, ſmooth, and ſhining; and in the inſide there are a great many glands, which ſecrete a certain fluid, to preſerve the flexibility of the parts, and to enable them to reſiſt any accidents which may be occaſioned by the roughneſs or ſharpneſs of particular grains. Each of theſe receptacles is capable of containing an ounce and an half of grain, which, on his return to his lodgings, the animal empties, by preſſing his two fore-feet againſt his cheeks. When we meet a hamſter having his cheeks filled with proviſions, it is eaſy to ſeize him with the hand, without the riſk of being bitten; becauſe in this condition he has not the free motion of his jaws. But if he is allowed a little time, he ſoon empties his pouches, and ſtands upon his defence. The quantity of proviſions found in the holes depends on the age and ſex of the inhabitant. The old hamſters frequently amaſs 100 pounds of grain; but the young and the females content themſelves with a quantity much ſmaller. Their object in laying up provifions, is not to nourifh them during winter, which they pafs in fleep, and without eating; but to fupport them after they awake in the fpring, and previous to their falling into a torpid ftate, which refembles a profound fleep. At the approach of winter, the hamfters retire into their fubterraneous abodes; the entrance to which they fhut up with great addrefs. Here the animal repofes, in the fituation already defcribed, upon a bed of ftraw, and in this ftate he is commonly dug up. They are preyed on by polecats, weafels, cats, dogs, foxes, and birds of prey; and are profcribed by man, on account of their devaftations. In winter the peafants generally go a *hamfter-nefting* as they call it; the retreat is known by a fmall eminence of earth raifed near the oblique paffage formerly defcribed. The peafants dig down till they difcover the hoard, and are generally well paid for their trouble; as they often find two bufhels of corn, befides the fkins of the animals, which are valuable furs: and it is remarkable, that the hair fticks fo faft to the fkin, that it cannot be plucked off without the utmoft difficulty. In fome feafons the hamfters are fo numerous, that they occafion a dearth of corn. In one year about 11,000 fkins, in a fecond 54,000, and in a third year 80,000, were brought to the town-houfe of Gotha, to receive a reward for their deftruction. They are likewife deftroyed by means of a pafte formed of honey and flour boiled up with arfenic or powdered hellebore.

Plate CCXIX. fig. 11.

3. The arenarius, or fand-hamfter, has the upper parts of the body hoary; the fides, belly, limbs, and tail, pure white. It inhabits the fandy defarts of Baraba, on the river Irtifh, in Siberia. The head is large, with a longifh fnout and a fharp nofe, having very long whifkers, very large pouches, and great oval brownifh ears; the body is fhort and thick, being about four inches long, and the tail rather more than one; the fur is very foft; the fore feet have only four toes each, the hind feet five, all the claws being white. This animal is very fierce and untameable: it forms burrows, like the preceding fpecies; is chiefly active at night, and feeds moftly upon leguminous plants.

Fig. 7.

4. The fongarus, or fongar hamfter, has the upper parts of the body of a grey afh-colour, marked with a black line along the back; the fides of the head and body are varied with large white and dark brown fpots; the feet and belly are white. It is about three inches long, with a very fhort, thick, blunt, and hairy tail, little more than one-third of an inch in length. It inhabits the defert of Baraba, near the Irtifh, in Siberia; where, like its congeners, it digs chambers for the reception of provifions. It is not, however, fo fierce as fome other fpecies of the hamfters; but may be tamed when caught young, and grows very familiar.

There are two or three other fpecies belonging to this divifion.

Fig. 18.

5. The phæus, or rice-hamfter, has the upper parts of the body of a hoary afh-colour, with long dufky hairs along the back; the fides whitifh; the circumference of the mouth, breaft, belly, and extremities of the limbs, pure, white. It is about three inches and a half long, and the tail fcarcely one inch.—This fpecies inhabits about Zarizyn in the defarts of Siberia, and in the mountains of the north of Perfia; where it does vaft mifchief in the rice fields. It is often caught in traps during winter, near ftables and other out-houfes, and never becomes torpid.

Fig. 14.

6. The furunculus, or Baraba hamfter, has the upper parts of the body of a cinereous yellow, with a black ftreak on the back; the under parts dirty white. It is about three inches long, and the tail near one. This fpecies inhabits Dauria, Siberia in the defart of Baraba, towards the Ob, between the Onon and Argum, and in the Chinefe empire near lake Dalai; living chiefly on the feeds of the aftragulus and atriplex: but its manners are unknown.

IV. Myotalpæ †, or *Mole-rats*. Thefe have no external ears, very fmall eyes, and a very fhort tail or none. They live entirely under ground like the moles.

† Kerr—*Mures fubterranei*, *Gmelin*.

Plate CCCXIX. fig. 3.

1. The talpina, or Ruffian mole-rat, is of a dufky colour; has a very fhort tail, fcarce appearing beyond the fur; and no external ears: the fore-teeth are long, extended from the mouth, and wedge-fhaped: the eyes are very fmall, and hid in the fur: the feet have five toes; the fore feet are very ftrong, flat, and formed for digging. It is about four inches long, and in the general form refembles the water-rat. As to colour, the head, back, and fides are dufky, and the belly and limbs white. There is a variety (the *nigra)*, which is entirely black.—This fpecies inhabits the plains of Ruffia and Weftern Siberia, fcarcely extending beyond the Irtifh, and never beyond the Oby. It is fond of a turfy foil, avoiding fandy or muddy places; and digs holes like thofe of the hamfter, which it lines with foft grafs, and fills with bulbous roots, throwing up hillocks of earth all along the tracks; each individual has its feparate burrow: It works only in the night, and feldom comes out except in the feafon of love. Its fight is very weak in the day-time. It feeds chiefly on the roots of tulips, tuberofe lathyrus, and tuberofe phlomis. It procreates about the beginning of April, at which time it fmells ftrongly of mufk; and the females produce three or four young at a litter.

Plate CCCXVIII fig. 9.

2. The capenfis, or Cape mole-rat, is of a dark brown colour tinged yellowifh, with the fore-part of the face, orbits, and regions of the ears, white: It has a very fhort tail, and no external ears; and is about five inches and a half long. It inhabits the Cape of Good Hope, where it infefts the gardens.

3. The maritima, or African mole-rat, is of a pale brownifh afh-colour mixed with yellowifh on the upper parts, the fides and under parts paler: the tail is very fhort; and there are no external ears. It inhabits the fand hills adjacent to the fea at the Cape of Good Hope; and refembles the former fpecies, but is much larger, meafuring 12 or 13 inches long, and the head is more lengthened. It forms burrows in the fand like thofe of rabbits; and digs with furprifing celerity. It runs flowly; but is very fierce, and bites feverely. It feeds chiefly on the roots of ixiæ, antholyzæ, gladioli, and irides; and is reckoned good eating.

Fig. 10.

4. The afpalax, or Daurian mole-rat, is of a dirty yellow afh-colour on the upper parts, and whitifh afh on the lower: has a very fhort tail, and no external ears; the eyes are very fmall, and deep-feated; the feet have each five toes, the claws of the fore feet being very long.—This fpecies inhabits Dauria, and Siberia beyond the Irtifh, between the Alei and Tfcharyfch rivers.

Mus. rivers. It digs very long burrows in the black turfy soil or firm sand, throwing up numerous hillocks, which extend over a considerable surface; it works both with its feet and nose, and sometimes with its teeth. It feeds chiefly on the roots of bulbous plants. This species varies in size, those of Dauria being near nine inches long, while those farther east are scarcely six.

Plate CCCXVIII fig. 7. 5. The typhlus, or blind mole-rat, is of a reddish ash colour; and has no tail, external ears, or apparent eyes; the feet have each five toes; and the fore-teeth are broad. The body and head measure between seven and eight inches: the mouth is continually gaping, with short wrinkled fore-teeth above, and very long ones below, likewise furrowed or wrinkled, none of them being hid by the lips; the body is covered with short, soft, and close set fur, which is of a dusky colour at the bottom, with the ends of a rusty brown mixed with ash-colour; the legs are very short, having five toes on each foot armed with short claws, and slightly connected by a short membrane at their bases. This species inhabits the southern parts of Russia, from Poland to the Volga. Each individual forms burrows under the turfy soil of very considerable extent, with many lateral passages, and throws out the earth at different distances, in large hillocks sometimes two yards in circumference, and proportionally high. It works with its snout, feet, rump, and even with its teeth; and digs with great celerity, especially when frightened, in which case it digs directly downwards. When irritated, it snorts, gnashes its teeth, raises its head in a menacing posture, and bites with great severity. It feeds on roots, especially those of the bulbous chærophyllum. It is entirely blind, though it has the rudiments of very small eyes, which are covered over with a continuation of the skin; but it possesses the senses of touch and hearing in a very eminent degree, to make up for the loss of sight. It breeds in spring and summer; and the female, which has two teats, brings from two to four young ones at a birth.

The *Marmot*, *Agouti*, *Guinea-pig*, *Cavy*, *Jerboa*, *Dormouse*, &c. which were formerly comprehended under the present genus in the Linnæan arrangement, have, in consequence of more accurate investigation, been lately disjoined, and distributed under four new genera, *Myoxus*, *Arctomys*, *Dipus*, and *Cavia**. But as we are past the alphabetical order in which the three last of those genera should have been introduced, we must still describe the above animals (excepting the first) in this place; observing, however, to distinguish them according to their new generic arrangement.

* See Gmelin's edition of the *Systema Naturæ*; and the very elaborate and more ample edition in English, publishing by Kerr.

I. Myoxus, or *Dormouse*. See Myoxus, the *Marmot*.

II. Arctomys, the *Marmot*; the characters of which genus are: There are two wedge-like cutting teeth in each jaw; the grinders are five above, and four below, on each side; and there are perfect clavicles or collar-bones.

Plate CCCXVII. fig. 7. 1. The marmotta, or common marmot, has short round ears; gibbous cheeks; a short hairy tail; the upper parts of the body of a dusky brown colour, and the lower parts reddish. The body and head measure 16 inches, the tail six. This species inhabits the summits of the Alps and Pyrenean mountains, in dry places where there are no trees. It is more subject to be rendered torpid by cold than any other. In the end of September, or beginning of October, he retires into his hole, from which he comes not out till the beginning of April. His retreat is capacious, broader than long, and very deep, so that it can contain several marmots without any danger of corrupting the air. With their feet and claws, which are admirably adapted for the purpose, they dig the earth with surprising quickness, and throw it behind them. It is not a hole, or a straight or winding tube, but a species of gallery made in the form of a Y, each branch of which has an aperture, and both terminate in one where the animal lodges. As the whole is made on the declivity of a mountain, the innermost part alone is on a level. Both branches of the Y are inclined, and the one is used for depositing the excrements of the animals, and the other for their going out and coming in. The place of their abode is well lined with moss and hay, of which they make ample provision during the summer. It is even affirmed, that this labour is carried on jointly; that some cut the finest herbage, which is collected by others, and that they alternately serve as vehicles for transporting it to their dens. One, it is said, lies down on his back, allows himself to be loaded with hay, extends his limbs, and others trail him in this manner by the tail, taking care not to overset him. These repeated frictions are assigned as the reason why the hair is generally rubbed off their backs. But it is more probable, that this effect is produced by their frequent digging of the earth. But, whatever may be in this, it is certain that they dwell together, and work in common at their habitations, where they pass three-fourths of their lives. Thither they retire during rain or upon the approach of danger; and never go out but in fine weather, and even then to no great distance. One stands centinel upon a rock, while the others sport on the grass, or are employed in cutting it to make hay. When the centinel perceives a man, an eagle, a dog, &c. he alarms the rest with a loud whistle, and is himself the last to enter the hole. They make no provisions for winter; nor have they in that season any occasion for them, as lying asleep all that time. As soon as they perceive the first approaches of the sleeping season, they set to work in shutting up the two entrances of their habitation; and this they perform with such labour and solidity, that it is easier to dig the earth any where else than in the parts they have fortified. They are at this time very fat, weighing sometimes 20 pounds; and they continue to be plump for three months; but afterwards they gradually decay, and are extremely emaciated at the end of winter. When discovered in their retreats, they are found rolled up in the form of a ball, covered with hay; and they are carried off in so torpid a state, that they may be killed without seeming to feel pain. When taken young, they may be rendered nearly as tame as our other domestic animals. They are able to walk on their hind-feet, sit up often on their haunches, and carry food to their mouths with their fore-feet. They learn to seize a stick, to dance, to perform various gesticulations, and to obey the voice of their master. Like the cat, the marmot has an antipathy against dogs. When he begins to be familiar in the house, and perceives that

that he is protected by his master, he attacks and bites dogs of the most formidable kind. Though not so large as a hare, he is stouter, and his strength is aided by a peculiar suppleness and dexterity. With his fore-teeth, which are pretty long, he bites most cruelly; he attacks not, however, either dogs or men unless previously irritated. If not prevented, he gnaws furniture and stuffs; and when confined, pierces even through wood. His voice resembles the murmuring of a young dog when caressed or in a sporting humour; but when irritated or frighted, he makes a whistling noise, so loud and piercing, that it hurts the ear. The marmots eat every thing presented to them; as flesh, bread, fruit, roots, pot-herbs, may-bugs, grasshoppers, &c. but milk and butter they prefer to every other aliment. Though less inclined to theft than the cat, they endeavour to slip into the dairy, where they drink great quantities of milk, making, like the cat, a murmuring noise expressive of pleasure. Milk is also the only liquor that is agreeable to them; for they rarely drink water, and they refuse wine. They procreate but once a-year; and the female, after three or four weeks, produces two, three, or four young. The growth of their young is very quick; they live only nine or ten years; and the species is neither numerous nor much diffused. They are easily caught when on plain ground, but with difficulty in their holes, as they dig deeper when in danger of being taken, except in winter when torpid; at which time they are caught in great numbers. They are searched for partly on account of their flesh, which is tender and delicate; partly for their skins; and partly for their fat, which is esteemed medicinal by the inhabitants of the Alps: but they are chiefly taken by the Savoyards for the purpose of being exposed as shows through various parts of Europe. The marmot would make very good eating, if it had not always a disagreeable flavour, which cannot be concealed but by strong seasonings.

Plate CCCXVII. fig. 6.

2. The monax, or American marmot, is about the size of a rabbit. It has short rounded ears; the nose and checks are bluish; the body is of a deep brown colour; the tail is longish, and very hairy. This species inhabits the warmer states of North America and the Bahamas. It forms holes in the clefts of rocks and under the roots of trees, in which it passes the winter in a torpid state; though it is uncertain if those of the Bahamas hybernate, as the climate of these islands is very mild. It feeds on vegetables; and its flesh is very good, resembling that of a pig.

Plate CCCXIX. fig. 23.

3. The bobac, or Polish marmot, is of a greyish colour, mixed with long dusky hairs on the upper parts of the body, the under parts yellowish: It has small oval ears, small eyes, a hairy straight tail, and the fore-feet have each a claw in place of the thumb or fifth toe. The head and body measure sixteen inches, the tail four and a half. This species inhabits the dry and sunny places of the mountains, from the Boristhenes through the temperate climes of Asia as far as China and Kamtschatka. It forms very deep burrows, in which societies of 20 or more live together, each individual having a particular nest at the bottom of the common gallery, which is often three or four yards deep, and from which numerous galleries or passages branch off to the several apartments. They go about in search of food in the morning and middle of the day, placing a centinel to give warning of approaching danger. The bobak is a timid animal, and feeds only on vegetables, chiefly oleraceous plants. It sits up on the hams, and carries its food with the fore paws to its mouth, and defends itself in the same posture. It may be easily tamed even when old: it then eats cabbages or bread, and laps milk; but refuses to drink water. In summer it feeds voraciously; but remains torpid all winter, except when kept in very warm places: and even then it eats very little; and escapes if possible, that it may get to some place proper for hybernating; but returns to its master in spring. The flesh resembles that of a hare, though rank; the fat is used for dressing leather and furs; and the skins are employed for clothing by the Russians. The female has eight teats; and probably brings forth early, as by the month of June the young ones are half grown.

Plate CCCXVII. figs. 1. & 4.

4. The citillus, or earless marmot, is of a variable colour, has a convex head, no external ears, and a short hairy tail. This species inhabits the southern parts of Russia as far as Kamtschatka, and the islands between Asia and America; is found in Persia and China; but is now rarely met with in the rest of Europe. They dwell in open, high, dry, and uncultivated places, preferring turfy and loamy soils, near the high roads, and never frequent bogs or woods. Each individual has its separate burrow, in which, for provision in the beginning and end of winter, it lays up magazines of grain, tender vegetables, and berries; sometimes, though rarely, the carcases of mice and small birds are added. In the middle of winter these animals lie torpid during the greatest severity of the frost. From the very beginning of spring, as soon as the weather becomes mild, they go out in the day time in quest of food, which they eat sitting on their haunches, carrying it in their fore paws to the mouth. The male is very easily tamed; but the female is fiercer, more given to bite, and is less easily made tame; she goes between three and four weeks with young, and brings forth from three to eight young ones about the beginning of May. The fur is very good in the spring, and the flesh is reckoned tolerable. They are preyed on by polecats, weasels, hawks, carrion crows, and cranes.

This animal varies considerably both in size and colour, being sometimes as large as the common marmot, and sometimes not larger than the water-rat. In general the colour is of a yellowish ash on the upper parts, and dirty white on the belly, (the *zizel* of Buffon); sometimes it is variegated either with waves or small spots of white, (the souslik of the same author.) Some are white on the upper parts, and waved with tawny or yellow, being pale yellow on the lower parts of the body, and having a longish tail, with shed hair like that of a squirrel: others are of a grey colour on the upper parts of the body, spotted with white; the under parts being of a yellowish white, with white orbits, and the face, between the eyes and the nose, of a brownish yellow, with a short tail.

Fig. 8.

5. The empetra, or Canadian marmot, is of a mixed grey colour on the upper parts of the body; the lower parts orange; having short rounded ears, and a hairy tail. It is rather larger than a rabbit, and the tail is about two inches and a half long; the head is round, with a blunt nose, and short rounded ears; the cheeks

are

Mus. are full, and of a grey colour; the face is dusky, with a black nose; the hair on the back is grey at the roots, black in the middle, and whitish at the tips; the belly and legs are of an orange colour; the feet are black and naked, having four long, slender, divided toes, and the rudiments of a thumb on each fore foot, and five similar on each behind, all armed with pretty strong claws. This animal was described by Mr Pennant from a living specimen in possession of Mr Brooks, which was very tame, and made a hissing noise. It inhabits Canada, Hudson's Bay, and the other northern parts of America.

Five or six other species of arctomys, some of them suspected to be only varieties, are described by Kerr.

III. Dipus, or *Jerboa*. There are two fore-teeth in each jaw: the tail is long, and tufted at the end: but the most striking characteristic of this genus is the enormous length of the hind feet and extreme shortness of the fore-paws. From this conformation, instead of walking or running on all fours, they leap or hop on the hind feet like birds, making prodigious bounds, and only use the fore paws for burrowing, or for carrying their food to the mouth like squirrels. From this peculiarity of conformation, the kanguru, G. xix. sp. 15 and Philip's opossum, sp. 16. of the same genus (Mr Kerr observes), ought to have been arranged with this genus of the jerboa; but from a rigid adherence to artificial system, they are by Dr Gmelin ranked with the genus opossum, on account of the number and arrangement of their teeth. See the article Didelphis.

1. The jaculus, or common jarboa, has four toes on all the feet, and a claw in place of a thumb or fifth toe on each fore-foot. The body is somewhat more than seven inches long, and the hind legs and thighs are longer than the body. The upper parts are of a pale tawny colour, and the under parts white: the ears and feet are flesh coloured. The female has eight distantly placed teats. These animals inhabit Egypt, Arabia, Calmuck Tartary, and southern Siberia. They frequent firm hard ground, and fields covered with grass and herbs, where they form burrows of several yards long in a winding direction, leading to a large chamber about half a yard below the surface; and from this a second passage is dug to within a very little of the surface, by which they can escape when threatened with danger. When at rest, they sit with their hind legs bent under their belly, and keep the fore legs so near the throat as hardly to be perceptible. They eat grain and herbage like the hare. Their dispositions are mild, and yet they can never be perfectly tamed. Two that were kept in a house in London burrowed almost through the brick-wall of the room where they were; they came out of their hole at night for food; and when caught were much fatter and sleeker than when confined to their box.

This animal is eaten by the Arabs, who call it the *lamb of the children of Israel*. It has been particularly noticed and described by Mr Bruce in his Abyssinian Travels *. He says it inhabits the smoothest places of the desart, especially those where the soil is fixed gravel. In this it burrows, and has its hole divided into many apartments. It seems, however, to be afraid of the ground falling in upon it, as it chooses always to dig under the roots of some bushy plant or shrub. It particularly delights in those places which are frequented by the cerastes or horned viper, though it would appear that the serpent sometimes preyed upon it; for Mr Bruce tells us that he once saw a jerboa taken out of the belly of a female viper big with young, and almost consumed by the digestive powers of the animal. It is a very cleanly creature, and keeps its hair always in excellent order. It jumps about with great agility, in which it is assisted by its long tail, which we should suppose would rather be a hinderance to it. The Arabs of the kingdom of Tripoli in Africa teach their grehounds to hunt the Antelope, by learning them first to catch jerboas; and so agile are the latter, that Mr Bruce has often seen, in a large court-yard or inclosure, the grehound employed a quarter of an hour before he could kill his diminutive adversary; and had he not been well trained, so that he made use of his feet as well as his teeth, he might have killed two antelopes in the time he could have killed one jerboa. This animal is very fat, and the flesh well coloured; the buttocks, thighs, and part of the back, are roasted and eaten by the Arabs, as already mentioned, and taste almost exactly like a young rabbit, but without the strong smell of the latter. It is said, that the flesh dried in the air is very nourishing, and prevents costiveness; so that it seems to be endowed also with medicinal qualities. The animal is found in most parts of Arabia and Syria, and in all parts of the southern desarts of Africa; but nowhere in such plenty as in the Cyrenaicum or Pentapolis. In his journey thither, Mr Bruce employed several Arabs, together with his own servants, to kill these animals with sticks, that their skins might not be hurt with shot. Having got them dressed in Syria and Greece, and sewed together, making use of the tail, as in ermine, for the lining of a cloak, he found they had a very good effect, making a finer and glossier appearance the longer they were worn.

* Vol. V. p. 121.

Bochart thinks this animal is the *Saphon* of holy writ, and displays a vast deal of learning on the subject. But this opinion is refuted by Mr Bruce, who observes, that the saphon is gregarious, and builds in rocks; being likewise distinguished for its feebleness, which it supplies by its wisdom; and none of these characters apply to the jerboa: "therefore (says Mr Bruce) though he chews the cud in common with some others, and was in great plenty in Judea, so as to be known to Solomon, yet he cannot be the saphon of Scripture." He supposes with great probability, that it is the creature termed the *mouse*, Isa. lxvi. 17.; and says that in the Arabic version the word is expressly translated *jerboa*. See the article Saphon.

2. The sagitta, or Arabian jerboa, has three toes on the hind feet, and no thumb or fifth toe on the fore-paws. It is only about six inches long, and the tail rather shorter than the body; the soles of the hind-feet and bottom of the toes are covered with a very thick coat of hair; the head is more rounded than that of the preceding animal, and the ears are much longer than the head. It inhabits Arabia, and near the Irtish in Siberia, where it frequents the sandy plains.

The two following are distinguished as different species by Mr Pennant, though Dr Gmelin seems not to have considered them as distinct from the preceding.

Mus.

Plate CCCXVIII fig. 16. A. The ægyptius, or Egyptian Jerboa, has three toes only on the hind feet; and four toes, with a ſcarcely apparent thumb or fifth toe, furniſhed with a claw, on the fore-paws.

This animal Mr Pennant ſuppoſes to be the *mus bipes* of the ancients, *mus ſagitta* of Pallas, *jerbo* of Buffon, and *daman Iſrael* of the Arabs. He ſays, that it inhabits Egypt, Barbary, Paleſtine, the deſerts between Baſora and Aleppo, the ſandy tracks between the Don and Volga, and the hills ſouth of the Irtiſh.

Fig. 17. B. The ſibiricus, or Siberian jerboa, with three toes on the hind feet, and two ſpurious toes ſome way up the legs; five toes on the fore feet, the thumb or fifth toe having no nail. Of this ſpecies Mr Pennant diſtinguiſhes four varieties, the major, medius, minor, and pumilio; differing in ſize, colour, &c. But they all (he ſays) agree in manners. They burrow in hard ground, clay, or indurated mud; not only in high and dry ſpots, but even in low and ſalt places. They dig their holes with great celerity, not only with their fore-paws but with their teeth, and flinging the earth back with their hind feet ſo as to form a heap at the entrance. The burrows are many yards long, but not above half a yard deep. Theſe run obliquely; and end in a large ſpace or neſt, the receptacle of the fineſt herbs. They have uſually but one entrance; yet by a wonderful ſagacity they work from their neſt another paſſage to within a very ſmall ſpace of the ſurface, which in caſe of neceſſity they can burſt through, and ſo eſcape.

They ſleep rolled up with their head between their thighs: At ſun-ſet they come out of their holes, clear them of the filth, and keep abroad till the ſun has drawn up the dews from the earth. On approach of any danger, they immediately take to flight, with leaps of a fathom in height, and ſo ſwiftly that a man well mounted can hardly overtake them. They ſpring ſo nimbly, that it is impoſſible to ſee their feet touch the ground. They do not go ſtraight forward, but turn here and there till they gain a burrow, whether it is their own or that of another. When ſurpriſed, they will ſometimes go on all fours, but ſoon recover their attitude of ſtanding on their hind legs like a bird: even when undiſturbed, they uſe the former attitude; then riſe erect, liſten, and hop about like a crow. In digging or eating they drop on their fore legs; but in the laſt action will often ſit up and eat like a ſquirrel. They are eaſily tamed; and ſeek always a warm corner. They foretel cold or bad weather by wrapping themſelves cloſe up in hay; and thoſe which are at liberty ſtop up the mouths of their burrows. In a wild ſtate they live much on oleraceous plants: the ſmall ſtature of the pumilio is attributed to its feeding on ſaline plants. Thoſe of the middle ſize, which live beyond the lake Baikal, feed on the bulbs of the *lilium pomponium*, and they gnaw the twigs of the *robinia caragana*. When confined, they will not refuſe raw meat or the entrails of fowls.—They are the prey of all leſſer rapacious beaſts; and the Arabs, who are forbidden all other kinds of mice, eſteem theſe the greateſt delicacies. The Mongols have a notion that they ſuck the ſheep: certain it is they are during night very frequent among the flocks, which they diſturb by their leaps. Theſe animals breed often in the ſummer; in the ſouthern parts in the beginning of May; beyond Baikal not till June. They bring perhaps eight at a time, as they have ſo many teats. They ſleep the whole winter without nutriment. About Aſtracan, they will ſometimes appear in a warm day in February; but return to their holes on the return of cold.

3. The cafer, or Cape jerboa, has four toes on the hind-feet and five on the paws; the tail is very hairy, and tipt with black.—This ſpecies, which inhabits the Cape of Good Hope, is larger than any of the foregoing, being 14 inches long, the tail 15, the ears three. It is called *aerdmannetie*, or little earth man, and *ſpringen haas*, or leaping hare, by the Dutch at the Cape. It has a grunting voice; is very ſtrong, and leaps 20 or 30 feet at one bound. It burrows with its fore feet; and ſleeps ſitting on its hind legs, with the knees ſeparated, the head between, and holding its ears with the fore-paws over its eyes. It is eaten by the natives; and is caught by pouring water into its hole, which forces it to come out.

4. The meridianus, Caſpian jerboa, or long-legged mouſe, has five toes behind and three before, with the rudiments of a thumb or inner toe. It is five inches long, and the tail three.—This ſpecies inhabits the ſandy deſerts between the Ural and Volga, near the Caſpian.—It forms burrows, with three entrances, about a yard in depth; and feeds chiefly on the ſeeds of the pterococci and aſtragali. Plate CCCXIX. fig. 6.

5. The tamaricinus, or marſh jerboa, has five toes behind and three before, with the rudiments of a fourth; the tail is obſcurely annulated. The body and head meaſure about five inches and a half in length; the tail is about the ſame length.—This ſpecies inhabits the ſalt marſhes near the Caſpian ſea; and is ſuppoſed to feed on the fruit of the tamarix and nitrarium, which grow in theſe marſhes. Under the roots of theſe trees it forms very deep burrows, which have two entrances. It is a very elegant little animal. There are two or three other ſpecies of this genus. Fig. 19.

IV. The Cavia, or *Cavy*; a genus which ſeems to hold a midle place between the murine and the leporine quadrupeds. The characters are: there are two wedge-like cutting teeth in each jaw, and eight grinders in both jaws: the fore-feet are furniſhed with four or five toes: the hind-feet with three, four, or five each: the tail is either very ſhort or entirely wanting: there are no clavicles or collar-bones.

1. The paca, or ſpotted cavy, has five toes on all the feet; and the ſides are marked with rows of grey or pale yellow ſpots. The body and head meaſure about two feet in length; the tail is like a ſmall button, and ſo extremely ſhort as to be hardly apparent; the mouth is very ſmall, and the upper lip is divided; the noſtrils are very large, and the muzzle is garniſhed with long whiſkers; the ears are ſhort and roundiſh; the eyes are large, prominent, and browniſh; the two cutting teeth in each jaw are very long and of great ſtrength; the hind legs are longer than the fore.—This ſpecies inhabits Braſil, Guiana, and probably all the warmer parts of America. It lives in fenny places near rivers, burrowing in the ground, and keeping its hole exceedingly clean, to which it has always three diſtinct outlets: It grows very fat, and is eſteemed a great delicacy. The female has two Plate CCCXVII. fig. 13.

Mus.

two teats situated between the hind-thighs, and has only a single young one at a litter ---It is difficult to take this animal alive. When surprised in its hole, which the hunters lay open both before and behind, it defends itself, and even bites fiercely.—It is, however, easily accustomed to a domestic life. Unless industriously irritated, it is gentle and tractable, fond of adulation, and licks the hands of the person who caresses it. It knows those who take care of it, and readily distinguishes their voices. When gently stroaked on the back, it stretches itself out, lies down on its belly, by a small cry expresses its acknowledgement, and seems to ask a continuance of the favour: but if seized in a rough manner, it makes very violent efforts to escape. When kept in a wooden cage or box, this animal remains perfectly tranquil during the day, especially when plentifully supplied with food. It seems even to have an affection for its retreat as long as the day lasts; for, after feeding, it retires spontaneously into it. But when night approaches, by perpetual restlessness and agitation, and by tearing the bars of its prison with its teeth, it discovers a violent desire of getting out. Nothing of this kind happens during the day, unless it has occasion for some natural evacuation; for it cannot endure the smallest degree of dirtiness in its little apartment; and when about to void its excrements, always retires to the most distant corner it can find. When its straw begins to smell, it often throws it out, as if it meant to demand fresh litter. This old straw it pushes out with its muzzle, and goes in quest of rags or paper to replace it. In a female cavy, the following extraordinary instance of cleanliness was observed. A large male rabbit being shut up with her when she was in season, she took an aversion to him the moment he voided his excrement in their common apartment. Before this she was very fond of him; licked his nose, ears, and body; and allowed him to take almost the whole food that was given her. But as soon as the rabbit had infected the cage with his ordure, she retired into the bottom of an old press, where she made a bed with paper and rags, and returned not to her old lodging till she saw it neat, and freed from the unclean guest which had been presented to her.

2. The agouti, which is about the size of a rabbit, has a very short tail; four toes on the fore feet, and three on the hind ones; the upper parts of the body of a brownish colour mixed with red and black, the rump orange, and the belly yellowish. Of this

Plate CCCXVII. fig. 10. 11. species there are three varieties mentioned by authors, viz. the lesser cunicularis or long-nosed cavy, which is about the size of a rabbit; the leporina or larger rabbit, called the *java hare*, or *javan cavy*, which is as large as a hare; and the americana, which seems to be but little known. They all inhabit South America and the West India islands; dwelling in hollow trees, or burrowing in the ground. They search for their food, which is entirely vegetable, during the day, and carry it home with them to their dwellings: when feeding they sit on their hind legs, and carry their food with the fore-paws to the mouth. They grow very fat, and are very good eating, their flesh being white and savoury like that of a rabbit. They breed frequently in the same year, the female bringing three, four, or five young ones at a birth. They grunt like pigs, are very voracious, and when fat, their flesh is white like that of a rabbit, but dry. What food they cannot immediately consume they hoard in their retreats, and eat at their leisure. Their pace is hopping like that of a hare or rabbit; they beat the ground like them with their feet, when angry; they stop and listen to the sound of music; and they take shelter, when pursued, in their holes, or in hollow trees.—They are hunted with dogs. When one of them is forced among the cut sugar canes, he is soon taken; because these grounds being generally covered a foot thick with straw and leaves, at each leap he sinks in this litter, so that a man may overtake and slay him with a baton. He commonly runs very nimbly before the dogs; and when he gains his retreat, he lies squat, and remains obstinately in his concealment. The hunters are obliged to chace him out by filling his hole with smoke. The animal, half suffocated, utters mournful cries; but never issues forth unless when pushed to the last extremity. His cry, which he often repeats when disturbed or irritated, resembles that of a small hog. If taken young, he is easily tamed, and goes out and returns of his own accord.

3. The cobaya, or restless cavy, has four toes on the fore and three on the hind-feet, with no tail: it is about seven inches in length; and the whole body is white, usually variegated with irregular orange and black blotches. This species inhabits Brasil; but its manners in a wild state are not mentioned by authors. In a domestic state, as they appear in Europe, they are very restless, and make a continual noise.— They feed on all kinds of herbs; but especially on parsley, which they prefer to grain or bread; and they are likewise fond of apples and other fruits. They eat precipitately like the rabbit, little at a time, but very often. Buffon says they never drink; but Gmelin, that they drink water. Their voice is commonly a kind of grunt like a young pig; when engaged in their amours, it resembles the chirp of a bird; and when hurt, they emit a sharp cry. They are of a tame and gentle, but stupid disposition. The female breeds at two months old, bringing from four or five to ten or twelve young ones at a birth, though she has only two teats; and breeds very often during the year, as she goes but three weeks with young, and takes the male 12 or 15 days after littering. As they breed so fast, their multitudes would be innumerable, if there were not so many enemies which destroy them. They cannot resist either cold or moisture: when cold, they assemble and crowd close together; in which case they often all perish together. They are also devoured in great numbers by cats, and many are killed by the males. Rats are said to avoid their haunts. They are called in England *Guinea-pigs*, from their being supposed to come from that country. Fig. 5.

4. The magellanica, or Patagonian cavy, has hardly any tail; the sides of the nose are garnished with tufts of curly hair and long numerous whiskers. This species inhabits the country about Port Desire in Patagonia, and is of considerable size, sometimes weighing 26 pounds. It has the same manners with the rest of the genus; it sits on its hind legs, burrows in the ground, and feeds on vegetables. The flesh is very white, and has an excellent flavour. Fig. 12.

Mus.

Plate CCCXVII.

A. Bell. Prin. Wal. Sculptor fecit.

MUS. Plate CCCXVIII.

A. Bell Prin. Wal. Sculptor fecit.

A. Bell Prin. Wal. Sculptor fecit.

Mus. Plate CCXIX. fig. 22. 5. The capybara, or thick-nosed tapir, has no tail; the hind feet have each three webbed toes. The length of the animal, when full grown, is above two feet and a half: the head and nose are very large and thick; having small, erect, rounded, naked ears, and large black eyes: and the nose is garnished with numerous black whiskers; in each jaw are two large strong fore-teeth, and eight grinders; the legs are short, having the toes connected by a web, and their extremities are guarded with a kind of hoofs instead of claws; the neck is short and thick; the hair is short, rough, and harsh, like bristles, being longest on the back, and most of them are yellowish in the middle and black at both ends.—This species inhabits the eastern side of South America, from the isthmus of Darien to Brasil and Paraguay; living in fenny woods near the large rivers, such as the Amazons, Oroonoko, and Plata. They swim and dive remarkably well, and keep for a long time under water. They catch fish at night with great dexterity, and bring them on shore to eat them; which they do sitting on the hind legs, and holding the food in the fore-paws like the apes. They likewise live on fruits and vegetables, especially the sugar cane, and feed only in the night. They keep together in large herds, making a great noise like the braying of asses, and do vast mischief in gardens. They grow very fat; and the flesh is eaten, being tender, but has an oily and fishy flavour. In the breeding season, one male and one female live together, and the female only produces a single one at a birth. These animals are easily rendered tame, and become very familiar.

Plate CCCXVII. fig. 3. 6. The acuschy, or olive cavy, has a short tail; the upper parts of the body are of an olive colour, the under parts whitish. This species inhabits Guiana, Cayenne, and Brasil.—It is about the size of an half-grown rabbit, is easily tamed, and is reckoned very delicate food. The female brings one, sometimes two, at a litter. This animal resembles the agouti, but is uniformly smaller, has a tail of some length, and is of a different colour. It inhabits the woods, living on fruits; abhors water; and sometimes, though rarely, makes a cry like that of the restless cavy.

There are five or six other species described by authors as belonging to the cavy genus. Two of them, however, have been lately marked by Dr Gmelin under a new genus, *Hyrax*; which, as there was not an opportunity of introducing it in the order of the alphabet, we shall here subjoin, together with the descriptions of the species as given by Mr Kerr.

V. Hyrax, or *ashkoko*. There are two broad and distant fore-teeth above; four contiguous, broad, flat, notched fore-teeth below; and four large grinders on each side in both jaws. The fore feet have four toes, the hind feet only three. There is no tail; and the clavicles are wanting.

Fig. 9. 1. The capensis, or cape ashkoko, "has flat nails on all the toes, except one toe of each hind foot which is armed with a sharp pointed claw. It inhabits the Cape of Good Hope.—This animal is about the size of a rabbit, being about 15 inches long; the head is short, with the back part very thick, and the snout very short and blunt; the eyes are small; the ears are oval and open, brown, woolly, and half hid in the fur; the legs are very short, the upper joints of both being concealed beneath the skin; the hind legs are rather longer than the fore; the feet are large, black, and naked: the body is short, thick, and contracted, with a prominent belly, and is covered with a soft woolly fur of a yellowish brown or greyish colour, hoary at the roots; the sides are of a dirty whitish grey; and along the back is a brownish stripe: this fur is interspersed with longer and coarser black hairs, and a few very coarse long bristles. The fore-feet have four short, scarce divided, thick toes, furnished with flat nails; the two outer toes of the hind-feet are similar, but the inner toe is longer, and has a sharp claw. This animal has a sharp voice, and acute sense of hearing; its gait is very wavering and unsteady, owing to the shortness of its thighs and unequal length of the hind and fore legs; notwithstanding of which it is very active, and moves by leaps: it is very cleanly, lives entirely on vegetable food, drinks little, is fond of heat, and burrows in the ground. In manners and general appearance, this animal resembles the marmot and cavy; in the conformation of its toes it has some analogy with the maucauco; but from the circumstances of the teeth it cannot be ranked with the last; and the peculiarity of the feet has caused Dr Gmelin to separate it from both of the former."

2. The syriacus, or Syrian ashkoko, (Bruce, Schreber), "has soft tender nails on all the toes. It inhabits Syria and Ethiopia.—The body of this is more lengthened than that of the former, and the snout more oblong. The fur is of a reddish grey colour like that of the wild rabbit, the throat, breast, and belly, being white; all over the body a number of long, strong, and polished hairs are scattered among the fur. The body and head of the individual described by Mr Bruce measured 17 inches. The ears are broad, open, and rounded; each side of the mouth is garnished with long whiskers. In walking, which is performed creeping low with the belly almost touching the ground, the hind feet are used as far as the heel. All the toes have short, broad, weak, flat nails, except the inner toe of the hind foot, which is provided with a flat crooked nail somewhat longer than the rest; the soles of the feet are formed of fleshy naked protuberances, divided by furrows. It lives mostly about the mouths of caves or clefts in rocks; is gregarious; feeds entirely on vegetables; is mild, feeble, timid, and easily tamed, and has no voice or cry. Mr Bruce is of opinion, that this animal is the gannim or Daman Israel of the Arabs, and the saphan of sacred scriptures, which has erroneously been translated *the rabbit*.—Its flesh is very white, but is not eaten by the Abyssinians or Mahometans. The same celebrated traveller is of opinion, that it ruminates or chews the cud." Plate CCXIX. fig. 21.

Mus, Musa. MUSA, the plantain-tree: A genus of the monœcia order, belonging to the polyandria class of plants; and in the natural method ranking under the eighth order, *Scitamineæ*. The calyx of the male hermaphrodite is a spatha or sheath; the corolla is dipetalous; the one petal erect and quinquedentate; the other nectariferous, concave, and shorter; there are six filaments; five of which are perfect; one style; the germen inferior and abortive. The female hermaphrodite has the calyx, corolla, filaments, and pistil of the male hermaphrodite, with only one filament perfect; the berry is oblong, and three-angled below. The

most

most remarkable species are, 1. The *paradisaica*, or plantain; 2 The *musa sapientum*, or banana-tree. See Plate CCCXX.

The first sort is cultivated in all the islands of the West Indies, where the fruit serves the Indians for bread; and some of the white people also prefer it to most other things, especially to the yams and cassada bread. The plant rises with a soft stalk 15 or 20 feet high; the lower part of the stalk is often as large as a man's thigh, diminishing gradually to the top, where the leaves come out on every side;—these are often eight feet long, and from two to three feet broad, with a strong fleshy midrib, and a great number of transverse veins running from the midrib to the borders. The leaves are thin and tender, so that where they are exposed to the open air, they are generally torn by the wind; for as they are large, the wind has great power against them: these leaves come out from the centre of the stalk, and are rolled up at their first appearance; but when they are advanced above the stalk, they expand and turn backward. As these leaves come up rolled in the manner before-mentioned, their advance upward is so quick that their growth may almost be discerned by the naked eye; and if a fine line is drawn across level with the top of the leaf, in an hour's time the leaf will be near an inch above it. When the plant is grown to its full height, the spikes of flowers will appear in the centre, which is often near four feet in length, and nods on one side. The flowers come out in bunches; those in the lower part of the spike being the largest; the others diminish in their size upward. Each of these bunches is covered with a spath or sheath of a fine purple colour, which drops off when the flowers open. The upper part of the spike is made up of male or barren flowers, which are not succeeded by fruit, but fall off with their covers. The fruit or plantains are about a foot long, and an inch and a half or two inches diameter: it is at first green, but when ripe of a pale-yellow colour. The skin is tough; and within is a soft pulp of a luscious sweet flavour. The pikes of fruit are often so large as to weigh upwards of 40 lb. The fruit of this sort is generally cut before it is ripe. The green skin is pulled off, and the heart is roasted in a clear fire for a few minutes, and frequently turned: it is then scraped, and served up as bread. Boiled plantains are not so palatable. This tree is cultivated on a very extensive scale in Jamaica; without the fruit of which, Dr Wright says, the island would scarce be habitable, as no species of provision could supply their place. Even flour or bread itself would be less agreeable, and less able to support the laborious negro, so as to enable him to do his business or to keep in health. Plantains also fatten horses, cattle, swine, dogs, fowls, and other domestic animals.

The leaves being smooth and soft are employed as dressings after blisters. The water from the soft trunk is astringent, and employed by some to check diarrhœas. Every other part of the tree is useful in different parts of rural economy. The leaves are used for napkins and table-cloths, and are food for hogs.

The second sort differs from the first, in having its stalks marked with dark purple stripes and spots.—The fruit is shorter, straighter, and rounder: the pulp is softer, and of a more luscious taste. It is never eaten green; but when ripe, it is very agreeable, either eaten raw or fried in slices as fritters; and is relished by all ranks of people in the West Indies.

Both the above plants were carried to the West Indies from the Canary Islands; whither, it is believed, they had been brought from Guinea, where they grow naturally. They are also cultivated in Egypt, and in most other hot countries, where they grow to perfection in about 10 months from their first planting to the ripening of their fruit. When their stalks are cut down, there will several suckers come up from the root, which in six or eight months will produce fruit; so that by cutting down the stalks at different times, there is a constant succession of fruit all the year.

In Europe there are some of these plants preserved in the gardens of curious persons, who have hot-houses capacious enough for their reception, in many of whom they have ripened their fruit very well; but as they grow very tall, and their leaves are large, they require more room in the stove than most people care to allow them. They are propagated by suckers, which come from the roots of those plants which have fruited; and many times the younger plants, when they are stinted in growth, will also put out suckers.

The fruit of the banana-tree is four or five inches long, of the size and shape of a middling cucumber, and of a high, grateful flavour: the leaves are two yards long, and a foot broad in the middle; they join to the top of the body of the tree, and frequently contain in their cavities a great quantity of water, which runs out, upon a small incision being made into the tree, at the junction of the leaves. Bananas grow in great bunches, that weigh a dozen pounds and upwards. The body of the tree is so porous as not to merit the name of wood; the tree is only perennial by its roots, and dies down to the ground every autumn.

When the natives of the West Indies (says Labat) undertake a voyage, they make provision of a paste of banana; which, in case of need, serves them for nourishment and drink: for this purpose they take ripe bananas; and having squeezed them through a fine sieve, form the solid fruit into small loaves, which are dried in the sun or in hot ashes, after being previously wrapped up in the leaves of Indian flowering-reed.—When they would make use of this paste they dissolve it in water, which is very easily done; and the liquor, thereby rendered thick, has an agreeable acid taste imparted to it, which makes it both refreshing and nourishing.—The banana is greatly esteemed, and even venerated, by the natives of Madeira, who term it the *forbidden fruit*, and reckon it a crime almost inexpiable to cut it with a knife; because, after dissection, it exhibits, as they pretend, a similitude of our Saviour's crucifixion; and to cut the fruit open with a knife, is, in their apprehension, to wound his sacred image.

Some authors have imagined, that the banana-tree was that of the leaves of which our first parents made themselves aprons in Paradise. The sacred text, indeed, calls the leaves employed for that purpose *fig-leaves*; and Milton, in a most beautiful but erroneous description, affirms the bearded or Bengal fig to have been the tree alluded to. But besides that the fruit of the banana is often by the most ancient authors called

Musa.

called a *fig*, its leaves, by reason of their great size and solidity, were much more proper for a veil or covering than those of the Bengal fig, which are seldom above six or eight inches long and three broad. On the other hand, the banana leaves being three, four, and five feet long, and proportionably broad, could not fail to be pitched upon in preference to all others; especially as they might be easily joined, or sewed together, with the numerous thread-like filaments that may, with the utmost facility, be peeled from the body of this tree.

Some have supposed the Abyssinian plant *ensete* to be a species of musa. It is said to be a native of the province of Narea, where it grows in the great marshes and swamps for which that province is remarkable, owing to the many rivers which originate in that country, and have but a small declivity to the ocean. This plant, as well as the coffee-tree, is said to have been unknown in Abyssinia before the arrival of the Galla, who imported them both along with them. It comes to great perfection about Gondar; but the principal plantations of it are in that part of Maitsha and Gouth, to the west of the Nile, where it is almost the sole food of the Galla who inhabit that country. Maitsha is almost entirely on a dead level; so that the rains stagnate and prevent the sowing of grain. Were it not for the ensete, therefore, the Galla would have scarce any vegetable food. Mr Bruce * thinks that the ensete may have been cultivated in some of the gardens of Egypt about Rosetto, but that it was not a native of the country. He strongly controverts the opinion that this plant is a species of musa. "It is true (says he), the leaf of the banana resembles that of the ensete: it bears figs, and has an excrescence from its trunk, which is terminated by a conical figure, chiefly differing from the ensete in size and quantity of parts; but the figs of the banana are of the size and figure of a cucumber, and this is the part which is eaten. This fig is sweet, though mealy, and of a taste highly agreeable. It is supposed to have no seeds, though in fact there are four small black seeds belonging to every fig. But the figs of the ensete are not eatable: they are of a soft tender substance; watery, tasteless, and in colour and consistence resembling a rotten apricot: they are of a conical form, crooked a little at the lower end; about an inch and an half in length, and an inch in breadth where thickest. In the inside of these is a large stone half an inch long, of the shape of a bean or cashew-nut, of a dark-brown colour; and this contains a small seed, which is seldom hardened into fruit, but consists only of skin. The long stalk that bears the figs of the ensete springs from the centre of the plant, or rather is the body or solid part of the plant itself. Upon this, where it begins to bend, are a parcel of loose leaves; then grows the fig upon the body of the plant without any stalk; after which the top of the stalk is thickset with small leaves, in the midst of which it terminates the flower in the form of an artichoke; whereas in the banana, the flower in form of the artichoke grows at the end of that shoot or stalk, which proceeds from the middle of the plant, the upper part of which bears the row of figs. The leaves of the ensete are of a web of longitudinal fibres closely set together; the leaves grow from the bottom without stalks: whereas the banana is in form like a tree, and has been mistaken for such. One half of it is divided into a stem, the other is a head formed with leaves; and in place of the stem that grows out of the ensete, a number of leaves, rolled round together like a truncheon, shoots out of the heart of the banana, and renews the upper as the under leaves fall off: but all the leaves of the banana have a long stalk; this fixes them to the trunk, which they do not embrace by a broad base or involucrum as the ensete does.

* *Travels*, vol. v. p. 36.

"But the greatest differences are still remaining.—The banana has by some been mistaken for a tree of the palmaceous kind, for no other reason but a kind of similarity in producing the fruit on an excrescence or stalk growing from the heart of the stem: but still the musa is neither woody nor perennial; it bears the fruit but once; and in all these respects it differs from trees of the palmaceous kind, and indeed from all sort of trees whatever. The ensete, on the contrary, has no naked stem; no part of it is woody: the body of it, for several feet high, is esculent; but no part of the banana plant can be eaten. As soon as the stalk of the ensete appears perfect and full of leaves, the body of the plant turns hard and fibrous, and is no longer fit to be eaten: before, it is the best of all vegetables. When boiled, it has the taste of the best new wheat-bread not perfectly baked. When you make use of the ensete for eating, you cut it immediately above the small detached roots, and perhaps a foot or two higher, as the plant is of age. The green must be stripped from the upper part till it becomes white; when soft, like a turnip well boiled, if eat with milk or butter, it is the best of all food, wholesome, nourishing, and easily digested."

Our author now proceeds to consider an hieroglyphic sometimes met with in Egypt, viz. "the figure of Isis sitting between some branches of the banana tree, as is supposed, and some handfuls of ears of wheat. You see likewise the hippopotamus ravaging a quantity of the banana tree. Yet the banana is merely adventitious in Egypt: it is a native of Syria: it does not even exist in the low hot country of Arabia Felix; but chooses some elevation in the mountains where the air is temperate; and is not found in Syria farther to the southward than Lat. 34°.

For these reasons Mr Bruce thinks, that the banana not being a plant of the country, "could never have entered into the list of their hieroglyphics; for this reason it could not figure any thing regular or permanent in the history of Egypt or its climate. I therefore imagine (adds he), that this hieroglyphic was wholly Ethiopian; and that the supposed banana, which, as an adventitious plant, signified nothing in Egypt, was only a representation of the ensete; and that the record in the hieroglyphic of Isis and the ensete-tree was something that happened between harvest, which was about August, and the time that the ensete-tree came in use, which was in October.—The hippopotamus is generally thought to represent a Nile that has been so abundant as to be destructive. When, therefore, we see upon the obelisks the hippopotamus destroying the banana, we may suppose it meant, that the extraordinary inundation had gone so far as not only to destroy the wheat, but also to retard or hurt the growth of the ensete, which was to supply its place."

Musæus, Musca.

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.

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.

Burney's History of Music.

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, in zoology; a genus of insects belonging to the order of diptera. The mouth is furnished with a fleshy proboscis, and two lateral lips; but it has no palpi. This genus is divided into two different sections: 1. Those with simple antennæ. 2. Those which are furnished with a lateral hair or feather. Those have downy bodies, though scarce perceptibly so; and have either a lateral plume or feather on the antennæ, or a simple hair on the side of the antennæ. The pilosæ have a few hairs scattered upon their bodies, principally upon the thorax; they have either a lateral feather or a lateral hair. Under these divisions are comprehended about 400 different species, as enumerated in Dr Gmelin's edition of the *Systema Naturæ*. "Variety (as Mr Barbut observes) runs through their forms, their structure, their organization, their metamorphoses, their manner of living, propagating their species, and providing for their posterity. Every species is furnished with implements adapted to its exigencies. What exquisiteness! what proportion in the several parts that compose the body of a fly! What precision, what mechanism in the springs and motion! Some are oviparous, others viviparous; which latter have but two young ones at a time, whereas the propagation of the former is by hundreds. Flies are lascivious troublesome insects, that put up with every kind of food. When storms impend, they have most activity, and sting with greatest force. They multiply most in hot moist climates; and so great was formerly their numbers in Spain, that there were fly-hunters commissioned to give them chace. The vapour of sulphur or arsenic destroys them; and their numbers may be reduced by taking them in phials of honeyed water, or between boards done over with honey." There are 129 species, principally distinguished by the peculiarities in their feelers.

Musca || Musci.

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, as well as the liquor, is French: Some fetch its original 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 way of making muscadine at Frontignac is as follows: They let the muscadine grapes grow half dry on the vine; as soon as they are gathered, they tread and press them immediately, and tun up the liquor, without letting it stand and work in the fat; the lee occasioning its goodness.

MUSCHENBROECK (Peter de), a very distinguished natural philosopher and mathematician, was born at Utrecht a little before 1700. He was first professor of these 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, all of which show the greatest penetration and exactness in this way. He was also very consummate in the knowledge of law.

MUSCI, Mosses, one of the seven families or classes into which all vegetables are divided by Linnæus in the *Philosophia Botanica*. 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 several observations, that mosses are all

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all real diftinct plants, whofe feed, being extremely fmall, is inclofed in little capfulæ; which burfting of themfelves, the feed is carried off by the winds; till, falling into the inequalities of the bark of trees, it is there ftopped, takes root, and feeds at the expence of the tree, as mouldinefs does on bread, &c.

What the botanical writers ftrictly underftand by the word *mofs*, is a clafs of plants appearing of an inferior rank to the common vegetables; the lefs perfect genera of which have been fuppofed to be wholly deftitute of flower or feed, or any thing analogous to either, and to confift of fimple, fimilar, and uniform parts; the genera a little above thefe have fome diverfity of parts, and carry fomething that looks analogous to vegetation in the common way, having a refemblance of thofe parts which ferve other plants for their fructification. The more perfect genera of the moffes not only confift of different parts, but have alfo their appropriated organs containing a pulpy matter, which finally becomes dry, and affumes the form of a fine and fubtile powder, compofed of granules, each of which is either a feed or a granule of farina, ferving for the propagation of the fpecies.

The more imperfect moffes are diftinguifhed from the others by their appearance to the naked eye; they are either in form of a fine lanugo or down covering the furface of different bodies; or elfe they appear as flender filaments, or foliaceous bodies, floating about in the water; or as filaments of a tougher texture, hanging down from the branches of old trees; or as little fhrubs, or fingle horns, growing erect on the parched earth of mountains and heathy places; or finally, as broad and foliaceous bodies fpreading themfelves over the dry barks of trees or rocks, without any pedicle or other fupport.

The more perfect kinds of moffes are found in the fhape of fmall but regular plants, divided into feveral branches, and clothed with leaves: thefe are of various forms and ftructures; fome being broad and thin, others flender as hairs; fome pellucid, others opake; fome fmooth, others hairy. From the alæ of thefe leaves in fome kinds, and from the fummit of the ftalks in others, there arife heads or capfules of various figure and ftructure, but all unicapfular; fome of thefe are naked, and others covered with a calyptra or hood; fome ftand on long pedicles, and others are placed clofe to the ftalks. Thefe heads are ufually called *capfulæ*, which contain their feeds or farina, and their pedicles *fetæ*, in the *mnia*, *hypna*, *brya*, and *polytricha*, &c.

Thefe capfules in fome are covered with a calyptra or hood; in others they are naked. Of the firft kind are the *fplachnum*, *polytricum*, *mnium*, *bryum*, *hypnum*, *fontinalis*, and *buxbaumia*; and of the latter fort, the *lycopodium*, *porella*, *fphagnum*, and *phafcum*.

The fubftance with which the heads or capfules of all the moffes are filled, refembles either feeds, or the fmall globules of the farina of flowers, which all refemble feeds of particular figures in miniature. The fructifications of thefe minute plants feem to be either from thefe, as feeds falling to the earth; or, according to the opinion of fome, they feem to contain only farina in the capfules, which impregnating certain bulbs or nodules in the alæ of the leaves, caufe them to grow and vegetate, as is feen in fome of the larger plants; as in the bulbs produced in the alæ of the leaves of the dentaria, and of the lilies, and fome others. The former opinion, of the powder in the heads or capfules being actually perfect feeds, is the more probable, as the bulbs in the alæ of the leaves are found only in fome of the hypna, and others of a few other genera; whereas the propagation is as quick and certain in thofe which have none of them as in thofe which have; and the want of female parts of fructification, which makes fo many defiderata in the Linnæan fyftem of botany, is eafily made up, and the whole explained according to the ufual courfe of nature in other vegetables, by allowing the powder in the capfules to be real feeds, and the fmall globules on the pointals furrounding the aperture of the capfule, the farina.

The opinion of the moffes growing from thefe nodules in the alæ of the leaves, or from the impregnated ends of the branches which had received the powder from the capfules, was originally founded on the obferving that the trailing or branched hypna annually grew out in length, from the extremities of all their branches, and annually loft as much of the old ftalk at the root as they gained of the new at the fummit; but it appears from farther obfervations, that they are real feeds which are contained in form of powder in the capfules; fince the brya, and many others, are found growing from fmall points or fpots, which are affemblages of their minute leaves, propagated on the ground, under the old ones juft where the powder of the capfules has fallen; and though it be allowed that the hypna and other trailing moffes do grow from the ends of the branches, yet they may alfo be produced in form of new plants, from regular and perfect feeds fhed from the capfules. It is certain that the brya are by this means propagated and fpread into large tufts, and the other genera may alfo be fo propagated, though they have befide a property of increafing by growth of the ftalk; which feems no other than the property of many of the large plants to creep at the root, and fhoot out in length greatly from the extremities of their horizontal branches, lying on or under the ground, as thofe fpreading parts may more properly be fo called than roots, the fibres pufhed out from them perpendicularly into the earth being properly the roots; and it is well known that thefe plants, though they propagate themfelves thus by the root, produce feeds alfo like the others, by which they may be equally propagated: and this analogy is to be carried yet farther; for as thofe plants which creep by the roots produce fewer feeds than thofe which are propagated only by feeds; fo the hypna, which are the genus of moffes in which this growth by the ftalk is principally obferved, are very thinly befet with capfules of feed, and many of them produce but very few in a feafon; whereas the brya, and other moffes which have not this advantage of growing from the ends of the ftalks, are found every year profufely covered with capfules from every tuft; nay, there is fcarce any branch which does not produce its capfule. Now, if thefe capfules contained only a farina capable of impregnating the nodules or the ends of the branches, it is obvious there would be as much of it required for the hypna as for any other kinds of moffes; but if they are real and perfect feeds, it is no wonder that nature has given them profufely

to

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to such kinds as are to be propagated only by seeds, and more sparingly to those which are propagated also by the increase of the branches.

To this it may finally be added, that the ferns and other epiphyllospermous plants approach most of all others to the nature of the mosses; and though it has been suspected by many that the fine powder at the back of their leaves was not seeds, but only a farina, yet it is now well known that it is true and perfect seed; since, under many species of them, there are constantly found new and self-sown plants arising in their first rudiments of leaves and figure, which have plainly grown from the dust or powder fallen from the old plants; and as this is now found to be the case in regard to the ferns, probably it will also appear the same in regard to mosses, when they have been yet farther examined than at present. But whether these grains of powder have the lobes and radicles by which the seeds of larger plants propagate themselves, or whether they grow into plants like the parent ones, in the manner of the lichens, by mere expansion, is a thing that requires farther observation to determine.

Some of the mosses, it is evident, approach to the nature of the plants which have their male and female parts in the same flower, and others to those which have them in different ones.

After all, this tribe of plants, as well as the mushrooms, ferns, and sea-weed, is still imperfectly known. Dillenius, professor of botany at Oxford, was the first who attempted an arrangement of them. In his *Catalogus Plantarum circa Gissam*, published at Francfort in 1719, and afterwards in his *Historia Muscorum*, published at Oxford in 1741, he divides the mosses into 16 genera. This arrangement, however, includes the lichens, some of the fuci, and other plants which belong to very different families. The work in question is, notwithstanding, valuable, in having introduced the knowledge of upwards of 200 plants, which were unknown before Dillenius: it is, besides, of all his works of this kind, the best executed, both for the descriptions and figures, and should serve as a model to such authors as intend to publish in detail the history of any particular family of plants.

Micheli, in a work intitled *Nova Plantarum Genera*, published at Florence in folio in 1629, divides the mosses into two sections, from the figure and situation of their flowers. These sections comprehend together 16 genera, amongst which are improperly arranged, like those of Dillenius, several of the lichens and other sea-weed.

The discovery of the seeds of the mosses, though made by Dillenius in 1719, is arrogated by Linnæus to himself, who did not begin to write till 1735.

In Ray's method, the mosses form the third class: in Tournefort's, they constitute a single genus, by the name of *muscus*, in the first section of the 17th class, which comprehends the mosses, mushrooms, and some of the algæ or sea-weed, and is distinguished by the name of *aspermæ*, or plants without seed; the seeds of the mosses not having been detected by Tournefort.

The characteristics of these plants, according to the sexual system, are, 1. Tops without filaments or threads. 2. The male flower, constituted by the presence of the *antheræ* or tops, placed apart from the female, either on the same or distinct roots. 3. The female flowers deprived of the *pistillum* or pointal. 4 The seeds devoid of both lobes *(cotyledones)* and proper coverings; so that they exhibit the naked embryo

In the same system, these plants constitute the second order of the class *cryptogamia*, which contains all the plants in which the parts of the flower and fruit are wanting, or not conspicuous. This order is subdivided into 13 genera, from the presence or absence of the calyx, which in these plants is a veil or cover like a monk's cawl, that is placed over the male organs or tops of the stamina, and is denominated *calyptra*, from the sexes of the plants, which bear male and female flowers, sometimes on the same, sometimes on distinct roots; and from the manner of growth of the female flowers, which are sometimes produced singly, sometimes in bunches or cones. These distinctions are mostly borrowed from Dillenius, whose excellence in developing this part of the vegetable kingdom Linnæus very readily acknowledges.

The manner of seeding of mosses in general may be more clearly understood from the description of that genus of them which has been traced through all its stages, and to which most of the others, though every genus has its distinct fructification in some respects, yet bear a very great general analogy.

The genus already observed, is that called by Dr Dillenius the *hypnum*. The species of this are very numerous and common; but that particular one which was the subject of these observations, is the short-branched silky kind, common on old walls; and called by that author in his history *hypnum, vulgare, sericum, recurvum, capsulis erectis cuspidatis.*

The head of this moss appears to the naked eye a small, smooth, brownish-yellow, oblong body, of about a ninth of an inch long; this is covered at its upper end with a membranaceous calyptra or hood, in shape resembling an extinguisher or a funnel inverted. When this calyptra is taken off, and the head viewed with a microscope, the surface of it is seen to be ridged with longitudinal striæ. The basis of the head is of a deep orange colour, and more opaque than the rest; and the top is bounded by an orange-coloured ring, swelling out something beyond the surface of the contiguous parts of the head. Good glasses show that in this head there are not wanting the parts essential to the fructification of what are usually called the more perfect plants. This ring is truly a monophyllous undulated calyx, within which arise sixteen pyramidal fimbriated stamina; these are of a pale greenish colour, and are loaded with a whitish oval farina. The stamina all bend toward each other from their bases, and almost meet in a point at the tops. This is their appearance when the head is nearly ripe; and immediately under the arch formed by these stamina, is a cylindric hollow pistillum, through which the farina makes its way, and is dispersed among the seeds in the head; the fruit is a large capsule, filling every part of the membrane which shows itself on the outside of the head, and in most places is contiguous to it; this capsule is filled with perfect and very beautiful seeds; they are round, transparent when unripe, but afterwards opaque, and of a very beautiful green, which colour they retain even when dried.

When this head is first produced from the plant, the staminæ are very slender, and stand erect; the head is

Musci. Muscicapa. is scarce any thicker than the stalk, and the calyptra covers it all over, to shield the tender substance of the farina from external injuries. As the farina afterwards swells in the stamina, the seeds in the head increase also in bulk, and by their increase the head is more extended in thickness; and the stamina are by this means separated farther and farther from each other at their bases, but bend inwards toward their points, so as to form a kind of arched covering over the stigma of the pistillum, which is single; and from hence the farina falls as it ripens into the head, and impregnates the seeds.

The 11 principal genera are as follow: *Lycopodium, polytricum, bryum, selagines, usneæ, mnium, byssi, sphagnum, hypna, conservæ*, and *fontinalis*. These are found growing on the barks of trees as well as on the ground. See Plates CCCXXI and CCCXXII.

Mosses, by the inconsiderate mind, are generally deemed an useless or insignificant part of the creation. That they are not, is evident from hence; that He who made them has made nothing in vain, but on the contrary has pronounced all his works to be very good. Many of their uses we know; that they have many more which we know not, is unquestionable, since there is probably no one thing in the universe of which we dare to assert that we know all their uses. Thus much we are certain of with respect to mosses, that as they flourish most in winter, and at that time cover the ground with a beautiful green carpet, in many places which would be otherwise naked, and when little verdure is elsewhere to be seen; so at the same time they shelter and preserve the seeds, roots, gems, and embryo plants of many vegetables, which would otherwise perish; they furnish materials for birds to build their nests with; they afford a warm winter's retreat for some quadrupeds, such as bears, dormice, and the like, and for numberless insects, which are the food of birds and fishes, and these again the food or delight of men. Many of them grow on rocks and barren places, and rotting away, afford the first principles of vegetation to other plants, which could never else have taken root there. Others grow in bogs and marshes, and by continual increase and decay fill up and convert them either into fertile pastures, or into peat-bogs, the source of inexhaustible fuel to the polar regions.—They are applicable also to many domestic purposes: the lycopodiums are some of them used in dyeing of yarn, and in medicine; the sphagnum and polytrichum furnish convenient beds for the Laplanders; the hypnums are used in tiling of houses, stopping crevices in walls, packing up of brittle wares and the roots of plants for distant conveyance.—To which may be added, that all in general contribute entertainment and agreeable instruction to the contemplative mind of the naturalist, at a season when few other plants offer themselves to his view.

Musci, is likewise the name of the 56th order in Linnæus's Fragments of a natural Method. See Botany, p 470.

MUSCICAPA, or Fly-catcher, a genus of birds belonging to the order of passeres. The bill is flatted at the base, almost triangular, notched at the upper mandible, and beset with bristles; the toes (generally) divided as far as their origin.

1. The grisola, or spotted fly-catcher, is about five inches and three quarters long. The head is large, of a brownish hue spotted obscurely with black: the back is of a mouse-colour: the wings and tail are dusky: the breast and belly white: the throat and sides under the wings dashed with red: the legs and feet are short and black. It is a bird of passage; appears here in the spring, breeds with us, and departs in September. It builds its nest against any part of a tree that will support it; often in the hollow caused by the decay of some large limb, hole in a wall, &c. also on old posts and beams of barns; and is found to return to the same place season after season. It lays four or five pale eggs marked with reddish. It feeds on insects, and collects them on the wing. When the young can fly, the old ones withdraw with them into thick woods, where they frolic among the top branches; dropping from the boughs frequently quite perpendicular on the flies that sport beneath, and rising again in the same direction. It will also take its stand on the top of some stake or post, from whence it springs forth on its prey, returning still to the same stand, for many times together. They feed also on cherries, of which they seem very fond.

2. The pondiceriana, Pondicherry or Coromandel fly-catcher, is rather bigger than a sparrow. The general colour of the upper parts is a cinereous grey; the throat, breast, and belly, white; the legs black. It inhabits the coast of Coromandel; where, from the agreeableness of its song, it is called the *Indian nightingale*.

3. The flabellifera, or fan tailed fly-catcher, is in length six inches and a half: the head is black, which colour descends on the back part lower than the nape, whence it passes forward in a narrow collar to the throat; the chin, throat, and sides of the neck, except where this collar passes, are white; and over the eye is a white streak like an eye-brow: the upper parts of the body are olive-brown; the under parts yellowish rust, growing whitish towards the vent: the tail is longer than the body; the two middle feathers black, the others white: the legs are dusky. This species inhabits the southern isle of New Zealand; where it is seen constantly hunting after insects, and flies always with its tail in shape of a fan. It is easily tamed; and will then sit on any person's shoulder, and pick off the flies. It has a chirping kind of note; and is called by the natives *Diggo-wagh-wagh*. There is a beautiful figure of this bird in Mr Latham's Synopsis, plate xlix.

4. The caribonensis, or cat-bird, is somewhat bigger than a lark: length eight inches. Bill black: the upper parts of the body and wings are of a deep brown; the under ash-coloured: the crown of the head is black; the tail is blackish; and the legs are brown. This species is found in Virginia in the summer-season; where it frequents shrubs rather than tall trees, and feeds on insects: its cry resembles that of a cat, whence the English name given it by Catesby. See Plate CCCXX. fig. 1.

5. The crinita, or crested fly-catcher, is about the size of a lark: the head is crested, and of a dull green: the hind part of the neck and back are of the same colour; the under parts from the chin to the breast Fig. 2.

 of

Muscle.

of an ash-colour, and from thence to the vent yellow: the legs are black. This inhabits Carolina and Virginia in summer; builds there, and departs in autumn.

Fig. 3. 6. The rubricollus, purple-throated fly-catcher, is about the size of a blackbird: the whole plumage is black; except the chin, throat, and fore part of the neck, on which is a large bed of beautiful crimson, inclining to purple: the legs are black.—These birds inhabit Cayenne and other parts of South America; where they are found in flocks, and precede in general the toucans in their movements. They feed on fruits and insects; and are lively birds, always in action. They for the most part frequent the woods, like the toucans; and where the first are found the others are seldom far off.

7. The rubra, or summer red-bird of Catesby, is a most beautiful species, somewhat bigger than a sparrow: the bill is yellowish; the eyes are black; the legs dusky: the male is wholly of a scarlet colour, except the tips of the quill-feathers, which are of a dusky red: the colour of the female is brown tinged with yellow. It inhabits Carolina and Virginia in the summer.

This is a very numerous genus; there being about 90 other species described by authors. In the *Syst. Nat.* (Gmelin), the whole number is 92; in Mr Latham's *Index Ornithologicus*, 97 are enumerated.

MUSCLE, in anatomy. See Anatomy, Part II. sect. ii.

The motion of the muscles of animals has been thought a matter of such curiosity and importance, that an annual lecture upon it was founded by Dr Croone, one of the original members of the Royal Society at London. In consequence of this, the investigation of the subject hath exercised the pens of a great number of very learned and ingenious men; notwithstanding which it still remains involved in almost as much obscurity as ever. Many curious observations, however, have been made; and as far as the laws of *dead* mechanism can be applied to a *living* machine, the investigators have been successful: but still there has been a *ne plus ultra*, a certain barrier by which their investigations have been limited, which no person has hitherto been able to pass, and which it is very improbable ever will be passed. To give an account of all the different theories which have appeared on this subject is impossible; but in the year 1788 a lecture on the subject was delivered by Dr Blane, F. R. S. of which, as it seems to contain the substance of all that can be said upon the subject, we shall here give the following abridgement.

The Doctor considers as muscles not only those large masses of flesh which compose so great a part of the bulk of the body, but likewise all the minuter organs subservient to circulation, nutrition, and secretion; since not only the heart itself, but the whole vascular system and the intestines, owe their action to certain powers of irritability and contractility peculiar to muscular fibres.

The first and most obvious considerations with respect to the muscles is the regular organization of their fibres in a parallel direction. In this they are distinguished from every other matter of a fibrous structure, whether vegetable or mineral, by a certain degree of moisture, tenacity, and elasticity, entirely peculiar to themselves.

The fibres of the muscles visible to the naked eye are composed of others discoverable by glasses, and these others of fibres still smaller; neither hath any person been able to discover the ultimately fine fibres of a muscle, which are not composed of others. Some have indeed imagined that they have been able to do this, but their observations have been found fallacious; and it is now universally allowed that the fibres are divisible beyond what the best assisted sight can trace, and that they are to all appearance uniform. In this regular and fibrous organization they resemble the crystals of salts, many of which are found composed of fibres more and more fine, and which, like those of the muscles, can never be ultimately traced.

The doctor next touches a little upon the *vis inertiæ* of matter; and, contrary to the generally received opinion of modern philosophers, considers matter as an active substance. What is called the *vis inertiæ*, he thinks, "is not a resistance of change from rest to motion, or from motion to rest, but a resistance to acceleration or retardation, or to change of direction." The activity of matter is further proved by the attractions and repulsions which take place universally among its parts; and every instance of motion within the cognizance of our senses, may be referred, either in itself or its cause, to some mode of attraction or repulsion. These may both be considered as one principle, being both expressive of that state of activity originally inherent in matter; and because any two particles, having affinity with each other, must either attract or repel, according to their distance, their common temperature, and other circumstances; and it is so universal an agent in nature, that some modern philosophers have made it absorb, as it were, every other power and property in matter. It is evident, however, whether this hypothesis be just or not, that the cause of muscular motion cannot be referred to mechanism, which is itself only a secondary principle. Some have had recourse to a fluid conveyed into the fibres of muscles, by which they were swelled, and thereby shortened. One of the most plausible of these hypotheses supposes this fluid to be the blood: but this is plainly *a petitio principii*; for in order to set the blood in motion, muscular motion is necessary. Other fluids have been supposed to have this effect; but even the existence of these has not been proved, and indeed the most solid objections might be brought against all the theories that have hitherto been invented.

Our author having now established it as a maxim, that the primary properties of matter are attraction and repulsion, and that mechanism is only a secondary property, he next considers muscular motion as referable to an original law of animated matter, whereby its particles are endowed with an attractive power, for which no cause can be assigned any more than for gravitation, cohesion, or chemical affinity. If the shortening of a muscular fibre depends on this increased power of attraction between its particles, the effect will be to add to the power of cohesion in the fibre; and to determine this the Doctor made the following experiment: Having taken the flexor muscle of the thumb of a man newly dead while yet warm and flexible,

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Muſcle. ible, he appended a weight to it, continually augmenting it until the muſcle broke; and this he found was done when 26 pounds had been added: yet a living man of the ſame apparent ſtrength and age could with eaſe lift a weight of 38 pounds by the exertions of the ſame muſcle. "It is farther in proof of this fact (adds he), that in the caſe of a violent ſtrain from muſcular contraction in the living body, it is the tendon that gives way; whereas we have ſeen that in the dead body the muſcle is the weaker of the two. It is alſo well known, that in caſes of our exertion the muſcular fibres themſelves do not give way, though the ſtrongeſt tendons, ſuch as the tendo Achillis, and even bones, ſuch as the knee-pan, are broke by their living force, which in ſuch inſtances muſt be many times greater than the ſtrength of the dead fibres. There is a caſe related in the Philoſophical Tranſactions by Mr Amyand, wherein the os humeri was broken by an exertion of the muſcles. Every one has heard of fractures happening from very ſlight accidents. Theſe occur moſt probably from a jerk of the muſcles concurring with the external violence. The ſenſible increaſe of hardneſs in a muſcle, when in a ſtate of contraction, may alſo be conſidered as a proof of an increaſed attraction of its particles to each other at that time."

The Doctor next conſiders whether or not a muſcle, when in a ſtate of contraction, undergoes any change of denſity. "Every homogeneous body (ſays he) poſſeſſes a certain degree of denſity, determined by the diſtance of its integrant particles. The moſt common means in nature by which the denſity of ſuch bodies is altered are heat and cold; the one univerſally producing expanſion, the other condenſation. Whether mechanical force has the ſame effects, is a point in natural philoſophy not ſo well aſcertained; for though tenſion and colliſion produce in ſolid elaſtic bodies a change of figure, which they immediately reſume when the force is withdrawn, it has not been inquired whether in ſuch caſes a change of denſity takes place while the body is in a ſtate of elongation or compreſſion. Two elaſtic balls in the act of colliſion undergo a momentary change of figure, ſo that there muſt be an approximation of particles in the direction in which they are flattened; and in the elongation of an elaſtic cord by tenſion there muſt be an increaſed diſtance of the particles in one direction: but while theſe changes take place in one dimenſion of the reſpective bodies, they may be compenſated by contrary changes in the other dimenſions, ſo that the ſeveral bodies may preſerve, upon the whole, the ſame ſolid contents. In order to aſcertain this in the caſe of tenſion, which is the only caſe bearing analogy to muſcular motion, I made the following experiment: I took a piece of the elaſtic gum or *caoutchouck*, three inches ſquare, and about the eighth of an inch in thickneſs; I procured a piece of ſheet tin three inches broad and about ſix inches long, cut into ſharp teeth at each end. The gum was firſt weighed in air, and found to be 380.25 grains. It was then weighed in water along with the tin, to which it was looſely attached, and the weight of both was then 758.75 grains. The gum was then ſtretched upon the tin by means of the teeth at each end to a ſurface of about five inches ſquare, the tin being bent ſo as to leave a free ſpace between it and the gum, in order that when immerſed in water no air-bubbles might be entangled. In this ſituation, the weight of both in water was found to be 746.75 grains. Here was a difference of 12 grains, which could be owing only to a diminution of ſpecific gravity; and in order to be ſure that there was no fallacy nor inaccuracy in the experiment, the gum was immediately diſengaged from one end of the tin ſo as to allow it to ſhrink; and being again weighed in this ſtate in the water, it was found to have recovered exactly its former weight." Muſcle.

From this very remarkable experiment, the Doctor argues to what may probably happen in the contraction of the muſcles. "This point (he ſays) cannot be decided but by an experimental examination. It might be determined whether a muſcle occupies moſt ſpace when relaxed or when contracted, by finding its ſpecific gravity in each of thoſe ſtates by means of the hydroſtatical balance. But this would be found extremely difficult; for the ſtate of contraction is very tranſitory, and the motion itſelf would produce ſuch a diſturbance as would render the reſult unſatisfactory. As there is this obſtacle to an experiment on a living muſcle, it occurred to me that it might be performed on the muſcles of a fiſh which had undergone the operation of *crimping*, as it is called; for in conſequence of dividing the muſcles, by cutting them when alive, they undergo a contraction which continues after death; and upon comparing, by the hydroſtatical balance, portions of muſcle which had been crimped with thoſe of the oppoſite ſide of the ſame fiſh which had on purpoſe been ſaved from this operation, it did not appear that there was any difference in the ſpecific gravity. Two trials were made; one with the maſſeter muſcles of a ſkate, the other with the ſides of a large trout."

To determine whether the contraction or relaxation of a living muſcle made any alteration in its denſity, our author took one half of a living eel, and put it into a glaſs ſtalk, of which the mouth was afterwards fuſed by a blow pipe, and drawn out like the ſtem of a thermometer. The flaſk and tube being then filled with water, our author obſerved, with great attention, whether the convulſive agonies of the creature would make the fluid riſe or fall; but it did neither. The tail part of the eel was made uſe of in this experiment, that there might be no deception from the other, which contained the organs of reſpiration and the air-bladder. In one of his trials, the tail portions of two eels were introduced into the flaſk; but though they were frequently both in convulſions at once, not the leaſt motion of the fluid in the tube could be perceived. On this occaſion alſo the Doctor made ſome experiments to decide the queſtion, Whether the mere circumſtance of *life* made any alteration in the gravity of bodies? His firſt trials were with animals of warm blood incloſed in oil-ſkin and cloſe tin-veſſels; but not being ſatisfied with the accuracy of theſe, from the difficulty of cutting off all communication with the external air, he incloſed live eels in flaſks; and having ſealed them hermetically, he found that the weight of them when alive and dead was the very ſame.

The reſult of all our author's experiments is, that "the contraction of a muſcle produces no change in its denſity, and that animal life differs from inanimate matter in this reſpect, as well as in moſt of its other properties and laws. One purpoſe in nature for muſcles

Muſcle. always preſerving the ſame denſity may be, that as ſome of them act in confined cavities, inconveniences might ariſe from their occupying more ſpace at one time than at another. In the extremities of cruſtaceous animals, for inſtance, which are filled with muſcles, a change of denſity would be apt to burſt them.

"Another circumſtance in which the contractions of muſcles differ from ſimple elaſticity is, that the former, however frequent and violent, does not produce any heat, as colliſion and tenſion are known to do. This may admit of ſome cavil with regard to animals of warm blood; for one of the theories with regard to animal heat is, that it ariſes from the perpetual vibration of muſcular fibres, particularly thoſe of the vaſcular ſyſtem; but this will not hold with reſpect to animals of cold blood, in which the actions of life are equally vigorous. The principal phenomena, therefore, of muſcular motion are, the ſhortening of the fibres, the lateral ſwell, the increaſe of coheſion and hardneſs, and the unchanged denſity and temperature. It would appear from the two laſt circumſtances, that the intimate motions of the particles in relation to one another muſt be different from what take place in the ſeveral inſtances of contraction and expanſion of dead bodies. In the expanſion ariſing from the action of heat and the contraction from cold, the change of denſity ſhows, that in the one caſe the ultimate particles muſt recede from each other, and in the other they muſt approach. The ſame may be ſaid of elaſticity. But as there is no alteration in the denſity of a muſcle in paſſing from relaxation to contraction, this change cannot conſiſt in the approximation of the integrant parts of the fibres, but muſt depend on ſome other circumſtances in the intimate diſpoſitions of the particles. In attempting to conceive in what this conſiſts, the following explanation may be offered. It is probable that the regular ſtructure of ſolid bodies depends on the polarity and ſhape of their integrant parts. Now all bodies, except ſuch as are ſpherical, muſt have a long and a ſhort axis; and let us imagine the fibres of muſcles to be compoſed of ſpheroidal particles, we may then conceive relaxation to conſiſt in their being diſpoſed with their long axis in the line of their fibres, and contraction to conſiſt in their ſhort axis being diſpoſed more or leſs in that direction. This will not only account for the decurtation and uniform denſity, but for the lateral ſwell, and alſo for the increaſed hardneſs and coheſion; for though the particles do not approach or recede, as in bodies ſimply elaſtic, yet their power of attraction will be increaſed by their centres being brought nearer, and by being applied to each other by more oblate ſurfaces. This hypotheſis accords with what has been before proved concerning the unchangeable denſity, for what is loſt in one dimenſion is gained in another; and the cauſe for there being no increaſe in temperature depends probably on the ſame circumſtance by which the denſity is preſerved unaltered."

Thus far the Doctor has proceeded upon a plan, which may become plauſible by means of an hypotheſis at leaſt; but in the proſecution of his ſubject he is involved in the ſame difficulty which has proved too hard for every other perſon, and which he, indeed, does not attempt to ſolve. This is the action of ſtimuli, by which the muſcles are exerted to contraction, and upon which all the phenomena of life depends, and which indeed is the thing that particularly ought to be explained; but of this our author is forced to confeſs his entire ignorance, and to content himſelf with enumerating the ſtimuli of which he cannot explain the action. Stimuli then, according to him, are divided into internal and external. An example of the former kind is the circulation of the blood, which is kept up by an exciting influence of the blood upon the heart and veſſels which contain and impel it. The earlieſt perceivable inſtance of muſcular motion is the beating of the heart, as it is ſeen in the firſt rudiments of the embryo in an egg, and called the *punctum ſaliens*. There ſeems to be eſtabliſhed by nature a certain habitude of action between the veſſels and their fluids; for if a fluid even more mild than the blood, ſuch as milk, be injected into the circulation, it will produce great diſturbance; and if the blood, by being deprived of the influence of reſpirable air, becomes deſtitute of a certain property which it would naturally acquire in the act of reſpiration, it does not prove a ſtimulus to the heart.

In like manner, all the containing parts are accommodated to the nature of their reſpective contents.—The inteſtines are ſo calculated as to have proper motions excited in them by the aliment and the ſecretions which are mixed with it; and there are bodies which, though perfectly mild, ſuch as alimentary ſubſtances of difficult digeſtion, yet excite more violent commotions in the ſtomach than other ſubſtances which are very acrimonious. The various effects of poiſons in different parts of the body may alſo be mentioned as an illuſtration of the peculiar ſuſceptibility of the ſeveral organs of the body. The poiſon of a viper, for inſtance, is perfectly innocent, not only in the receptacles of the animal which produces it, but may be taken into the ſtomach of any animal without the leaſt bad effect, and only exerts its deleterious power when brought in contact with a wounded part. Some vegetable poiſons, on the contrary, ſuch as that of laurel water, prove deadly when taken into the mouth, or applied to any part of the alimentary canal, but are innocent when injected into the veins. It may be remarked alſo, that the receptacles of the ſeveral ſecreted fluids, ſuch as the gall-bladder and bladder of urine, are ſo adapted to their natural contents, by a due meaſure of irritability, as to bear their accumulation to a certain degree, and then to expel them. We have here alſo a proof that irritability is not in proportion to ſenſibility; for both theſe receptacles are extremely ſenſible to pain and irritation from extraneous acrimony, though ſo moderately ſenſible to the acrimony of their natural contents. This diſpoſition in the ſeveral organs to perform their natural functions, in conſequence of the ſtimulus of the reſpective fluids they contain, has aptly enough been called the natural perception of theſe organs.

Our author now conſidering that the internal organs are calculated to perform their functions in conſequence of certain ſtimuli, concludes the application of chemical and mechanical ſtimuli is not a mode of experiment likely to produce uſeful knowledge; and hence, he thinks, we may ſuggeſt the moſt likely means of reſtoring loſt irritability and action to the vital functions, when ſuſpended by ſuffocation, ſtrangulation, or immerſion. In theſe caſes, he ſays, that all other means are far inferior to that of inflating the lungs with atmospheric air, and stroking and pressing the ribs in such a manner as to imitate natural respiration. The only other thing which he supposes to be any way useful, is the application of heat to such as have been immersed in cold water; but of cool air to those who have suffered from mephitic vapours.

The Doctor having then considered some other parts of the animal economy, enters into an investigation of the analogy between motion and sensation. "This analogy (says he) is the more exact, that the nerves seem to be the instruments of both; for not only the organs of sensation and voluntary motion, but those of involuntary motion, are supplied with nerves, and dependant upon them; for if the influence of the nerves leading to the heart or intestines is interrupted by cutting, ligature, or palsy, the function of these parts is thereby destroyed. Thus, as there is a peculiar sensibility belonging to the several senses, so is there a peculiar irritability belonging to the several organs of motion. The intention of nature, therefore, in distinguishing nerves to every muscular organ, was probably in order to constitute those peculiar perceptions on which the various vital and natural functions depend. But I give this only as a conjecture; and though the nervous influence may thus *modify* irritability, there is reason to think that it does not *bestow* it."

Our author controverts the principle which has been held by some very able physiologists, that all muscular irritability depends upon a sentient principle. "There have been several instances (says he) of the production of fœtuses without the brain; and a principal fact in support of this opinion is, the existence of animals without brain or nerves. That there are such, was, I believe, first observed by Haller, and has been confirmed by Mr Hunter; who maintains farther, that the stomach is a centre or seat of life more essential to it than the brain. That the stomach should be an organ of so much consequence, seems natural enough from the importance of its function, which is that of assimilation; and life can be more immediately and completely extinguished by an injury to it, such as a blow, than by the same violence to any other part of the body. It is also well known, that the muscular fibres of animals endowed with a nervous system, will retain their irritability for some time after their separation from the brain and nerves.—It is evident likewise, from the phenomena of vegetation, that irritability may exist in nature without sensation, consciousness, or any suspicion of the existence of a nervous system. In favour of this opinion, it is farther observable, that those animals which are destitute of brain and nerves are of the class of *vermes*, the most simple in nature, having only one function, viz. that of assimilation; and therefore not requiring that variety of action, and those perceptions which are peculiar to more complex animals. Lastly, the state of an egg before incubation, and the condition of those animals which become torpid from cold, and afterwards revive, afford facts which favour this opinion; as they show that there is a certain principle of self-preservation, independent not only of the operation of the nervous system, but even of the circulation; for in this quiescent state, those portions of animal matter are preserved for a great length of time from that corruption to which they would otherwise be liable, and their fluids are prevented from freezing in a degree of cold which would congeal them, were they destitute of every principle of life."

In the course of his reasoning, our author considers the nervous system not only as a mere appendage to life, but as tending to impede its operation, and shorten its existence. "Simple life (adds he) will not only survive sensation, but will survive it longer, if the animal is killed by destroying the nervous system, than if it had been destroyed by hæmorrhagy, suffocation, or other violence. If a fish, immediately upon being taken out of the water, be stunned by a violent blow on the head, or by having the head crushed, the irritability and sweetness of the muscles will be preserved much longer than if it had been allowed to die with the organs of sense entire. This is so well known to fishermen, that they put it in practice in order to make them longer susceptible of the operation called *crimping*. A salmon is one of the fishes least tenacious of life, insomuch that it will lose all signs of life in less than half an hour after it is taken out of the water, if suffered to die without any farther injury; but if, immediately after being caught, it receives a violent blow on the head, the muscles will show visible irritability for more than 12 hours afterwards."

To the same purpose, our author observes, that in warm-blooded animals an excessive exertion of voluntary motion immediately before death, prevents the muscles from being rigid when cold, and renders them more prone to putrefaction. Thus, if an ox is killed immediately after being overdrove, the carcase will not become stiff when it grows cold, nor is it capable of being preserved by means of salt. In confirmation of the same hypothesis also, our author observes, that in some disorders of the brain, such as hydrocephalus, and apoplectic palsy, in which the functions of the brain are suspended, the office of digestion is sometimes better performed than in health.

From all this our author concludes, along with Mr Hunter, that the exercise of sensation is inimical to life, and that a sort of fatigue is induced by this as well as by voluntary motion; "so that all that intercourse carried on through the nerves, whether *towards* the brain in the case of sensation, or *from* the brain in acts of volition, tends to wear out the animal powers. And, as intense and long-continued thought, though not terminating in any outward action, tends also to produce an inability for farther exertions, it would appear that the brain or sensorium is more particularly the organ which is subject to that species of sufferance called *fatigue*. From these facts we perceive the necessity of sleep, which consists in a temporary suspension of sensation, volition, and thought, and is a resource of nature, whereby the powers of life recover themselves after satiety and fatigue, which are provided as guards to warn us when nature is in danger of being strained, either by repletion or over-exertion; and it is evident that such barriers were absolutely necessary, in order to set bounds to operations which are only occasionally requisite, and which would otherwise depend on the caprice of the will. The exercise of sensation and voluntary motion in a moderate degree is conformable to the intention of nature, and therefore salutary; and it is only when they are exceffive that they tend to wear out the powers of life, and more efpecially if thefe are not duly recruited by fleep. It follows, from the fame principle, that when life is threatened by certain difeafes, of which the chief fymptom is irritation, any means by which fenfation, whether natural or morbid, and mufcular motion, whether voluntary or involuntary, convulfive or fpafmodic, can be foothed or fufpended, will prove falutary, by allowing the powers of life to rally as it were, and to recover themfelves. In this confifts the operation of narcotic medicines, fuch as opium;—which, in complaints both of a general and local nature, proves ufeful, not merely as a palliative by the removal of temporary pain or fpafm, or by procuring fleep, but as a principal inftrument of recovery, by allowing the powers of life to exert their natural action, in confequence of the removal of irritation."

In treating this fubject, the Doctor confiders the effects of opium as affecting fimple or fenfitive life; and to determine this, he made the following experiments: Having made a folution of opium in water, he put into one portion of it fome found living eels, and others with their heads bruifed; and in a number of trials it was found that the found eels generally died much fooner than the bruifed ones. This, however was the cafe only when the folution was of a certain degree of ftrength, fuch as half a grain of opium at leaft to an ounce of water; for when only about half this ftrength, the found eels lived much longer, the time being then protracted to that in which the bruifed eels would have died merely in confequence of their injury; but it muft be obferved, that even the wounded eels died confiderably fooner than when put into plain water.

From all this, our author concludes, that "the great maffes of mufcle in the trunk and extremities of the body are the inftruments of the mind in acting upon external bodies; and we may therefore rank in the lift of ftimuli the nervous power by which the will and the paffions excite external motions. This is a function fufficiently important for the nerves, without admitting them as the principle on which irritability depends."

Having difclaimed all inquiry into the connection between mufcular motion and volition, the Doctor proceeds to confider the effects of the different paffions upon the mufcles. Though thefe are diftinct from the motions directly produced by the will, yet he confiders them among thofe arifing from confcioufnefs; "for there are emotions of the heart which have vifible and powerful effects upon the mind and vafcular fyftem, which are organs entirely out of the reach of the will. Not to mention the well-known effects of grief, fear, and joy, which affect the whole circulation, there are certain paffions and fentiments which produce partial and local effects. Thefe are eftablifhed by nature, either to anfwer fome important purpofe in nature, as in the cafe of the congeftion of the fluids in the parts of generation in confequence of the venereal appetite, or to ferve as natural expreffions, as in the cafe of blufhing or weeping. One of the moft ftriking effects of the paffions upon mufcular action, is the influence they have upon the ftrength or mechanical force of the voluntary mufcles. Fear produces debility almoft amounting to palfy. Courage and order of mind, on the contrary, add to the natural ftrength. When the mind is agitated by fome interefting object, and calls upon the body for an extraordinary exertion to effect its end, the mufcles are thereby enabled, as it were by magic, to perform acts of ftrength of which they would be entirely incapable in cold-blood. In circumftances of danger, for inftance, where life or honour are at ftake, exertions are made for overcoming mechanical refiftance which feem incredible, and would be impoffible, were not the mind in a fort of phrenzy; and it is truly admirable in the economy of nature, that an idea in the mind fhould thus in a moment augment the powers of motion, and infpire additional refources of ftrength adequate to the occafional calls of life. The great increafe of ftrength in maniacs is alfo referable to the paffions of the mind. Thefe confiderations would almoft lead us to doubt whether or not the accounts we have of the great feats of ftrength afcribed to individuals in the heroic ages be fabulous or not. It is alfo worthy of remark, that, in great and lafting exertions of ftrength to which men are impelled by active and generous affections, fatigue is not induced in the fame proportion by many degrees as by the fame quantity of mufcular action in the cool and deliberate actions of common life."

Having thus difcuffed the fubject of *internal* ftimuli, our author next proceeds to take notice of the fecond clafs, viz. fuch as are *external*. Thefe are either immediate or remote, viz. fuch as are excited by mechanical means, or by acrimony directly and artificially applied to a mufcular fibre; or fuch as occur in the inftances of fympathy, and in the cafe of thofe inftincts which nature has inftituted for the purpofe of felf-prefervation in brutes, and in the early part of human life. "There are certain habitudes (fays he) between outward ftimuli and the moving powers whereby natural propenfities are conftituted, equally neceffary to the fupport of life as the internal functions. Thus, in a new born animal, the firft contact of the external air excites the act of refpiration, and the contact of the nipple excites the act of fucking; both of which actions are abfolutely neceffary to the maintenance of life, and require the nice co-operation of a great number of mufcles prior to all experience. Actions of this kind are called *inftinctive*; but though different from thofe of voluntary motion, they neverthelefs run into one another; fo that what was at firft merely inftinctive, may afterwards become a matter of deliberate choice. The fame mufcles are the inftruments of both; and they differ from the mufcles obeying the internal ftimuli, fuch as the heart, in being liable to fatigue, and thereby concurring with the exercife of fenfation and of thought, in rendering fleep neceffary. There are no mufcles except thofe of refpiration, of which the conftant action is neceffary to life, and which are void of confcioufnefs in their ordinary exercife, but which are yet in fome meafure under the controul of the will. The principal end anfwered by this power of the will over the mufcles of refpiration in man, is to form and regulate the voice. But, though inftinctive motions are in fome cafes convertible into thofe which are voluntary, they ought by no means to be confounded together; for even thofe animals which are deftitute of brain and nerves, are capable of actions evidently of the inftinctive kind.—

A leech

A leech, for inſtance, being brought into contact with a living animal, is impelled by an inſtinct of its nature to faſten upon it, and ſuck its blood. There is ſomething very ſimilar to this even in vegetables, as in the caſe of tendrils and creeping plants being ſtimulated by the contact of other bodies to cling round them in a particular direction ‡.

‡ See *Vegetable Motion*.

Beſides theſe obſervations on the inferior animals, our author brings ſome experiments to ſhow, that inſtinctive actions, even in animals furniſhed with a brain and nerves, do not depend on ſenſation. Having divided the ſpinal marrow of a live kitten a few days old, he irritated the hind-paws by touching them with a hot wire. By this the muſcles of the poſterior extremities were thrown into contractions, ſo as to produce the motion of ſhrinking from the injury; and the ſame effects were obſerved in another kitten of which the head was entirely ſeparated from the body. In repeating this experiment he found, that when the ſpinal marrow was cut through between the lumbar vertebræ and os ſacrum, the poſterior extremities loſt their irritability, but the tail reſumed it. Even the head retained its irritability after it was cut off; as appeared by touching the ears with a hot wire, or by pricking them: "and (ſays our author) as the extremities are alſo irritable, it will not be ſaid that conſciouſneſs and ſenſation exiſt in two ſeparated portions of the body."

The effects of habit are then conſidered: and the concluſion from the doctor's reaſoning upon this ſubject is, that "there is a *co-ordinance*, or pre-eſtabliſhed harmony, as it were, between the faculties of animals and the laws of external matter, which is the foundation of all the inſtinctive habits of animals, as well as the rational conduct of man."

To the law of habit have been referred the effects of certain contagions, ſuch as that of the ſmall-pox, which do not produce their effect more than once in life. With reſpect to this he obſerves, "that upon whatever principle this property of the animal economy depends, it is an undoubted fact, that theſe morbid poiſons, after exciting a certain degree of diſturbance, and a certain ſeries of diſeaſed actions, no longer make any impreſſion on the powers of life, otherwiſe there could be no ſuch thing as recovery: for at the time in which a perſon begins to recover from the ſmall-pox, the poiſon actually preſent in the circulating ſyſtem is multiplied infinitely beyond what it was when it excited the diſeaſe. The conſtitution has therefore at that time, with reſpect to this acrimony, acquired an inſenſibility, or rather want of irritability; and this it preſerves ever afterwards. This, however, holds only with regard to thoſe morbid poiſons which excite febrile affections, and ſeems to be a neceſſary proviſion of nature to guard againſt ſuch noxious principles as are generated within the body itſelf."

Having laſtly conſidered the effects of *irritation* upon the human body, the Doctor goes on to conſider a very remarkable property of living muſcles, viz. that of their being in a conſtant ſtate of tenſion, more or leſs, independent of any temporary ſtimulus. This is evident from what happens when any muſcle is cut; for then there is an immediate retraction of the ſeparated parts; and that this is their natural ſtate is farther proved by the ſpontaneous motion which takes place in conſequence of the relaxation of an antagoniſt muſcle, as when the mouth is drawn to one ſide in conſequence of hemiplegia. Some degree of tenſion indeed is neceſſary for the performance of the natural motions of the muſcles, whether voluntary or involuntary; and the vigour with which the ſeveral actions are performed depends on the due degree of this tone.

This tone of the muſcles is every where maintained by a certain counteracting mechanical power: the great muſcles are kept on the ſtretch by the bones, the heart and veſſels by the maſs of fluids, and the inteſtines by the aliments taken in, and their other contents. Diſeaſes of various kinds may ariſe from the different degrees of this tenſion, and the vaſcular ſyſtem is more apt to be affected by different degrees of tenſion than any other part of the body; and our author conſiders what is called a *nervous* habit as one of the effects of want of tenſion. He likewiſe attributes to the different degrees of tenſion, more than to any thing elſe, the great difference of conſtitutions obſervable among mankind. He obſerves alſo, that the tenſion of the muſcles is greatly affected by ſympathy. "This (ſays he) is particularly obſerved in the blood-veſſels and inteſtines; for a relaxation in theſe will produce a like affection in every other part of the animal ſyſtem. With regard to the inteſtines, it may be mentioned among other proofs, that it is common for perſons in a ſtate of great weakneſs to be affected by ſyncope, and even inſtantaneous death, in the act of evacuating the bowels. It ſeems to be from a like cauſe that a temporary lowneſs is produced by an abſceſs being opened.

The Doctor concludes his ſubject with conſidering the muſcles as mechanical powers. "As they conſtitute the ſtrength of animals, it may be proper to conſider the relation of their ſtrength to their bulk, and the relation of the bulk and ſtrength of the body to the denſity and coheſion of its own materials; and to the bulk, denſity, and coheſion of the external inanimate bodies with which it is converſant.

"It has been demonſtrated by Galileo, that in ſimilar unequal bodies, of a cylindrical or priſmatic ſhape, ſuch as the limbs of animals nearly are, the ratio of their efforts to break by their own weight is in the quadruplicate ratio of their lengths; but that the reſiſtance they make to the ſame force is only in the triplicate ratio of their lengths. It follows from this, that in order to endow the limbs of animals with the ſame relative force, it is not only neceſſary that the bones ſhould poſſeſs an increaſed proportion of thickneſs, in order to give an adequate increaſe of what may be called the dead ſtrength; but a ſimilar increaſe of living ſtrength is neceſſary, by a ſuitable addition of muſcular power, in order to keep pace with the increaſed ſize of the bones. Now we obſerve, in fact, that in the large-ſized animals, ſuch as the bull and the elephant, the thickneſs both of their bones and muſcles becomes greater in proportion to the length of their limbs than in the ſmaller animals, and they are therefore of a leſs elegant form. But nature has not carried this ſo far as to compenſate for the diſadvantage ariſing from the increaſe of ſize; for the greater animals have not the ſame proportional ſtrength, in relation to their bulk, that the ſmaller animals have. It has been computed that a flea can draw from 70

to

Muscle. to 80 times its own weight, whereas a horse cannot with ease draw more than three times his own weight. This disproportion between size and strength is very observable in different individuals of the human species; for tall men are not muscular, even in the simple proportion of their stature."

Our author now proceeds to assign some reasons why the stature of mankind in general is not larger than we see it. Some observations upon this subject are made under the article GIANT, where it is attempted to show, that by increasing the proportional strength of the materials, the size of the human body might have been augmented in any proportion. To this, however, the Doctor replies, that "had the bones been harder, they would not have been calculated for the common duration of life, the effect of which being to increase their hardness and dryness, they must be endowed originally with a certain degree of softness and succulence: and, with regard to muscles, a degree of hardness much greater than they possess would have been incompatible with their contractility." But this reasoning does not seem to be conclusive. The bones of a lion are said to be much harder than those of any other animal; yet we do not find that these creatures are liable to any kind of disease in consequence of this superior hardness. Neither is any inconvenient degree of hardness in the muscles a necessary consequence of their increased strength; for silk, though equally soft and flexible, nay much more so than hemp or flax, is nevertheless much stronger; and we cannot by any means doubt, that if men had formerly been of a larger stature than they are at present, the materials of their bones and muscles might have been proportionably stronger, without the least injury or impediment to any of the operations of life.

When we consider the manner in which the muscles act upon the bones into which they are inserted, we may be apt to think that nature has been very prodigal of mechanical power; for, considering the bones as levers, the muscles act upon them at a very great disadvantage, being always inserted much nearer the fulcrum than the weight to be raised. Thus the two muscles of the arm, named *biceps* and *brachiæus internus*, in order to support in the hand a weight of one pound with the fore-arm at right angles to the humerus, must exert a power equal to ten pounds. Another circumstance also which tends to waste the power, is the obliquity with which they are inserted into their bones; so that the greater part of the force is expended in pressing one bone against another at the articulation, and only a small part of it in making the flexures and extensions. These disadvantages, however, are compensated by a number of conveniences which could not have been obtained on any other plan. We must distinguish between those actions which consist in pressure and those which depend on percussion; for as the momentum of this last depends on velocity, it is evident that there must be a great advantage from the insertion of the tendon being near the centre of motion, as greater velocity with less expence of contraction will thus be communicated to the extremity. The muscles, for instance, which are attached to the *olecranon*, in performing those actions with the hand which require rubbing, act with a disadvantage exactly proportional to the inequality of the distance from their insertion to the joint of the elbow, and that from the same joint to the hand. This is an act of pressure. But in the case of percussion, as in the action of using a hammer, there is an evident advantage resulting from the velocity communicated to the extremity; for, in order to have produced the same velocity, with the insertion at a greater distance from the centre of motion, a much greater degree of contraction would have been necessary; and our author shows that fatigue principally depends on a contraction of the muscles. "If any one (says he) will take the trouble of comparing the fatigue of the biceps muscle, in bearing a weight in the hand with the elbow joint bent to a right angle, with that of bearing the same weight for the same length of time with the joint at an acute angle, he will be sensible how much the degree of fatigue depends on the extent of contraction; and, by attending to the relative situation of muscular fibres, it will appear, that Nature, in distributing the fibres of muscles obliquely, has had it in view not only to increase their number, but to save contraction."

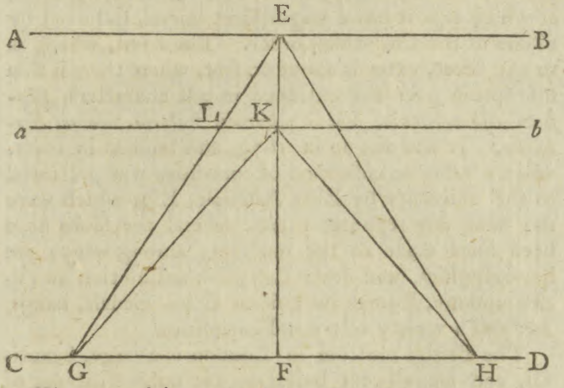
In considering the actions of the various muscles in producing the different actions of the body, we find scarce one produced that can be called direct. In some instances we find two muscles, or two sets of muscles, co-operating, so that the motion effected by them shall be in the diagonal of their direction. This is the case of the oblique muscles of the abdomen in some of their actions, and of the intercostal muscles in all theirs. Sometimes different portions of the same muscle combine in like manner to produce a similar effect; and in all the long muscles, however simple their origin and insertion may be, there is an internal obliquity of their fibres with regard to one another; for these do not run from end to end, but there are parts of the tendon running into the belly of the muscle, so as to divide it into penniform and rhomboidal portions. This distribution of the fibres takes off from the length; but as it takes place in those cases where the origin and insertion are at a considerable distance, this can be afforded: and this, as well as the waste of power, in consequence of oblique action, is more than compensated by the increased strength from the fibres being multiplied; for, in consequence of this structure, there is an extent of tendon afforded sufficient for the insertion of a greater number of fleshy fibres.

The Doctor illustrates this principle in the mechanism of muscular action from the example of fish; a species of animals which exert greater muscular powers than any others. "The muscles of most fish (says he) consist of regular series of oblique short fibres, forming those strata which every one must have observed in their muscular substance. Their motions are more simple and limited than those of land-animals, but much more vigorous; for a fish in the sea has to make its way through a medium about 1000 times more dense than air, and with more rapidity than those which inhabit the land. Nature, therefore, instead of giving them muscles whose fibres would run straight from one end of their body to the other, has multiplied their numbers, by distributing them into short and oblique portions. I have seen the sword of a sword-fish sticking in a plank, which it had penetrated from side to side; and when it is considered that

Muſcle.

that the animal was then moving through ſo denſe a medium, and in the ſame direction with the ſhip, we muſt form a high conception of its muſcular power."

Laſtly, our author gives a mathematical demonſtration, that by the obliquity of the muſcles a very conſiderable quantity of contraction is ſaved, and conſequently a proportional degree of fatigue prevented.—"Let the line AB (ſays he) in the annexed diagram, repreſent a moveable bone, and the line CD a fixed bone parallel to it. Let FE, perpendicular to theſe lines, repreſent a muſcle acting in its own direction, and the lines GE, HE, repreſent two muſcles acting obliquely, and producing by a diagonal action the ſame effect as the other. If the bone AB be brought to the ſituation *a b* by the action of the muſcle FE, the muſcle will then be in the ſituation FK. If the bone is brought into the ſame ſituation by the action of the muſcles GE, HE, theſe muſcles will then be in the ſituation GK, HK.



"The propoſition to be demonſtrated is, that the line GK bears a greater proportion to the line GE, than the line FK does to line FE; for FK is to FE as GL is to GE (Euc. Elem. B. vi Prop. 2.); and the angle ELK being leſs than a right angle, the angle GLK, which is adjacent to it, muſt be greater than a right angle; and the angle GKL being in the ſame triangle with GLK, muſt be leſs than a right angle. The line GK, therefore, which ſubtends the greater angle, is greater than the line GL, ſubtending the leſſer, and therefore bears a greater proportion to GE. But the line GL is to GE as FK is to FE; and therefore GK bears a greater proportion to GE than FK does to FE; that is, the fibres of the muſcles acting obliquely, ſuffer a leſs proportional decurtation than thoſe of the muſcle acting directly.

"It is farther obvious, that the more oblique the action becomes, the greater ſaving there will be of contraction; for in moving the line *a b* towards CD, the line FK diminiſhes in a ſwifter ratio than the line GK; and when the former has vaniſhed, the latter is in the ſituation GF."

Beſides theſe advantages in point of diminiſhing fatigue, there are others relating to the ſhape of the members. Thus, if the inſertions of the muſcles had been at a great diſtance from the joints, they muſt upon every occaſion have paſſed like bow-ſtrings from one bow to the other, and the limbs muſt have been exceedingly clumſy and unwieldy; all the motions muſt alſo have been extremely ſlow: and notwithſtanding the ſuperior ſtrength which people would then have enjoyed, it is very plain that they would ſcarce have been fit for any of the offices of life which they now perform.

Muſcle || Muſes.

MUSCLE, in zoology. See MYTULUS.

MUSCOVY. See RUSSIA.

Muscovy-Glaſs, or GLIMMER. See MICA.

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

Burney's Hiſt. of Muſic.

(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.

Muses.

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.

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 characterising 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 Abbe 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 they might be supposed to have over the productions of the mind. At first three muses only were admitted, Melete, 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 poetry, 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."

* *Travels of Anacharsis*, vol. iii p. 261.

Pythagoras, and afterwards Plato, make the muses the soul of the planets in our system; from whence the imaginary music of the spheres.

Museum || Mushroom.

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 building, 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 chymicha.* 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.

The British museum in London is a large, beautiful, and magnificent building, the noblest cabinet of curiosities in the world. See the article LONDON, n° 155.

MUSGRAVE (Dr William), a learned physician and antiquary, was born at Charlton-Musgrave in Somersetshire, about the year 1657; and studied at New-college, Oxford. Having distinguished himself by his knowledge in his profession, and his skill in natural philosophy, he was elected fellow of the Royal Society; and being made secretary in 1684, he continued the Philosophical Transactions from n° 167 to n° 178 inclusive. After having taken his degrees in physic, and being admitted a fellow of the college of physicians, he went and settled at Exeter, where he practised physic with great reputation and success. Being a man of extensive learning, he composed, at his leisure hours, several curious and valuable works; as, 1. *De arthritide anomala sive interna dissertatio.* 2. *De arthritide symptomatica dissertatio.* 3. *Julii Vitalis epitaphium, cum commentario.* 4. *De legionibus epistola.* 5 *De aquilis Romanis epistola.* 6 *Inscriptio Terraconensis, cum commentario.* 7. *Geta Britannicus*, &c.—8 *Belgium Britannicum.* This learned physician died in 1721.

MUSHROOM, in botany. See AGARICUS and LYNCURIUS

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;

1 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,

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 objects 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

ſible 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 imitatators. 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 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 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 eafy it is to repeat a found in the fame pitch with one juft heard. In tuning an inftrument, a good ear can as eafily determine that two ftrings are in unifon by founding them feparately, as by founding them together; their difagreement is alfo as eafily, I believe I may fay more eafily and better diftinguifhed when founded feparately; for when founded together, though you know by the beating that one is higher than the other, you cannot tell which it is. I have afcribed to memory the ability of comparing the pitch of a prefent tone with that of one paft. But if there fhould be, as poffibly there may be, fomething in the ear fimilar to what we find in the eye, that ability would not be entirely owing to memory. Poffibly the vibrations given to the auditory nerves by a particular found may actually continue for fome time after the caufe of thefe vibrations is paft, and the agreement or difagreement of a fubfequent found become by comparifon with them more difcernible. For the impreffion made on the vifual nerves by a luminous object will continue for 20 or 30 feconds."

After fome experiments to prove the permanency of vifible impreffions, he continues thus:

"Farther, when we confider by whom thefe ancient tunes were compofed, and how they were firft performed, we fhall fee that fuch harmonical fucceffions of founds was natural and even neceffary in their conftruction. They were compofed by the minftrels of thofe days, to be played on the harp accompanied by the voice. The harp was ftrung with wire, which gives a found of long continuance; and had no contrivance like that of the modern harpfichord, by which the found of the preceding note can be ftopt the moment a fucceeding note begins. To avoid actual difcord, it was therefore neceffary that the fucceeding emphatic note fhould be a cord with the preceding, as their founds muft exift at the fame time. Hence arofe that beauty in thofe tunes that has fo long pleafed, and will pleafe for ever, though men fcarce know why. That they were originally compofed for the harp, and of the moft fimple kind, I mean a harp without any half-notes but thofe in the natural fcale, and with no more than two octaves of ftrings, from C to C, I conjecture from another circumftance; which is, that not one of thefe tunes, really ancient, has a fingle artificial half-note in it; and that in tunes where it is moft convenient for the voice to ufe the middle notes of the harp, and place the key in F, there the B, which if ufed fhould be a B flat, is always omitted, by paffing over it with a third. The connoiffeurs in modern mufic will fay I have no tafte: but I cannot help adding, that I believe our anceftors, in having a good fong, diftinctly articulated, fung to one of thofe tunes, and accompanied by the harp, felt more real pleafure than is communicated by the generality of modern operas, exclufive of that arifing from the fcenery and dancing. Moft tunes of late compofition, not having this natural harmony united with their melody, have recourfe to the artificial harmony of a bafs, and other accompanying parts. This fupport, in my opinion, the old tunes do not need, and are rather confufed than aided by it. Whoever has heard *James Ofwald* play them on his violincello, will be lefs inclined to difpute this with me. I have more than once feen tears of pleafure in the eyes of his auditors: and yet I think, even *his* playing thofe tunes would pleafe more if he gave them lefs modern ornament."

As thefe obfervations are for the moft part true and always ingenious, we need no other apology for quoting them at length. It is only proper to remark, that the tranfition in Scots mufic by confonant intervals, does not feem, as Dr Franklin imagines, to arife from the nature of the inftruments upon which they played. It is more than probable, that the ancient Britifh harp was not ftrung with wire, but with the fame materials as the Welfh harps at prefent. Thefe ftrings have not the fame permanency of tone as metal; fo that the found of a preceding emphatic note muft have expired before the fubfequent accented note could be introduced. Befides, they who are acquainted with the manœuvre of the Irifh harp, know well that there is a method of difcontinuing founds no lefs eafy and effectual than upon the harpfichord. When the performer finds it proper to interrupt a note, he has no more to do but return his finger gently upon the ftring immediately ftruck, which effectually ftops its vibration.

That fpecies of Scots mufic which we have diftinguifhed by the name of *feftive* feems now limited to reels and country-dances. Thefe may be either in common or treble time. They moft frequently confift of two ftrains: each of thefe contains eight or twelve bars. They are truly rhythmical; but the mirth which they excite feems rather to be infpired by the vivacity of the movement, than either by the force or variety of the melody. They have a manœuvre and expreffion peculiar to themfelves, which it is impoffible to defcribe, and which can only be exhibited by good performers.

THUS far we have purfued the general idea of mufic. We fhall, after the hiftory, give a more particular detail of the fcience from Monfieur D'Alembert.

HISTORY OF MUSIC.

No accurate accounts of the ftate of mufic in the earlieft ages of the world.

MUSIC is capable of a variety fo infinite, fo greatly does the moft fimple differ from the moft complex, and fo multiplied are the degrees between thefe two extremes, that in no age could the incidents refpecting that fafcinating art have been few or uninterefting. But, that accounts of thefe incidents fhould have been handed down to us, fcanty and imperfect, is no matter of furprife, when we recollect that the hiftory of mufic is the hiftory only of founds, of which writing is a very inadequate medium; and that men would long employ themfelves in the pleafing exercife of cultivating mufic before they poffeffed either the ability or the inclination to record their exertions.

No accurate traces, therefore, of the actual ftate of mufic, in the earlier ages of the world, can be difcerned. Our ideas on the fubject have no foundation firmer than conjecture and analogy.

It is probable, that among all barbarous nations fome degree of fimilarity is difcernible in the ftyle of their

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.

3 Muſic not the invention of any one 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.

4 Egyptian muſic.

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

5 An Egyptian muſical inſtrument.

a muſical inſtrument of two ſtrings, and with a neck. It reſembles much the calaſcione ſtill uſed in the kingdom of Naples.

This curious relict 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 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 an improvement ſo wonderful in literature.

6 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 intitled 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!

7 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

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.

8
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.

9
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.* L. 3. c. 9.

10
coarſe and noiſy.

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 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.

11
Grecian muſic.

Cadmus, wish 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.

12
Progreſs of the Grecian lyre.

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

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.

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 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 (†). During the century which elapsed between the days of Sappho and those of Anacreon, no literary productions are preserved entire.—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.

13 Occupation of the first poets and musicians in Greece.

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.

14 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.

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 the 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.

15 Vociferous music of the Greeks.

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 L. 581, 5 s. 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*.

16 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

(†) 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 æra.

ſelves. Amœbæus, a harper, was paid an Attic talent, or L. 193, 15s. *per* day for his performance (‡).

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, as well as many other elevated female ſpirits, 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. Of their theories, mention is made in the Appendix to this article.

17 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.

18 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 fruit 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.

19 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 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.

20 Introduced into the Engliſh church.

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 Copromymus VI. In Italy, Germany, and England, that inſtrument became frequent during the 10th century.

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.

21 The great improvements in muſic had their origin in Italy.

21 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

(‡) Roſcius gained 500 ſeſtertia, or L. 4036:9:2 d. Sterling *per* annum.

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 ſecular muſic began to be cultivated.

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

22 The invention of the time-table.

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.

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

23 Troubadours.

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 cloaths, 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.

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. 24 The harp the favourite inſtrument of the Troubadours.

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 25 The viol or violin.

to four strings: and still under the denomination of *violin* holds the first place among 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 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.

26 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 authorise the religious veneration paid to her by the votaries of music; nor is it easy to discover whence it has arisen. As an incident relative to the period of which we speak, it may be mentioned, that, according to Spelmann, 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.

27 Origin of the degree of Mus. D.

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

28 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 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 antiquary † of the present age, 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 Bannatyne's Collection, and of which several have been published by Allan Ramsay in his *Evergeen*.

† See *Tytler's Dissertation on the Scotch Music*, vol. i. of the Transactions of the Society of Antiquaries in Scotland.

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, and to have pursued the same course. Like 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.

29 In the 16th century music an indispensable part of education.

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 of study all over Europe.

The most eminent musical theorists of Italy, who flourished in the 16th century, were, Franchinus Gaferius, or Gafforio of Lode, Pietro Aaron of Florence, 30 Eminent musicians in Italy during the 16th century.

rence, Lodovico Fogliano, Giov. Spataro, Giov. Maria da Terentio Lanfranco, Steffano Uanneo, Anton. Francifco Done, Luigi Dentice, Nicolo Vicentino, and Giofeffo Zarlino, the moft general, voluminous, and celebrated theorift of that period.

Vincentio Galilei, a Florentine nobleman, and father of the great Galileo Galilei.

Maria Artufe of Bologna, Orafeo Tegrini, Pietro Pontio, and Lodovico Zacconi.

The principal Roman authors were, Giovanni Ammuccia, Giovanni Pierluigi da Paleftrina, juftly celebrated; Ruggiero Giovanelli, Luca Marenzio, who brought to perfection madrigals, the moft cheerful fpecies of fecular mufic.

Of the Venetians, Adrian Willaeri is allowed to be at the head.

At the head of the Neapolitans is defervedly placed Rocco Rodio.

At Naples, too, the illuftrious dilettante, Don Carlo Gefualdo prince of Venofa, is highly celebrated. He feems, however, to have owed much of his fame to his high rank.

Lombardy would alfo furnifh an ample lift of eminent muficians during the 16th century, of whom our limits will not admit of a particular enumeration:—The chief of them were, Conftanzo Porta, Gaftoldi, Biffi, Cima, Vocchi, and Monteverde.

At Bologna, befides Artufi already mentioned, Andrea Rota of the fame city appears to have been an admirable contrapunctift.

Francifco Corteccia, a celebrated organift and compofer, and Aleffandro Strigglio, a lutaneft and voluminous compofer, were the moft eminent Florentines.

31 In Germany.

The inhabitans of the extenfive empire of Germany have long made mufic a part of general education.—They hold the place, next Italy, among the moft fuccefsful cultivators of the art. During the 16th century, their moft eminent compofers of mufic and writers on the fubject were, Geo. Reifchius, Michael Rofwick, Andreas Ornithorparchus, Paul Hofhaimer, Lufpeinius, Henry Loris or Lorit, Faber, Fink, Hofman, and many others whom it would be tedious to mention; and for a particular account of whofe treatifes and compofitions we muft refer to more voluminous hiftories of mufic.

32 In France.

In France, during the 16th century, no art except the art of war made much progrefs in improvement.—Ronfard, Baif, Goudimel, Claud le Jeune, Caurroy, and Maudit, are the chief French muficians of that period.

33 Spain.

In Spain, mufic was early received into the circle of fciences in the univerfities. The mufical profefforfhip at Salamanca was founded and endowed by Alforzo the Wife, king of Caftile.

One of the moft celebrated of the Spanifh muficians was Francis Salinas, who had been blind from his infancy. He was a native of Burgos.

D. Criftofero Morales, and Tomafo Lodovico da Vittorio, deferve likewife to be mentioned; and to mention them is all we can attempt; the purpofe of which is, to excite more minute inquiry by thofe who may choofe to inveftigate the fubject particularly.

34 The Netherlands.

The Netherlands, likewife, during the period of which we have been fpeaking, produced many eminent compofers; 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, Bafton, Kerl, Rore, Orlando di Laffo, and his fons Ferdinand and Rodolph.

35 Mufical compofers in England during the 17th century.

In the 17th century, the mufical writers and compofers who acquired fame in England, were, Dr Nathanael Giles, Thomas Tomkins, and his fon of the fame name, Elway Bevin, Orlando Gibbons, Dr William Child, Adrian Batten, Martin Pierfon, William Lawes, Henry Lawes, Dr John Wilfon, John Hilton, John Playford, Captain Henry Cook, Pelham Humphrey, John Blow, William Turner, Dr Chriftopher Gibbons, Benjamin Rogers, and Henry Purcell. Of thefe, Orlando Gibbons, Pelham Humphrey, and Henry Purcell, far excelled the reft.

About the end of the reign of James I. a mufic-lecture or profefforfhip was founded in the univerfity of Oxford by Dr William Hychin.

In the reign of Charles I. a charter was granted to the muficians of Weftminfter, incorporating them, as the king's muficians, into a body politic, with powers to profecute and fine all who, except themfelves, fhould "attempt to make any benefit or advantage of mufic in England or Wales:" powers which in the fubfequent reign were put in execution.

About the end of the reign of Charles II. a paffion feems to have been excited in England for the violin, and for pieces exprefsly compofed for it, in the Italian manner (*). Prior to 1600, there was little other mufic except maffes and madrigals, the two principal divifions of facred and fecular mufic; but from that time to the prefent, dramatic mufic becomes the chief object of attention. The mufic of the church and of the chamber continued indeed to be cultivated in Italy with diligence, and in a learned and elaborate ftyle, till near the middle of the century; yet a revolution in favour of melody and expreffion was preparing, even in facred mufic, by the fuccefs of dramatic compofition, confifting of recitation and melodies for a fingle voice. Such melodies began now to be preferred to mufic of many parts; in which canons, fugues, and full harmony, had been the productions which chiefly employed the mafter's ftudy and the hearer's attention.

36 Mean ftate of the opera in the beginning of the prefent century.

So late as the beginning of the prefent century, according to Riccoboni, the performers in the operas of Germany, particularly at Hamburg, "were all tradefmen or handicrafts; your fhoemaker (fays he) was often the firft performer on the ftage; and you might have bought fruit and fweetmeats of the fame girls,

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(*) The moft celebrated violin players of Italy, from the 16th century to the prefent time, have been Farina, M. Angelo Roffi, Baffani the violin-mafter of Corelli, the admirable Angelico Corelli himfelf, Torelli, Alberti, Albenoni, Teffarini, Vivaldi, Geminiani one of the moft diftinguifhed of Corelli's fcholars, Tartini, Veracini, Barbella, Locatelli, Ferrari, Martini, Boccherini, and Giardini.

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.

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.

37 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 was equally fond of both sexes, fought and loved like a man, resisted and fell like a woman. She eloped from her husband with a fencing-master, of whom she learnt the small sword; she became an excellent fencer. At Marseilles she became enamoured of a young lady, whom she seduced: on account of this whimsical affection the lady was by her friends confined in a convent. La Maupin obtained admission into the same convent as a novice: she set fire to the convent, 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 mens 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 mens clothes; and having behaved impertinently to a lady, three of the lady's friends, supposing the 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 L. 40,000 livres: she threw it at the count's head, telling him, it was a recompence worthy of such a scoundrel and cuckold as himself. 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.

38 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 Green, 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.

39 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 by the names of *opera* and *oratorio*, had existence in Italy before the beginning of the 17th century. It was above the 1600, or a little before that time, that eunuchs were first employed for singing in Italy.

40 First singing eunuchs.

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.

41 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 chace: 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 chace, wild boar, stag, deer, bears. At the end of the third act, an enormous globe, descended 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

Europe has been furnished with composers and performers from that city.

42 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 wholely 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 Arsinoe 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 Arsinoe, 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 deficiences 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 Baroness*, arrived. Margarita de l'Epini, who afterwards married Dr Pepusch, had been in this country some time before.

† See also *Spectator*, vol. i. n° 13.

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.

43 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 of an engagement at the Opera, where her salary is said to have been L. 1000, 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 a few years ago at the age of 88, entitled her to be mentioned even in a compend too short for biography. The conducting of the opera having been found to be more expensive than profitable, it was entirely suspended from 1717 till 1720, when a fund of L. 50,000 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 L. 1000, 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.

44 Progress of the opera under his management.

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 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 L. 50,000 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 Signor Bernacchi, Signora Merighi, Signora Strada, Signor Anibale Pio Fabri, his wife, Signora Bertoldi, and John Godfrid Reimschneider.

45 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 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 party, who at this time arrived. This renowned singer seems to have transcended the limits 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 L. 800.

46 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.

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. Caluppi 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. 47 Revived.

The arrival of Giardini in London this year forms a memorable æra in the 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 Caluppi, 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,

pieces, and ladies in full dreſs, without ſervants or carriages, were obliged to walk home, amidſt the merriment of the ſpectators on the ſtreets.

48 1764 and 1765, Manzoli. At this period the arrival of Giovanni Manzoli marked a ſplendid æra 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.

49 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.

50 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.

51 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.

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 the 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. She now reſides at Bologna. 52 Caterina Gabrielli.

About the time of which we have been treating, the proprietors of the Pantheon ventured to engage the *Agujari* at the enormous ſalary of L. 100 *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 baſs 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. 53 Agujari at the Pantheon.

In 1776 arrived Anna Pozzi, as ſucceſſor to the 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. Since that time, however, Pozzi, with more ſtudy and knowledge, has become one of the beſt and moſt admired female ſingers in Italy. 54 Anna Pozzi.

After the departure of Agujari for the ſecond and laſt time, the managers of the Pantheon engaged the *Georgi* as her ſucceſſor. Her voice was exquiſitely fine, but 55 Georgi.

but totally uncultivated. She is now employed as the first woman in the operas of the principal cities of Italy.

56 Roncaglia and Danze.

During the seasons 1777 and 1778, the principal singers at the opera in London were Frandesco Roncaglia and Francesca 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, leaves 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.

57 Pacchierotti.

This year *Gasparo Pacchierotti* appeared in London, whither his high reputation had penetrated long before. The natural tone of his voice is interesting, sweet, and pathetic. His compass downwards is great, with an ascent up to B b, and sometimes to C *in alt*. He possesses 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.

58 Dancing gains the afcendant over music at the opera-house.

During the last ten years, dancing has become 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 to 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 dance*, should be disturbed by audible approbation. Since that time, the most mute and respectful attention has been 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 have been disturbed, not by the violence of applause, but the clamour of inattention.

59 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.

Dr Burney published An Account of the Musical Performances in Commemoration of Handel, for the 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 then in Europe.

60 Excellence of Madam Mara.

As a compensation for these losses, this memorable year is distinguished by the arrival of Madam 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 ecstasy and rapture.

61 Rubinelli.

In 1786 arrived *Giovanni Rubinelli*. His voice is a true and full contralto from C in the middle of the scale to the octave above. His style is grand; his execution neat and distinct; his taste and embellishments new, select, and masterly.

62 A new dance by M. Noverre.

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.

63 Marchesi.

This year arrived Signor 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 is 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 are wonderful. Many of his graces are elegant and of his own invention.

64 Discriminated characters of Pacchierotti, Rubinelli, and Marchesi.

The three greatest Italian singers of the present times are 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 present century many eminent composers have 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 particularised, would our limits permit.

65 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.

Besides the opera-singers whom we have mentioned, our

66 Singers on theatres and in public gardens. 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, afterward the wife of Dr Arne. Her style of singing was infinitely superior to that of any other English woman of her time.

67 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.

68 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.

69 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.

70 Style of Arne. Of near 150 musical pieces brought on our national theatres within these 40 years, 30 of them at least were set by Arne. The style of this composer, if analysed, would perhaps appear to be neither Italian nor English; but an agreeable mixture of both and of Scotch.

71 The earl of Kelly. The late earl of Kelly, who died but a few 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.

72 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 an adagio soon became the model of imitation for all our young performers on bowed instruments. Bartholemon, Cervetto, Cramer, and Crosdil, may in this respect 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 last century was a necessary appendage of a nobleman's or gentleman's family throughout Europe, previous to the admission of violins, tenors, and bases, 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 lutanists. 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, after distinguishing herself in childhood as a neat and expressive performer on the piano-forte, appeared all at once in 1786 as a sweet and captivating singer. In emulation of the Mara and other great bravura singers, she at first too frequently attempted passages of difficulty; now, however, so greatly has she improved, that no song seems too high or too rapid for her execution. 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: and to describe the distinctive powers of Bartholemon, Cramer, Pieltain, Raimonde, and Salamon, would be too delicate a task for us to undertake. 73 Mrs Billington.

The Catch-club at the Thatched House, instituted in 1762 by the late earl of Eglinton, the present 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. [73] The catch-club and the concert of ancient music.

We have been somewhat particular in our account of musical affairs in our own country during the present 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 is not to be expected to content himself with disquisitions much more minute than those of which our limits can be supposed to admit.

ELEMENTS OF MUSIC.

Theoretical and Practical (†).

PRELIMINARY DISCOURSE.

74 Music considered in a double view.

MUSIC may be confidered, either as an art, which has for its object one of the greateft pleafures of which our fenfes (‡) are fufceptible; or as a fcience, by which that art is reduced to principles. This is the double view in which we mean to treat of mufic in this work.

75 Progrefs of mufic like that of other arts and fciences.

It has been the cafe with mufic as with all the other arts invented by men: fome facts were at firft difcovered by accident; foon afterwards reflection and obfervation inveftigated others; and from thefe facts, properly difpofed and united, philofophers were not flow in forming a body of fcience, which afterwards increafed by degrees.

The firft theories of mufic were perhaps as ancient as the earlieft age which we know to have been diftinguifhed by philofophy, even as the age of Pythagoras; nor does hiftory leave us any room to doubt, that from the period when that philofopher taught, the ancients cultivated mufic, both as an art and as a fcience, with great affiduity. But there remains to us much uncertainty concerning the degree of perfection to which they brought it. Almoft every queftion which has been propofed with refpect to the mufic of the ancients has divided the learned; and may probably ftill continue to divide them, for want of monuments fufficient in their number, and inconteftable in their nature, from whence we might be enabled to exhibit teftimonies and difcoveries inftead of fuppofitions and conjectures. In the preceding hiftory we have ftated a few facts refpecting the nature of ancient mufic, and the inventors of the feveral mufical inftruments; but it were to be wifhed, that, in order to elucidate, as much as poffible, a point fo momentous in the hiftory of the fciences, fome perfon of learning, equally fkilled in the Greek language and in mufic, fhould exert himfelf to unite and difcufs in the fame work the moft probable opinions eftablifhed or propofed by the learned upon a fubject fo difficult and curious. This philofophical hiftory of ancient mufic is a work which might highly embellifh the literature of our times.

76 The hiftory of mufic a defideratum in literature.

In the mean time, till an author can be found fufficiently inftructed in the arts and in hiftory to undertake fuch a labour with fuccefs, we fhall content ourfelves with confidering the prefent ftate of mufic, and limit our endeavours to the explication of thofe acceffions which have accrued to the theory of mufic in thefe latter times.

There are two departments in mufic, melody * and harmony †. Melody is the art of arranging feveral founds in fucceffion one to another in a manner agreeable to the ear; harmony is the art of pleafing that organ by the union of feveral founds which are heard at one and the fame time. Melody has been known and felt through all ages: perhaps the fame cannot be affirmed of harmony (§); we know not whether the ancients made any ufe of it or not, nor at what period it began to be practifed.

* See Melody † See Harmony.

Not but that the ancients certainly employed in their mufic

(†) To deliver the elementary principles of mufic, theoretical and practical, in a manner which may prove at once entertaining and inftructive, without protracting this article much beyond the limits prefcribed in our plan, appears to us no eafy tafk. We therefore hefitated for fome time, whether to try our own ftrength, or to follow fome eminent author on the fame fubject. Of thefe the laft feemed preferable. Amongft thefe authors, none appeared to us to have written any thing fo fit for our purpofe as M. D'Alembert, whofe treatife on mufic is the moft methodical, perfpicuous, concife, and elegant differtation on that fubject with which we are acquainted. As it was unknown to moft Englifh readers before the former edition of this work, it ought to have all the merit of an original. We have given a faithful tranflation of it; but in the notes, feveral remarks are added, and many authors quoted, which will not be found in the original. It is a work fo fyftematically compofed, that all attempts to abridge it, without rendering it obfcure and imperfect, would be impracticable. It is perhaps impoffible to render the fyftem of mufic intelligible in a work of lefs compafs than that with which our readers are now prefented; and, in our judgment, a performance of this kind, which is written in fuch a manner as not to be generally underftood, were much better fuppreffed.

(‡) In this paffage, and in the definitions of melody and harmony, our author feems to have adopted the vulgar error, that the pleafures of mufic terminates in corporeal fenfe. He would have pronounced it abfurd to affert the fame thing of painting. Yet if the former be no more than a mere pleafure of corporeal fenfe, the latter muft likewife be ranked in the fame predicament We acknowledge that corporeal fenfe is the vehicle of found; but it is plain from our immediate feelings, that the refults of found arranged according to the principles of melody, or combined and difpofed according to the laws of harmony, are the objects of a reflex or internal fenfe.

For a more fatisfactory difcuffion of this matter, the reader may confult that elegant and judicious treatife on Mufical Expreffion by Mr Avifon. In the mean time it may be neceffary to add, that, in order to fhun the appearance of affectation, we fhall ufe the ordinary terms by which mufical fenfations, or the mediums by which they are conveyed, are generally denominated.

(§) Though no certainty can be obtained what the ancients underftood of harmony, nor in what manner and in what period they practifed it; yet it is not without probability, that, both in fpeculation and practice, they

Prelim. Discourse.

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 practice 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.

77 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 evolutions of its powers, and the progress of its attainments.

78 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.

79 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.

80 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 treatise I now present to the public. I had formerly composed it for the use of some friends. As the work appeared to them clear and methodical, they have engaged me to publish it, persuaded (though perhaps with too much credulity) that it might be useful to facilitate the progress of initiates in the study of harmony.

This was the only motive which could have determined me to publish a book of which I might without hesitation assume the honour, if its materials had been the fruits of my own invention, but in which I can now boast no other merit than that of having developed, elucidated, and perhaps in some respects improved, the ideas of another (c).

81 Improvements of this edition.

The first edition of this essay, published 1752, having been favourably received by the world, and copies no longer to be found in the hands of booksellers, I have endeavoured to render this more perfect.

82 Account of the work in general.

The detail which I mean to give 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 a-wanting, and might be advantageous to the theory of this amiable 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.

83 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

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they were in possession of what we denominate *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, 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.

(c) See M. Rameau's letter upon this subject, *Merc. de Mai* 1752.

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tutes 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 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 *System*. † See *Chord*. ‡ See *Tetrachord*. ‖ See *Diatonic*. § See *Value*. * See *Bass*. ¶ See *Alteration*. † See *Mode*. ‡ See *Intonation*. ‖ See *Tone*. § See *Discord*. * See *Chromatic*. † See *Enharmonic*. ‡ See *Temperament*.

One end which we have proposed in this treatise, was not only to place the discoveries of M. Rameau in their most conspicuous and advantageous light, but even in particular respects to render them more simple. —For instance, besides the fundamental experiment which we have mentioned above, that celebrated musician, to render the explication of some particular phenomena in music more accessible, had recourse to another experiment; I mean 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 give a satisfactory account of some other rules established in harmony; and with respect to this in our first edition we have implicitly followed him: in this 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 the questions which were foreign to it.

It is the same case with some other points (as the origin of the chord of the sub-dominant §, and the explication of the seventh in some peculiar respects), upon which it is imagined that we have simplified, and perhaps in some measure extended, the principles of the celebrated artist.

§ See *Subdominant*.

We have likewise banished from this edition, as from the former, every consideration of geometrical, arithmetical, and harmonical proportions and progressions, which authors have endeavoured to find 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.

84 Theoretical musicians cautioned with regard to the admission of mathematical or metaphysical principles in 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 those who shall read this treatise, that they may be careful not to deceive themselves, either by misapprehending the nature of our object, or the end which our endeavours pursue.

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 absurd to expect what is called *demonstration*: it is an atchievement of no small importance, to have reduced the principal facts to a system consistent with itself, and firmly connected in its parts; 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 in another view, if here it be improper to require that intimate and unalterable conviction which can only be produced by the strongest evidence, we remain in the mean time doubtful whether it is possible to elucidate this subject more strongly.

After this declaration, one should not be astonished, that, amongst the facts which are deduced from our fundamental experiment, there should be some which appear immediately to depend upon that experiment, and others which are deduced 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, except such as arise from analogy or congruity, it is natural that the analogy should be sometimes more sometimes less sensible: and we will venture to assert, that such a mind must be very improper for philosophy, 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 conductress 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 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*.

Thus, though the greatest number of the phenomena in the art of music appear to be deducible in a simple and easy manner from the protracted tone of sonorous bodies, one ought not perhaps with too much temerity to affirm as yet, that this mixed and protracted tone is *demonstratively* the only original principle of

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Rameau's primary experiment has not as yet accounted for all the phenomena of music. Perhaps some other may be necessary.

of harmony (D). 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 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; to have made its practice more simple and easy; and to have taught musicians to employ in this subject the light of reason and analogy.

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 (†). If at once two different sounds are produced from two instruments of the same kind, these two sounds

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Tartini's experiment.

(D) The *demonstration* of the principles of harmony by M. Rameau was not thus intitled in the exposition which he presented in the year 1749 to the Academy of Sciences, and which that Society besides approved with all the eulogiums which the author deserved; the title, as inserted in the register of the academy, was, "A memorial, in which are explained the foundations of a system of music theoretical and practical." It is likewise under this title that it was announced and approved of by the Commissioners, who in their printed report, which the public may read along with M. Rameau's memorial, have never dignified his theory with any other name than that of a *system*, the only name in reality which is expressive of its nature. M. Rameau, who, after the approbation of the Academy, has thought himself at liberty to adorn his system with the name of a *demonstration*, did not certainly recollect what the Academy has frequently declared; that, in approving any work, it was by no means implied, that the principles of that work appeared to them demonstrated. In short, M. Rameau himself, in some writings posterior to what he calls his *demonstration*, acknowledges, that upon particular points in the theory of the musical art, he is under a necessity of having recourse to analogy and aptitude; this excludes every idea of demonstration, and restores the theory of the musical art exhibited by M. Rameau to the class in which it can only be ranked with propriety, I mean the class of probabilities.

(†) 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, nor 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 connection 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, Malcom'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 Sig. 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,

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sounds generate* a third different from both the others. They have inserted in the *Encyclopédie*, under the article *Fundamental*, a detail of this experiment according to M. Tartini; and we owe to the public an information of which in composing this article we were ignorant: M. Rameau, a member of the Royal Society at Montpellier, 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.

* See *Generate*.

87 Its discovery originally due to Rameau.

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 he has not discovered with sufficient perspicuity, and from whence the art might perhaps derive considerable advantage if they were placed in a proper light. Of this I am 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.

In exhorting philosophers and artists to make new attempts for the advancement of the theory of music, we ought at the same time to let them know the danger of mistaking what is 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 an exact theory of music, where nothing is wanting, nothing obscure, but every thing discovered in its full extent, and in its proper light. The philosopher who is properly enlightened, will not give himself the trouble to explain such facts as are less essential to his art, because he can discern those on which he ought to expatiate for its proper illustration. If one would estimate them according to their proper value, he will only find it necessary to cast his eyes upon 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. These sages, after 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, from thence 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? Some pretend that there are particles in the air, which, by their different degrees of magnitude and texture, being naturally susceptible of different oscillations, produce the multiplicity of sound in question. But what do we know of all this hypothetical doctrine? 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?

88 Mechanical conclusions inadequate to the situation of musical phenomena.

† See *Inappretiable*.

89 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

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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.

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us more than others. The futility of these suppositious 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 one should grant it, would it not follow from thence, 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, I mean the octave, cannot suffer the most inconsiderable change? Let us in sincerity confess our ignorance concerning the genuine causes of these effects (†). The metaphysical conjectures concerning the accoustic 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 deviate from truth and taste, when they engage in subjects of which they are ignorant.

The rules which we have attempted to establish concerning the track which every one ought to pursue 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 nothing to do here (for it is proper that we repeat it), we have nothing to do with the mechanical principles of protracted and harmonic tones produced by sonorous bodies; principles which till now have been explored in vain, and which perhaps may be long explored with the same success; we have still less

(†) 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 freqnency 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 recognising 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 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.

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less to do with the metaphysical causes of those pleasing sensations which are 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 chief and most essential laws of harmony may be deduced from one single experiment; and 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, I 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.

90 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 and powers of the syllables, *ut*, *re*, *mi*, *fa*, *sol*, *la*, *si*, or C, D, E, F, G, A, B, which all the world knows (†).

The theory of harmony requires some arithmetical calculations, which are necessary for comparing sounds one with another. These calculations are very short, extremely simple, and conducted in such a manner as to be sensibly comprehended by every one; they demand no operation but what is clearly explained, and which every school-boy with the slightest attention may perform. Yet, that even the trouble of this may be spared to such as are not disposed to take it, I have not inserted these calculations in the body of the treatise, but transferred them to the notes, which the reader may omit, if he can satisfy himself by taking for granted the propositions contained in the work, which will be found proved in the notes.

These calculations I have not endeavoured to multiply; I could even have wished to suppress them, if it had been possible: so much did it appear to me to be apprehended that my readers might be misled upon this subject, and might either believe themselves, or at least suspect me of 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, to speak more properly, of so little importance, that nothing can require a less minute or ostentatious display. Do not let us 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 credulity and ignorance, and serve no other purpose but to render their treatises more obscure and less instructive. In the character of a geometer, I think I have some right to protest here (if I may be permitted to express myself in this manner) against such ridiculous abuse of geometry in music.

91 Mathematical conclusions not transferable to sensible objects without caution.

This I may do 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 not only be useless, but even contrary to sound philosophy, should any one incline to invent other relations, 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

* See *Composition*.

(†) The names of the seven notes used by the French are here retained, and will indeed be continued through the whole ensuing work; as we imagine, that, if properly associated with the sounds which they denominate, they will tend to impress these sounds more distinctly on the memory of the scholar than the letters C, D, E, F, G, A, B, from which characters, except in sol-fa'ing, the notes in the diatonic series are generally named in Britain. Amongst us, in the progress of intonation, the syllables *ut*, *re*, and *si*, have been omitted, by which means the teachers of church-music have rendered it still more difficult to express by the four remaining denominations the various changes of the semitones in the octave. As these artificially change their places, the seven syllables above mentioned also diversify their powers, and are variously arranged according to the intervals in which the notes they are intended to signify may be placed.

For an account of these variations, see Rousseau's Musical Dictionary, article GAMME. See also the Essay towards a Rational System of Music, by John Holden, part i. chap. 1.

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the *first* where the reasons for establishing that rule are given.

92 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, I 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, strictly speaking, 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 rules and manner of intonation, but merely the position of the notes in the cleff *fa* or F on the fourth line, and that of *sol* or G upon the second: and even this knowledge may be acquired from the work itself; for in the beginning of the second part I explain the positions of the cleffs and of the notes. Nothing else is necessary but to render it a little familiar to our memory, and we shall have no more difficulty in it.

93 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 I may be allowed the expression, 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 Mr Rameau's treatise of harmony, or in the code of music which he published more lately (I), or lastly in the explication of the theory and practice of music by M. Bethizi (K): this last book appears to me clear and methodical.

One may look upon it (with respect to a practical detail) as a supplement to my own performance. I do this justice to the author with so much more cheerfulness, as he is entirely unknown to me, and as his animadversions upon my work appear to me less severe than it deserved (L).

94 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.

Such was the aim I pursued in its composition, and such should be the ideas of the reader in its perusal. Once more let me add, that to the discovery of its fundamental principles I have not the remotest claim. The sole end which I proposed was to be useful; to reach that end, I have omitted nothing which appeared necessary, and I should be sorry to find my endeavours unsuccessful. Definitions.

DEFINITIONS OF SEVERAL TECHNICAL TERMS.

I. *What is meant by Melody, by Chord, by Harmony, by Interval.*

1. Melody is nothing else but a series of sounds which succeed one to another in a manner agreeable to the ear. 95 Melody, what.

2. That is called a *chord* which arises from the mixture of several sounds heard at the same time; and harmony is properly a series of chords which in their succession one to another delights the ear. A single chord is likewise sometimes called *harmony*, to signify the coalescence of sounds which that chord creates, 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. 96 Chord and harmony, what.

3. In melody and harmony, the distance between one sound and another is called an *interval*; and this is increased or diminished as the sounds between which it intervenes are higher or lower one than the other. See *Interval.*

4. That we may learn to distinguish the intervals, and the manner of perceiving them, let us take the ordinary scale *ut, re, mi, fa, sol, la, si, UT,* / C, D, E, F, G, A, B, C, which every person whose ear or voice is not extremely false naturally modulates. These are the observations which will occur to us in singing this gammut.

The sound *re* is higher or sharper than the sound *ut*, the sound *mi* higher than the sound *re*, the sound *fa* higher than the sound *mi*, &c. and so through the whole octave; so that the interval or the distance from the sound *ut* to the sound *re*, is less than the interval or distance between the sound *ut* and the sound *mi*, the interval from *ut* to *mi* is less than that between *ut* and *fa*, &c. and in short that the interval from the first to the second *ut* is the greatest of all.—To distinguish the first from the second *ut*, I have marked the last with capital letters. 97 Account of the simple intervals.

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; 98 The distinction between strong and faint, or acute and grave.

(I) From my general recommendation of this code, I except the reflections on the principles of sound which are at the end, and which I should not advise any one to read.

(K) Printed at Paris by Lambert in the year 1754.

(L) That criticism and my answers may be seen in the *Journeaux Economiques* of 1752.

Definitions.

lation ; let any one form a ſound by gradually impelling or ſwelling the voice, the ſound may be perceived to increaſe in its energy, whilſt it continues always equally low or equally high.

99 Between tonic and ſemitonic intervals.

6. We muſt likewiſe obſerve concerning the ſcale, that the intervals between *ut* and *re*, between *re* and *mi*, between *fa* and *ſol*, between *ſol* and *la*, between *la* and *ſi*, are equal, or at leaſt nearly equal ; and that the intervals between *mi* and *fa*, and between *ſi* and *ut*, 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 (A).

7. It is for this reaſon that they have called the interval from *mi* to *fa*, and from *ſi* to *ut*, a ſemitone ; whereas thoſe between *ut* and *re*, *re* and *mi*, *fa* and *ſol*, *ſol* and *la*, *la* and *ſi*, are tones.

The *tone* is likewiſe called a *ſecond major* *, and the *ſemitone* a *ſecond minor* †.

* See the figure marked A.
† See *Interval*.

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 *re* to *ut*, or from *ut* to *re*, from *fa* to *mi*, or from *mi* to *fa*.

II. *The Terms by which the different Intervals of the Gammut are denominated.*

Definitions.

9. An interval compoſed of a tone and a ſemitone, as from *mi* to *ſol*, from *la* to *ut*, or from *re* to *fa*, is called a *third minor*. 100 Third minor, what.

An interval compoſed of two full tones, as from *ut* to *mi*, from *fa* to *la*, or from *ſol* to *ſi*, is called a *third major*. 101 Third major, what.

An interval compoſed of two tones and a ſemitone, as from *ut* to *fa*, or from *ſol* to *ut*, is called a *fourth*. 102 Fourth, what.

An interval conſiſting of three full tones, as from *fa* to *ſi*, is called a *triton* or *fourth redundant*. 103 Triton, what.

An interval conſiſting of three tones and a ſemitone, as from *ut* to *ſol*, from *fa* to *ut*, from *re* to *la*, or from *mi* to *ſi*, &c. is called a *fifth*. 104 Fifth, what.

An interval compoſed of three tones and two ſemitones, as from *mi* to *ut*, is called a *ſixth minor*. 105 Sixth minor, what.

An interval compoſed of four tones and a ſemitone, as from *ut* to *la*, is called a *ſixth major*. 106 Sixth major, what.

An interval conſiſting of four tones and two ſemitones, as from *re* to *ut*, is called a *ſeventh minor*. 107 Seventh minor, what.

An interval compoſed of five tones and a ſemitone, as from *ut* to *ſi*, is called a *ſeventh major*. 108 Seventh major, what.

And

(A) This experiment may be eaſily tried. Let any one ſing the ſcale of *ut, re, mi, fa, ſol, la, ſi, UT,*
C, D, E, F, G, A, B, C, it will be immediately obſerved without difficulty, that the laſt four notes of the octave *ſol, la, ſi, UT,*
G, A, B, C, are quite ſimilar to the firſt *ut, re, mi, fa ;* inſomuch, that if, after having ſung this ſcale, one would chooſe to repeat it, beginning with *ut* in the ſame tone which was occupied by *ſol* in the former ſcale, the note *re* of the laſt ſcale would have the ſame ſound with the note *la* in the firſt, the *mi* with the *ſi*, and the *fa* with the *ut*.

From whence it follows, that the interval between *ut* and *re*, is the ſame as between *ſol* and *la ;* between *re* and *mi*, as between *la* and *ſi ;* and *mi* and *fa*, as between *ſi* and *ut*.

It will likewiſe be found, that from *re* to *mi*, from *fa* to *ſol*, there is the ſame interval as from *ut* to *re*. To be convinced of this, we need only ſing the ſcale once more ; then ſing it again, beginning with *ut*, in this laſt ſcale, in the ſame tone which was given to *re* in the firſt ; and it will be perceived, that the *re* in the ſecond ſcale will have the ſame ſound, at leaſt as far as the ear can diſcover, with the *mi* in the former ſcale ; from whence it follows, that the difference between *re* and *mi* is, at leaſt as far as the ear can perceive, equal to that between *ut* and *re*. It will alſo be found, that the interval between *fa* and *ſol* is, ſo far as our ſenſe can determine, the ſame with that between *ut* and *re*.

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 *ſol, la, ſi, ut*, and in performing with the voice at the ſame time *ut, re, mi, fa*, in ſuch a manner that the ſame ſound may be given to *ut* in the voice with that of the key *ſol* in the harpſichord, it will be found that *re* in the vocal intonation ſhall be the ſame with *la* upon the harpſichord, &c.

It will be found likewiſe by the ſame harpſichord, that if one ſhould ſing the ſcale beginning with *ut* in the ſame tone with *mi* on the inſtrument, the *re* which ought to have followed *ut*, will be higher by an extremely perceptible degree than the *fa* which follows *mi :* thus it may be concluded, that the interval between *mi* and *fa* is leſs than between *ut* and *re ;* and if one would riſe from *fa* to another ſound which is at the ſame diſtance from *fa* as *fa* from *mi*, he would find in the ſame manner, that the interval from *mi* to this new ſound is almoſt the ſame as that between *ut* and *re*. The interval then from *mi* to *fa* is nearly half of that between *ut* and *re*.

Since then, in the ſcale thus divided, *ut, re, mi, fa,*
ſol, la, ſi, Ut, the firſt diviſion is perfectly like the laſt ; and ſince the intervals between *ut* and *re*, between *re* and *mi*, and between *fa* and *ſol*, are equal ; it follows, that the intervals between *ſol* and *la*, and between *la* and *ſi*, are likewiſe equal to every one of the three intervals between *ut* and *re*, between *re mi*, and between *fa* and *ſol ;* and that the intervals between *mi* and *fa* and between *ſi* and *ut* are alſo equal, but that they only conſtitute one half of the others.

Definitions. And in short, an interval consisting of five tones and two semitones, as from *ut* to *UT*, is called an *octave*.

109 Octave, what.

A great many of the intervals which have now been mentioned, are still signified by other names, as may be seen in the beginning of the second part; but those which we have now given are the most common, and the only terms which our present purpose demands.

110 Unison, what.

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 *mi*, *sol*, where *mi* is the lowest and *sol* the highest sound, *sol* is a third minor from *mi ascending*, and *mi* is third minor from *sol 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.*

See fig. B.

13. If, after having sung the scale *ut*, *re*, *mi*, *fa*, *sol*, *la*, *si*, *UT*, one would carry this scale still farther in ascent, it would be discovered without difficulty that a new scale would be formed, UT, RE, MI, FA, &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 RE, the second note of the second scale, will be an octave in ascent to the *re* of the first scale; in the same manner MI shall be the octave to *mi*, &c. and so of the rest.

Definitions.

14. As there are nine notes from the first *ut* to the second RE, 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 *ut* to FA is called an *eleventh*, and the interval between *ut* and SOL, a *twelfth*, &c.

111 Ninth, what.

112 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.

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.

§ See *Interval* and *Double Octave*.

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. (B).

IV. *What is meant by Sharps and Flats.*

113 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 *ut* to *re*, forming in his progress an intermediate sound, which shall be higher by a semitone than *ut*, and lower in the same degree than *re*. A sound in the scale is called *sharp*, when it is raised by a semitone; and it is marked with this character ✕: thus *ut* ✕ signifies *ut sharp*, that is to say, *ut* 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 *la* ♭ signifies *la flat*, or *la* depressed by a semitone.

V. *What is meant by Consonances and Dissonances.*

114 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

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(B) 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 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.

Definitions. nant 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.

115 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 triton, and the seventh of a sound, are dissonants with relation to it. Thus the sounds *ut re, ut si*, or *fa si*, &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 founds, 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 above 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 (c).

21. The principal sound is called the *generator* *; and * See *Generator*.

(c) 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 *ut*, 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, $\frac{3}{2}$; 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 *ut*, for instance, is *fa*, of which the double octave *fa* is the fourth above *ut*. 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 *mi*, from the sound *ut*, and its fifth *sol*, form between them a third minor *mi, sol*; now *mi* is $\frac{5}{4}$, and *sol* $\frac{3}{2}$, by what has been immediately demonstrated: from whence it follows, that the third minor, or the interval between *mi* and *sol*, 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 $\frac{10}{8}$, and that $\frac{3}{2}$ are the same thing with $\frac{12}{8}$: 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

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and the two other sounds which it produces, and with which it is accompanied, are, inclusive of its octave, called its *harmonics* §.

116 Generator, what.

§ See *Harmonic*.

EXPERIMENT II.

22. There is no person insensible of the resemblance which 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; I affirm, that, without being initiated in the art of music, he will naturally take his new key in the octave below or the octave above the first; and that 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 (D).

CHAP. II. *The Origin of the Modes Major and Minor; of the most natural Modulation, and the most perfect Harmony.*

117 Fundamental and harmonics, what.

23. To render our ideas still more precise and permanent, we shall call the tone produced by the sonorous body *ut*: 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 *sol*, and the double octave of *mi*.

24. This octave of *sol* then, and this double octave of *mi*, produce the most perfect chord which can be joined with *ut*, since that chord is the work and choice of nature (E).

118 Harmony reduced to chords, fifths, and octaves.

25. For the same reason, the modulation formed by *ut* with the octave of *sol* and the double octave of *mi*, 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

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Thus the third minor, an harmonic sound which is even found in the protracted and coalescent tones of a sonorous body between the sound *mi* and *sol*, 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 *ut* 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 $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$, $\frac{5}{6}$.

(D) 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.

(E) 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 in short, the second part, or tenor above, gives the twelfth.

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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.

119 Mode major, what.

26. It is on this account that, after having ſung the tone *ut*, we naturally modulate the third *mi*, and the fifth *ſol*, inſtead of the double octave of *mi*, and the octave of *ſol*; from whence we form, by joining the octave of the ſound *ut*, this modulation, *ut*, *mi*, *ſol*, *ut*, 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 *ut*, *mi*, *ſol*, *ut*, in which the chord *ut*, *mi*, 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.

120 Mode minor, what.

28. In the modulation *ut*, *mi*, *ſol*, of which we have now been treating, the ſounds *mi* and *ſol* are ſo proportioned one to the other, that the principal ſound *ut* (art. 19.) cauſes both of them to reſound; but the ſecond tone *mi* does not cauſe *ſol* to reſound, which only forms the interval of a third minor.

29. Let us then imagine, that, inſtead of this ſound *mi*, one ſhould ſubſtitute between the ſounds *ut* and *ſol* another note which (as well as the ſound *ut*) has the power of cauſing *ſol* to reſound, and which is, however, different from the ſound *ut*; the ſound which we explore ought to be ſuch, by art. 19. that it may have for its 17th major *ſol*, or one of the octaves of *ſol*; of conſequence the ſound which we ſeek ought to be a 17th major below *ſol*, or, what is the ſame thing, a third major below the ſame *ſol*. Now the ſound *mi* being a third minor beneath *ſol*, 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 *mi*, and of conſequence *mi* ♭.

30. This new arrangement, *ut*, *mi* ♭, *ſol*, in which the ſounds *ut* and *mi* ♭ have both the power of cauſing *ſol* to reſound, though *ut* does not cauſe *mi* ♭ to reſound, is not indeed equally perfect with the firſt arrangement *ut*, *mi*, *ſol*; becauſe in this the two ſounds *mi* and *ſol* are both the one and the other generated by the principal ſound *ut*; whereas, in the other, the ſound *mi* ♭ is not generated by the ſound *ut*; but this arrangement *ut*, *mi* ♭, *ſol*, 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.

121 Origin of mode minor. See *Mode*. See alſo *Interval*.

31. In this modulation or chord *ut*, *mi* ♭, *ſol*, *ut*, it is evident that the third from *ut* to *mi* ♭ is minor; and ſuch is the origin of that mode which we call *minor* (F).

122 Perfect chords, what.

32. The moſt perfect chords then are, 1. All chords related one to another, as *ut*, *mi*, *ſol*, *ut*, conſiſting of any ſound of its third major, of its fifth, and of its octave. 2. All chords related one to another, as *ut* *mi* ♭, *ſol*, *ut*, conſiſting of any ſound, of its third 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 Series which the Fifth requires, and of the Laws which it obſerves.*

123 Fundamental baſs, what.

33. Since the ſound *ut* cauſes the ſound *ſol* to be heard, and is itſelf heard in the ſound *fa*, which ſounds *ſol* and *fa* are its two-twelfths, we may imagine a modulation compoſed of that ſound *ut* and its two-twelfths, or, which is the ſame thing (art. 22.), of its two-fifths, *fa* and *ſol*, the one below, the other above; which gives the modulation or ſeries of fifths *fa*, *ut*, *ſol*, which I call the *fundamental baſs* of *ut* by fifths.

We ſhall find in the ſequel (Chap. XVIII.), that there may be ſome fundamental baſes 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 *ut*, one may make a tranſition indifferently to the ſound *ſol*, or to the ſound *fa*.

35. One may, for the ſame reaſon, continue this kind of fifths in aſcending, and in deſcending, from *ut*, in this manner:

mi ♭, *ſi* ♭, *fa*, *ut*, *ſol*, *re*, *la*, &c.

And from this ſeries of fifths one may paſs to any ſound which immediately precedes or follows it.

36. But it is not allowed in the ſame manner to paſs

(F) The origin which we have here given of the mode minor, is the moſt ſimple and natural that can poſſibly be given. In the firſt edition of this treatiſe, I had followed M. Rameau in deducing it from the following experiment.—If you put in vibration a muſical ſtring AB, and if there are at the ſame time contiguous to this two other ſtrings CF, LM, of which the firſt ſhall be a twelfth below the ſtring AB, and the ſecond LM a ſeventeenth major below the ſame AB, the ſtrings CF, LM, will vibrate without being ſtruck as ſoon as the ſtring AB 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 CF, you may eaſily diſtinguiſh two points at reſt D, E, and in the tremulous motion of the ſtring LM four acquieſcent points N, O, P, Q, 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 *ut* the tone of the ſtring AB, the two other ſtrings will repreſent the ſounds *fa* and *la* ♭; and from thence M. Rameau deduces the modulation *fa*, *la* ♭, *ut*, and of conſequence the mode minor. The origin which we have aſſigned to the minor mode in this new edition, appears to me more direct and more ſimple, becauſe it preſuppoſes no other experiment than that of art. 19. and becauſe alſo the fundamental ſound *ut* is ſtill retained in both the modes, without being obliged, as M. Rameau found himſelf, to change it into *fa*.

See fig. C.

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pass from one sound to another which is not immediately contiguous to it; for instance, from *ut* to *re*, or from *re* to *ut*: for this very simple reason, that the sound *re* is not contained in the sound *ut*, nor the sound *ut* in that of *re*; and thus these sounds have not any alliance the one with the other, which may authorise the transition from one to the other.

124 Exception to the rule.

125 Two perfect chords in succession proscribed.

37. And as these sounds *ut* and *re*, by the first experiment, naturally bring along with them the perfect chords consisting of greater intervals *ut, mi, sol, ut, re, fa*✕, *la, re*; hence may be deduced this rule, That two perfect chords, especially if they are major (G), 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.*

126 Mode in general, what.

38. A *mode*, in music, is nothing else but the order of sounds prescribed, as well in harmony as melody, by the series of fifths. Thus the three sounds *fa, ut, sol*, 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 *ut*.

127 Modes, how represented by the series of fifths.

39. The series of fifths then, or the fundamental bass *fa, ut, sol*, of which *ut* holds the middle space, may be regarded as representing the mode of *ut*. One may likewise take the series of fifths, or fundamental bass, *ut, sol, re*, as representing the mode of *sol*; in the same manner *si* ♭, *fa, ut*, will represent the mode of *fa*.

By this we may see, that the mode of *sol*, or rather the fundamental bass of that mode, has two sounds in common with the fundamental bass of the mode of *ut*. It is the same with the fundamental bass of the mode *fa*.

128 Principal mode, and adjuncts, what. See *Adjunct*.

40. The mode of *ut (fa, ut, sol)* is called the *principal mode* with respect to the modes of these two fifths, which are called its two *adjuncts*.

129 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 *sol* seems a little more eligible: for *sol* is heard amongst the harmonics of *ut*, and of consequence is implied and signified by *ut*; whereas *ut* does not cause *fa* to be heard, though *ut* is included in the same sound *fa*. It is hence that the ear, affected by the mode of *ut*, is a little more prepossessed for the mode of *sol* than for that of *fa*. Nothing likewise is more frequent, nor more natural, than to pass from the mode of *ut* to that of *sol*.

130 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 *sol* the fifth above the generator the *dominant* sound, and the fifth *fa* beneath the generator the *subdominant*.

131 Transition to contiguous sounds, how to be managed.

43. It remains to add, as we have seen in the preceding chapter, that, in the series of fifths, we may indifferently pass from one sound to that which is contiguous: In the same manner, and for the same reason, one may pass from the mode of *sol* to the mode of *re*, after having made a transition from the mode of *ut* to the mode of *sol*, as from the mode of *fa* to the mode of *si* ♭. 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 (‡ *aa*) 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, *fa, ut, sol*, it follows, that one may form this modulation, or this fundamental bass, by fifths, *sol, ut, sol, ut fa, ut, fa*.

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 *sol*, may be reckoned to sing at the same time the notes *sol, si, re, sol*: in the same manner the sound *ut* in the fundamental bass brings along with it this modulation, *ut, mi, sol, ut*; and, in short, the same sound *fa* brings along with it *fa, la, ut, fa*. This modulation then, or this fundamental bass, See fig. D.

132 Formation of the Greek diatonic scale by the fundamental bass.

sol, ut, sol, ut, fa, ut, fa,

gives the following diatonic series,

si, ut, re, mi, fa, sol, la;

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 *sol, ut, sol, ut, fa, ut, fa*; and that of consequence this bass is justly called *fundamental*, as being the real primitive modulation, that which conducts See D.

(G) I say *especially if they are major*; for in the major chord *re, fa*✕, *la, re*, besides that the sounds *ut* and *re* have no common harmonical relation, and are even dissonant between themselves (Art. 18.), it will likewise be found, that *fa*✕ forms a dissonance with *ut*. The minor chord *re, fa, la, re*, would be more tolerable, because the natural *fa* which occurs in this chord carries along with it its fifth *ut*, 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.

(‡ *aa*) As the mere English reader, unacquainted with the technical phraseology of music, may be surprised at 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 terminate in a repose by a cadence more or less perfect.

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conducts the ear, and which it feels to be implied in the diatonic modulation, *ſi, ut, re, mi, fa, ſol, la*, (H).

46. We ſhall be ſtill more convinced of this truth by the following remarks.

In the modulation *ſi, ut, re, mi, fa, ſol, la*, the ſounds *re* and *fa* form between themſelves a third minor, which is not ſo perfectly true as that between *mi* and *ſol* (I). Nevertheleſs, this alteration in the third minor between *re* and *fa* gives the ear no pain, becauſe that *re* and that *fa*, 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 *re* in the ſcale is the true fifth of *ſol*, which anſwers to it in the fundamental baſs; and *fa* in the ſcale is the true octave of *fa*, which anſwers to it in the ſame baſs.

133 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.

134 Reaſons why this ſcale includes only ſeven ſounds.

48. Moreover, this diatonic ſcale includes only ſeven ſounds, and goes no higher than *ſi*, which would be the octave of the firſt: a new ſingularity, for which a reaſon may be given by the principles above eſtabliſhed. In reality, in order that the ſound *ſi* may ſucceed immediately in the ſcale to the ſound *la*, it is neceſſary that the note *ſol*, which is the only one from whence *ſi* as a harmonic may be deduced, ſhould immediately ſucceed to the ſound *fa*, in the fundamental baſs, which is the only one from whence *la* can be harmonically deduced. Now, the diatonic ſucceſſion from *fa* to *ſol* cannot be admitted in the fundamental baſs, according to what we have remarked (art. 36.). The ſounds *la* and *ſi*, then, cannot immediately ſucceed one another in the ſcale: we ſhall ſee in the ſequel why this is not the caſe in the ſeries *ut, re, mi, fa, ſol, la, ſi, UT*, which begins upon *ut*; whereas the ſcale in queſtion here begins upon *ſi*.

135 Completion of the Greek octave.

49. The Greeks likewiſe, to form an entire octave, added below the firſt *ſi* the note *la*, which they diſtinguiſhed and ſeparated from the reſt of the ſcale, and which for that reaſon they called *proſlambanomene*, that is to ſay, a ſtring or note ſubadded to the ſcale, and put before *ſi* to form the entire octave.

See *Proſlambanomene*.

136 The ſcale compoſed of two ſimilar conjunctive tetrachords.

50. The diatonic ſcale *ſi, ut, re, mi, fa, ſol, la*, is compoſed of two tetrachords, that is to ſay, of two diatonic ſcales, each conſiſting of four ſounds, *ſi, ut, re, mi*, and *mi, fa, ſol, la*. Theſe two tetrachords are exactly ſimilar; for from *mi* to *fa* there is the ſame interval as from *ſi* to *ut*, from *fa* to *ſol* the ſame as from *ut* to *re*, from *ſol* to *la* the ſame as from *re* to *mi*

(H) Nothing is eaſier than to find in this ſcale the value or proportions of each ſound with relation to the ſound *ut*, which we call 1; for the two ſounds *ſol* and *fa* in the baſs are $\frac{3}{2}$ and $\frac{2}{3}$; from whence it follows,

1. That *ut* in the ſcale is the octave of *ut* in the baſs; that is to ſay, 2.
2. That *ſi* is the third major of *ſol*; that is to ſay $\frac{5}{4}$ of $\frac{3}{2}$ (note C), and of conſequence $\frac{15}{8}$.
3. That *re* is the fifth of *ſol*; that is to ſay $\frac{3}{2}$ of $\frac{3}{2}$, and of conſequence $\frac{9}{4}$.
4. That *mi* is the third major of the octave of *ut*, and of conſequence the double of $\frac{5}{4}$; that is to ſay, $\frac{5}{2}$.
5. That *fa* is the double octave of *fa* of the baſs, and conſequently $\frac{8}{3}$.
6. That *ſol* of the ſcale is the octave of *ſol* of the baſs, and conſequently 3.
7. In ſhort, that *la* in the ſcale is the third major of *fa* 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	$\frac{10}{3}$
	ſi,	*ut,*	*re,*	*mi,*	*fa,*	*ſol,*	*la.*
Fundamental Baſs.	*ſol,*	*ut,*	*ſol,*	*ut,*	*fa,*	*ut,*	*fa.*
	$\frac{3}{2}$	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 *ut*, of the ſcale 1; in this caſe there is nothing to do but to divide each of the numbers by 2, which repreſent the diatonic ſcale, and we ſhall have

$\frac{15}{16}$	1	$\frac{9}{8}$	$\frac{5}{4}$	$\frac{4}{3}$	$\frac{3}{2}$	$\frac{5}{3}$
ſi,	*ut,*	*re,*	*mi,*	*fa,*	*ſol,*	*la.*

(I) In order to compare *re* with *fa*, 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 *re* to *fa*, 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 *re* and *fa*, 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 *mi* and *ſol*, in the continued tone of thoſe ſonorous bodies of which *mi* and *ſol* 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.

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mi (L): this is the reason why the Greeks distinguished these two tetrachords; yet they joined them by the note *mi*, which is common to both, and which gave them the name of *conjunctive tetrachords*.

137 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 *ut mi*, and *si re*, are thirds, the one major and the other minor, exactly true, as well as the fourth *si mi* (M); it is the same thing with the tetrachord *mi*, *fa*, *sol*, *la*, since this tetrachord is exactly like the former.

138 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 *re* in the first tetrachord forms with the note *fa* in the second a third minor, which is not true. In like manner it will be found, that the fifth from *re* to *la* is not exactly true, which is evident; for the third major from *fa* to *la* is true, and the third minor from *re* to *fa* 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.

139 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.

140 The source of tones major and minor investigated.

54. It may be ascertained by calculation, that in the tetrachord *si*, *ut*, *re*, *mi*, the interval, or the tone from *re* to *mi*, is a little less than the interval or tone from *ut* to *re* (N). In the same manner, in the second tetrachord *mi*, *fa*, *sol*, *la*, which is, as we have proved, perfectly similar to the first, the note from *sol* to *la* is a little less than the note from *fa* to *sol*. It is for this reason that they distinguish two kinds of tones; the greater tone*, as from *ut* to *re*, from *fa* to *sol*, &c.; and the lesser †, as from *re* to *mi*, from *sol* to *la*, &c.

* Greater tone. See *Interval*.
† Lesser tone. See *Interval*.

Chap. VI. *The formation of the Diatonic Scale among the Moderns, or the ordinary Gammut.*

141 The modern scale, how formed.

55. We have just shown in the preceding chapter, how the scale of the Greeks is formed, *si*, *ut*, *re*, *mi*, *fa*, *sol*, *la*, by means of a fundamental bass composed of three sounds only, *fa*, *ut*, *sol*: but to form the scale *ut*, *re*, *mi*, *fa*, *sol*, *la*, *si*, *UT*, which we use at present, we must necessarily add to the fundamental bass the note *re*, and form, with these four sounds *fa*, *ut*, *sol*, *re*, the following fundamental bass:

ut, *sol*, *ut*, *fa*, *ut*, *sol*, *re*, *sol*, *ut*; See *fig.* E. See *Scale*.

from whence we deduce the modulation or scale

ut, *re*, *mi*, *fa*, *sol*, *la*, *si*, *UT*.

In effect (O), *ut* in the scale belongs to the harmony of *ut* which corresponds with it in the bass; *re*, which is the second note in the gammut, is included in the harmony of *sol*, the second note of the bass; *mi*, the third note of the gammut, is a natural harmonic of *ut*, which is the third sound in the bass, &c.

142 The Greek diatonic scale simpler than ours, and why.

56. From thence 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 *ut*; whereas ours is originally and primitively formed, not only from the mode of *ut* (*fa*, *ut*, *sol*), but likewise from the mode of *sol*, (*ut*, *sol*, *re*.)

It will likewise appear, that this last scale consists of two parts; of which the one, *ut*, *re*, *mi*, *fa*, *sol*, is in the

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(L) The proportion of *si* to *ut* is as $\frac{15}{16}$ to 1, that is to say as 15 to 16; that between *mi* and *fa* is as $\frac{5}{4}$ to $\frac{4}{3}$, that is to say (note C), 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 *ut* to *re* is as 1 to $\frac{9}{8}$, or as 8 to 9; that between *fa* and *sol* is as $\frac{4}{3}$ to $\frac{3}{2}$; that is to say (note C), as 8 to 9. The proportion of *mi* to *ut* is as $\frac{5}{4}$ to 1, or as 5 to 4; that between *fa* and *la* is as $\frac{5}{3}$ to $\frac{4}{3}$, or as 5 to 4: the proportions here then are likewise equal.

(M) The proportion of *mi* to *ut* is as $\frac{5}{4}$ to 1, or as 5 to 4, which is a true third major; that from *re* to *si* 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 *mi* to *si* 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.

(N) The proportion of *re* to *ut* is as $\frac{9}{8}$ to 1, or as 9 to 8; that of *mi* to *re* 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 *re* to *mi* is a little less than that from *ut* to *re*.

If any one would wish to know the proportion which $\frac{10}{9}$ bear to $\frac{9}{8}$, he will find (note C) 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 *re fa*, of which we have taken notice in the scale (note I); for we have seen, that this third minor thus altered is in the proportion of 80 to 81 with the true third minor.

(O) The values or estimates of the notes shall be the same in this as in the former scale, excepting only the tone *la*; for *re* being represented by $\frac{9}{8}$, its fifth will be expressed by $\frac{27}{16}$; so that the scale will be numerically signified thus:

$$\begin{array}{cccccccc} 1 & \frac{9}{8} & \frac{5}{4} & \frac{4}{3} & \frac{3}{2} & \frac{27}{16} & \frac{15}{8} & 2 \\ ut, & re, & mi, & fa, & sol, & la, & si, & UT. \end{array}$$

Where you may see, that the note *la* of this scale is different from that in the scale of the Greeks; and that the *la* 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 *la*'s then likewise differ by a *comma*.

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143 The note *sol* twice repeated in the diatonic scale from its harmonic relations to the fundamental bass.

the mode of *ut*; and the other, *sol, la, si, ut*, in that of *sol*.

57. It is for this reason that the note *sol* is found to be twice repeated in immediate succession in this scale; once as the fifth of *ut*, which corresponds with it in the fundamental bass; and again, as the octave of *sol*, which immediately follows *ut* in the same bass. As to what remains, these two consecutive *sol's* are otherwise in perfect unison. It is for this reason that we are satisfied with singing only one of them when one modulates the scale *ut, re, mi, fa, sol, la, si, UT*: but this does not prevent us from employing a pause or repose, expressed or understood, after the sound *fa*. There is no person who does not perceive this whilst he himself sings the scale.

144 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, *ut, re, mi, fa*, and *sol, la, si, ut*, one in the mode of *ut*, the other in that of *sol*. For what remains, we shall see in the sequel by what artifice one may cause the scale *ut, re, mi, fa, sol, la, si, UT*, to be regarded as belonging to the mode of *ut* 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.

145 The mode of *sol* introduced in the fundamental bass productive of conveniences.

59. The introduction of the mode proper to *sol* in the fundamental bass has this happy effect, that the notes *fa, sol, la, si*, 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 *ut* alone. From whence it follows:-

1. That we change the mode at every time when we modulate three notes in succession.

2. That if these three notes are sung in succession in the scale *ut, re, mi, fa, sol, la, si, UT*, this cannot be done but by the assistance of a pause expressed or understood after the note *fa*; insomuch, that the three tones *fa, sol, la, si*, (three only because the note *sol* which is repeated is not enumerated) are supposed to belong to two different tetrachords.

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 *ut, re, mi, fa*, and by *sol, la, si, ut*, where there is no more than a semitone between *mi* and *fa*, and between *si* and *ut*. 146

146 Change of mode the cause of the difficulty in singing three consecutive tones ascending.

61. We may likewise observe in the scale *ut, re, mi, fa*, that the third minor from *re* to *fa* is not true, for the reasons which have been already given (art. 49.). It is the same case with the third minor from *la* to *ut*, and with the third major from *fa* to *la*: but each of these sounds form otherwise consonances perfectly true, with their correspondent sounds in the fundamental bass. 147

147 Intervals, though altered in themselves, form true consonances with the fundamental bass.

62. The thirds *la ut, fa la*, which were true in the former scale, are false in this; because in the former scale *la* was the third of *fa*, and here it is the fifth of *re*, which corresponds with it in the fundamental bass.

148 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 (P); and this likewise happens from the introduction of the mode of *sol* into the fundamental bass (Q). 148

We see likewise that the value of *la* in the diatonic scale, a value which authors have been divided in ascertaining, solely depends upon the fundamental bass, and that it must be different according as the note *la* has *fa* or *re* for its bass. See the note (O).

Chap. VII. *Of Temperament.*

149 Temperament, 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. 149

Let

(P) In the scale of the Greeks, the note *la* being a third from *fa*, there is an altered fifth between *la* and *re*: but in ours, *la* being a fifth to *re*, produces two altered thirds, *fa la*, and *la ut*; and likewise a fifth altered, *la mi*, 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.

(Q) 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 *ut*, 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 I may speak so, in this they are included: on the contrary, neither the scale of the Greeks, nor its fundamental bass, commences with *ut*; but it is from this *ut* that we must depart, in order to regulate our intonation, whether in rising or descending: now, in ascending from *ut*, the intonation, even of the Greek scale, gives the series *ut, re, mi, fa, sol, la*: and so true is it that the fundamental sound *ut* is here the genuine guide of the ear, that if, before we modulate the sound *ut*, we 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 *si*, and by the semitone from *si* to *ut*. Now to make a transition from *si* to *ut*, by this semitone, the ear must of necessity be predisposed for that modulation, and consequently preoccupied with the mode of *ut*: if this were not the case, we should naturally rise from *si* to *ut*※, and by this operation pass into another mode.

See fig. F.

Let us choose in that harpsichord one of the strings which will sound the note UT, and let us tune the string SOL to a perfect fifth with UT in ascending; let us afterwards tune to a perfect fifth with this SOL the RE which is above it; we shall evidently perceive that this RE will be in the scale above that from which we set out: but it is also evident that this RE must have in the scale a *re* which corresponds with it, and which must be tuned a true octave below RE; and between this and SOL there should be the interval of a fifth; so that the *re* in the first scale will be a true fourth below the SOL of the same scale. We may afterwards tune the note LA of the first scale to a just fifth with this last *re*; then the note MI in the highest scale to a true fifth with this new LA, and of consequence the *mi* in the first scale to a true fourth beneath this same LA: Having finished this operation, it will be found that the last *mi*, thus tuned, will by no means form a just third major from the sound UT (R): that is to say, that it is impossible for *mi* to constitute at the same time the third major of UT and the true fifth of LA; or, what is the same thing, the true fourth of LA in descending.

65. What is still more, if, after having successively and alternately tuned the strings UT, SOL, *re*, LA, *mi*, in perfect fifths and fourths one from the other, we continue to tune successively by true fifths and fourths the strings *mi*, *si*, *fa*※, *ut*※, *sol*※, *re*※, *mi*※, *si*※; we shall find, that, though *si*※, being a semitone higher than the natural note, should be equivalent to UT natural, it will by no means form a just octave to the first *ut* in the scale, but be considerably higher (S); yet this *si*※ upon the harpsichord ought not to be different from the octave above UT; for every *si*※ and every UT 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 150 Reasons and rules for temperament.

(R) The LA considered as the fifth of *re* is $\frac{27}{16}$, and the fourth beneath this LA will constitute $\frac{3}{4}$ of $\frac{27}{16}$, that is to say, $\frac{81}{64}$; $\frac{81}{64}$ then shall be the value of *mi*, considered as a true fourth from LA in descending: now *mi*, considered as the third major of the sound UT, is $\frac{5}{4}$, or $\frac{80}{64}$: these two *mi*'s then are between themselves in the proportion of 81 to 80; thus it is impossible that *mi* should be at the same time a perfect third major from UT, and a true fourth beneath LA.

(S) 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.

UT, SOL, a fifth; *re* a fourth; LA a fifth; *mi* a fourth; *si* a fifth; *fa*※ a fourth; *ut*※ a fifth; *sol*※ a fourth; RE※ a fifth; *la*※ a fourth; MI※ or FA a fifth; *si*※ a fourth: now it will be found, by a very easy computation, that the first UT being represented by 1, SOL shall be $\frac{3}{2}$, *re* $\frac{9}{8}$, LA $\frac{27}{16}$, *mi* $\frac{81}{64}$, &c. and so of the rest till you arrive at *si*※, which will be found $\frac{531441}{262144}$. This fraction is evidently greater than the number 2, which expresses the perfect octave *ut* to its correspondent UT; and the octave below *si*※ would be one half of the same fraction, that is to say $\frac{531441}{524288}$, which is evidently greater than UT 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 *si*※, is not equal to the unity which expresses the value of the sound UT; though, upon the harpsichord, *si*※ and UT 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 N), and which is only $\frac{1}{80}$.

We have already proved that the series of fifths produces an *ut* different from *si*※, the series of thirds major gives another still more different. For, let us suppose this series of thirds, *ut*, *mi*, *sol*※, *si*※, we shall have *mi* equal to $\frac{5}{4}$, *sol*※ to $\frac{25}{16}$, and *si*※ to $\frac{125}{64}$, whose octave below is $\frac{125}{128}$; from whence it appears, that this last *si* is less than unity (that is to say, than *ut*), 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 *si*※, deduced from the series of thirds, is to the *si*※ 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 *si*'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 *sol*※ equal to $\frac{25}{16}$, we then tune by fifths and by fourths, *sol*※, *re*※, *la*※, *mi*※, *si*※, as we have done with respect to the first series of fifths, we find that the *si*※ must be $\frac{2025}{2048}$; its difference, then, from unity, or, in other words, from UT, 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*.

In a word, if, after having found *mi* equal to $\frac{5}{4}$ in the progression of thirds, we then tune by fifths and fourths *mi*, *si*, *fa*※, *ut*※, &c. we shall arrive at a new *si*※, 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 *mi* to *sol*※, from *sol*※ to *si*※ or *ut*, &c. are extremely false, and greatly altered.

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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 *ut* or *ſi*※ 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, UT, SOL, *re*, LA, *mi*, *ſi*, *fa*※, *ut*※, *ſol*※, *re*※, *la*※, *mi*※, *ſi*※, 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.

151 Its definition.

68. This change in the intervals of inſtruments which have, or even which have not, keys, is that which we call *temperament*.

152 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, UT, SOL, *re*, LA, *mi*, *ſi*, *fa*※, *ut*※, *ſol*※, *re*※, *la*※, *mi*※, *ſi*※, in which *ſi*※ or *ut* is not the true octave of the firſt UT, it is propoſed to alter all the fifths equally, in ſuch a manner that the two *ut's* may be in a perfect octave the one to the other.

153 Practical directions for temperament.

70. For a ſolution of this queſtion, we muſt begin with tuning the two *ut'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 (T) the alteration made in each fifth will be very conſiderable, but equal in all of them.

154 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, UT: then tune the note SOL 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

(T) All the ſemitones being equal in the temperament propoſed by M. Rameau, it follows, that the twelve ſemitones *ut*, *ut*※, *re*, *re*※, *mi*, *mi*※, &c. ſhall form a continued geometrical progreſſion; that is to ſay, a ſeries in which *ut* ſhall be to *ut*※ in the ſame proportion as *ut*※ to *re*, as *re* to *re*※, &c. and ſo of the reſt.

Theſe twelve ſemitones are formed by a ſeries of thirteen ſounds, of which *UT* and its octave *ut* 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.

UT	*ut*※	*re*	*re*※	*mi*	*fa*	*fa*※	*ſol*	*ſol*※
1	$\sqrt[12]{2}$	$\sqrt[12]{2^2}$	$\sqrt[12]{2^3}$	$\sqrt[12]{2^4}$	$\sqrt[12]{2^5}$	$\sqrt[12]{2^6}$	$\sqrt[12]{2^7}$	$\sqrt[12]{2^8}$
la	*la*※	*ſi*	*ut*					
$\sqrt[12]{2^9}$	$\sqrt[12]{2^{10}}$	$\sqrt[12]{}^{11}$	$\sqrt[12]{}^{12}$					

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 *ut* to *ſol*, 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 *ut* to *mi*, 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 *ut*, *mi*, *ſol*※, *ſi*※, that this laſt *ſi*※ is very different from *ut* (note s); from whence it follows, that if we would tune this *ſi*※ in uniſon with the octave of *ut*, 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.

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another in ascent: and as the ear does not appretiate 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 *mi*※ to *si*※, which should of themselves be in tune; that is to say, they ought to be in such a state, that *si*※, the highest note of the two which compose the fifth, may be identical with the sound UT, with which you began, or at least the octave of that sound perfectly just: it will be necessary then to try if this UT, or its octave, forms a just fifth with the last sound *mi*※ or *fa* 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 (υ).

By

(υ) All that remains, is to acknowledge, with M. Rameau, that this temperament is far remote from that which is now in practice: you may here see in what this last temperament consists as applied to the organ or harpsichord. They begin with *UT* in the middle of the keys, and they flatten the four first fifths *sol*, *re*, *la*, *mi*, till they form a true third major from *mi* to *ut*; afterwards, setting out from this *mi*, they tune the fifths *si*, *fa*※, *ut*※, *sol*※, but flattening them still less than the former, so that *sol*※ may almost form a true third major with *mi*. When they have arrived at *sol*※, they stop; they resume the first *ut*, and tune to it the fifth *fa* in descending, then the fifth *si*♭, &c. and they heighten a little all the fifths till they have arrived at *la*♭, which ought to be the same with the *sol*※ 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 *ut* to that of *sol*, from the mode of *sol* to that of *re*, &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 *ut*,

ut, *re*, *mi*, *fa*, *sol*, *la*, *si*, *UT*,

is not perfectly similar to the gammut or diatonic scale of the mode of *mi*

mi, *fa*※, *sol*※, *la*※, *si*, *ut*※, *re*※, *mi*,

which, in their judgment, renders the modes of *ut* and *mi* 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, or at least very little different from that which they practise 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 we must not suffer our readers to be ignorant, that M. Rameau, in his *New System of Music*, printed in 1726, had 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 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 strain, as you may see, is immensely different from that which this celebrated musician afterwards

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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.

155 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 alterations 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. Strike upon an organ the three keys *mi, sol, si*, you will hear nothing but the minor perfect chord; though *mi*, by the construction of that instrument, must cause *sol*※ likewise to be heard; though *sol* should have the same effect upon *re*, and *si* upon *fa*※; insomuch, that the ear is at once affected with all these sounds, *re, mi, fa*※, *sol*, *sol*※, *si*: 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 sounds as might offend!

Chap. VIII. *Of Reposes or Cadences* (†).

156 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 *ut* to *sol*; 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*.

157 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

ut, sol, ut, fa, ut, sol, re, sol, ut,

which forms, as we have seen, the diatonic scale of the moderns, there is an absolute repose from *re* to *sol*, as from *sol* to *ut*: yet this last absolute repose is more perfect than the preceding, because the ear, prepossessed with the mode of *ut* by the multiplied impression of the sound *ut* which it has already heard thrice before, feels a desire to return to the generator *ut*; and it accordingly does so by the absolute repose *sol, ut*.

158 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 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 (x).

159 Cadences in the fundamental bass necessary in the diatonic scale, and of 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 *sol ut*, is of

terwards 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.

(†) 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 Repos in Rousseau's Musical Dictionary.

(x) 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.

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of all others the moſt perfect in the fundamental baſs, the repoſe from *ſi* to *ut*, 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.

160 Definition and uſe of a 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*, as introducing the generator, and preparing us for the moſt perfect repoſe.

See *Senſible Note*.

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.*

161 The diatonic ſeries of the minor mode aſcertained by different examples.

78. In the ſecond chapter, we have explained (art. 29. 30. 31. and 32.) by what means, and upon what principle, the minor chord *ut*, *mi*♭, *ſol*, *ut*, may be formed, which is the characteriſtical chord of the minor mode. Now what we have there ſaid, taking *ut* 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 *ut*, *mi*♭, *ſol*, *ut*, there occurs a *mi*♭ 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. *re*, *fa*, *la*, *re*; *la*, *ut*, *mi*, *la*; and *mi*, *ſol*, *ſi*, *mi*. Amongſt theſe three we ſhall chooſe *la*, *ut*, *mi*, *la*; becauſe this chord, without including any ſharp or flat, has two ſounds in common with the major chord *ut*, *mi*, *ſol*, *ut*; and beſides, one of theſe two ſounds is the very ſame *ut*: ſo that this chord appears to have the moſt immediate, and at the ſame time the moſt ſimple, relation with the chord *ut*, *mi*, *ſol*, *ut*. Concerning this we need only add, that this preference of the chord *la*, *ut*, *mi*, *la*, 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.

162 Tonic or key in harmony, what.

80. Let us now remark, that in every mode, whether major or minor, the *principal* ſound which implies the perfect chord, whether major or minor, may be called the *tonic note* or *key*; thus *ut* is the key in its proper mode, *la* in the mode of *la*, &c. Having laid down this principle,

See *Principal*. See *Tonic*.

163 The formation of the ſcale purſued.

81. We have ſhown how the three ſounds *fa*, *ut*, *ſol*, which conſtitute (art. 38.) the mode of *ut*, of which the firſt *fa* and the laſt *ſol* are the two-fifths of *ut*, one deſcending the other riſing, produce the ſcale *ſi*, *ut*, *re*, *mi*, *fa*, *ſol*, *la*, of the major mode, by means of the fundamental baſs *ſol*, *ut*, *ſol*, *ut*, *fa*, *ut*, *fa*: let us in the ſame manner take the three ſounds *re*, *la*, *mi*, which conſtitute the mode of *la*, for the ſame reaſon that the ſounds *fa*, *ut*, *ſol*, conſtitute the mode of *ut*; and of them let us form this fundamental baſs, perfectly like the preceding, *mi*, *la*, *mi*, *la*, *re*, *la*, *re*: 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 *re* and *la* as implying their thirds minor in the fundamental baſs to characteriſe the minor mode; and we ſhall have the diatonic ſcale of that mode,

See *fig.* D. See *fig* G.

ſol♯, *la*, *ſi*, *ut*, *re*, *mi*, *fa*.

82. The *ſol*♯, which correſponds with *mi* in the fundamental baſs, forms a third major with that *mi*, 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 *la*.

83. It is true, that, in cauſing *mi* to imply its third major *ſol*, one might alſo riſe to *la* by a diatonic progreſs. But that manner of riſing to *la* would be leſs perfect than the preceding; for this reaſon (art. 76.), that the abſolute repoſe or perfect cadence, *mi*, *la*, which is found 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 *la*, the key itſelf upon which the repoſe is made. From whence it follows, that the preceding note *ſol* ought rather to be ſharp than natural; becauſe *ſol*♯, being included in *mi* (art. 19.), much more perfectly repreſents the note *mi* in the baſs, than the natural *ſol* could do, which is not included in *mi*.

See *Imply* or *Carry*.

164 Diverſities in the ſcales of the major and minor mode.

84. We may remark this firſt difference between the ſcale

ſol♯, *la*, *ſi*, *ut*, *re*, *mi*, *fa*,

and the ſcale which correſponds with it in the major mode

ſi, *ut*, *re*, *mi*, *fa*, *ſol*, *la*,

that from *mi* to *fa*, which are the two laſt notes of the former ſcale, there is only a ſemitone; whereas from *ſol* to *la*, 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.

165 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,

ut, *re*, *mi*, *fa*, *ſol*, *ſol*, *la*, *ſi*, *ut*. See *fig.* E.

That laſt ſeries, as we have ſeen, was formed by means of the fundamental baſs *fa*, *ut*, *ſol*, *re*, diſpoſed in this manner,

ut, *ſol*, *ut*, *fa*, *ut*, *ſol*, *re*, *ſol*, *ut*.

Let us take in the ſame manner the fundamental baſs *re la mi ſi*, and arrange it in the following order,

la, *mi*, *la*, *re*, *la*, *mi*, *ſi*, *mi*, *la*, See *fig.* H.

and it will produce the ſcale immediately ſubjoined,

la, *ſi*, *ut*, *re*, *mi*, *mi*, *fa*♯, *ſol*♯, *la*,

in which *ut* forms a third minor with *la*, which in the fundamental baſs correſponds with it, which denominates the minor mode; and, on the contrary, *ſol*♯ forms a third major with *mi* in the fundamental baſs, becauſe *ſol*♯ riſes towards *la*, (art. 82. and 83.)

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86. We see besides a *fa*♯, which does not occur in the former,

sol♯, *la*, *si*, *ut*, *re*, *mi*, *fa*,

where *fa* is natural. It is because, in the first scale, *fa* is a third minor from *re* in the bass; and in the second, *fa*♯ is the fifth from *si* in the bass.

166 Difference between the two scales of the minor mode greater than between 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 *la* as it stands in each of these scales, but this amounts to much less than a semitone.

167 *Fa* and *sol* sharp in the minor mode, and why.

88. From thence it may be seen why *fa* and *sol* are sharp when ascending in the minor mode; nay, besides, the *fa* is only natural in the first scale *sol*♯, *la*, *si*, *ut*, *re*, *mi*, *fa*, because this *fa* cannot rise to *sol*♯, (art. 48.)

168 The case different in descending, and why.

89. It is not the same case in descending. For *mi*, the fifth of the generator, ought not to imply the third major *sol*♯, but in the case when that *mi* descends to the generator *la* to form a perfect repose (art. 77. and 83.); and in this case the third major *sol*♯ rises to the generator *la*: but the fundamental bass *la mi* may, in descending, give the scale *la sol* natural, provided *sol* does not rise towards *la*.

169 Explication of the descending scale in the minor mode from a fundamental bass difficult.

90. It is much more difficult to explain how the *fa*, which ought to follow this *sol* in descending, is natural and not sharp; for the fundamental bass

la, *mi*, *si*, *mi*, *la*, *re*, *la*, *mi*, *la*,

produces in descending,

la, *sol*, *fa*♯, *mi*, *mi*, *re*, *ut*, *si*, *la*.

And it is plain that the *fa* cannot be otherwise than sharp, since *fa*♯ is the fifth of the note *si* of the fundamental bass. In the mean time, experience evinces that the *fa* is natural in descending in the diatonic scale of the major mode of *la*, especially when the preceding *sol* is natural: and it must be acknowledged, that here the fundamental bass appears in some measure defective.

170 Rameau's solution, though the only one, yet unsatisfactory.

M. Rameau has invented the following means for obtaining a solution of this difficulty. According to him, in the diatonic scale of the minor mode in descending, *la*, *sol*, *fa*, *mi*, *re*, *ut*, *si*, *la*, *sol*, 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 *fa* natural. It is easily perceived, according to M. Rameau, by this fandametal bass,

la, *re*, *la*, *re*, *la*, *mi*, *la*,

which produces

la, *fa*, *mi*, *re*, *ut*, *si*, *la*;

which may be regarded, as he says, as the real scale of the minor mode in descending; to which is added *sol* natural between *la* and *fa*, to preserve the diatonic order.

This answer appears the only one which can be given to the difficulty above proposed: but I 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 (Y).

Chap. X. *Of Relative Modes.*

171 Modes relative, what.

91. Two modes which are of such a nature that we can pass from the one to the other, are called *relative modes*. Thus we have already seen, that the major mode of *ut* is relative to the major mode of *fa* and to that of *sol*. It may likewise appear from what goes before, how many intimate connections there are between the *species* (†) or major mode of *ut*, and the *species* or minor mode of *la*. For, 1. The perfect chords, one major *ut mi sol ut*, the other minor *la ut mi la*, which characterise each of those two kinds of modulation* or harmony, have two sounds in common, *ut* or *mi*. 2. The diatonic scale of the minor mode of *la* in descent, absolutely contains the same sounds with the gammut or diatonic scale of the major mode of *ut*. See *Mode*. * See *Modulation*.

It is for this reason that the transition is so natural and easy from the major mode of *ut* to the minor mode of *la*, or from the minor mode of *la* to the major mode of *ut*, as experience proves.

92. In the minor mode of *mi*, the minor perfect chord *mi sol si mi*, which characterises it, has likewise two sounds, *mi*, *sol*, in common with the perfect chord major *ut mi sol ut*, which characterises the major mode of *ut*. But the minor mode of *mi* is not so closely related nor allied to the major mode of *ut* as to the minor mode of *la*; because the diatonic scale of the minor mode of *mi* in descent, has not, like the series of the

(Y) For what remains, when *sol* is said to be natural in descending the diatonic scale of the minor mode of *la*, this only signifies, that this *sol* is not necessarily sharp in descending as it is in rising; for this *sol*, besides, may be sharp in descending to the minor mode of *la*, as may be proved by numberless examples, of which all musical compositions are full. It is true, that when the sound *sol* is found sharp in descending to the minor mode of *la*, still we are not sure that the mode is minor till the *fa* or *ut* natural is found; both of which impress a peculiar character on the minor mode, viz. *ut* natural, in rising and in descending, and the *fa* natural in descending.

(†) *Species* was the only word which occurred to the translator in English by which he could render the French word *genre*. It is, according to Rousseau, intended to express the different divisions and dispositions of the intervals which formed the two tetrachords in the ancient diatonic scale; and as the gammut of the moderns consists likewise of two tetrachords, though diversified from the former, as our author has shown at large, the *genre* or *species*, as the translator has been obliged to express it, must consist in the various dispositions and divisions of the different intervals between the notes or semitones which compose the modern scale.

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the minor mode of *la*, all these sounds in common with the scale of *ut*. In reality, this scale is *mi re ut si la sol fa*♯ *mi*, where there occurs a *fa* sharp which is not in the scale of *ut*. We may add, that though the minor mode of *mi* is less relative to the major mode of *ut* than that of *la*; yet the artist does not hesitate sometimes to pass immediately from the one to the other.

Of this may be seen one instance (among many others) in the prologue *des Amours des Dieux*, at this passage, *Ovide est l'objet de la fete*, which is in the minor mode of *mi*, though what immediately precedes it is in the major mode of *ut*.

We may see besides, that when we pass from one mode to another by the interval of a third, whether in descending or rising, as from *ut* to *la*, or from *la* to *ut*, from *ut* to *mi*, or from *mi* to *ut*, 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 *ut*. It is the minor mode of *ut* itself in which the perfect minor chord *ut mi*♭ *sol ut* has two sounds, *ut* and *sol*, in common with the perfect major chord *ut mi sol ut*. Nor is there any thing more common than a transition from the major mode of *ut* to the minor mode, or from the minor to the major(z).

Chap. XI. *Of Dissonance.*

172 Cases in which the mode is uncertain.

94. We have already observed, that the mode of *ut* (*fa, ut, sol*), has two sounds in common with the mode of *sol* (*ut, sol, re*); and two sounds in common with the mode of *fa* (*si*♭, *fa, ut*); of consequence, this procedure of the bass *ut sol* may belong to the mode of *ut*, or to the mode of *sol*, as the procedure of the bass *fa ut*, or *ut fa*, may belong to the mode of *ut* or the mode of *fa*. When any one therefore passes from *ut* to *fa* or to *sol* in a fundamental bass, he is still ignorant even to that crisis 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.

173 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 *sol* and *fa* in the same harmony, that is to say, by joining to the harmony *sol si re* of the fifth *sol*, the other fifth *fa* in this manner, *sol, si, re, fa*; this *fa* which is added, forms a dissonance with *sol* (art. 18.) It is for that reason that the chord *sol si re fa*, is called a *dissonant* chord, or a chord of the seventh. It serves to distinguish the fifth *sol* from the generator *ut*, which always implies, without mixture or alteration, the perfect chord *ut, mi, sol, ut*, resulting from nature itself (art. 32.) By this we may see, that when we pass from *ut* to *sol*, one passes at the same time from *ut* to *fa*, because *fa* is found to be comprehended in the chord of *sol*; and the mode of *ut* by these means plainly appears to be determined, because there is none but that mode to which the sounds *fa* and *sol* at once belong.

174 Manner of treating dissonances continued.

96. Let us now see what may be added to the harmony *fa, la, ut*, of the fifth *fa* 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 *sol*, so that the generator *ut*, in passing to *fa*, may at the same time pass to *sol*, and that by this the mode should be determined: but this introduction of *sol*, in the chord *fa, la, ut*, would produce two seconds in succession *fa, sol, sol, la*, that is to say, two dissonances whose union would prove extremely harsh to the ear; an inconvenience which ought carefully to be avoided. For if, to distinguish the mode, we should alter the harmony of the fifth *fa* in the fundamental bass, it must only be altered in the least degree possible.

175 Chord of the great sixth.

97. For this reason, instead of *sol*, we shall take its fifth *re*, which is the sound that approaches it the nearest; and we shall have, instead of the fifth *fa*, the chord *fa, la, ut, re*, which is called a *chord of the great sixth*.

One may here remark the analogy there is observed between the harmony of the fifth *sol* and that of the fifth *fa*.

176 The subject of dissonances continued.

98. The fifth *sol*, in rising above the generator, gives a chord entirely consisting of thirds ascending from *sol*, *sol, si, re, fa*; now the fifth *fa* being below the generator *ut* in descending, we shall find, as we go lower by thirds from *ut* towards *fa*, the same sounds *ut, la, fa, re*, which form the chord *fa, la, ut, re*, given to the fifth *fa*.

99. It appears besides, that the alteration of the harmony in the two fifths consists only in the third minor *re, fa*, which was reciprocally added to the harmony of these two fifths.

Chap. XII. *Of the Double Use or Employment of Dissonance.*

177 Account of the double employment.

100. It is evident by the resemblance of sounds to their octaves, that the chord *fa, la, ut, re*, is in effect the same as the chord *re, fa, la, ut*, taken inversely *, that the inverse of the chord *ut, la, fa, re*, has been found

* See *Inverted*.

(z) There are likewise other minor modes, into which we may pass in our egress from the mode major of *ut*; as that of *fa* minor, in which the perfect minor chord *fa, la*♭, *ut*, includes the sound *ut*, and whose scale in ascent *fa, sol, la*♭, *si*♭, *ut, re, mi, fa*, only includes the two sounds *la*♭, *si*♭, which do not occur in the scale of *ut*. We find an example of this transition from the mode major of *ut* to that of *fa* minor, in the opera of *Pygmalion* by M. Rameau, where the *sarabando* is in the minor mode of *fa*, and the *rigadoon* in the mode major of *ut*. This kind of transition, however, is not frequent.

The minor mode of *re* has only in its scale ascending *re, mi, fa, sol, la, si, ut*♯, *re*, one *ut* sharp which is not found in the scale of *ut*. For this reason a transition may likewise be made, without grating the ear, from the mode of *ut* major to the mode of *re* minor; but this passage is less immediate than the former, because the chords *ut, mi, sol, ut, re, fa, la, re*, not having a single sound in common, one cannot (art. 37.) pass immediately from the one to the other.

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found (art. 98.) in descending by thirds from the generator *ut* (AA).

178 Difference between dominant and tonic dominant.

101. The chord *re*, *fa*, *la*, *ut*, is a chord of the seventh like the chord *sol*, *si*, *re fa*: with this only difference, that in this the third *sol*, *si*, is major: whereas in the second, the third *re*, *fa*, is minor. If the *fa* were sharp, the chord *re*, *fa*※, *la*, *ut*, would be a genuine chord of the dominant, like the chord *sol*, *si*. *re*, *fa*; and as the dominant *sol* may descend to *ut* in the fundamental bass, the dominant *re* implying or carrying with it the third major *fa*※ might in the same manner descend to *sol*.

102. Now I say, that if the *fa*※ should be changed into *fa* natural, *re*, the fundamental tone of this chord *re*, *fa*, *la*, *ut*, might still descend to *sol*; for the change from *fa*※ to *fa* natural, will have no other effect, than to preserve the impression of the mode of *ut*, instead of that of the mode of *sol*, which the *fa*※ would have here introduced. For what remains, the note *re* will always preserve its character as the dominant, on account of the mode of *ut*, which forms a seventh. Thus in the chord of which we treat, *re*, *fa*, *la*, *ut*, *re*, may be considered as an *imperfect dominant*: I call it *imperfect*, because it carries with it the third minor *fa*, instead of the third major *fa*※. It is for this reason that in the sequel I shall call it simply the *dominant*, to distinguish it from the dominant *sol*, which shall be named the *tonic dominant* †.

† See *Dominant*.

103. Thus the sounds *fa* and *sol*, which cannot succeed each other (art. 36.) in a diatonic bass, when they only carry with them the perfect chords *fa*, *la*, *ut*, *sol*, *si*, *re*, may succeed one another if you join *re* to the harmony of the first, and *fa* to the harmony of the second; and if you invert the first chord, that is to say, if you give to the two chords this form, *re*, *fa*, *la*, *ut*, *sol*, *si*, *re*, *fa*.

179 Seeming contradictions reconciled.

104. Besides, the chord *fa*, *la*, *ut*, *re*, being allowed to succeed the perfect chord *ut*, *mi*, *sol*, *ut*, it follows for the same reasons, that the chord *ut*, *mi*, *sol*, *ut*, may be succeeded by *re*, *fa*, *la*, *ut*; which is not contradictory to what we have above said (art. 37.), that the sounds *ut* and *re* cannot succeed one another in the fundamental bass: for in the passage quoted, we had supposed that both *ut* and *re* carried with them a perfect chord major; whereas, in the present case, *re* carries the third minor *fa*, and likewise the sound *ut*, by which the chord *re fa la ut* is connected with that which precedes it *ut mi sol ut*; and in which the sound *ut* is found. Besides, this chord, *re fa la ut*, is properly nothing else but the chord *fa la ut re* inverted, and, if we may speak so, disguised.

180 Double employment, what, and why so called.

105. This manner of presenting the chord of the sub-dominant 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.

† See *Double employment*.

We may add, that as this double employment is a kind of licence, it ought not to be practised without some precaution. We have lately seen that the chord *re fa la ut*, considered as the inverse of *fa la ut re*, may succeed to *ut mi sol ut*, but this liberty is not reciprocal: and though the chord *fa la ut re* may be followed by the chord *ut mi sol ut*, we have no right to conclude from thence that the chord *re fa la ut*, considered as the inverse of *fa la ut re*, may be followed by the chord *ut mi sol ut*. For this the reason shall be given Chap. XVI.

Chap. XIII. *Concerning the Use of this Double Employment, and its Rules.*

181 By the double use of the abovementioned chord, the impression of the mode may be preserved.

106. We have shown (chap. vi.) how the diatonic scale, or ordinary gammut, may be formed from the fundamental bass *fa*, *ut*, *sol*, *re*, by twice repeating the word *sol* in that series; so that this gammut is primitively and originally composed of two similar tetrachords, one in the mode of *ut*, the other in that of *sol*. Now it is possible, by means of this double employment, to preserve the impression of the mode of *ut* through the whole extent of the scale, without twice repeating the note *sol*, or even without supposing this repetition. For this effect we have nothing to do but form the following fundamental bass,

ut, *sol*, *ut*, *fa*, *ut*, *re*, *sol*, *ut*:

in which *ut* is understood to carry with it the perfect chord *ut mi sol ut*; *sol*, the chord *sol si re fa*; *fa*, the chord

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(AA) "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 *re*, *fa*, *la*, *ut*, as the primary chord and generator of the chord *fa*, *la*, *ut*, *re*, which is nothing but that chord itself 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 great artist has neither expressed himself upon this subject with so much uniformity nor with so much precision as is required. For my own part, I think there is some foundation for considering the chord *fa*, *la*, *ut*, *re*, as primitive: 1. Because in this chord, the fundamental and principal note is the sub-dominant *fa*, 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 *re* to the harmony of the fifth *fa* (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."

Thus far our author. We do not enter with him into the controversy concerning the origin of the chord in question; but only propose to add to his definition of the sub-dominant Rousseau's idea of the same note. It is a name, says he, given by M. Rameau to the fourth note in any modulation relative to a given key, which, of consequence is in the same interval from the key in descending as the dominant in rising; from which circumstance it takes its name.

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chord *fa la ut re;* and *re*, the chord *re fa la ut*. It is plain from what has been said in the preceding chapter, that in this case *ut* may ascend to *re* in the fundamental bass, and *re* descend to *sol*, and that the impression of the mode of *ut* is preserved by the *fa* natural, which forms the third minor *re fa*, instead of the third major which *re* ought naturally to imply.

107. This fundamental bass will give, as it is evident, the ordinary diatonic scale,

ut, re, mi, fa, sol, la, si, UT,

which of consequence will be in the mode of *ut* alone; and if one should choose to have the second tetrachord in the mode of *sol*, it will be necessary to substitute *fa*※ instead of *fa* natural in the harmony of *re* (BB).

108. Thus the generator *ut* may be followed according to pleasure in ascending diatonically either by a tonic dominant (*re fa*※ *la ut*), or by a simple dominant (*re fa la ut*).

109. In the minor mode of *la*, the tonic dominant *mi* ought always to imply its third major *mi sol*※, when this dominant *mi* descends to the generator *la* (art. 83.); and the chord of this dominant shall be *mi sol*※ *si re*, entirely similar to *sol si re fa*. With respect to the sub-dominant *re*, it will immediately imply the third minor *fa*, to denominate the minor mode; and we may add *si* above its chord *re fa la*, in this manner *re fa la si*, a chord similar to that of *fa la ut re*; and as we have deduced from the chord *fa la ut re* that of *re fa la ut*, we may in the same manner deduce from the chord *re fa la si* a new chord of the seventh *si re fa la*, which will exhibit the *double employment of dissonances* in the minor mode.

110. One may employ this chord *si re fa la*, to preserve the impression of the mode of *la* in the diatonic scale of the minor mode, and to prevent the necessity of twice repeating the sound *mi*; but in this case, the *fa* must be rendered sharp, and change this chord to *si re fa*※ *la*, the fifth of *si* is *fa*※, as we have seen above; this chord is then the inverse of *re fa*※ *la si*, where the subdominant implies the third major, which ought not to surprise us. For in the minor mode of *la*, the second tetrachord *mi fa*※ *sol*※ *la* is exactly the same as it would be in the major mode of *la*; now, in the major mode of *la*, the sub-dominant *re* ought to imply the third major *fa*※.

182 Diversities in the minor mode more numerous than in the major.

111. From thence we may see that the minor mode is susceptible of a much greater number of varieties than the major: likewise the major mode is the product of 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.*

183 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 sub-dominant, though in some measure insinuated 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.

184 Different chords of the seventh.

113. We have already three different kinds of chords of the seventh, *viz.*

1. The chord *sol si re fa*, composed of a third major followed by two thirds minor.

2. The chord *re fa la ut*, or *si re fa*※ *la*, composed of a third major between two minors.

3. The chord *si re fa la*, composed of 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, *ut mi sol si*, or *fa la ut mi*; the other is wholly composed of thirds minor *sol*※ *si re fa*. 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:

185 The chords last described admissible, and why.

115. According to what has been said above, if we would add a seventh to the chord *ut mi sol*, to make a dominant of *ut*, one can add nothing but *si*♭; and in this case *ut mi sol si*♭ would be the chord of the tonic dominant in the mode of *fa*, as *sol si re fa* is the chord of the tonic dominant in the mode of *ut*; but if you would preserve the impression of the mode of *ut* in the harmony, you then change this *si*♭ into *si* natural, and the chord *ut mi sol si*♭ becomes *ut mi sol si*. It is the same case with the chord *fa la ut mi*, which is nothing else but the chord *fa la ut mi*♭; in which one may substitute for *mi*♭, *mi* natural, to preserve the impression of the mode of *ut*, or of that of *fa*.

Besides, in such chords as *ut mi sol si*, *fa la ut mi*, the sounds *si* and *mi*, though they form a dissonance with

(BB) We need only add, that it is easy to see, that this fundamental bass *ut sol, ut fa, ut re, sol ut*, which formed the ascending scale *ut, re, mi, fa, sol, la, si, UT*, cannot by inverting it, and taking it inversely in this manner *si, ut, sol, re, ut, fa, ut, sol, UT*, form the diatonic scale *UT, si, la, sol, fa, mi, re, ut*, in descent. In reality, from the chord *sol, si, re, fa*, we cannot pass to the chord *re, fa, la, ut*, nor from thence to *ut, mi, sol, ut*. It is for this reason that in order to have the fundamental bass of the scale, *UT, si, la, sol, fa, mi, re, ut*, in descent, we must either determine to invert the fundamental bass mentioned in art. 55. in this manner, *ut, sol, re, sol, ut, fa, ut, sol, ut*, in which the second *sol* and the second *ut* answer to the *sol* alone in the scale; or otherwise we must form the fundamental bass *ut, sol, re, sol, ut, sol, ut*, in which all the notes imply perfect chords major, except the second *sol*, which implies the chord of the seventh *sol, si, re, fa*, and which answers to the two notes of the scale *sol, fa*, both comprehended in the chord *sol, si, re, fa*.

Whichever of these two basses we shall choose, it is obvious that neither the one nor the other shall be wholly in the mode of *ut*, but in the mode of *ut* and in that of *sol*. From 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.

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with *ut* in the first case, and with *fa* in the second, are nevertheless supportable to the ear, because these sounds *si* and *mi* (art. 19.) are already contained and understood, the first in the note *mi* of the chord *ut mi sol si*, as likewise in the note *sol* of the same chord; the second in the note *la* of the chord *fa la ut mi*, as likewise in the note *ut* of the same chord. All together then seem to allow the artist to introduce the note *si* and *mi* into these two chords (CC).

186 Chords of the seventh continued and explained.

116. With respect to the chord of the seventh *sol*✕ *si re fa*, wholely composed of thirds minor, it may be regarded as formed from the union of the two chords of the dominant and of the sub-dominant in the minor mode. In effect, in the minor mode of *la*, for instance, these two chords are *mi sol*✕ *si re*, and *re fa la si*, whose union produces *mi*, *sol*✕, *si*, *re*, *fa*, *la*. Now, if we should suffer this chord to remain thus, it would be disagreeable to the ear, by its multiplicity of dissonances, *re mi*, *mi la*, *la sol*✕, *la si*, *re sol*✕, (art. 18.); so that, to avoid this inconveniency, the generator *la* is immediately expunged, which (art. 19.) is as it were understood in *re*, and the fifth or dominant *mi* whose place the sensible note *sol*✕ is supposed to hold: thus there remains no more than the chord *sol*✕ *si re fa*, wholly composed of thirds minor, and in which the dominant *mi* is considered as understood; in such a manner that the chord *sol*✕ *si re fa* represents the chord of the tonic dominant *mi sol*✕ *si re*, to which we have joined the chord of the sub-dominant *re fa la si*, but in which the dominant *mi* is always reckoned the principal note (DD).

117. Since, then, from the chord *mi sol*✕ *si re*, we may pass to the perfect *la ut mi la*, and *vice versa*, we may in like manner pass from the chord *sol*✕ *si re fa* to the chord *la ut mi la*, and from this last to the chord *sol*✕ *si re fa*: this remark will be very useful to us in the sequel.

Chap. XV. *Of the Preparation of Discords.*

187 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 *fa* is the dissonance of the chord *sol si re fa*, *ut* in the chord *re fa la ut*, &c.

188 Manner of preparing dissonances investigated.

119. When the chord *sol si re fa* follows the chord *ut mi sol ut*, as this may happen, and in reality often happens, it is obvious that we do not find the dissonance *fa* in the preceding chord *ut mi sol ut*. 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 *fa la ut re* follows the chord *ut mi sol ut*, the note *re*, which forms a dissonance with *ut*, is not found in the preceding chord.

It is not so when the chord *re fa la ut* follows the chord *ut mi sol ut*; for *ut*, which forms a dissonance in the second chord, stands as a consonance in the preceding.

189 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 serve to connect the two chords. From whence follows this rule:

190 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. From thence it follows, that in order to prepare a dissonance, it is absolutely necessary that the fundamental bass should ascend by the interval of a second, as

UT mi sol ut, RE fa la ut;

or descend by a third, as

UT mi sol ut, LA ut mi sol;

or descend by a fifth, as

UT mi sol ut, FA la ut mi:

in every other case the dissonance cannot be prepared. This is what may be easily ascertained. If, for instance, the fundamental bass rises by a third, as *ut mi sol ut*, *mi sol si re*, the dissonance *re* is not found in the chord *ut mi sol ut*. The same might be said of *ut mi sol ut*, *sol si re fa*, and *ut mi sol ut*, *si re fa la*, in which the fundamental bass rises by a fifth or descends by a second.

124. It may only be added, that 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 procedure may be regarded as a process from that same tonic to another, which has been

(CC) On the contrary, a chord such as *ut mi*♭ *sol si*, in which *mi* would be flat, could not be admitted in harmony, because in this chord the *si* is not included and understood in *mi*♭. It is the same case with several other chords, such as *si re fa la*✕, *si re*✕ *fa la*, &c. It is true, that in the last of these chords, *la* is included in *fa*, but it is not contained in *re*✕; and this *re*✕ likewise forms with *fa* and with *la* a double dissonance, which, joined with the dissonance *si fa*, 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.

(DD) We have seen (art. 109.) that the chord *si re fa la*, in the minor mode of *la*, may be regarded as the inverse of the chord *re fa la si*; it would likewise seem, that, in certain cases, this chord *si re fa la* may be considered as composed of the two chords *sol si re fa*, *fa la ut re*, of the dominant and of the sub-dominant of the major mode of *ut*; which chords may be joined together, after having excluded from them, 1. The dominant *sol*, represented by its third major *si*, which is presumed to retain its place. 2. The note *ut* which is understood in *fa*, which will form this chord *si re fa la*. The chord *si re fa la*, considered in this point of view, may be understood as belonging to the major mode of *ut* upon certain occasions.

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been rendered a dominant by the addition of the diſſonance.

Moreover, we have ſeen (art. 119. and 120.) that a diſſonance does not ſtand in need of preparation in the chords of the tonic dominant and of the ſub-dominant: from 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 ſubdominant (whether the chord be major or minor) by adding the diſſonance all at once.

Chap. XVI. *Of the Rules for* reſolving *Diſſonances.*

191 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.

192 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 rather to deſcend than to riſe; for this reaſon. Let us take, for inſtance, the chord *ſol ſi re fa* followed by the chord *ut mi ſol ut;* the part which formed the diſſonance *fa* ought to deſcend to *mi* rather than riſe to *ſol*, though both the ſounds *mi* and *ſol* are found in the ſubſequent chord *ut mi ſol ut;* becauſe it is more natural and more conformed to the connection which ought to be found in every part of the muſic, that *ſol* ſhould be found in the ſame part where *ſol* has already been ſounded, whilſt the other part was ſounding *fa*, as may be here ſeen (parts firſt and fourth.)

Firſt part,	- -	*fa mi,*
Second,	- - -	*ſi ut,*
Third,	- - -	*re ut,*
Fourth,	- - -	*ſol ſol,*
Fundamental baſs,	- -	*ſol ut.*

193 Conſequences of the former rule.

127. For the ſame reaſon, in the chord of the ſimple dominant *re fa la ut*, followed by *ſol ſi re fa*, diſſonance *ut* ought rather to deſcend to *ſi* than riſe to *re*.

194 Another conſonance

128. In ſhort, for the ſame reaſon, we ſhall find, that in the chord of the ſub-dominant *fa la ut re*, the diſſonance *re* ought to riſe to *mi* of the following chord *ut mi ſol ut*, rather than deſcend to *ut;* whence may be deduced the following rules.

195 But i- 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 ſubdominant, the diſſonance ought to riſe diatonically upon the third of the ſubſequent chord.

196 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 *re fa la ut*, though one ſhould even conſider it as the inverſe of *fa la ut re*, cannot be ſucceeded by the chord *ut mi ſol ut*, ſince there is not in this laſt chord of *ſi* any note upon which the diſſonance *ut* of the chord *re fa la ut* 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 *re fa la ut*, to *ut mi ſol ut*, it is neceſſary that *re fa la ut* ſhould in this caſe be underſtood as the inverſe of *fa la ut re*. Now the chord *re fa la ut* can only be conceived as the inverſe of *fa la ut re*, when this chord *re fa la ut* precedes or immediately follows the *ut mi ſol ut;* in every other caſe the chord *re fa la ut* is a primitive chord, formed from the perfect minor chord *re fa la*, to which the diſſonance *ut* was added, to take from *re* the character of a tonic. Thus the chord *re fa la ut*, could not be followed by the chord *ut mi ſol ut*, 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, *ut mi ſol ut, re fa la ut, ut mi ſol ut*, it would be much more eaſy and natural to ſubſtitute this other, which furniſhes this natural proceſs, *ut mi ſol ut, fa la ut re, ut mi ſol ut.* 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.*

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 *ut re ut*, performing on the *re* a ſhake, which is commonly called a *cadence;* the modulation will appear to him to be finiſhed after the ſecond *ut*, 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 *ut ſol ut:* but if, inſtead of this baſs, we ſhould give it the following, *ut ſol la;* in this caſe the modulation *ut re ut* would not appear to be finiſhed, and the ear would ſtill expect and deſire ſomething more. This experiment may eaſily be made. 197 The teſt of perfection in cadences to be found in the fundamental baſs.

132. This paſſage *ſol la*, when the dominant *ſol* diatonically aſcends upon the note *la*, inſtead of deſcending by a fifth upon the generator *ut*, as it ought naturally to do, is called a *broken cadence;* becauſe the perfect cadence *ſol ut*, which the ear expected after the dominant *ſol*, is, if we may ſpeak ſo, broken and ſuſpended by the tranſition from *ſol* to *la*. 198 Broken cadences what, and why. See *Cadence.*

133. From thence it follows, that if the modulation *ut re ut* appeared finiſhed when we ſuppoſed no baſs to it at all, it is becauſe its natural fundamental baſs *ut ſol ut* is ſuppoſed to be implied; becauſe the ear deſires ſomething to follow this modulation, as ſoon as it is reduced to the neceſſity of hearing another baſs.

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199 Origin of interrupted cadence in the double employment of dissonances.

134. The interrupted cadence may, as it seems to me, 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 *sol si re fa* to the chord *ut mi sol la*, by converting the tonic *ut* into a sub-dominant, that is to say, by passing all at once from the mode of *ut* to the mode of *sol*: now to descend from *sol si re fa* to *ut mi sol la* is the same thing as to rise from the chord *sol si re fa* to the chord *la ut mi sol*, in changing the chord of the subdominant *ut mi sol la* for the imperfect chord of the dominant, according to the laws of the double employment.

200 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 *sol si re fa*, *la ut mi sol*, the dissonance *fa* is resolved by descending diatonically upon the fifth *mi*.

201 Interrupted cadence, what. See *Cadence*.

136. There is still 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 process of the bass, *sol si re fa*, *mi sol si re*; 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 *fa* is resolved upon the octave of *mi*.

202 Origin of this kind of cadence, likewise in the double employment.

137. This kind of interrupted cadence, as it seems to me, has likewise its origin in the double employment of dissonances. For let us suppose these two chords in succession, *sol si re fa*, *sol si re mi*, where the note *sol* is successively a tonic dominant and sub-dominant; that is to say, in which we pass from the mode of *ut* to the mode of *re*; 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 *sol si re fa*, *mi sol si re*.

Chap. XVIII. *Of the Chromatic Species.*

203 Fundamental bass may be formed by thirds major.

138. The series of 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.

204 A chromatic interval or minor semitone, how found. See fig. K.

139. If then we should form this bass *ut*, *mi*, *sol*※, the two first sounds carrying each along with it their thirds major and fifths, it is evident that *ut* will give *sol*, and that *mi* will give *sol*※: now the semitone which is between this *sol* and this *sol*※ is an interval much less than the semitone which is found in the diatonic scale between *mi* and *fa*, or between *si* and *ut*. This may be ascertained by calculation (EE): it is for this reason that the semitone from *mi* to *fa* is called *major*, and the other *minor* (FF).

140. If the fundamental bass should proceed by thirds minor in this manner, *ut*, *mi*♭, a succession which is allowed when we have investigated the origin of the minor mode (chap. ix.), we shall find this modulation *sol*, *sol*♭, which would likewise give a minor semitone (GG).

205 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 *mi* to *fa*, results from a fundamental bass by fifths *ut fa*, 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 *sol* to *sol*※; they rise at first from *sol* to *la*, then descend from *la* to *sol*※ by the interval of a semitone major; for this *sol* sharp, which is a semitone major below *la*, proves a semitone minor above *sol*. [See the notes (EE) and (FF).]

206 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, *ut*, *la*, gives *ut*, *ut*※ (HH);

(EE) In reality, *ut* being supposed 1, as we have always supposed it, *mi* is $\frac{4}{5}$, and *sol*※ $\frac{25}{16}$: now *sol* being $\frac{3}{2}$, *sol*※ then shall be to *sol* as $\frac{25}{16}$ to $\frac{3}{2}$; that is to say, as 25 times 2 to 3 times 16: the proportion then of *sol*※ to *sol* is as 25 to 24, an interval much less than that of 16 to 15, which constitutes the semitone from *ut* to *si*, or from *fa* to *mi* (note L.)

(FF) It may be observed, that a minor joined to a major semitone will form a minor tone; that is to say, if one rises, for instance, from *mi* to *fa*, by the interval of a semitone major, and afterwards from *fa* to *fa*※ by the interval of a minor semitone, the interval from *mi* to *fa*※ will be a minor tone. For let us suppose *mi* to be 1, *fa* will be $\frac{16}{15}$, and *fa*※ will be $\frac{25}{24}$ of $\frac{16}{15}$; that is to say, 25 times 16 divided by 24 times 15, or $\frac{10}{9}$; *mi* then is to *fa*※ as 1 is to $\frac{10}{9}$, the interval which constitutes the minor tone (note N.)

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 $\frac{9}{8}$, the interval which constitutes (note N) 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 give still less.

(GG) In effect, *mi*♭ being $\frac{6}{5}$, *sol*♭ will be $\frac{6}{5}$ of $\frac{6}{5}$; that is to say, (note C) $\frac{36}{25}$: now the proportion of $\frac{3}{2}$ to $\frac{36}{25}$ (note C) is that of 3 times 25 to 2 times 36; that is to say, as 25 to 24.

(HH); and the series of thirds major in descending, *ut*, *la*♭, gives *ut*, *ut*♭, (II).

207 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.*

208 Diesis or enharmonic interval, what, and how formed. * See *Fourth of a Tone.*

144. The two extremes, or highest and lowest notes, *ut sol*♯, of the fundamental bass by thirds major, *ut mi sol*♯, give this modulation *ut fi*♯; and these two sounds *ut*, *fi*♯, differ between themselves by a small interval which is called the *diesis*, or *enharmonic fourth** *of a tone* (LL), which is the difference between a semitone major and a semitone minor (MM). 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.

209 Manner of seemingly introducing this interval upon instruments of fixed scales.

145. We have explained (art. 116.) in what manner the chord *sol*♯ *fi re fa* 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 cord of the dominant (art. 116.) from thence we may pass to that of the tonic or generator *la* (art. 117.). But we must remark,

1. That this chord *sol*♯ *fi re fa*, entirely consisting of thirds minor, may be inverted or modified according to the three following arrangements, *fi re fa sol*♯, *re fa sol*♯ *fi*, *fa sol*♯ *fi re*; 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 *fa* and *sol*♯ entirely just; for a true third minor, as that from *mi* to *sol* in the diatonic scale, is composed of a semitone and a tone both major. Now from *fa* to *sol* there is a tone major, and from *sol* to *sol*♯ there is only a minor semitone. There is then awanting (art. 144.) the enharmonic fourth of a tone, to render the third *fa sol*♯ 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,

fi	*re*	*fa*	*sol*♯
re	*fa*	*sol*♯	*fi*,
fa	*sol*♯	*fi*	*re*,

which are absolutely the same, for chords composed every one of thirds minor exactly just.

Now the chord *sol*♯ *fi re fa*, belonging to the minor mode of *la*, where *sol*♯ is the sensible note; the chord *fi re fa sol*♯, or *fi re fa la*♭, will, for the same reason, belong to the minor mode of *ut*, where *fi* is the sensible note. In like manner, the chord *re fa sol*♯ *fi*, or *fi re fa la*♭ *ut*♭, will belong to the minor mode of *mi*♭, and the chord *fa sol*♯ *fi re*, or *fa la*♭ *ut*♭ *mi*♭♭, to the minor mode of *sol*♭.

After having passed then by the mode of *la* to the chord *sol*♯ *fi re fa* (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 *ut* minor, of *mi*♭ minor, or of *sol*♭ minor; that is to say, into the modes which have nothing, or almost nothing,

(HH) *La* being $\frac{5}{6}$, *ut*♯ is $\frac{5}{4}$ of $\frac{5}{6}$; that is to say $\frac{25}{24}$, and *ut* is 1: the proportion then between *ut* and *ut*♯ is that of 1 to $\frac{25}{24}$, or of 24 to 25.

(II) *La*♭ being the third major below *ut*, will be $\frac{4}{5}$ (note c): *ut*♭, then, is $\frac{7}{5}$ of $\frac{4}{5}$; that is to say $\frac{24}{25}$. The proportion, then, between *ut* and *ut*♭, is as 25 to 24.

(LL) *Sol*♯ being $\frac{25}{16}$ and *fi*♯ being $\frac{5}{4}$ of $\frac{25}{16}$, we shall have *fi*♯ equal (note c) 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 *fi*♯ in question must be considerably lower than *ut*.

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 tone 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 $\frac{1}{43}$, 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 FF) 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.

(MM) That is to say, that if you rise from *mi* to *fa*, for instance, by the interval of a semitone major, and afterwards, returning to *mi*, 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, *fa*+, the two sounds *fa*+ and *fa* will form the enharmonic fourth of a tone: for *mi* being 1, *fa* will be $\frac{16}{15}$; and *fa*+ $\frac{25}{24}$: the proportion then between *fa*+ and *fa* is that of $\frac{25}{24}$ to $\frac{16}{15}$ (note c); 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.

Theory of Harmony.

nothing, in common with the minor mode of *la*, and which are entirely foreign to it (†).

210 The alteration, how ever, by which it is effectuated, abrupt and fenfible.

146. It muft, however, be acknowledged, that a tranfition fo abrupt, and fo little expected, cannot deceive nor elude the ear; it is ftruck with a fenfation fo unlooked-for without being able to account for the paffage to itfelf. And this account has its foundation in the enharmonic fourth of a tone; which is overlooked as nothing, becaufe it is inappretiable by the ear; but of which, though its value is not afcertained, the whole harfhnefs is fenfibly perceived. The inftant of furprife, however, immediately vanifhes; and that aftonifhment is turned into admiration, when one feels himfelf tranfported as it were all at once, and almoft imperceptibly, from one mode to another, which is by no means relative to it, and to which he never could have immediately paffed by the ordinary feries of fundamental notes.

Chap. XX. *Of the Diatonic Enharmonic Species.*

See *fig.* M.

147. If we form a fundamental bafs, which rifes alternately by fifths and thirds, as *fa*, *ut*, *mi*, *fi*, this bafs will give the following modulation, *fa*, *mi*, *mi*, *re*※; in which the femitones from *fa* to *mi*, and from *mi* to *re*※, are equal and major (NN).

See *Enharmonic.*

This fpecies of modulation or of harmony, in which all the femitones are major, is called the *enharmonic diatonical* fpecies. The major femitones peculiar to this fpecies give it the name of *diatonic*, becaufe major femitones belong to the diatonic fpecies; and the tones which are greater than major by the excefs of a fourth, refulting from a fucceffion of major femitones, give it the name of *enharmonic* (note LL).

Chap. XXI. *Of the Chromatic Enharmonic Species.*

211 Chromatic enharmonic intervals, how formed. *See fig.* N.

148. If we pafs alternately from a third minor in defcending to a third major in rifing, as *ut*, *ut*, *la*, *ut*※, *ut*※, we fhall form this modulation *mi*♭, *mi*, *mi*, *mi*, *mi*※, in which all the femitones are minor (OO).

This fpecies is called the *chromatic enharmonical* fpecies: the minor femitones peculiar to this kind give it the name of *chromatic*, becaufe minor femitones belong to the chromatic fpecies; and the femitones which are leffer by the diminution of a fourth refulting from a fucceffion of minor femitones, give it the name of *enharmonic* (note LL).

212 From this fpecies, the effects of harmony and melody appear to be in the fundamental bafs.

149. Thefe new fpecies confirm what we have all along faid, that the whole effects of harmony and melody refide in the fundamental bafs.

213 Diatonic fpecies moft agreeable, and why.

150. The diatonic fpecies is the moft agreeable, becaufe the fundamental bafs which produces it is formed from a fucceffion of fifths alone, which is the moft natural of all others.

214 The chromatic next.

151. The chromatic being formed from a fucceffion of thirds, is the moft natural after the preceding.

215 Laftly, the enharmonic.

152. Finally, the enharmonic is the leaft agreeable of all, becaufe the fundamental bafs which gives it is not immediately indicated by nature. The fourth of a tone which conftitutes this fpecies, and which is itfelf inappretiable to the ear, neither produces nor can produce its effect, but in proportion as imagination fuggefts the fundamental bafs from whence it refults; a bafs whofe procedure is not agreeable to nature, fince it is formed of two founds which are not contiguous one to the other in the feries of thirds (art. 144.)

Chap. XXII. *Showing that Melody is the Offspring of Harmony.*

216 The effects of melody to be inveftigated in harmony expreffed or underftood.

153. All that we have hitherto faid, as it feems to me, is more than fufficient to convince us, that melody has its original principle in harmony; and that it is in harmony, expreffed or underftood, that we ought to look for the effects of melody.

154. If this fhould ftill appear doubtful, nothing more is neceffary than to pay due attention to the firft experiment (art. 19.), where it may be feen that the principal found is always the loweft, and that the fharper founds which it generates are with relation to it what the treble of an air is to its bafs.

155. Yet more, we have proved, in treating of broken cadence (chap. xvii.), that the diverfification of baffes

(†) As this method for obtaining or fupplying enharmonic gradations cannot be practifed on every occafion when the compofer or practitioner would wifh to find them, efpecially upon inftruments where the fcale is fixed and invariable, except by a total alteration of their œconomy, and re-tuning the ftrings, Dr Smith in his Harmonics has propofed an expedient for redreffing or qualifying this defect, by the addition of a greater number of keys or ftrings, which may divide the tone or femitone into as many appretiable or fenfible intervals as may be neceffary. For this, as well as for the other advantageous improvements which he propofes in the ftructure of inftruments, we cannot with too much warmth recommend the perufal of his learned and ingenious book to fuch of our readers as afpire to the character of genuine adepts in the theory of mufic.

(NN) It is obvious, that if *fa* in the bafs be fuppofed 1, *fa* of the fcale will be 2, *ut* of the bafs $\frac{3}{2}$, and *mi* of the fcale $\frac{5}{4}$ of $\frac{3}{2}$, that is, $\frac{15}{8}$; the proportion of *fa* to *mi* is as 2 to $\frac{15}{8}$, or as 1 to $\frac{15}{16}$. Now *mi* of the bafs being likewife $\frac{5}{4}$ of $\frac{3}{2}$, or $\frac{15}{8}$; *fi* of the bafs is $\frac{3}{2}$ of $\frac{15}{8}$, and its third major *re*※ $\frac{5}{4}$ of $\frac{3}{2}$ of $\frac{15}{8}$, or $\frac{15}{8}$ of $\frac{15}{8}$; this third major, approximated as much as poffible to *mi* in the fcale by means of octaves, will be $\frac{15}{16}$ of $\frac{15}{8}$: *mi* then of the fcale will be to *re*※ which follows it, as $\frac{15}{8}$ is to $\frac{15}{16}$ of $\frac{15}{8}$, that is to fay, as 1 to $\frac{15}{16}$. The femitones then from *fa* to *mi*, and from *mi* to *re*※, are both major.

(OO) It is evident that *mi*♭ is $\frac{6}{5}$ (note C), and that *mi* is $\frac{5}{4}$: thefe two *mi*'s, then, are between themfelves as $\frac{6}{5}$ to $\frac{5}{4}$, that is to fay, as 6 times 4 to 5 times 5, or as 24 to 25, the interval which conftitutes the minor femitone. Moreover, the *la* of the bafs is $\frac{5}{6}$, and *ut*※ $\frac{5}{4}$ of $\frac{5}{6}$, or $\frac{25}{24}$: *mi*※ then is $\frac{5}{4}$ of $\frac{25}{24}$, the *mi* in the fcale is likewife to the *mi*※ which follows it, as 24 to 25. All the femitones therefore in this fcale are minor.

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 nothing to do but examine the different baſſes which may be given to this very ſimple modulation *ſol, ut;* of which it will be found ſuſceptible of a great many, and each of theſe baſſes will give a different character to the modulation *ſol ut*, though in itſelf it remains always the ſame; in ſuch a manner that we may change the whole nature and effects of a modulation, without any other alteration except that of changing its fundamental baſs.

M. Rameau has ſhown, in his *New Syſtem of Muſic*, printed at Paris 1726, p. 44. that this modulation *ſol ut*, 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?

217 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 (PP).

2. That the character of a juſt harmony is only to form in ſome meaſure one ſyſtem with the modulation, 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 from thence 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 licence 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 *ut*, to repreſent all the major modes in general, and the minor mode of *la* 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.

218 Compoſition in harmony, what. See *Compoſition.*

158. Composition, which is likewiſe called *counterpoint*, is not only the art of compoſing an agreeable air, but alſo that of compoſing a great many 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.*

219 Particular intervals ſignified by different names, and why.

159. In the introduction (art. 9.), which is at the front of this treatiſe, we have ſeen a detail of the moſt common names which are given to the different intervals. But there are particular intervals which have obtained different names, according to particular circumſtances; which it is proper to explain.

220 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 *ut* to *re*♯ in aſcending, or that of *la* to *ſol*♭ deſcending.

221 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 you deduce that ſharp or that flat, the interval will be that of a ſecond.

222 Falſe fifth, what.

161. An interval compoſed of two tones and two ſemitones, as that from *ſi* to *fa*, is called a *falſe fifth.* This interval is the ſame with the *triton* (art. 9.), ſince two tones and two ſemitones are equivalent to three tones. There are, however, ſome reaſons for diſtinguiſhing them, as will appear below.

223 Fifth redundant, what.

162. As the interval from *ut* to *re*♯ in aſcending has been called a ſecond redundant, they likewiſe call the interval from *ut* to *ſol*♯ in aſcending a *fifth redundant*, or from *ſi* to *mi*♭ in deſcending, each of which intervals are compoſed of four tones.

224 Diſtinguiſhed from the fixth minor.

This interval is, in the main, the ſame with that of the ſixth minor (art. 6.): but in the ſifth redundant there is always a ſharp or a flat; inſomuch, that if this ſharp or flat were deduced, the interval would become a true fifth.

225 Seventh diminiſhed, what.

163. For the ſame reaſon, an interval compoſed of three tones and three ſemitones, as from *ſol*♯ to *fa* in aſcending,

(PP) There are likewiſe ſeveral eminent muſicians, who in their compoſitions, if we can depend on what has been affirmed, begin with determining and writing the baſs. This method, however, appears in general more proper to produce a learned and harmonious muſic, than a ſtrain prompted by genius and animated by enthuſiaſm.

Principles of Composition.

ascending, is called a *seventh diminished;* because, if you deduce the sharp from *sol*, the interval from *sol* to *fa* 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.)

226 Seventh major and redundant coincident.

164. The major seventh is likewise sometimes called a *seventh redundant* (QQ.)

CHAP. II. *Comparison of the Different Intervals.*

227 Notes in different octaves or scales replications each of the other.

165. If we sing *ut si* in descending by a second, and afterwards *ut si* in ascending by a seventh, these two *si*'s shall be octaves one to the other; or, as we commonly express it, they will be *replications* one of the other.

228 Hence to descend to one replication, and rise to another, has the same effect.

166. On account then of the resemblance between every sound and its octave (art. 22.), it follows, that *to rise by a seventh*, or *descend by a second*, amount to one and the same thing.

167. In like manner, it is evident that the sixth is nothing but a replication of the third, nor the fourth but a replication of the fifth.

229 Detail of replications.

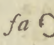
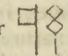
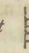
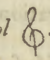
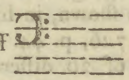
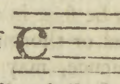
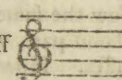
168. The following expressions either are or ought to be regarded as synonymous.

230 Examples of this.

To rise / To descend	by a second.	To descend / To rise	by a seventh.
To rise / To descend	by a third.	To descend / To rise	by a sixth.
To rise / To descend	by a fourth.	To descend / 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 different Cleffs; of the Value or Quantity; of the Rithmus; and of Syncopation.*

170. There are three cleffs * in music; the cleff of *fa* , or ; the cleff *ut* ; and the cleff of *sol* . But, in Britain, the following characters are used: The F, or bass-cleff ; the C, or tenor cleff ; and the G, or treble cleff .

* See Cleff.

231 Cleffs, what,

232 and how placed. See fig. O.

The cleff of *fa* is placed on the fourth line, or on the third; and the line upon which this cleff is placed gives the name of *fa* or *F*, to all the notes which are upon that line.

See fig. P.

The cleff of *ut* is placed upon the fourth, the third, the second, or the first line; and in these different positions all the notes upon that line where the cleff is placed take the name of *ut*, or *C*.

See fig. Q.

Lastly, the cleff of *sol* is placed upon the second or first line; and all the notes upon that line where the cleff is placed take the name of *sol*, or *G*.

233 Names of notes to be investigated from the position of the cleffs. See fig. O.

171. As the notes are placed on the lines, and in the spaces between the lines, any one, when he sees the cleff, may easily find the name of any note whatever. Thus he may see, that, in the first cleff of *fa*, the note which is placed on the lowest line ought to be *sol;* that the note which occupies the space between the two first lines should be *la;* and that the note which is on the second line is a *si*, &c. (RR).

5 172. A

(QQ) The chief use of these different denominations is 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.

(RR) It is on account of the different compasses of voices and instruments that these cleffs have been invented.

The masculine voice, which is the lowest, may at its greatest depth, without straining, descend to *sol*, which is in the last line of the first cleff of *fa;* and the female voice, which is the sharpest, may at its highest pitch rise to a *sol*, which is a triple octave above the former.

The lowest of masculine voices is adapted to a part which may be called a *mean bass*, and its cleff is that of *fa* on the fourth line; this cleff is likewise that of the violoncello and of the deepest instruments. A mean bass extremely deep is called a *baritonus* or *counter-bass*.

The masculine voice which is next in depth to what we have called the *mean bass* may be termed the *concordant bass*. Its cleff is that of *fa* on the third line.

The masculine voice which follows the *concordant bass* may be denominated a *tenor;* a voice of this pitch is the most common, yet seldom extremely agreeable. Its cleff is that of *ut* on the fourth line. This cleff is also that of the bassoon or bass-hautboy.

The highest masculine voice of all may be called *counter tenor*. Its cleff is that of *ut* on the third line. It is likewise the cleff of tenor violins, &c.

The deepest female voice immediately follows the counter tenor, and may be called *bass in alt*. Its cleff is that of *ut* upon the first line. The cleff of *ut* upon the second line is not in frequent use.

The sharpest female voice is called *treble;* its cleff is that of *sol* on the second line.

This last cleff, as well as that of *sol* on the first line, is likewise the cleff of the sharpest instruments, such as the violin, the flute, the trumpet, the hautboy, the flagelet, &c.

The *ut* which may be seen in the cleffs of *fa* and in the cleffs of *ut* is a fifth above the *fa* which is on the line of the cleff of *fa;* and the *sol* which is on the two cleffs of *sol* is a fifth above *ut:* insomuch that *sol* which is

234 Marks and powers of ſharps, flats, and naturals, what.

172. A note before which there is a ſharp (marked thus ※) ought to be raiſed by a ſemitone; and if, on the contrary, there is a ♭ before it, it ought to be depreſſed by a ſemitone, (♭ being the mark of a flat).

The natural (marked thus ♮) reſtores to its natural value a note which had been raiſed or depreſſed by a ſemitone.

173. When you place at the cleff a ſharp or a flat, all the notes upon the line on which this ſharp or flat is marked are ſharp or flat. Thus let us take, for inſtance, the cleff of *ut* upon the firſt line, and let us place a ſharp in the ſpace between the ſecond and third line, which is the place of *fa*; all the notes which ſhall be marked in that ſpace will be *fa*※; and if you would reſtore them to their original value of *fa* natural, you muſt place a ♮ or a ♭ before them. *See fig.* R. *See fig.* S.

In the ſame manner, if a flat be marked at the cleff, and if you would reſtore the note to its natural ſtate, you muſt place a ♮ or a ※ before it. *See fig.* X.

235 Bars and times, what.

174. Every piece of muſic is divided into different equal times, which they call *meaſures* or *bars*; and each bar is likewiſe divided into different times.

There are properly two kinds of meaſures or modes of time (*See* T): the meaſure of two times, or of common time, which is marked by the figure 2 placed at the beginning of the tune; and the meaſure of three times, or of triple time, which is marked by the figure 3 placed in the ſame manner. (*See* V.) See *Time*.

The different bars are diſtinguiſhed by perpendicular lines.

In a bar we diſtinguiſh between the *perfect* and *imperfect* time; the *perfect* time is that which we *beat*, the *imperfect* that in which we *lift up the hand or foot*. A bar conſiſting of four times ought to be regarded as compounded of two bars, each conſiſting of two times: thus there are in this bar two perfect and two imperfect times. In general, by the words *perfect* and *imperfect*, even the parts of the ſame time are diſtinguiſhed: thus the firſt note of each time is reckoned as belonging to the *perfect* part, and the others as belonging to the *imperfect*. *See fig.* V.

236 The value of notes in duration.

175. The longeſt of all notes is a ſemibreve. A minim is half its value; that is to ſay, in ſinging, we only employ the ſame duration in performing two minims which was occupied in one ſemibreve. A minim in the ſame manner is equivalent to two crotchets, the crotchet to two quavers, &c.

237 Syncopation, what.

176. A note which is divided into two parts by a time, that is to ſay, which begins at the end of a time, and terminates in the time following, is called (ss) a *ſyncopated note*. (*See* Z; where the notes *ut*, *ſi*, and *la*, are each of them ſyncopated.) (†). See *Syncopation*.

177. A

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is on the loweſt line of the firſt cleff of *fa*, is lower by two whole octaves than the *ſol* which is on the loweſt line of the ſecond cleff of *ſol*.

[Thus far the tranſlator has followed his original as accurately as poſſible; but this was by no means an eaſy taſk. Among all the writers on muſic which he has found in Engliſh, there is no ſuch thing as different names for each particular part which is employed to conſtitute full or complete harmony. He was therefore under a neceſſity of ſubſtituting by analogy ſuch names as appeared moſt expreſſive of his author's meaning. To facilitate this attempt, he examined in Rouſſeau's muſical dictionary the terms by which the different parts were denominated in D'Alembert; but even Rouſſeau, with all his depth of thought and extent of erudition, inſtead of expreſſing himſelf with that preciſion which the ſubject required, frequently applies the ſame names indiſcriminately to different parts, without aſſigning any reaſon for this promiſcuous and licentious uſe of words. The Engliſh reader therefore will be beſt able to form an accurate idea of the different parts, by the nature and ſituation of the cleffs with which they are marked; and if he ſhould find any impropriety in the names which are given them, he may adopt and aſſociate others more agreeable to his ideas.]

(ss) Syncopation conſiſts in a note which is protracted in two different times belonging partly to the one and partly to the other, or in two different bars; yet not ſo as entirely to occupy or fill up the two times, or the two bars. A note, for inſtance, which begins in the imperfect time of a bar, and which ends in the perfect time of the following, or which in the ſame bar begins in the imperfect part of one time and ends in the perfect of the following, is ſyncopated. A note which of itſelf occupies one or two bars, whether the meaſure conſiſts of two or three times, is not conſidered as ſyncopated: this is a conſequence of the preceding definition. This note is ſaid to be *continued* or *protracted*. In the end of the example Z, the *ut* of the firſt bar conſiſting of three times is not ſyncopated, becauſe it occupies two whole times. It is the ſame caſe with *mi* of the ſecond bar, and with the *ut* of the fourth and fifth. Theſe therefore are continued or protracted notes.

(†) *Times* and *bars* in muſic anſwer the very ſame end as punctuation in language. They determine the different periods of the movement, or the various degree of completion, which the ſentiment, expreſſed by that movement, has attained. Let us ſuppoſe, for inſtance, a compoſer in muſic intending to expreſs grief or joy, in all its various gradations, from its firſt and fainteſt ſenſation, to its acme or higheſt poſſible degree. We do not ſay that ſuch a progreſs of any paſſion either has been or can be delineated in practice, yet it may ſerve to illuſtrate what we mean to explain. Upon this hypotheſis, therefore, the degrees of the ſentiment will paſs from leſs to more ſenſible, as it riſes to its moſt intenſe degree. The firſt of theſe gradations may be called a *time*, which is likewiſe the moſt convenient diviſion of a bar or meaſure into its elementary or aliquot parts, and may be deemed equivalent to a comma in a ſentence; a bar denotes a degree ſtill more ſenſible, and may be conſidered as having the force of a ſemicolon; a ſtrain brings the ſentiment to a tolerable degree of perfection, and may be reckoned equal to a colon: the full period is the end of the imitative piece. It muſt have been remarked by obſervers of meaſure in melody or harmony, that the notes of which a bar or meaſure conſiſts, are not diverſified by their different durations alone, but likewiſe by greater or leſſer degrees of emphaſis.

238 Value of a pointed note.

177. A note followed by a point or dot is increased half its value. The *si*, for instance, in the fifth bar of the example Y, followed by a point, has the value (*) or duration of a minim and of a crotchet at the same time.

Chap. IV. *Containing a Definition of the principal Chords.*

239 Perfect chords, what.

178. The chord composed of a third, a fifth, and an octave, as *ut mi sol ut*, is called a *perfect chord* (art. 32.)

If the third be major, as in *ut mi sol ut*, the perfect chord is denominated *major:* if the third be minor, as in *la ut mi la*, the perfect chord is minor. The perfect chord major constitutes what we call the *major mode;* and the perfect chord minor, what we term the *minor mode* (art. 31).

240 Chord of the seventh, what, and how to be practised.

179. A chord composed of a third, a fifth, and a seventh, as *sol si re fa*, or *re fa la ut*, &c. is called a *chord of the seventh.* It is obvious that 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 *ut mi♭ sol si;* and that which might carry a false fifth and a seventh major, as *si re fa la*✻, (chap. xiv. Part I)

241 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, *si re fa la*, which is composed of a third, a false fifth, and a seventh.

242 Of the greater sixth, what.

181. A chord composed of a third, a fifth, and a sixth, as *fa la ut re*, *re fa la si*, is called a *chord of the greater sixth.*

243 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 *ut*'s equally carry a perfect chord.

244 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. *re* carries the chord *re fa la ut*, and *sol* the chord *sol si re fa.*

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.

[244] 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. *fa* caries the chord of *fa la ut re.* You ought to remark that the sixth should always be major, (art. 97, and 109).

245 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 *ut* in the example I. *re* and *sol* in the example II. and *fa* in the example III. are fundamental notes.

246 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 *sol si re fa*, *re fa la ut*, *fa* and *ut* are the dissonances, viz. *fa* with relation to *sol* in the first chord, and *ut* with relation to *re* in the second. In the chord of the great sixth *fa la ut re*, *re* is the dissonance (art. 120.); but that *re* is only, properly

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phasis. The most emphatic parts of a bar are called the *accented parts;* those which require less energy in expression are called the *unaccented.* The same observation holds with regard to times as bars. The stroke, therefore, of the hand or foot in beating marks the accented part of the bar, the elevation or preparation for the stroke marks the unaccented part. Let us once more resume our composition intended to express the different periods in the progress of grief or joy. There are some revolutions in each of these so rapid as not to be marked by any sensible transition whether diatonic or consonant. In this case, the most expressive tone may be continued from one part of a time or measure to another, and end before the period of that time or measure in which it begins. Here therefore is a natural principle upon which the practice of syncopation may be founded even in melody: but when music is composed in different parts to be simultaneously heard, the continuance of one note not divided by regular times and measures, nor beginning and ending with either of them, whilst the other parts either ascend or descend according to the regular divisions of the movement, has not only a sensible effect in rendering the imitation more perfect, but even gives the happiest opportunities of diversifying the harmony, which of itself is a most delightful perception.

For the various dispositions of accent in times and measures, according to the movement of any piece, see a Treatise on Music by Alexander Malcolm.

For the opportunity of diversifying harmony afforded by syncopation, see Rameau's Principles of Composition.

(*) To prevent ambiguity or confusion of ideas, it is necessary to inform our readers, that we have followed M. D'Alembert in his double sense of the word *value*, though we could have wished he had distinguished the different meanings by different words. A sound may be either estimated by its different degrees of intenseness, or by its different quantities of duration.

To signify both those ideas the word *value* is employed by D'Alembert. The reader, therefore, will find it of importance to distinguish the value of a note in height from its value in duration. This he may easily do, by considering whether the notes are treated as parts of the diatonic scale, or as continued for a greater or lesser duration.

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properly ſpeaking, a diſſonance with relation to *ut* from which it is a *ſecond*, and not with reſpect to *fa* from which it is a *ſixth major* (art 17, and 18).

247 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 *ſol ſi re fa*, the fundamental *ſol* is the *tonic dominant;* but in the other chords of the ſeventh, as *ut mi ſol ſi*, *re fa la ut*, &c. the fundamentals *ut* and *re* are *ſimple dominants.*

248 Major chords, how rendered minor, and *vice verſa.*

188. In every chord, whether perfect, or of the ſeventh, or of the ſixth, if you have a mind that the third above the fundamental note ſhould be major, though it is naturally minor, you muſt place a ſharp above the fundamental note. For example, if I would mark the perfect major chord *re fa*※ *la re*, as the third *fa* above *re* is naturally minor, I place above *re* a ſharp, as you may ſee in example IV. In the ſame manner the chord of the ſeventh *re fa*※ *la ut*, and the chord of the great ſixth *re fa*※ *la ſi*, is marked with a ※ above *re*, and above the ※ a 7 or a 6 (ſee V. and VI.).

On the contrary, when the third is naturally major, and if you ſhould incline to render it minor, you muſt place above the fundamental note a ♭. Thus the examples VII. VIII. IX. ſhow the chords *ſol ſi*♭ *re ſol*, *ſol ſi*♭ *re fa*, *ſol ſi*♭ *re mi* (TT).

Chap. V. *Of the Fundamental Baſs.*

249 Fundamental baſs, how formed.

189. Invent a modulation at your 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. XVIII.) you will find that this modulation, *ut re mi fa ſol la ſi ut*, has or may admit for its fundamental baſs, *ut* $\overset{7}{\textit{ſol}}$ *ut* $\overset{6}{\textit{fa}}$ $\overset{7}{\textit{ut}}$ $\overset{7}{\textit{re}}$ *ſol ut.*

In reality, the firſt note *ut* in the upper part is found in the chord of the firſt note *ut* in the baſs, which chord is *ut mi ſol ut;* the ſecond note *re* in the treble is found in the chord *ſol ſi re fa*, 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.*

250 Rules for the formation of this 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

(TT) 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 the cleff of *fa* (ſee Exam. X.), one may ſatiſfy himſelf with ſimply writing *re*, without a ſharp to mark the perfect chord major of *re*, *re fa*※ *la re.* In the ſame manner, in the Example XI. where the flat is at the cleff upon *ſi*, one may ſatiſfy himſelf with ſimply writing *ſol*, to mark the perfect chord minor of *ſol ſi*♭ *re ſol.*

But if a caſe occurs where there is a ſharp or a flat at the cleff, if any one ſhould wiſh to render the chord minor which is major, or *vice verſa*, he muſt place above the fundamental note a ♮ or natural. Thus the Example XII. marks the minor chord *re fa la re*, and Example XIII. the major chord *ſol ſi re ſol.*—Frequently, in lieu of a natural, a flat is uſed to ſignify the minor chord, and a ſharp to ſignify the major. Thus Example XIV. marks the minor chord *re fa la re*, and Example XV. the major chord *ſol ſi re ſol.*

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, they write before or after the 6 a ※; and if this ſixth ſhould be flat according to the cleff, they 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, they 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 a ſharp on the cleff of *fa*, and if I ſhould incline to mark the chord *ſol ſi re fa*, or the chord *la ut mi fa*, I would place before the ſeventh or the ſixth a ♮ or a ♭.

In the ſame manner, if there be a flat on the cleff at *ſi*, and if I ſhould incline to mark the chord *ut mi ſol ſi*, I would place before the ſeventh a ※ or a ♮; and ſo of the reſt.

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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 *fa la ut re*, it is necessary that *fa*, *la*, or *ut*, which are the consonances of the chord, should be found in the chord preceding. The dissonance *re* 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 you choose; 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 you will presently see. For let us assume the succession of the two chords *la ut*※ *mi sol*, *re fa la ut* (see Exam. XIX.), this succession is by no means legitimate, though in it the first dominant descends by a fifth; because the *ut* 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, one should take away the sharp carried by the *ut* in the first; or if, without meddling with the first chord, one should render *ut* or *fa* sharp in the second (UU); or in short, if one should simply render the *re* of the second chord a tonic dominant, in causing it to carry *fa*※ instead of *fa* natural (119. & 122.).

It is likewise by the same rule that we ought to reject the succession of the two following chords,

re fa la ut, *sol si re fa*※;

(see Exam. XX.).

RULE V.

195. Every sub-dominant ought to rise by a fifth; and the note which follows it may, at your pleasure, be either a tonic, a tonic dominant, or a sub-dominant.

REMARK.

251 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 nothing but consequences from them, and which you may pass unnoticed if you think it proper.

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 XXI. and XXII. (XX); a *tonic dominant* (124.), see XXIII. and XXIV.; or a *sub-dominant* (124.), see XXV. and XXVI.; or, to express the rule more simply, that second note may be any one you please, 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. XXVII. and XXVIII.; or a tonic dominant, or a simple dominant, yet in such a manner that the rule of art. 192. may be observed (124.), see XXIX. XXX. XXXI. XXXII.; or a sub-dominant (124.), see XXXIII. and XXXIV.

The procedure of the bass *ut mi*♭ *sol ut*, *fa la ut mi*, from the tonic *ut* to the dominant *fa* (Ex. XXXV.), 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 XXXVI. and XXXVII. (YY).

We must here advertise our readers, that the examples XXXVIII. XXXIX. XL. XLI. belong to the fourth rule above, art. 194.; and the examples XLII. XLIII. XLIV. to the fifth rule above, art. 195. See the articles 34, 35, 121, 123, 124.

REMARK I.

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 cadences are formed at the distance of four bars one from another, whilst the tonic then falls within the first time of the bar. See XLV. and XLVI. 252 Perfect and imperfect cadences, what, and how employed.

REMARK II.

197. We must avoid, as much as we can, syncopations in the fundamental bass; that, within the first time of which a bar is constituted, the ear may be entertained with a harmony different from that which it had 253 Syncopation only admissible in the fundamental bass by licence.

(UU) In this chord it is necessary that the *ut* and *fa* should be sharp at the same time; for the chord *re fa la ut*※, in which *ut* would be sharp without the *fa*, is excluded by art. 179.

(XX) 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 I ascend from the tonic *ut* to the tonic *mi*, the major mode of *ut*, *ut mi sol ut*, will be changed into the minor mode of *mi*, *mi sol si mi*. For what remains, we must never ascend from one tonic to another, when there is no sound common to both their modes: for example, you cannot rise to the mode of *ut*, *ut mi sol ut*, from the minor mode of *mi*♭, *mi*♭ *sol*♭ *si*♭ *mi*♭ (91.)

(YY) By this we may see, that all the intervals, viz. the third, the fifth, and second, may be admitted in the fundamental bass, except that of a second in descending. For what remains, it is very proper to remark, that the rules immediately given for the fundamental bass are not 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 entertain initiates with 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.

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had before perceived in the last time of the preceding bar. Nevertheless, syncopation may be sometimes admitted in the fundamental bass, but it is by a licence (zz).

Chap. VII. *Of the Rules which ought to be observed in the Treble with relation to the Fundamental Bass.*

254 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. XVIII. the scale *ut re mi fa sol la si ut*, is a treble with respect to the fundamental bass *ut sol ut fa ut re sol ut*.

255 One note in the treble or bass may answer to several of its correspondent parts, and why.

199. We are just 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 *ut mi sol mi ut*, may have for its fundamental bass the note *ut* alone, because the chord of that note comprehends the sounds *ut*, *mi*, *sol*, 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, *sol* alone may answer to these three notes in the bass, *ut sol ut* (aaa).

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 *re*, bearing the chord of the simple dominant *re fa la ut*; and that this *ut*, 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 an *ut*.

201. And it is requisite to observe, that, according to the rules which we have given for the fundamental bass, *ut* will always be found in the chord of that note in the fundamental bass which precedes the simple dominant *re*. See XLVIII. XLIX. L. In the first example the dissonance is *ut*, in the second *sol*, and in the third *mi*; and these notes are already in the preceding chord (bbb).

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

(zz) There are notes which may be found several times in the fundamental bass in succession with a different harmony. For instance, the tonic *ut*, after having carried the chord *ut mi sol ut*, may be followed by another *ut* which carries the chord of the seventh, provided that this chord be the chord of the tonic dominant *ut mi sol si♭*. See LXXII. In the same manner, the tonic *ut* may be followed by the same tonic *ut*, which may be rendered a *sub-dominant*, by causing it to carry the chord *ut mi sol la*. See LXXIII.

A dominant, whether tonic or simple, sometimes descends or rises upon one another by the interval of a tritone or false fifth. For example, the dominant *fa*, carrying the chord *fa la ut mi*, may be followed by another dominant *si*, carrying the chord *si re fa la*. 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 *ut* to which *fa* and *si* belong. If one should descend from *fa* to *si♭* by the interval of a just fifth, he would then depart from that scale, because *si♭* is no part of it.

(aaa) 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 Exam. XLVII. in which this modulation *ut re mi fa sol*, may be regarded as equivalent to this other, *ut mi sol*, as *re* and *fa* are no more than notes of passage. So that the bass of this modulation may be simply *ut sol*.

When the notes are of equal duration, and arranged in a diatonic order, the notes which occupy the perfect part of each time, or those which are accented, ought each of them to carry chords. Those which occupy the imperfect part, or which are unaccented, are no more than mere notes of passage. Sometimes, however, the note which occupies the imperfect part may be made to carry harmony; but the value of this note is then commonly increased by a point which is placed after it, which proportionably diminishes the continuance of the note that occupies the perfect time, 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.

(bbb) 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, as long as this dominant may be retained. For instance, let us imagine this modulation,

	ut |	*re*	*ut*	*si*	*ut* |	*re*;
and this fundamental bass,	*ut* |	$\overset{7}{re}$		$\overset{7}{sol}$	*ut* |	$\overset{7}{sol}$

(see Example LI.); the $\overset{7}{re}$ of the fundamental bass answers to the two notes *re ut* of the treble. The dissonance *ut* has no need of preparation, because the note $\overset{7}{re}$ of the fundamental bass having already been employed for the *re* which precedes *ut*, the dissonance *ut* is afterwards presented, below which the chord *re* may be preserved, or *re fa la ut*.

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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. One may likewiſe obſerve here, that, according to the rules for the fundamental baſs which we have given, the note upon which the diſſonance ought to deſcend or riſe will always be found in the ſubſequent chord (ccc).

Chap. VIII. *Of the Continued Baſs, and its Rules.*

* See *Continued baſs*.

256 Thorough-baſs, what.

204. A continued * or thorough baſs, is nothing elſe but 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 *ſol ſi re fa*, I ſhould ſay *ſi re fa ſol*. or *re fa ſol ſi*, &c. the chord is inverted. Let us ſee then, in the firſt place, all the poſſible ways in which a chord may be inverted.

257 Chords inverted, how.

The ways in which a Perfect Chord may be Inverted.

205. The perfect chord *ut mi ſol ut* may be inverted in two different ways.

1. *Mi ſol ut mi*, which we call a chord of the *ſixth*, compoſed of a third, a ſixth, and an octave, and in this caſe the note *mi* is marked with a 6. (See LVI.)

2. *Sol ut mi ſol*, 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 $\frac{6}{4}$. (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 *ſol ſi re fa*, the third major *ſi* above the fundamental note *ſol* is called a *ſenſible note* (77.); and the inverted chord *ſi re fa ſol*, compoſed of a third, a falſe fifth, and ſixth, is called the *chord of the falſe fifth*, and is marked with an 8 or a ♭5 (ſee LVIII. and LIX.)

The chord *re fa ſol ſi*, compoſed of a third, a fourth, and a ſixth, is called the *chord of the ſenſible ſixth*, and marked with a 6 or a ※6. In this chord thus figured, the third is minor, and the ſixth major, as it is eaſy to be perceived. (See LX.)

The chord *fa ſol ſi re*, compoſed of a ſecond, a tritone, and a ſixth, is called the *chord of the tritone*, and is marked thus 4+, thus ×4, or thus ※4. (See LXI.)

207. In the chord of the ſimple dominant *re fa la ut*, we find,

1. *Fa la ut re*, a chord of the great ſixth, which is compoſed of a third, a fifth, and a ſixth, and which is figured with a $\frac{6}{5}$. See LXIII. (ddd).

2. *La ut re fa*, a chord of the leſſer ſixth, which is figured with a 6. See LXIV. (eee).

3. *Ut re fa la*, a chord of the ſecond, compoſed of a ſecond, a fourth, and a ſixth, and which is marked with a 2. See LXII. (fff).

The ways in which the Chord of the ſub-dominant may be inverted.

208. The chord of the ſub-dominant, as *fa la ut re*, 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 *la ut re fa*, which is marked with a 6, and the chord of the ſeventh *re fa la ut*. See LXIV.

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 LXV. in which the fundamental baſs which in itſelf is monotonic and little ſuited for ſinging, *ut ſol ut ſol ut ſol ut*, produces, by inverting its chords, this continued

(ccc) 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 *ſol* is in concord with the notes *ut mi ſol ut*, which anſwer to it in the fundamental baſs, and where the ſecond part is a diſſonance in the ſubſequent chord *la ut mi ſol*. In the ſame manner, the firſt part of the ſyncopated note *fa* is in concord with the notes *re fa la ut*, which anſwer to it; and the ſecond part is a diſſonance in the ſubſequent chord *ſol ſi re fa*, which anſwer to it, &c.

(ddd) We are obliged to mark likewiſe, in the continued baſs, the chord of the ſub-dominant with a $\frac{6}{5}$, 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 LXIV.) For what remains, 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 *ut mi ſol ſi*, gives the chord of the great ſixth *mi ſol ſi ut*, thus improperly called, ſince the ſixth from *mi* to *ut* is minor.

(eee) M. Rameau has juſtly obſerved, that we ought rather to figure this leſſer ſixth with a $\frac{3}{4}$, 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, though we thought with him, that it would be better to mark this chord by a particular figure.

(fff) The chord of the ſeventh *ſi re fa la* gives, when inverted, the chord *fa la ſi re*, compoſed of a third, a tritone, and a ſixth. This 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 *fa* be a tritone or a fourth redundant. One may, as to what remains, figure this chord thus $\begin{smallmatrix}6\\4*\\3\end{smallmatrix}$.

tinued bafs highly proper to be fung, *ut fi ut re mi fa mi*, &c. (GGG.)

The continued bafs then is properly nothing elfe but a treble with refpect to the fundamental bafs. Its rules immediately follow, which are properly no other than thofe already given for the treble.

Rule I.

210. Every note which carries the chord of the falfe fifth, and which of confequence muft be what we have called a *fenfible note*, ought (77) to rife diatonically upon the note which follows it. Thus in example LXV. the note *fi*, carrying the chord of the falfe fifth marked with an 8, rifes diatonically upon *ut* (HHH).

Rule II.

211. Every note carrying the chord of the tritone fhould defcend diatonically upon the fubfequent note. Thus in the fame example LXV. *fa*, which carries the chord of the tritone figured with a 4+, defcends diatonically upon *mi*. (Art. 202.)

Rule III.

212. The chord of the fecond is commonly put in practice upon notes which are fyncopated in defcending, becaufe thefe notes are diffonances which ought to be prepared and refolved (200, 202.) See the example LXVI. where the fecond *ut*, which is fyncopated, and which defcends afterwards upon *fi*, carries the chord of the fecond (III).

(GGG) The continued bafs is proportionably better adapted to finging, as the founds which form it more fcrupuloufly obferve the diatonic order, becaufe this order is the moft agreeable of all. We muft therefore endeavour to preferve it as much as poffible. It is for this reafon that the continued bafs in Example LXV. is much more in the tafte of finging, and more agreeable, than the fundamental bafs which anfwers to it.

(HHH) The continued bafs being a kind of treble with relation to the fundamental bafs, it ought to obferve the fame rules with refpect to that bafs as the treble. Thus a note, for inftance *re*, carrying a chord of the feventh *re fa la ut*, to which the chord of the fub-dominant *fa la ut re* correfponds in the fundamental bafs, ought to rife diatonically upon *mi*, (art. 129, n° 2. and art. 202.)

(III) When there is a *repofe* in the treble, the note of the continued bafs ought to be the fame with that of the fundamental bafs, (fee example LXVII.) In the clofes which are found in the treble at *fi* and *ut* (bars third and fourth), the notes in the fundamental and continued bafs are the fame, viz. *fol* for the firft cadence, and *ut* for the fecond. This rule ought above all to be obferved in final cadences which terminate a piece or a modulation.

It is neceffary, as much as poffible, to prevent coincidences of the fame notes in the treble and continued bafs, unlefs the motion of the continued bafs fhould be contrary to that of the treble. For example, in the fecond note of the fecond bar in example LXVII. *mi* is found at the fame time in the continued bafs and in the treble; but the treble defcends from *fa* to *mi*, whilft the bafs rifes from *re* to *mi*.

Two octaves, or two fifths, in fucceffion, muft likewife be fhunned. For inftance, in the treble founds *fol mi*, the bafs muft be prevented from founding *fol mi*, *ut la*, or *re fi*, becaufe in the firft cafe there are two octaves in fucceffion, *fol* againft *fol*, and *mi* againft *mi*; and becaufe in the fecond cafe there are two fifths in fucceffion, *ut* againft *fol*, and *la* againft *mi*, or *re* againft *fol*, and *fi* againft *mi*. This rule, as well as the preceding, is founded upon this principle, that the continued bafs ought not to be a copy of the treble, but to form a different melody.

Every time that feveral notes of the continued bafs anfwer to one note alone of the fundamental, the compofer fatisfies himfelf with figuring the firft 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 LXVIII. where the fundamental bafs *ut* gives the continued bafs *ut mi fol mi*; the two *mi*'s ought in this bafs to carry the chord 6, and *fol* the chord $\frac{6}{4}$: but as thefe chords are comprehended in the perfect chord *ut mi fol ut*, which is the firft of the continued bafs, we place nothing above *ut*, only we draw a line over *ut mi fol mi*.

In like manner, in the fecond bar of the fame example, the notes *fa* and *re* of the continued bafs, rifing from the note *fol* alone of the fundamental bafs which carries the chord *fol fi re fa*, we think it fufficient to figure *fa* with the number of the tritone 4X, and to draw a line above *fa* and *re*.

It fhould be remarked, that this *fa* ought naturally to defcend to *mi*; but this note is confidered as fubfifting fo long as the chord fubfifts; and when the chord changes, we ought neceffarily to find the *mi*, as may be feen by that example.

In general, whilft the fame chord fubfifts in paffing through different notes, the chord is reckoned the fame as if the firft note of the chord had fubfifted; in fuch a manner, that, if the firft note of the chord is, for inftance, the fenfible note, we ought to find the tonic when the chord changes. See example LXIX. or this continued bafs, *ut fi fol fi re ut*, is reckoned the fame with this *ut fi ut*. (Example LXX.)

If a fingle note of the continued bafs anfwers to feveral notes of the fundamental bafs, it is figured with the different chords which agree to it For example, the note *fol* in a continued bafs may anfwer to this fundamental bafs *ut fol ut*, (fee example LXXI.); in this cafe, we may regard the note *fol* as divided into three parts, of which the firft carries the chord $\frac{6}{4}$, the fecond the chord 7, and the third the chord $\frac{6}{4}$.

We fhall repeat here, with refpect to the rules of the continued bafs, what we have formerly faid concerning the rules of the fundamental bafs in the note upon the third rule, art. 193. The rules of the continued bafs have exceptions, which practice and the perufal of good authors will teach. There are likewife feveral other rules which might require a confiderable detail, and which will be found in the *Treatife of Harmony* by M. Rameau, and elfewhere. Thefe rules, which are proper for a complete differtation, did not appear to me indifpenfably neceffary in an *elementary effay upon mufic*, fuch as the prefent. The books which we have quoted at the end of our *preliminary difcourfe* will more particularly inftruct the reader concerning this practical detail.

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Chap. IX. *Of some Licences assumed in the Fundamental Bass.*

§ 1. *Of* Broken *and* Interrupted Cadences.

258 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 licence. See, in the example LXXIV. *sol la*, (132, and 134).

259 Interrupted cadence, how formed.

214. The interrupted cadence is formed by a dominant which descends by a third upon another (136). See, in the example LXXV. *sol mi* (LLL).

These cadences ought to be permitted but rarely and with precaution.

§ 2. *Of* Supposition.

260 Chord by supposition, what. See *Supposition.*

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.*

For example, let us suppose, that in the fundamental bass we have a dominant *sol* carrying the chord of the seventh *sol si re fa;* let us add to this chord the note *ut*, which is a fifth below this dominant, and we shall have the total chord *ut sol si re fa*, or *ut re fa sol si*, which is called *a chord by supposition* (MMM.)

Of the different kinds of chords by supposition.

216. It is easy to perceive, that chords by supposition are of different kinds. For instance, the chord of the tonic *sol si re fa* gives,

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261 These different chords what, and how figured.

1. By adding the fifth *ut*, the chord *ut sol si re fa*, called a *chord of the seventh redundant*, and composed of a fifth, seventh, ninth, and eleventh. It is figured with a ※ 7; see LXXVI. (NNN). 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 QQQ, upon the art. 219; it is then reduced to *ut fa sol re*, and marked with $\frac{5}{4}$ or $\frac{5}{2}$.

2. By adding the third *mi*, we shall have the chord *mi sol si re fa*, called a *chord of the ninth*, and composed of a third, fifth, seventh, and ninth. It is figured with a 9. This third may be added to every third of the dominant. See LXXVII. (OOO).

3. If to a chord of the simple dominant, as *re fa la ut*, we should add the fifth *sol*, we would have the chord *sol re fa la ut*, called a *chord of the eleventh*, and which is figured with a $\frac{9}{4}$ or $\frac{4}{9}$. (See LXXVIII.)

Observe.

262 Occasions when retrenchments of chords are proper.

217. When the dominant is not a tonic dominant, they often take away some notes from the chord. For example, let us suppose that there is in the fundamental bass this simple dominant *mi*, carrying the chord *mi sol si re:* if there should be added the third *ut* beneath, we shall have this chord of the continued bass *ut mi sol si re*, but they suppress the seventh *si*, for reasons which shall be explained in the note QQQ upon art.

(LLL) One may sometimes, but very rarely, cause several tonics in succession to follow one another in ascending or descending diatonically, as *ut mi sol ut, re fa la re, si♭ re fa si♭*; 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 *fa*, a fifth below the first tonic *ut*, is found in the chord *re fa la re*, and in the chord *si♭ re fa si♭* (37 and note G.)

(MMM) Though supposition be a kind of licence, yet it is in some measure founded on the experiment related in the note (F), 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, *ut* added beneath *sol*, causes *sol* to resound. Thus *sol* is found in some measure to be implied in *ut*.

If the third added beneath the fundamental sound be minor, for example, if to the chord *sol si re fa*, we add the third *mi*, 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.

(NNN) Many musicians figure this chord with a ※$\frac{7}{2}$; 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 choid, it would be useless to repeat it. Thus $\overset{7}{\underset{re}{※}}$ *sol*, according to M. Rameau, would indicate *re fa※ la ut, sol si re fa※*. If we would change *fa※* of the second chord into *fa*, it would then be necessary to write $\overset{7}{\underset{re}{※}}$ $\overset{7♮}{sol}$. In notes such as *ut*, 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 *ut sol si re fa*, from the simple chord of the seventh *ut mi sol si*, which is marked with a 7 alone. All this appears just and well founded.

(OOO) Supposition introduces into a chord dissonances which were not in it before. For instance, if to the chord *mi sol si re*, we should add the note of supposition *ut* descending by a third, it is plain that, besides the dissonance

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art. 219. In this ſtate the chord is ſimply compoſed of a third, fifth, and ninth, and is marked with a 9. See LXXIX. (PPP)

218. What is more, in the chord of the ſimple dominant, as *re fa la ut*, when the fifth *ſol* is added, they frequently obliterate the ſounds *fa* and *la*, that too great a number of diſſonances may be avoided, which reduces the chord to *ſol ut re*. 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. (See LXXX.)

219. Sometimes they only remove the note *la*, and then the chord ought to be figured with $^{7}_{4}$ or $^{4}_{7}$ (QQQ).

263 Chord of the fifth redundant what, and how figured.

220. Finally, in the minor mode, for example, in that of *la*, where the chord of the tonic dominant (109,) is *mi ſol※ ſi re*; if we add to this chord the third *ut* below, we ſhall have *ut mi ſol※ ſi re*, called the *chord of the fifth redundant*, and compoſed of a third, a fifth redundant, a ſeventh, and a ninth. It is figured with a ※5, or a +5. See LXXXI. (RRR.)

§ 3. *Of the* Chord *of the* Diminished Seventh.

264 Chord of the flat ſeventh what, and how figured.

221. In the minor mode, for inſtance, in that of *la*, *mi* a fifth from *la* is the tonic dominant (109), and carries the chord *mi ſol※ ſi re*, in which *ſol* is the ſenſible note. For this chord they ſometimes ſubſtitute that other *ſol※ ſi re fa*, (116), all compoſed of minor thirds; and which has for its fundamental ſound the ſenſible note *ſol※*. This chord is called a *chord of the flat, or diminiſhed ſeventh*, and is figured with a 7̸ in the fundamental baſs, (ſee LXXXII.): but it is always conſidered as repreſenting the chord of the tonic dominant.

265 Chords produced in the continued baſs by this what, and how figured.

222. This chord in the fundamental baſs produces in the continued baſs the following chords:

1. The chord *ſi re fa ſol※*, 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 thus ※$^{6}_{8}$, or +$^{6}_{8}$. (See LXXXIII).

2. The chord *re fa ſol※ ſi*, compoſed of a third, a tritone, and a ſixth, they call it the *chord of the tritone and third minor*; and they mark it thus ※$\overset{4}{\flat}$. (See LXXXIV).

3. The chord *fa ſol※ ſi re*, compoſed of a ſecond redundant, a tritone, and a ſixth. They call it the *chord of the ſecond redundant*, and they figure it thus ※2, or +2. See LXXXV. (SSS).

266 Alterations by ſuppoſition, chords which they produce what, and how figured.

223. Beſides, ſince the chord *ſol※ ſi re fa* repreſents the chord *mi ſol※ ſi re*, it follows, that if we operate by ſuppoſition upon the firſt of theſe chords, it muſt be performed as one would perform it upon *mi*

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diſſonance between *mi* and *re* which was in the original chord, we have two new diſſonances, *ut ſi*, and *ut re*; 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.)

(PPP) 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.

(QQQ) They 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 *ut* is preceded by the ſenſible note *ſi*, carrying the chord of the falſe fifth, and that we ſhould chooſe to form upon this note *ut* the chord *ut mi ſol ſi re*, we muſt obliterate the ſeventh *ſi*, becauſe in retaining it we ſhould deſtroy the effect of the ſenſible note *ſi*, which ought to riſe to *ut*.

In the ſame manner, if to the harmony of a tonic dominant *ſol ſi re fa*, one ſhould add the note by ſuppoſition *ut*, it is uſual to retrench from this chord the ſenſible note *ſi*; becauſe, as the *re* ought to deſcend diatonically to *ut*, and the *ſi* to riſe to it, the effect of the one would deſtroy that of the other. This above all takes place in the *ſuſpence*, concerning which we ſhall preſently treat.

(RRR) *Suppoſition* produces what we call *ſuſpence*; 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, if this fundamental baſs be given *ut* $\overset{7}{\textit{ſol}}$ *ut*, and this continued baſs above it *ut ut* $\overset{※7}{\textit{ut}}$, it is a ſuppoſition; but if we have this fundamental baſs *ut* $\overset{7}{\textit{ſol}}$ $\overset{7}{\textit{ſol}}$ *ut*, and this continued baſs above it *ut ſol* $\overset{7}{\textit{ut}}$ $\overset{※7}{\textit{ut}}$, it is a ſuſpenſe; becauſe the perfect chord of *ut*, which we naturally expect after *ſol* in the continued baſs, is *ſuſpended* and *retarded* by the chord $\overset{※7}{\textit{ut}}$, which is formed by retaining the ſounds *ſol ſi re fa* of the preceding chord to join them to the note *ut* in this manner, *ut ſol ſi re fa*; but this chord $\overset{※7}{\textit{ut}}$ does nothing in this caſe but *ſuſpend* for a moment the perfect chord *ut mi ſol ut*, which ought to follow it.

(SSS) The chord of the diminiſhed ſeventh, ſuch as *ſol※ ſi re fa*, and the three derived from it, are termed *chords of ſubſtitution*. They are in general harſh, and proper for imitating melancholy objects.

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mi sol※ *si re*; that is to say, that it will be necessary to add to the chord *sol*※ *si re fa*, the notes *ut* or *la*, which are the third or fifth below *mi*, and which will produce,

1. By adding *ut*, the chord *ut sol*※ *si re fa*, 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 thus marked $^{+5}_{4}$, or $※^{5}_{4}$. (See LXXXVI.)

2. By adding *la*, we shall have the chord *la sol*※ *si re fa*, 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 $\flat\overset{7}{6}$, or $\overset{※7}{\flat}$. (See LXXXVII.) It is of all chords the most harsh, and the most rarely practised (TTT).

In the *Treatise of Harmony* by M. Rameau, and elsewhere, may be seen a much longer detail of the chords by supposition: But here we delineate the elements alone.

Chap. X. *Of some Licences used in the Treble and Continued Bass.*

267 Licence 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 licence ought to be rarely practised.

In like manner, in a continued bass, the dissonance in a chord of the sub-dominant inverted, as *la* in the chord *la ut mi sol*, inverted from *ut mi sol la*, 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.

268 Licence 2d. 225. Sometimes likewise, to render a continued bass more agreeable by causing it to proceed diatonically, they place between two sounds of that bass a note which belongs to the chord of neither. See example XCIV, in which the fundamental bass *sol ut* produces the continued bass *sol la si sol ut*, where *la* is added on account of the diatonic modulation. This *la* has a line drawn above it to show its resolution by passing under the chord *sol si re fa*.

In the same manner, (see XCV), this fundamental bass *ut fa* may produce the continued bass *ut re mi ut fa*, where the note *re* which is added passes under the chord *ut mi sol ut*.

Chap. XI. *Containing the Method of finding the Fundamental Bass when the Continued Bass is figured.*

269 How to find the fundamental bass when the continued is figured. 226. To exercise yourself with greater ease in finding the fundamental bass, and to render it more familiar to you, it is necessary to observe how eminent masters, and above all how M. Rameau has put the rules in practice. Now, as they never place any thing but the continued bass in their works, it becomes then 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 either is a tonic, or reckoned such, (UUU).

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 LXIV, and the note ZZZ).

* 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 ♯, is the same in both basses, and with the same figure (XXX).

5. Every note figured with a 2 gives in the fundamental bass the diatonic note above figured with a 7. See LXII. (YYY).

6. Every note marked with a 4 gives in the fundamental

(TTT) As the chord of the diminished seventh *sol*※ *si re fa*, and the chord of the tonic dominant *mi sol*※ *si re*, only differ one from the other by the notes *mi* and *fa*; 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 XCII.)

For the same reason, as the chord of the diminished seventh *sol*※ *si re fa*, and the chord *si re fa la*, which carries the fifth *si* of the tonic dominant *mi*, only differs by the sensible note *sol*※, and the tonic *la*; one may sometimes, while the treble modulates *sol*※ *la sol*※ *la sol*※ *la*, 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 XCIII.) As to what remains, this and the preceding examples are licences.

(UUU) I 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 *sol*, carrying a perfect chord, is preceded by *re* a simple dominant, carrying the chord *re fa la ut*, that note *sol* is not a real tonic; because, in order to this, it would have been necessary that *re* should have been a tonic dominant, and should have carried the chord *re fa*※ *la ut*; and that a simple dominant, as *re*, carrying the chord *re fa la ut*, should only naturally descend to a dominant, (art. 194.)

(XXX) 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 $\overset{7}{la}\ \overset{8}{si}\ ut$ gives this fundamental bass $\overset{6}{ut}\ \overset{7}{sol}\ ut$; but in this case it is necessary that the note figured with a 6 should rise by a fifth, as we see here *ut* rise to *sol*.

(YYY) A note figured with a 2, gives likewise sometimes in the fundamental bass its fourth above, figured with

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mental bafs the diatonic note above, figured with a 7. (See LXI.)

7. Every note figured with an 8 gives its third below figured with a 7. (See LVIII.)

8. Every note marked with a $\not 6$ gives the fifth below marked with a 7; (fee LX.) and it is plain by art. 187, that in the chord of the feventh, of which we treat in thefe three laft articles, the third ought to be major, and the feventh minor, this chord of the feventh 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 fame cafe with the notes marked $\frac{7}{4}$, $\begin{smallmatrix}5\\4\\2\end{smallmatrix}$, or $\frac{5}{2}$: which fhows a retrenchment, either in the complete chord of the eleventh, or in that of the feventh 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 ※$\frac{6}{8}$ gives the third minor below, figured with a $\not 7$. (See LXXXIII.)

15. Every note marked with a ※$\overset{4}{\flat}$ gives the tritone above figured with a $\not 7$. (See LXXXIV.)

16. Every note marked with a +2 gives the fecond redundant above, figured with a $\not 7$. (See LXXXV.)

17. Every note marked with a ※$\frac{5}{4}$ gives the fifth redundant above, figured with a $\not 7$. (See LXXXVI.)

18. Every note marked with a $\begin{smallmatrix}\text{※}7\\ \flat 6\end{smallmatrix}$ gives the feventh redundant above, figured with a $\not 7$. See LXXXVII. (zzz).

REMARK.

228. We have omitted two cafes, which may caufe fome uncertainty. 230 A difficulty in finding the fundamental bafs.

The firft is that where the note of the continued bafs is figured with a 6. We now prefent the reafon of the difficulty.

Suppofe we fhould have the dominant $\overset{7}{re}$ in the fundamental bafs, the note which anfwers to it in the continued bafs may be *la* carrying the figure 6 (fee LXIV.); that is to fay, the chord *la ut re fa*: now if we fhould have the fub-dominant $\overset{6}{fa}$ in the fundamental

7

with a 6; but it is neceffary in that cafe that the note figured with a 6, may even here rife to a fifth. (See note xxx).

Thefe variations in the fundamental bafs, as well in the chord concerning which we now treat, as in the chord figured with a 7, and in two others which fhall afterwards be mentioned (art. 228 and 229), are caufed by a deficiency in the figns proper for the chord of the fub-dominant, and for the different arrangements by which it is inverted.

M. l'Abbe Rouffier, to redrefs this deficiency, had invented a new manner of figuring the continued bafs. His method is moft fimple for thofe who know the fundamental bafs. It confifts in expreffing each chord by only fignifying the fundamental found with that letter of the fcale by which it is denominated, to which is joined a 7 or $\not 7$, or a 6, in order to mark all the difcords. Thus the fundamental chord of the feventh *re fa la ut* is expreffed by a $\overset{7}{\text{D}}$; and the fame chord, when it is inverted from that of the fub-dominant *fa la ut re*, is characterized by $\overset{6}{\text{F}}$; the chord of the fecond *ut re fa la*, inverted from the dominant *re fa la ut*, is likewife reprefented by $\overset{7}{\text{D}}$; and the fame chord *ut re fa la* inverted from that of the fub-dominant *fa la ut re* is fignified by F; the cafe is the fame when the chords are differently inverted. By this means it would be impoffible to miftake either with refpect to the fundamental bafs of a chord, or with refpect to the note which forms its diffonance, or with refpect to the nature and fpecies of that difcord.

(zzz) We may only add, that here and in the preceding articles, we fuppofe, that the continued bafs is figured in the manner of M. Rameau. For it is proper to obferve, that there are not, perhaps, two muficians who characterife their chords with the fame figures; which produces a great inconveniency to the perfon who plays the accompaniments: but here we do not treat of accompaniments. For every reafon, then, we fhould advife initiates to prefer the continued baffes of M. Rameau to all the others, as by them they will moft fuccefsfully ftudy the fundamental bafs.

It is even neceffary to advertife the reader, and I have already done it (note EEE), that M. Rameau only marks the leffer fixth by a 6 without a line, when this leffer fixth does not refult from the chord of the tonic dominant; in fuch a manner that the 6 renders it uncertain whether in the fundamental bafs we ought to choofe the third or the fifth below: but it will be eafy to fee whether the third or the fifth is fignified by that figure. This may be diftinguifhed, 1. In obferving which of the two notes is excluded by the rules of the fundamental bafs. 2. If the two notes may with equal propriety be placed in the fundamental bafs, the preference muft be determined by the tone or mode of the treble in that particular paffage. In the following chapter we fhall give rules for determining the mode.

There is a chord of which we have not fpoken in this enumeration, and which is called the *chord of the fixth redundant*. This chord is compofed of a note, of its third major, of its redundant fourth or tritone, and its redundant fixth, as *fa la fi re*※. It is marked with a 6※. It appears difficult to find a fundamental bafs for this chord; nor is it indeed much in ufe amongft us. (See the note upon the art. 115.)

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mental bass, this sub-dominant might produce in the continued bass the same note *la* figured with a 6. When therefore one finds 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.

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Another.

229. The second case is that in which the continued bass is figured with a $^6_5$. For instance, if there should be found $\overset{6}{\underset{5}{}}$*fa* in the continued bass, one may be ignorant whether he ought to insert in the fundamental bass *fa* marked with a 6, or *re* figured with a 7.

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Solution.

230. You may easily extricate yourself from this little difficulty, in leaving for an instant this uncertain note in suspence, and in examining what is the succeeding note of the fundamental bass; for if that note be in the present case a fifth above *fa*, that is to say, if it is *ut*, in this case, and in this alone, he may place $\overset{6}{}$*fa* 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.*

273
Method of determining the mode in which we are.

231. In the first part of this treatise (chap. vi), we have explained, how by the means of the note *ut*, and of its two fifths *sol* and *fa*, one in ascending, which is called a *tonic dominant*, the other in descending, which is called a *sub-dominant*, the scale *ut re mi fa sol la si ut* may be found: the different sounds which form this scale compose what we call the *major mode* of *ut*, because the third *mi* above *ut* is major. If therefore we would have a modulation in the major mode of *ut*, no other sounds must enter into it than those which compose this scale; in such a manner that if, for instance, I should find *fa*♯ in this modulation, this *fa*♯ discovers to me that I am not in the mode of *ut*, or at least that, if I have been in it, I am no longer so.

232. In the same manner, if I form this scale in ascending *la si ut*♯ *re mi fa*♯ *sol*♯ *la*, which is exactly similar to the scale *ut re mi fa sol la si ut* of the major mode of *ut*, this scale, in which the third from *la* to *ut*♯ is major, shall be in the major mode of *la*; and if I incline to be in the minor mode of *la*, I have nothing to do but to substitute for *ut* sharp *ut* natural; so that the major third *la ut*♯ may become minor *la ut*; I shall have then

la si ut re mi fa♯ *sol*♯ *la*,

which is (85) the scale of the minor mode of *la* in ascending; and the scale of the minor mode of *la* in descending shall be (90)

la sol fa mi ut re si la,

in which the *sol* and *fa* 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).

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Hence it appears what sharps and flats should be placed at the cleff in the major mode of *la*, 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 *la*, we place three sharps at the cleff upon *fa*, *ut*, and *sol*; and on the contrary, in the minor mode of *la*, we place none, because the minor mode of *la*, in descending, has neither sharps nor flats.

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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 *ut*	*ut re mi fa sol la si ut.*
of *sol*	*sol la si ut re mi fa*♯ *sol.*
of *re*	*re mi fa*♯ *sol la si ut*♯ *re.*
of *la*	*la si ut*♯ *re mi fa*♯ *sol*♯ *la.*
of *mi*	*mi fa*♯ *sol*♯ *la si ut*♯ *re*♯ *mi.*
of *si*	*si ut*♯ *re*♯ *mi fa*♯ *sol*♯ *la*♯ *si.*
of *fa*♯	*fa*♯ *sol*♯ *si ut*♯ *re*♯ *mi*♯ *fa*♯ (AAAA).
of *ut*♯ or *re*♭	*re*♭ *mi*♭ *fa sol*♭ *la*♭ *si*♭ *ut re*♭.
of *sol*♯ or *la*♭	*la*♭ *si*♭ *ut re*♭ *mi*♭ *fa sol la*♭.
of *re*♯ or *mi*♭	*mi*♭ *fa sol la*♭ *si*♭ *ut re mi*♭.

of

(AAAA) The major mode of *fa*♯, of *ut*♭ or *re*♯, and of *sol*♯ or *la*♭, are not much practised. In the opera of *Pyramus* and *Thisbe*, p. 267, there is a passage in the scene, of which one part is in the major mode of *fa*♯, and the other in the major mode of *ut*♯, and there are six sharps at the cleff.

When a piece begins upon *ut*♯, 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 *re*♭, which is almost the same thing with *ut*♯. It is for this reason that we substitute here the mode of *re*♭ for that of *ut*♯.

It is still much more necessary to substitute the mode of *la*♭ for that of *sol*♯; for the scale of the major mode of *sol* is *sol*♯, *la*♯, *si*♯, *ut*♯, *re*♯, *mi*♯, *sol*, *sol*♯, in which you may see that there are at the same time both a *sol* natural and a *sol*♯: it would then be necessary, even at the same time, that upon *sol* there should and should not be a sharp at the cleff; which is shocking and inconsistent. It is true that this inconvenience may be avoided by placing a sharp upon *sol* at the cleff, and by marking the note *sol* 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. One might likewise in this series, instead of *sol* natural, which is the note immediately before the last, substitute *fa*♯♯, that is to say, *fa* twice sharp: which, however, is not absolutely the same sound with *sol* natural, especially upon instruments whose scales are fixed, or whose intervals are invariable. But in that case two sharps may be placed at the cleff upon *fa*, which would produce another inconvenience. But by substituting *la*♭ for *sol*♯, the trouble is eluded.

of *la*♯ or *si*♭ } *si*♭ *ut re mi*♭ *fa sol la si.*
of *mi*♯ or *fa*♭ } *fa sol la si*♭ *ut re mi fa.*
of *si*♯ or *ut*♭ } *ut re mi fa sol la si ut.*

Minor Modes.

Of *la*.

In descending. *la sol fa mi re ut si la.*
In rising. *la si ut re mi fa*♯ *sol*♯ *la.*

Of *mi*.

In descending. *mi re ut si la sol fa*♯ *mi.*
In rising. *mi fa*♯ *sol la si ut*♯ *re*♯ *mi.*

Of *si*.

In descending. *si la sol fa*♯ *mi re ut*♯ *si.*
In rising. *si ut*♯ *re mi fa*♯ *sol*♯ *la*♯ *si.*

Of *fa*♯.

In descending. *fa*♯ *mi re ut*♯ *si la sol*♯ *fa.*
In rising. *fa*♯ *sol*♯ *la si ut*♯ *re*♯ *mi*♯ *fa*♯.

Of *ut*♯

In descending. *ut si la sol*♯ *fa*♯ *mi re*♯ *ut*♯.
In rising. *ut*♯ *re*♯ *mi fa*♯ *sol*♯ *la*♯ *si*♯ *ut*♯.

Of *sol*♯ or *la*♭.

In descending. *sol*♯ *fa*♯ *mi ut*♯ *si la*♯ *sol*♯.
In rising. *la*♭ *si*♭ *ut*♭ *re*♭ *mi*♭ *fa sol la*♭.

Of *re*♯ or *mi*♭.

In descending. *mi*♭ *re*♭ *ut*♭ *si*♭ *la*♭ *sol*♭ *fa mi*♭.
In rising. *mi*♭ *fa sol*♭ *la*♭ *si*♭ *ut re mi*♭.

Of *la*♯ or *si*♭.

In descending. *si*♭ *la*♭, *sol*♭ *fa mi*♭ *re*♭ *ut si*♭.
In rising. *si*♭ *ut re*♭ *mi*♭ *fa sol la si*♭.

Of *mi*♯ or *fa*♭.

In descending. *fa mi*♭ *re*♭ *ut si*♭ *la*♭ *sol fa.*
In rising. *fa sol la*♭ *si*♭ *ut re mi fa.*

Of *ut*.

In descending. *ut si*♭ *la*♭ *sol fa mi*♭ *re ut.*
In rising. *ut re mi*♭ *fa sol la si ut.*

Of *sol*.

In descending. *sol fa mi*♭ *re ut si*♭ *la sol.*
In rising. *sol la si*♭ *ut re mi fa*♯ *sol.*

Of *re*.

In descending. *re ut si*♭ *la sol fa mi re.*
In rising. *re mi fa sol la si ut*♯ *re* (BBBB.)

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. 276 Modes crowded with sharps and flats little practised.

236. From thence it follows, 277 Results.

1. That when there are neither sharps nor flats at the cleff, it is a token that the piece begins in the major mode of *ut*, or in the minor mode of *la*.

2. That when there is one single sharp, it will always be placed upon *fa*, and that the piece begins in the major mode of *sol*, or the minor of *mi*, in such a manner that it may be sung as if there were no sharp, by singing *si* instead of *fa*♯, and in singing the tune as if it had been in another cleff. For instance, let there be a sharp upon *fa* in the cleff of *sol* upon the first line; one may then sing the tune as if there were no sharp: And instead of the cleff of *sol* upon the first line, let there be the cleff of *ut*; for the *fa*♯, when changed into *si*, will require that the cleff of *sol* should be changed to the cleff of *ut*, as may be easily seen. This is what we call *transposition* (‡). See *Transposition.*

237. It is evident, that when *fa*♯ is changed into *si*, *sol* must be changed into *ut*, and *mi* into *la*. Thus by transposition, the air has the same melody as if it were in the major mode of *ut*, or in the minor mode of 278 All the modes reducible to the major of *ut* and the minor of *la*.

(BBBB) 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 beneath 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 beneath 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 *re* in the mode of *ut*, and *si* in that of *la*, is termed a *sub-tonic*; the following note, which is a third major or minor from the tonic, according as the chord is major or minor, such as *mi* in the major mode of *ut*, and *ut* in the minor mode of *la*, is called a *mediant*; in short, the note which is a tone above the dominant, such as *la* in the mode of *ut*, and *fa*♯ in that of *la*, is called a *sub-dominant*.

‡ 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

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of *la*. The major mode then of *ſol*, and the minor of *mi*, are by tranſpoſition reduced to thoſe of *ut* major, and of *la* minor. It is the ſame caſe with all the other modes, as any one may eaſily be convinced (cccc).

Chap. XIII. *To find the Fundamental Baſs of a given Modulation.*

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, 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

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279 Method of finding a fundamental baſs to a given air not difficult, and why.

for inſtance, your air ſhould begin upon *ut* or C, requiring the natural diatonic ſeries through the whole gammut, in which the diſtance between *mi* and *fa*, or E and F, as alſo that between *ſi* and *ut*, or 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 *ſol* or 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 *ſol* or G, the note with which you propoſe to begin, the three tones immediately ſucceeding are full; but the fourth, *ut* or C, is only a ſemitone; it may therefore be kept in its place. But from *fa* or F, the ſeventh note above, to *ſol* or G, the eighth, the interval is a full tone, which muſt conſequently be redreſſed by raiſing your *fa* 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: But the order in which you muſt proceed, and the intervals required in every mode, are minutely and ingeniouſly delineated by our author.

(cccc) Two ſharps, *fa*♯ and *ut*♯, indicate the major mode of *re*, or the minor of *ſi*; and then, by tranſpoſition, the *ut*♯ is changed into *ſi*, and of conſequence, *re* into *ut* and *ſi* into *la*.

Three ſharps, *fa*♯ *ut*♯ *ſol*♯ indicate the major mode of *la*, or the minor of *fa*♯; and it is then *ſol*♯, which muſt be changed into *ſi*, and of conſequence *la* into *ut*, and *fa*♯ into *la*.

Four ſharps, *fa*♯ *ut*♯ *ſol*♯ *re*♯, indicate the major mode of *mi*, or the minor of *ut*♯; then the *re*♯ is changed into *ſi*, and of conſequence *mi* into *ut*, and *ut*♯ into *la*.

Five ſharps, *fa*♯ *ut*♯ *ſol*♯ *re*♯ *la*♯, indicate the major mode of *ſi*, or the minor of *ſol*♯; *la* then is changed into *ſi*, and of conſequence *ſi* into *ut*, and *ſol*♯ into *la*.

Six ſharps, *fa*♯ *ut*♯ *ſol*♯ *re*♯ *la*♯ *mi*♯, indicate the major mode of *fa*♯; *mi*♯ then is changed into *ſi*, and of conſequence *fa*♯ into *ut*.

Six flats, *ſi*♭ *mi*♭ *la*♭ *re*♭ *ſol*♭ *ut*♭, indicate the minor mode of *mi*♭; *ut* is changed into *fa*, and of conſequence *mi*♭ into *la*.

Five flats, *ſi*♭ *mi*♭ *la*♭ *re*♭ *ſol*♭, indicate the major mode of *re*♭, or the minor mode of *ſi*♭; then the *ſi*♭ is changed into *fa*, and of conſequence the *re*♭ into *ut*, and the *ſi*♭ into *la*.

Four flats, *ſi*♭ *mi*♭ *la*♭ *re*♭, indicate the major mode of *la*♭, or the minor mode of *fa*; *re*♭ then is changed into *fa*, and of conſequence *la*♭ into *ut*, and *fa* into *la*.

Three flats, *ſi*♭ *mi*♭ *la*♭, indicate the major mode of *mi*♭, or the minor of *ut*; the *la*♭ then is changed into *fa*, and of conſequence *mi*♭ into *ut*, and the *ſol* into *la*.

Two flats, *ſi*♭ *mi*♭, indicate the major mode of *ſi*♭, or the minor of *ſol*; *mi*♭ then is changed into *fa*, and of conſequence *ſi*♭ into *ut*, and the *fa* into *la*.

One flat, *ſi*♭, indicates the major mode of *fa*, or the minor mode of *re*, and *ſi*♭ is changed into *fa*; of conſequence the *fa* is changed into *ut*, and the *re* into *la*.

All the major modes then may be reduced to that of *ut*, and the modes minor to that of *la* minor.

It only remains to remark, that 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 *re*, they place neither ſharp nor flat at the cleff; in the minor mode of *ſol*, one flat only; in the minor mode of *ut*, 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.

However this be, I here preſent you with a rule for tranſpoſition, which appears to me more ſimple than the rule in common uſe.

For the Sharps.

Suppoſe *ſol*, *re*, *la*, *mi*, *ſi*, *fa*, and change *ſol* into *ut* if there is one ſharp at the cleff, *re* into *ut* if there are two ſharps, *la* into *ut* if there are three, &c.

For the Flats.

Suppoſe *fa*, *ſi*, *mi*, *la*, *re*, *ſol*, and change *fa* into *ut* if there is only one flat at the cleff, *ſi* into *ut* if there are two flats, *mi* into *ut* if there are three, &c.

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this bass, will both be prepared, if it is necessary that they should be so, and always resolved (DDDD).

280 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 *sol ut* may belong to all the modes, as well major as minor, in which *sol* and *ut* are found together; and each of these two sounds may even be considered as belonging to a different mode.

281 Reasons why one may proceed without the knowledge of the mode, and how he may be preserved from deviating in composition.

240. For what remains, one 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 (ch. VI.) for the procedure of the fundamental bass.

282 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 *ut* is *ut*, and *la* in that of *la*, &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.

283 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 *ut* from the minor of *la*. 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.

284 Means by which the modes may be determined.

1. From the principal and characteristical sounds of the mode, which are *ut mi sol* in the one, and *la ut mi* in the other; so that if a piece should, for instance, begin thus, *la ut mi la*, it may be almost constantly concluded, that the tone or mode is in *la* minor, although the notes *la ut mi* belong to the mode of *ut*.

2. From the sensible note, which is *si* in the one, and *sol*※ in the other; so that if *sol*※ appears in the first bars of a piece, one may be certain that he is in the mode of *la*.

3. From the adjuncts of the mode, that is to say, the modes of its two fifths, which for *ut* are *fa* and *sol*, and *re* and *mi* for *la*. For example, if after having begun

(DDDD) We often say, *that we are upon a particular key*, instead of saying *that we are in a particular mode*. The following expressions therefore are synonymous; *such a piece is in* ut *major*, or *in the mode of* ut *major*, or *in the key of* ut *major*.

We have seen that the diatonic scale or gammut of the Greeks was *la si ut re mi fa sol la* (art. 49.) A method has likewise been invented of representing each of the sounds in this scale by a letter of the alphabet; *la* by A, *si* by B, *ut* by C, &c. It is from hence that these forms of speaking proceed: Such a piece is upon A, *with* mi, la, *and its third minor*; or, simply, it is upon A, *with* mi, la, *and its minor*; such another piece upon C, *with* sol, ut, *and its third major*; or, simply, upon C, *with* sol, ut, *and its major*; to signify that the one is the mode of *la minor*, or that the other is in that of *ut major*; this last manner of speaking is more concise, and on this account it begins to become general.

They likewise call the cleff of *ut fa*F, the cleff of *re sol*G, &c. to denominate the cleff of *fa*, the cleff of *sol*, &c.

They say likewise to take the A *mi la*, to give the A *mi la*; that is to say, to take the unison of a certain note called *la* in the harpsichord, which *la* is the same that occupies the fifth line, or the highest line in the first cleff of *fa*. This *la* divides in the middle the two octaves which subsist (note RR) between the *sol* which occupies the first line in the cleff of *sol* upon that same line, and that *sol* which occupies the first line in the cleff of *fa* upon the fourth; and as it possesses (if we may speak so) the middle station between the sharpest and lowest sounds, it has been chosen to be the sound with relation to which all the voices and instruments ought to be tuned in a concert (§).

(§) Thus far our author: and though the note is no more than an illustration of the technical phraseology in his native language, we did not think it consistent with the fidelity of a translation to omit it. We have little reason to envy, and still less to follow, the French in their abbreviations of speech; the native energy of our tongue supersedes this necessity in a manner so effectual, that, in proportion as we endeavour to become succinct, our style, without the smallest sacrifice of perspicuity, becomes more agreeable to the genius of our language; whereas, in French, laconic diction is equally ambiguous and disagreeable. Of this we cannot give a more flagrant instance than the note upon which these observations are made, in its original. We must, however, follow the author's example, in reciting a few technical phrases upon the same subject, which occur in our language, and which, if we are not mistaken, will be found equally concise, at the same time that they are more natural and intelligible. When we mean to express the fundamental note of that series within the diatonic octave which any piece of music demands, we call that note the *key*. When we intend to signify its mode, whether major or minor, we denominate the harmony *sharp* or *flat*. When in a concert we mean to try how instruments are in tune by that note upon which, according to the genius of each particular instrument, they may best agree in unison, we desire the musicians who join us to sound A.

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gun a melody by ſome of the notes which are common to the modes of *ut* and of *la* (as *mi re mi fa mi re ut ſi ut*), I ſhould afterwards find the mode of *ſol*, which I aſcertain by the *fa*♯, or that of *fa* which I aſcertain by the *ſi*♭ or *ut*♮, I may conclude that I have begun in the mode of *ut*; but if I find the mode of *re*, or that of *mi*, which I aſcertain by *ſi*♭, *ut*♯, or *re*♯, &c. I conclude from thence that I have begun in the mode of *la*.

4. A mode is not for ordinary deſerted, eſpecially in the beginning of a piece, but that we may paſs into one or other of theſe modes which are moſt relative to it, which are the mode of its fifth above, and that of its third below, if the original mode be 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 *ut*, are the major mode of *ſol*, and that of *la* minor. From the mode of *ut* 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. For what remains, 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 *fa* and *mi* for the mode of *ut* (EEEE).

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*, is always eaſy to be found. For the ſounds which occur in the treble may be conſulted M. Rameau, p. 54. of his *Nouveau Syſteme de Muſique theorique et pratique* (FFFF).

* See *Cadence*.

285 Having aſcertained the mode, the fundamental baſs not difficult.

When a perſon is once able to aſcertain the mode, and can render himſelf ſure of it 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 UT. *ut mi ſol ut.*
Minor mode of LA. *la ut mi la.*

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 UT. *ſol ſi re fa.*
Tonic dominant.
Minor mode of LA. *mi ſol*♯ *ſi re.*

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 UT. *fa la ut re.*
Minor mode of LA. *re fa la ſi.*

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 *ut*, and that we find in the melody theſe two notes *la ſi* in ſucceſſion; if we confine ourſelves to place in the fundamental baſs one of the three ſounds *ut ſol fa*, we ſhall find nothing for the ſounds *la* and *ſi* but this fundamental baſs $\overset{6}{fa}$ $\overset{7}{ſol}$; now ſuch a ſucceſſion as $\overset{6}{fa}$ to $\overset{7}{ſol}$ is prohibited by the fifth rule for the fundamental baſs, according to which every ſub-dominant, as *fa*, ſhould riſe by a fifth; ſo that $\overset{6}{fa}$ can only be followed by *ut* in the fundamental baſs, and not by $\overset{7}{ſol}$.

To remedy this, the chord of the ſub-dominant *fa la ut re* muſt be inverted into a fundamental chord of the ſeventh, in this manner, *re fa la ut*, which has been called the *double employment* (art. 105.) becauſe it is a ſecondary manner of employing the chord of the ſub-

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(EEEE) It is certain that the minor mode of *mi* has an extremely natural connection with the mode of *ut*, 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 *re* may be joined to the major mode of *ut*: and thus in a particular ſenſe, this mode may be conſidered as relative to the mode of *ut*, but it is ſtill leſs ſo than the major modes of *ſol* and *fa*, or than thoſe of *la* and *mi* minor; becauſe we cannot immediately, and without licence, paſs in a fundamental baſs from the perfect minor chord of *ut* to the perfect minor chord of *re*; and if you paſs immediately from the major mode of *ut* to the minor mode of *re* in a fundamental baſs, it is by paſſing, for inſtance, from the tonic *ut*, or from *mi ſol ut*, to the tonic dominant of *re*, carrying the chord *la ut*♯ *mi ſol*, in which there are two ſounds, *mi ſol*, which are found in the preceding chord; or otherwiſe from *ut mi ſol ut* to *ſol ſi*♭ *re mi*, a chord of the ſub-dominant in the minor mode of *re*, which chord has likewiſe two ſounds, *ſol* and *mi*, in common with that which went immediately before it.

(FFFF) 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, *mi ut ſol*, we muſt not with too much precipitation conclude from thence that we are in the major mode of *ut*, although theſe three ſounds, *mi ut ſol*, be the principal and characteriſtical ſounds in the major mode of *ut*: we may be in the minor mode of *mi*, eſpecially if the note *mi* ſhould be long. You may ſee an example in the fourth act of *Zoroaſter*, where the firſt air ſung by the prieſts of Arimanes begins thus with two times *ſol mi*♭ *ſi*♭, each of theſe notes being a crotchet. The air is in the minor mode of *ſol*, and not in the major mode of *mi*♭, as one would at firſt be tempted to believe it. Now we may be ſenſible that it is in *ſol* minor, by the relative modes which follow, and by the notes where the cadences fall.

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sub-dominant. By these means we give to the modulation *la si*, this fundamental bass $\overset{7}{re}\ \overset{7}{sol}$, which procedure is agreeable to rules.

Here then are four chords, *ut mi sol ut*, *sol si re fa*, *fa la ut re*, *re fa la ut*, which may be employed in the major mode of *ut*. We shall find in like manner, for the minor mode of *la*, four chords,

la ut mi la, *mi sol*♯ *si re*,
re fa la si, *si re fa la*.

And in this mode we sometimes change the last of these chords into *si re fa*♯ *la*, substituting the *fa*♯ for *fa*♮. For instance, if we have this melody in the minor mode of *la mi fa*♯ *sol*♯ *la*, we would cause the first note *mi* to carry the perfect chord *la ut mi la*, the second note *fa*♯ to carry the chord of the seventh *si re fa*♯ *la*, the third note *sol*♯ the chord of the tonic dominant *mi sol*♯ *si re*, and in short, the last the perfect chord *la ut mi la*.

On the contrary, if this melody is given always in the minor mode *la la sol*♯ *la*, the second *la* being syncopated, it might have the same bass as the modulation *mi fa*♯ *sol*♯ *la*, with this difference alone, that *fa*♮ might be substituted for *fa*♯ in the chord *si re fa*♯ *la*, the better to mark out the minor mode.

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,

$$\text{ut}\ \overset{7}{\text{la}}\ \overset{7}{\text{re}}\ \overset{7}{\text{sol}}\ \overset{7}{\text{ut}}\ \overset{7}{\text{fa}}\quad \overset{7}{\text{si}}\ \overset{7}{\text{mi}}\ \overset{7}{\text{la}}\ \overset{7}{\text{re}}\ \overset{7}{\text{sol}}\ \text{ut},$$

which are terminated equally in the tonic *ut*, either entirely belong, or at least may be reckoned as belonging (GGGG) to the mode of *ut*; because none of these dominants are tonic dominants, except *sol*, which is the tonic dominant of the mode of *ut*; and besides, because the chord of each of these dominants forms no other sounds than such as belong to the scale of *ut*.

But if I were to form this fundamental bass,

$$\overset{7}{\text{ut}}\ \overset{7}{\text{la}}\ \overset{7}{\text{re}}\ \overset{7\flat}{\text{sol}}\ \text{ut},$$

considering the last *ut* as a tonic dominant in this manner, *ut mi sol si*♭; the mode would then be changed at the second *ut*, and we should enter into the mode of *fa*, because the chord *ut mi sol si*♭ indicates the tonic dominant of the mode of *fa*; besides, it is evident that the mode is changed, because *si*♭ does not belong to the scale of *ut*.

In the same manner, were I to form this fundamental bass

$$\overset{7}{\text{ut}}\ \overset{7}{\text{la}}\ \overset{7}{\text{re}}\ \overset{6}{\text{sol}}\ \text{ut},$$

considering the last *ut* as a tonic dominant in this manner, *ut mi sol la*; this last *ut* would indicate the mode of *sol*, of which *ut* is the *sub-dominant*.

In like manner, still, if in the first series of dominants, I caused the first *re* to carry the third major, in this manner, *re fa*♯ *la ut*; this *re* having become a tonic dominant, would signify to me the major mode of *sol*, and the $\overset{7}{sol}$ which should follow it, carrying the chord $\overset{7}{si}$ *re fa*, would relapse into the mode of *ut*, from whence we had departed.

Finally, in the same manner, if in this series of dominants, one should cause *si* to carry *fa*♯ in this manner, *si re fa*♯ *la*, this *fa* would show that we had departed from the mode *ut*, to enter into that of *sol*.

From hence it is easy to form this rule for discovering the changes of mode in the fundamental bass.

1. When we find a tonic in the fundamental bass, 286 A rule for discovering the changes of mode.
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, one cannot be secure by the assistance of this dominant alone, whether the mode be major or minor: but it is only necessary for the composer to cast his eye upon the following note, which must be the tonic of the mode in which he is; by the third of this tonic he will discover 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 (HHHH).

I here subjoin the soliloquy of Armida, with the continued and fundamental basses. The changes of the mode will be easily distinguished in the fundamental bass,

(GGGG) 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 *ut*, viz. *ut* carrying the perfect chord, *fa* carrying that of the sub-dominant, and *sol* that of the tonic dominant, to which we may join the chord of the seventh, *re fa la ut* (art 105.): but we here regard *as extended* the series of dominants in question, as belonging to the mode of *ut*, 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 *la* belongs naturally to the mode of *sol*, the simple dominant *si* to that of *la*, &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 *ut*.

(HHHH) 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 *ut* and the major of *sol*, or the major mode of *ut* and the minor

 of

Principles of Composition.

basʃ, by the rules which we have juſt given at the end of the article 242. This ſoliloquy will ſerve for a leſſon to beginners. M. Rameau quotes it in his New Syſtem of Muſic, as an example of modulation highly juſt and extremely ſimple. (See Plate VI. and the following (IIII).

Chap. XIV. *Of the Chromatic and Enharmonic.*

287 Chromatic, what.

245. We call that melody *chromatic* which is compoſed of ſeveral notes in ſucceſſion, whether riſing or deſcending by ſemitones. (See LXXXVIII. and LXXXIX.)

288 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 LXXXVIII (LLLL).

289 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 LXXXIX). 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.

290 Enharmonic little practiſed.

248. With reſpect to the enharmonic, it is very rarely put in practice; and we have explained its formation in the firſt book, to which we refer our readers. We ſhall content ourſelves with ſaying, that, in the beautiful ſoliloquy of the fourth act of Dardanus, at the words *lieux funeſtes*, &c. "fatal places, &c." we find an example of the enharmonic; an example of the diatonic enharmonic in the trio of the Fatal Siſters, in Hippolitus and Aricia, at the words, *Ou cours-tu malheureux*, "Whither, unhappy, doſt thou run;" and that there are no examples of the chromatic enharmonic, at leaſt in our French operas. M. Rameau had imitated an earthquake by this ſpecies of muſic, in the ſecond act of the Gallant Indians; but he informs us, that in 1735 he could not cauſe it to be executed by the band. The trio of the Fatal Siſters in Hippolitus has never been ſung in the opera as it is compoſed. But M. Rameau aſſerts, (and we have heard it elſewhere by people of taſte, before whom the piece was performed), that the trial had ſucceeded when made by able hands that were not mercenary, and that its effect was aſtoniſhing.

Chap. XV. *Of Deſign, Imitation, and Fugue.* See *Deſign*.

291 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*.

250. *Imitation* conſiſts in cauſing to be repeated the melody of one or of ſeveral bars in one ſingle part, or in the whole harmony, and in any of the various modes that See *Imitation*. 292 Imitation, what.

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of *la*: 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 *ut* and the minor of *ſi*, &c.

When you find yourſelf 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, you muſt continue in it but for a ſhort time, becauſe the ear is always impatient to return to the former mode.

(IIII) It is extremely proper to remark, that we have given the fundamental, the continued baſs, and in general the modulation of this ſoliloquy, merely as a leſſon in compoſition extremely ſuitable to *beginners*; not that we recommend the ſoliloquy in itſelf as a model of expreſſion. Upon this laſt object what we have ſaid may be ſeen in what we have written concerning the liberties to be taken in muſic, Vol. IV. p. 435, of our Literary Miſcellany. It is preciſely becauſe this ſoliloquy is a proper leſſon for initiates, that it would be a bad one for the mature and ingenious artiſt. The novice ſhould learn tenaciouſly to obſerve his rules; the man of art and genius ought to know on what occaſions and in what manner they may be violated when this expedient becomes neceſſary.

(LLLL) 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 XC. 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 *re* to *ſol*♯, and a fifth redundant from *ſol*♯ to *ut*.

The reaſon of this licence is, as it appears to me, 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

$\overset{7}{la}\ \overset{\not 7}{re}\ \overset{7}{ſol♯}\ \overset{7}{ut}\ \ fa♯\ \overset{7}{ſi}\ \overset{\overset{7}{♯}}{mi}\ la$

(ſee Example XCI.) may be conſidered as repreſenting (art. 116.) that which is written below,

$\overset{7}{la}\ \overset{\overset{7}{♯}}{re}\ \overset{7}{mi}\ \overset{7}{ut}\ fa♯\ \overset{7}{ſi}\ \overset{\overset{7}{♯}}{mi}\ la$

Now this laſt fundamental baſs is formed according to the common rules, unleſs that there is a broken cadence from *re* to $\overset{\overset{7}{♯}}{mi}$, and an interrupted cadence from *mi* to *ut*, which are licenſes (art. 213 and 214.)

Principles of Composition.

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*. *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.

* See *Air*, *Canon*, *Fugue*.

293 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 (MMMM) 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; the province of men who are adorned with taste and genius is to find the exceptions.

Chap. XVI. *Definitions of the Different Airs.*

252. We shall finish this treatise by giving in a few words the characteristic distinctions of the different airs to which names have been given, as *chacoon*, *minuet*, *rigadoon*, &c.

The *chacoon* is a long piece of music, containing three times in each bar, of which the movement is regular, and the bars sensibly distinguished. It consists of several couplets, which are varied as much as possible. Formerly the bass of the chacoon was a *constrained bass*, or regulated by a rhythmus terminating in 4 bars, and proceeding again by the same number; at present composers of this species no longer confine themselves to that practice. The chacoon begins, for the most part, not with the perfect time, which is struck by the hand or foot, but with the imperfect, which passes while the hand or foot is elevated.

The *villanelle* is a chacoon a little more lively, with its movement somewhat more brisk than the ordinary chacoon.

The *passacaille* only differs from a chacoon as it is more slow, more tender, and beginning for ordinary with a perfect time.

The *minuet* is an air in triple time, whose movement is regular, and neither extremely brisk nor slow, consisting of two parts or strains, which are each of them repeated; and for which reason they are called by the French *reprises*: each strain of the minuet begins with a time which is struck, and ought to consist of 4, of 8, or of 12 bars; so that the cadences may be easily distinguished, and recur at the end of each 4 bars.

The *sarabando* is properly a slow minuet; and the *courant* a very slow sarabando: this last is no longer in use. The *passepied* is properly a very brisk minuet, which does not begin like the common minuet, with a stroke of the foot or hand; but in which each strain begins in the last of the three times of which the bar consists.

The *loure* is an air whose movement is slow, whose time is marked with $\frac{6}{4}$, and where two of the times in which the bar consists are beaten; it generally begins with that in which the foot is raised. For ordinary the note in the middle of each time is shortened, and the first note of the same time pointed.

The *jig* is properly nothing else but a loure very brisk, and whose movement is extremely quick.

The *forlana* is a moderate movement, and in a mediocrity between the loure and the jig.

The *rigadoon* has two times in a bar, is composed of two strains, each to be repeated, and each consisting of 4, of 8, or of 12 bars: its movement is lively; each strain begins, not with a stroke of the foot, but at the last note of the second time.

The *bourée* is almost the same thing with the rigadoon.

The *gavotte* has two times in each bar, is composed of two strains, each to be repeated, and each consisting of 4, of 8, or of 12 bars: the movement is sometimes slow, sometimes brisk; but never extremely quick, nor very slow.

The *tambourin* has two strains, each to be repeated, and each consisting of 4, of 8, or of 12 bars, &c. Two of the times that make up each bar are beaten, and are very lively; and each strain generally begins in the second time.

The *musette* consists of two or three times in each bar; its movement is neither very quick nor very slow; and for its bass it has often no more than a single note, which may be continued through the whole piece.

APPENDIX.

The treatise of D'Alembert, of which we have given a translation, 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 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

(MMMM) 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 *fa re*, and the other *ut la* in rising, *ut* is the fifth of *fa*, and *la* the twelfth of *re*.

General observations on Harmonics.

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 different 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.

Aristoxenus, 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*.

General observations on Harmonics.

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.

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.

M U S

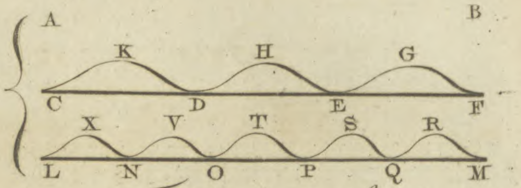
Buffon supposes it to be the sheep in a wild state; and it is described as such by Mr Pennant. These animals live in the mountains, and run with great swiftness among the rocks. Those of Kamtschatka are so strong, that 10 men can scarce hold one; and the horns are so large as sometimes to weigh 30 pounds, and

Tone tone semitone tone tone tone semitone

A ut re mi fa sol la si VT

B ut re mi fa sol la si VT RE MI FA SOL &c

Scale first. Scale Second.

C 

The Chromatic Species.

The diatonic Scale of the Greeks.

D
Si Ut Re Mi Fa Sol La
Sol Ut Sol Ut Fa Ut Fa

The Fundamental bass.

K
Scale.
Sol Sol &c
Ut Mi Sol ✳
The Fundamental bass.

E
Ut Re Mi Fa Sol Sol La Si Ut
Ut Sol Ut Fa Ut Sol Re Sol Ut
The Fundamental bass.

L
Scale.
Ut Mi Si ✳
Ut Mi Sol ✳
The Fundamental bass.

F VT, VT ✳, re, re ✳, mi, mi ✳, fa ✳, SOL, sol ✳, LA, la ✳, si, si ✳, ut, ut ✳, RE, RE ✳, MI, MI ✳,

Scale first. Scale Second.

The first Scale of the minor mode.

G
Sol La Si Ut Re Mi Fa
Third minor. Third minor. Third minor.
Mi La Mi La Re La Re
The Fundamental bass.

N
Scale.
Mi♭ Mi Mi Mi Mi ✳
Ut Ut La Ut Ut
The Fundamental bass.

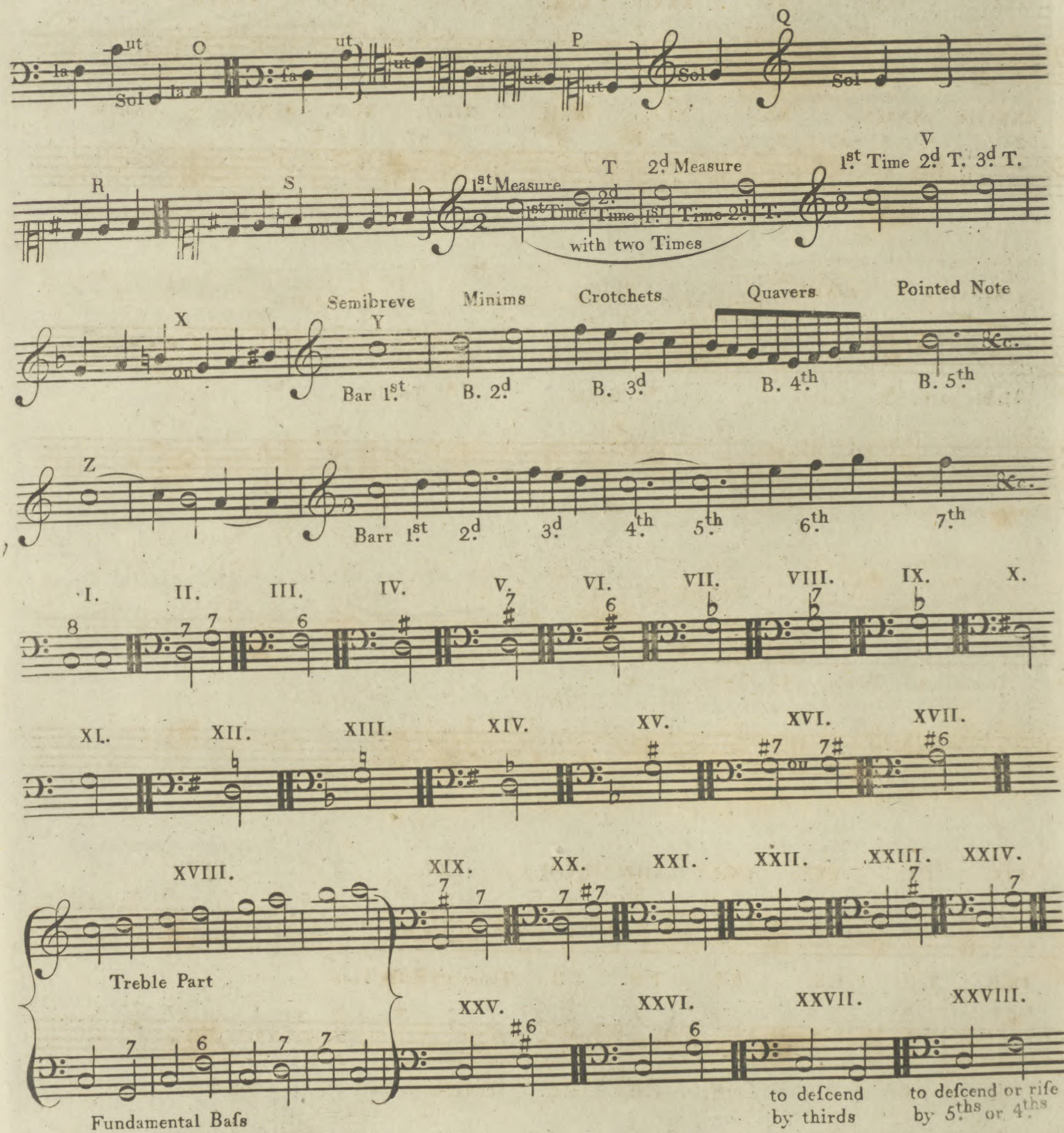
The second Scale of the minor mode.

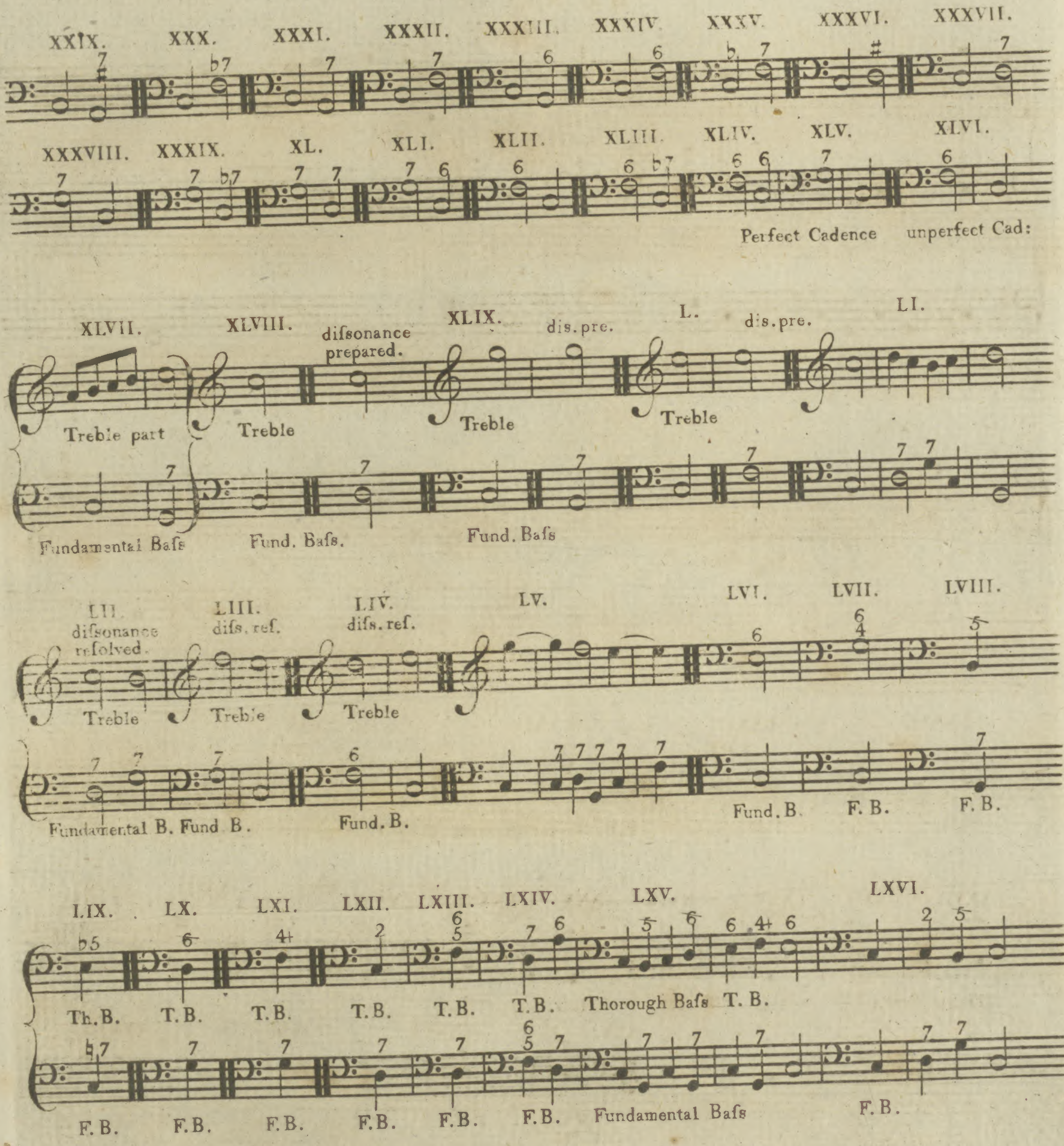
H
La Si Ut Re Mi mi fa ✳ Sol ✳ La
La Mi La Re La Mi Si Mi La
The Fundamental bass.

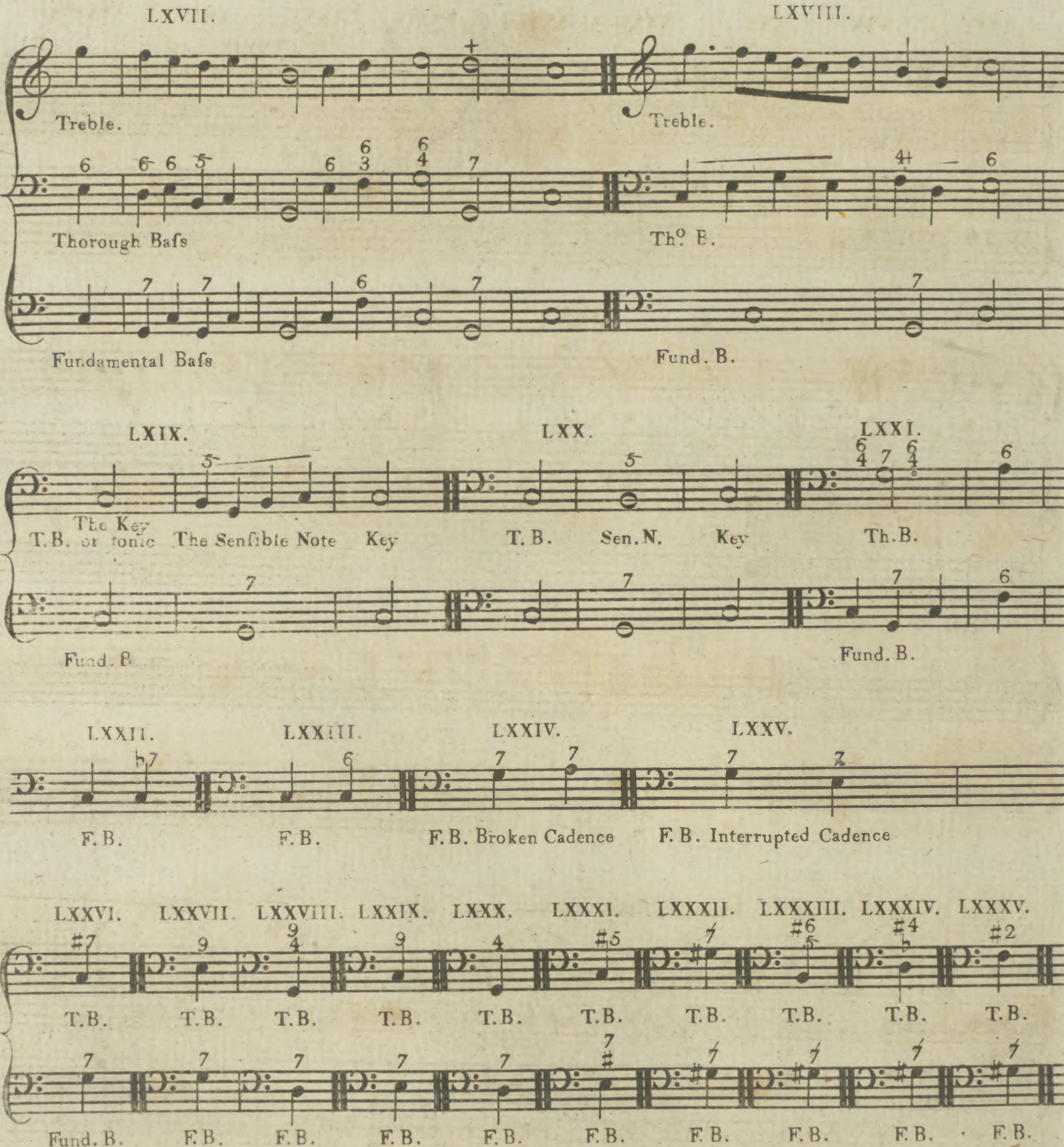
M
Scale.
Fa Mi Mi Re
Fa Ut Mi Si
The Fundamental bass.

I
Scale.
Ut Re Mi Fa Sol La Si Ut
Ut Sol Ut Fa Ut Re Sol Ut

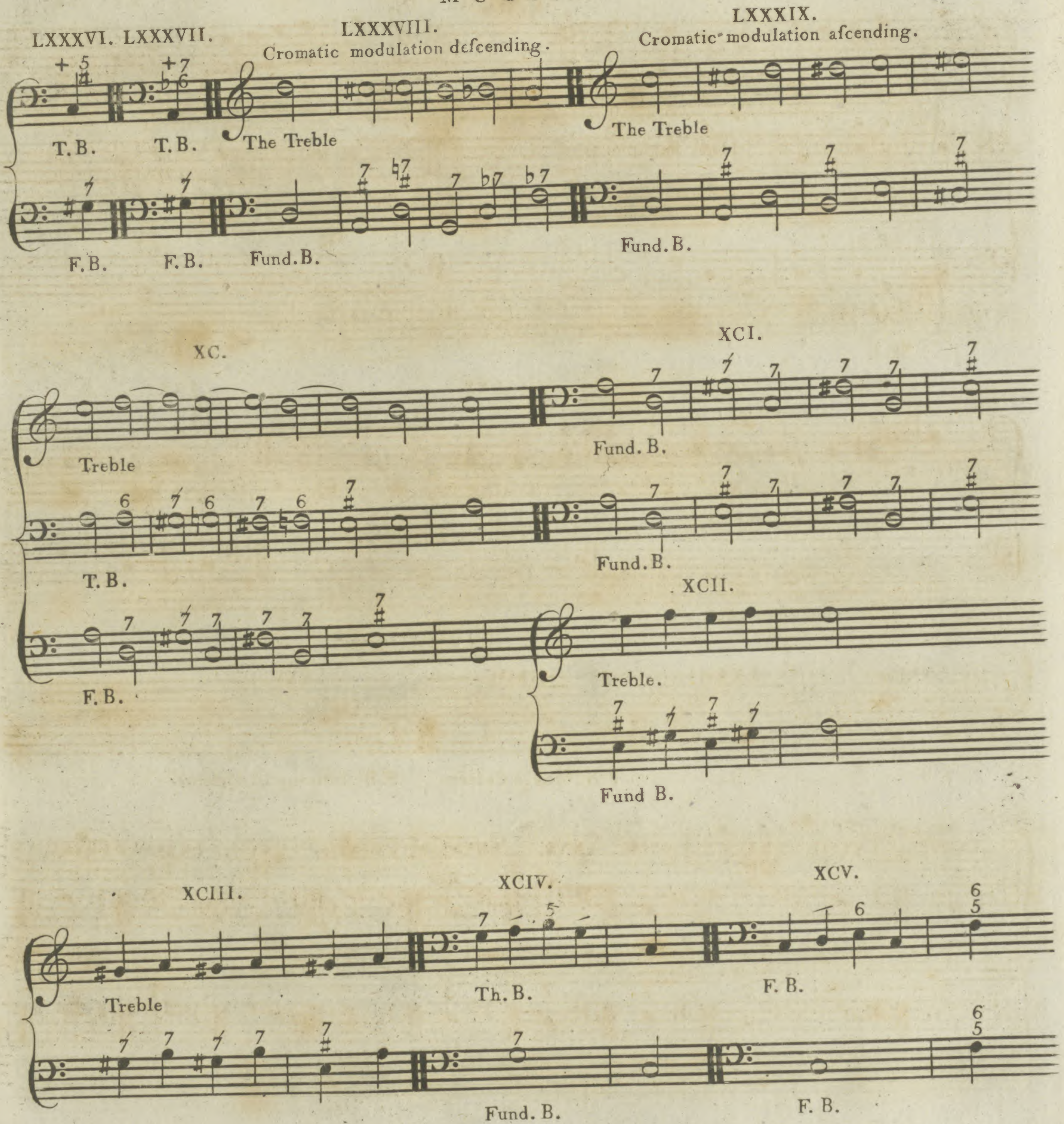
A. Bell Prin. Wal. Sculptor fecit.

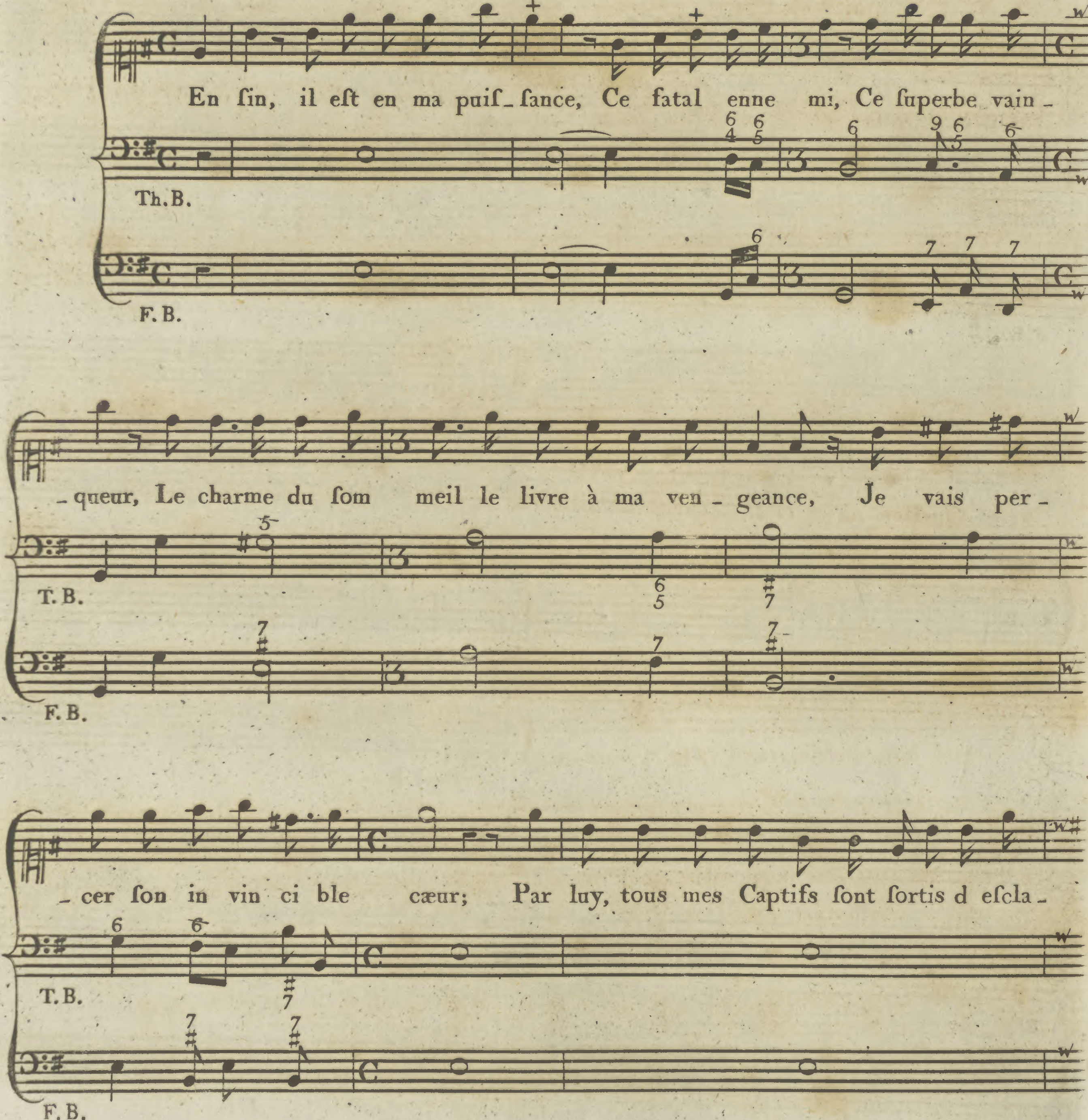

la ut Sol la O fa ut ut ut ut ut P ut Sol Q Sol
R S on
1st Measure
1st Time
T 2d Time
2d Measure
1st Time 2d T.
with two Times
1st Time 2d T. 3d T.
V
X on
Semibreve Y Minims Crotchets Quavers Pointed Note &c.
Bar 1st B. 2d B. 3d B. 4th B. 5th
Z
Barr 1st 2d 3d 4th 5th 6th 7th &c.
I. II. III. IV. V. VI. VII. VIII. IX. X.
XI. XII. XIII. XIV. XV. XVI. XVII.
ou
XVIII. XIX. XX. XXI. XXII. XXIII. XXIV.
Treble Part
XXV. XXVI. XXVII. XXVIII.
Fundamental Baſs
to deſcend by thirds
to deſcend or riſe by 5ths or 4ths


XXIX. XXX. XXXI. XXXII. XXXIII. XXXIV. XXXV. XXXVI. XXXVII.
XXXVIII. XXXIX. XL. XLI. XLII. XLIII. XLIV. XLV. XLVI.
Perfect Cadence
unperfect Cad:
XLVII. XLVIII. XLIX. L. LI.
difsonance prepared.
dis.pre.
dis.pre.
Treble part
Treble
Treble
Treble
Fundamental Bafs
Fund. Bafs.
Fund. Bafs
LII. LIII. LIV. LV. LVI. LVII. LVIII.
difsonance refolved.
difs. ref.
difs. ref.
Treble
Treble
Treble
Fundamental B. Fund B.
Fund. B.
Fund. B
F. B.
F. B.
LIX. LX. LXI. LXII. LXIII. LXIV. LXV. LXVI.
Th. B. T. B. T. B. T. B. T. B. T. B.
Thorough Bafs T. B.
F. B. F. B. F. B. F. B. F. B. F. B.
Fundamental Bafs
F. B.

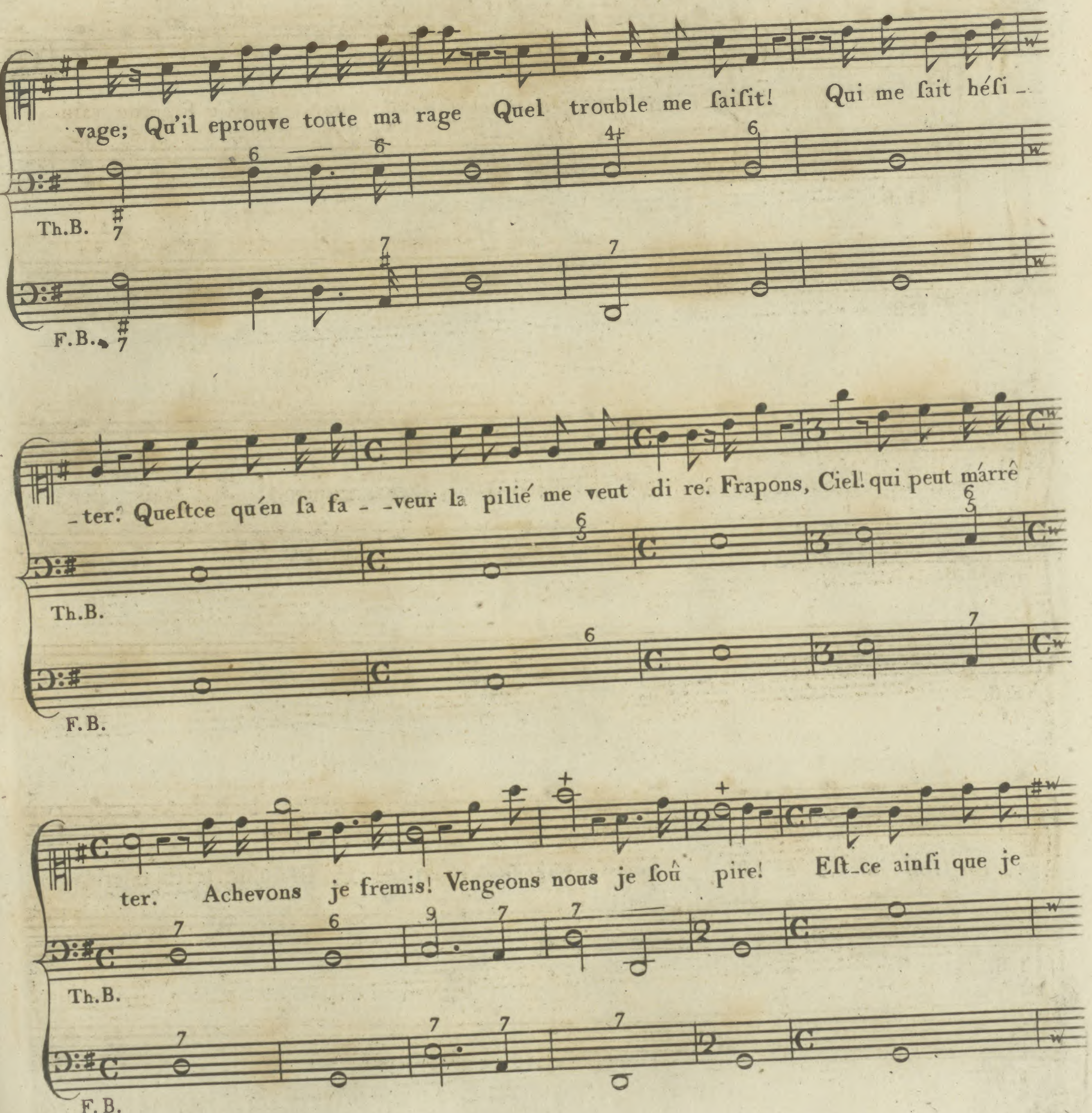

LXVII.
Treble.
Thorough Bafs
Fundamental Bafs
LXVIII.
Treble.
Th.o B.
Fund. B.
LXIX.
T.B.
The Key or tonic
The Senfible Note
Key
Fund. B.
LXX.
T. B.
Sen. N.
Key
LXXI.
Th. B.
Fund. B.
LXXII.
F. B.
LXXIII.
F. B.
LXXIV.
F. B. Broken Cadence
LXXV.
F. B. Interrupted Cadence
LXXVI.
LXXVII.
LXXVIII.
LXXIX.
LXXX.
LXXXI.
LXXXII.
LXXXIII.
LXXXIV.
LXXXV.
T.B.
Fund. B.
F.B.

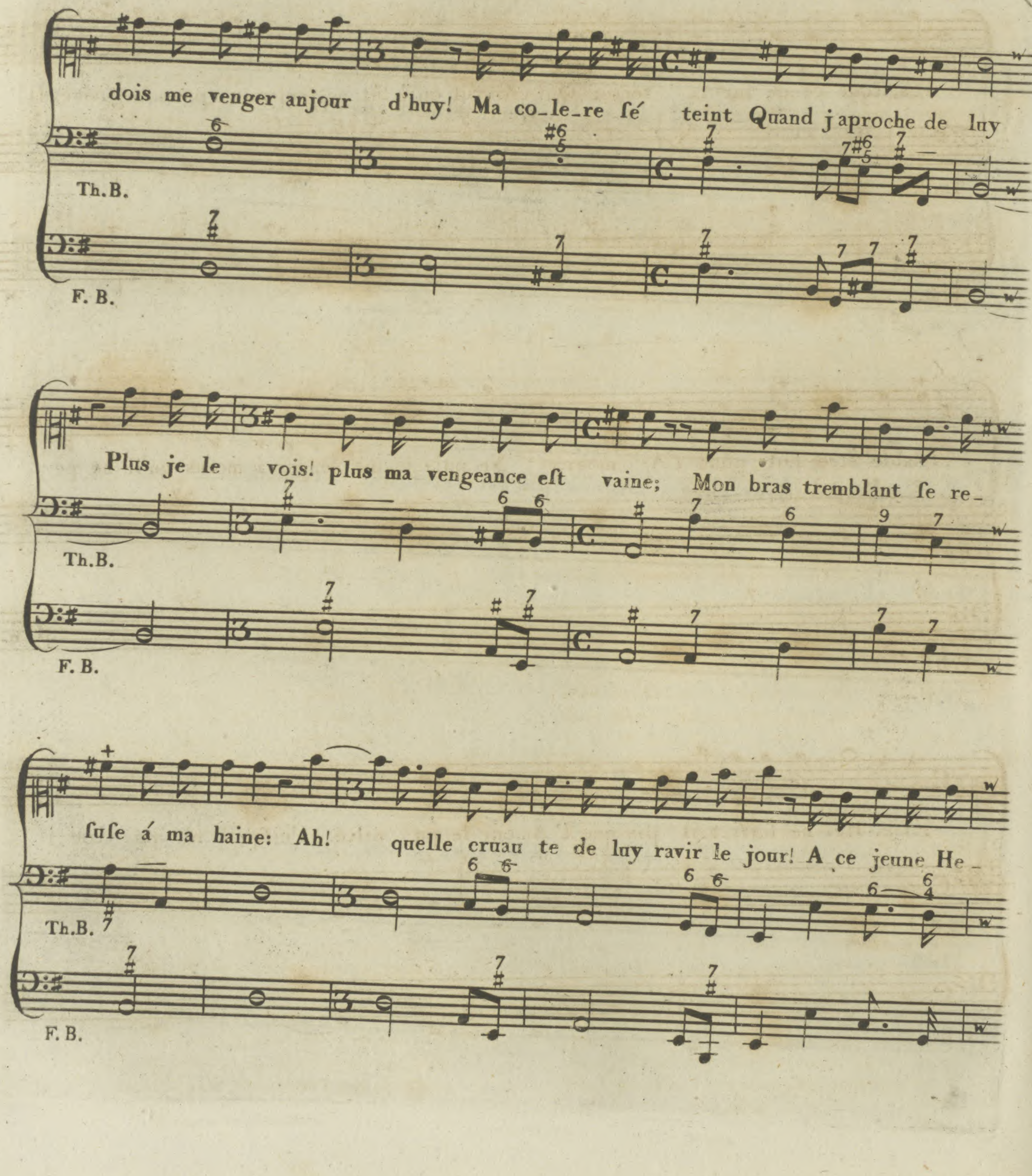
MUSIC.

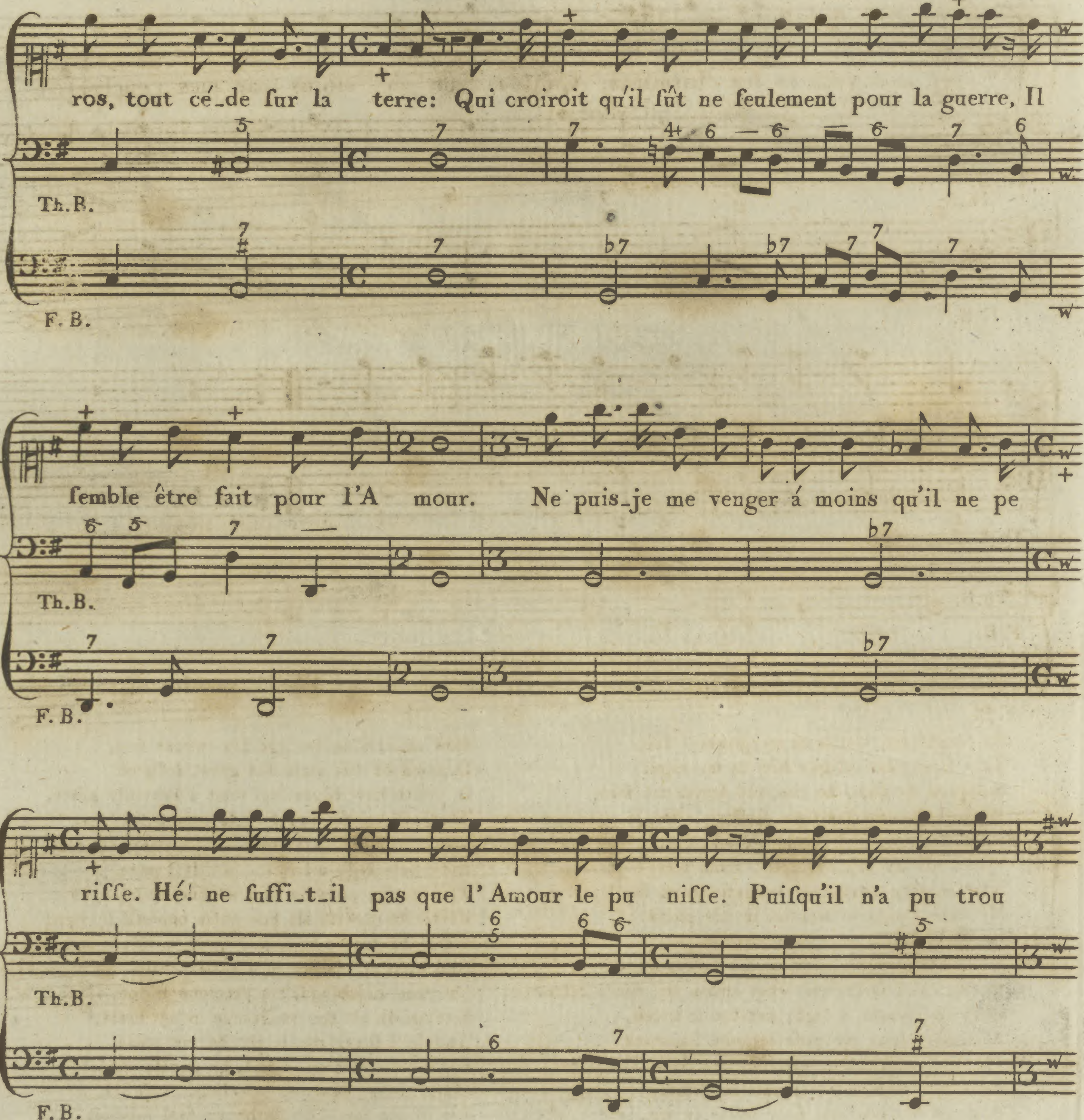

LXXXVI.
LXXXVII.
T. B.
T. B.
F. B.
F. B.
LXXXVIII.
Cromatic modulation descending.
The Treble
Fund. B.
LXXXIX.
Cromatic modulation ascending.
The Treble
Fund. B.
XC.
Treble
T. B.
F. B.
XCI.
Fund. B.
Fund. B.
XCII.
Treble.
Fund B.
XCIII.
Treble
XCIV.
Th. B.
Fund. B.
XCV.
F. B.
F. B.

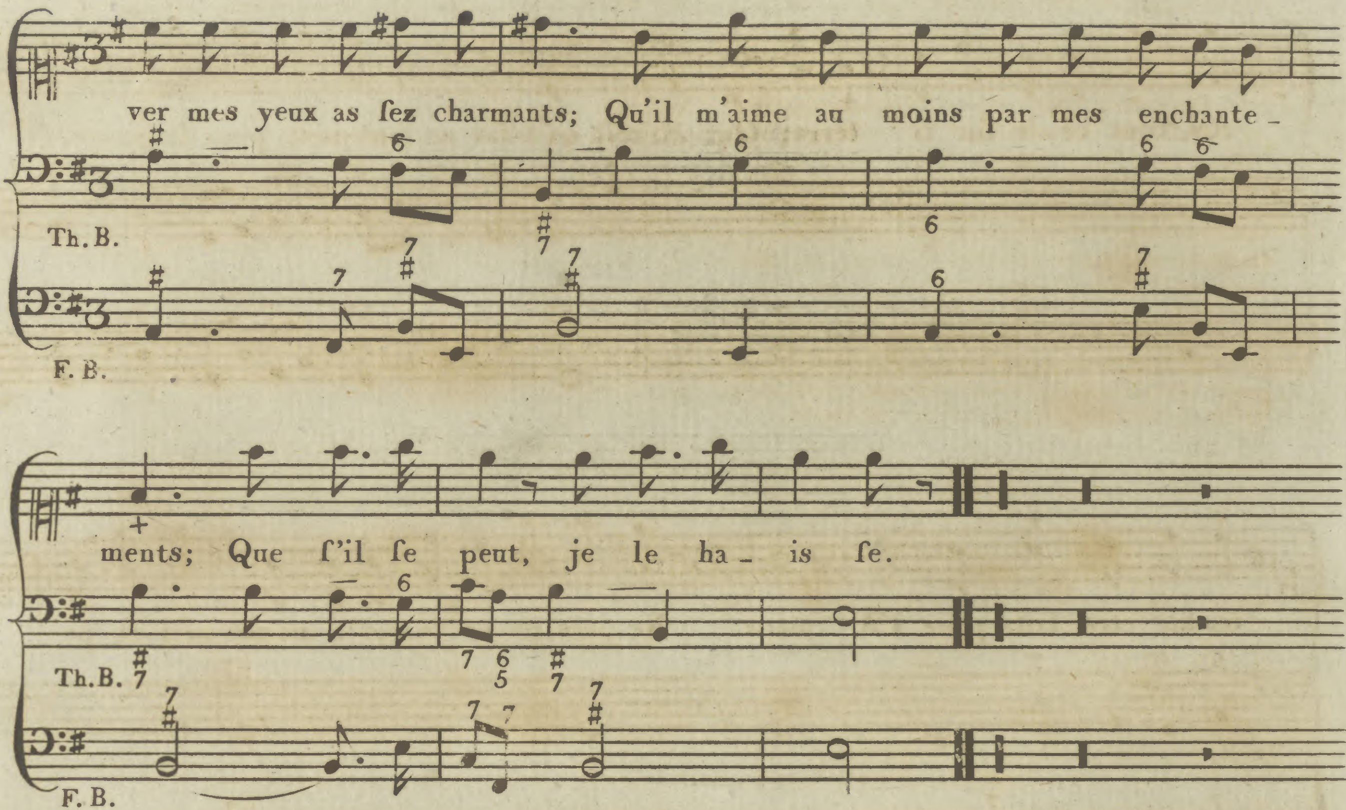

En ſin, il eſt en ma puiſ_ſance, Ce fatal enne mi, Ce ſuperbe vain_
Th.B.
F.B.
_queur, Le charme du ſom meil le livre à ma ven_geance, Je vais per_
T.B.
F.B.
cer ſon in vin ci ble cæur; Par luy, tous mes Captifs ſont ſortis d eſcla
T.B.
F.B.

MUSIC.


vage; Qu'il eprouve toute ma rage Quel trouble me ſaiſit! Qui me ſait héſi -
Th.B.
F.B.
- ter? Queſtce qu'en ſa fa - -veur la pilié me veut di re. Frapons, Ciel! qui peut m'arrê
Th.B.
F.B.
ter. Achevons je fremis! Vengeons nous je ſou pire! Eſt-ce ainſi que je
Th.B.
F.B.


dois me venger aujour d'huy! Ma co_le_re ſé teint Quand j aproche de luy
Th.B.
F. B.
Plus je le vois! plus ma vengeance eſt vaine; Mon bras tremblant ſe re_
Th.B.
F. B.
ſuſe á ma haine: Ah! quelle cruau te de luy ravir le jour! A ce jeune He_
Th.B.
F. B.


ros, tout cé_de ſur la terre: Qui croiroit qu'il ſût ne ſeulement pour la guerre, Il
Th.B.
F.B.
ſemble être fait pour l'A mour. Ne puis_je me venger á moins qu'il ne pe
Th.B.
F.B.
riſſe. Hé! ne ſuffi_t_il pas que l' Amour le pu niſſe. Puiſqu'il n'a pu trou
Th.B.
F.B.



Tranſlation. Intended to give ſuch Readers as do not underſtand French, an idea of the Song.

At length the victim in my power I ſee,
This fatal year reſigns him to my rage;
Subdued by ſleep he lies, and leaves me free,
With chaſtening hand my fury to aſswage.
That mighty heart invincible and fierce.
Which all my captives free'd from ſervile chains;
That mighty heart, my vengeful hand ſhall pierce;
My rage inventive wanton in his pains.
Ha! in my ſoul what perturbation reigns!
What would compaſsion in his favour plead.
Strike, hand. O heaven! what charm thy force reſtrains.
Obey my wrath. I ſigh; yet let it bleed.
And is it thus my juſt revenge improves
The fair occaſion to chaſtize my foe
As I approach, a ſofter paſsion moves,
And all my boaſting fury melts in wo.
Trembling, relax'd, and faithleſs to my hate,
The dreadful taſk this coward arm declines.

How cruel thus to urge his inſtant fate,
Depriv'd of life amid his great deſigns!
In youth how blooming! what a heavenly grace,
Thro' all his form, reſiſtleſs power diſplays!
How ſweet the ſmile that dwells upon his face,
Relentleſs rage diſarming whilſt I gaze!
Tho' to the prowess of his conquering arms
Earth ſtood with all her hoſts oppos'd in vain;
Yet is he form'd to ſpread more mild alarms,
And bind all nature in a ſofter chain.
Can then his blood, his precious blood, alone
Extinguiſh all the vengeance in my heart.
Tho' ſtill ſurviving, might he not atone.
For all the wrongs I feel, by gentler ſmart.
Since all my charms, unfeeling, he defies,
Let Magic force his ſtubborn ſoul ſubdue;
Whilſt I, inflexible to tears and ſighs,
With hate (if I can hate) his peace purſue.

Musis || Musk.

and so capacious, that young foxes often shelter themselves in the hollow of such as by accident fall off in the deserts. See Ovis.

MUSIS (Agostino de), a noted engraver, better known by the name of *Agostino Veneziano*, or in England by that of "Augustin the Venetian;" but *Musis* was his proper family name. He was a native of Venice, and scholar of Marc Antonio Raimondi. It is not certain at what period he begun his studies under that celebrated master; but the first dated print by Agostino appeared A. D. 1509, at which time, it is probable, his tutor still resided at Venice. After the death of Raphael, which happened in 1520, Agostino de Musis, and Marc de Ravenna, his fellow-disciple, who had conjointly assisted each other, separated, and worked entirely upon their own account. It is uncertain at what time Agostino died; but his prints are not dated later than 1536. So that it may be reasonably supposed that he did not long survive that period. Agostino de Musis imitated the style of his master with great attention, and was, upon the whole, the most successful of all his scholars. In neatness and mechanical execution with the graver, he has often equalled if not sometimes exceeded him; but in point of taste, and in the purity and correctness of outline, he certainly fell greatly short of him. Agostino's drawing had more of manner and stiffness; the heads of his figures are not so accurately marked; nor the other extremities expressed with equal truth.

MUSIVUM AURUM. See CHEMISTRY, n° 1224.

MUSK, a very strong-scented substance found under the belly of an East Indian animal. See MOSCHUS.

According to Tavernier, the best and greatest quantities of musk come from the kingdom of Boutan, from whence it is carried for sale to Patna, the chief town of Bengal. After killing the animal, the peasants cut off the bag, which is about the size of an egg, and is situated nearer the organs of generation than the navel. They next take out the musk, which has then the appearance of clotted blood. When they want to adulterate it, they put a mash of the animal's blood and liver into the place of the musk they had extracted. In two or three years this mixture produces certain small animals which eat the good musk; so that, when opened, a great consumption is perceived. Others, after extracting a portion of the musk, put in small pieces of lead to augment the weight. The merchants who transport the musk to foreign countries are less averse to this trick than the former; because in this case none of the animals abovementioned are produced. But the deceit is still worse to discover, when, of the skin taken from the belly of a young animal, they make little bags, which they sew so dexterously with threads of the same skin, that they resemble genuine bags. Those they fill with what they take out of the genuine bags, and some fraudulent mixture, which it is extremely difficult for the merchants to detect. When the bags are sewed immediately on their being cut, without allowing any part of the odour to dissipate in the air, after they have abstracted as much of the musk as they think proper, if a person applies one of these bags to his nose, blood will be drawn by the mere force of the odour, which must necessarily be weakened or diluted in order to render it agreeable without injuring the brain. Our author brought one of the animals with him to Paris, the odour of which was so strong, that it was impossible for him to keep it in his chamber. It made every head in the house giddy; and he was obliged to put it in a barn, where the servants at last cut away the bag: the skin, notwithstanding, always retained a portion of the odour. The largest musk-bag seldom exceeds the size of a hen's egg, and cannot furnish above half an ounce of musk: three or four of them are sometimes necessary to afford a single ounce. In one of his voyages to Patna, Tavernier purchased 1663 bags, which weighed 1557 ounces and a half; and the musk, when taken out of the bags, weighed 452 ounces.

Musk.

Musk affords the strongest of all known odours. A small bit of it perfumes a large quantity of matter. The odour of a small particle extends through a considerable space. It is likewise so fixed and permanent, that at the end of several years it seems to have lost no part of its activity. When it comes to us, it is dry, with a kind of unctuosity, of a dark reddish-brown or rusty blackish colour, in small round grains, with very few hard black clots, and perfectly free from any sandy or other visible foreign matter. If chewed, and rubbed with a knife on paper, it looks smooth, bright, yellowish, and free from bitterness. Laid on a red hot iron, it catches flame, and burns almost entirely away, leaving only an exceeding small quantity of light greyish ashes: if any earthy substances have been mixed with the musk, the quantity of the residuum will readily discover them.

Musk has a bitterish subacrid taste; a fragrant smell, agreeable at a distance, but when smelt near to, so strong as to be disagreeable unless weakened by the admixture of other substances. If a small quantity be infused in spirit of wine in the cold for a few days, it imparts a deep, but not red tincture: this, though it discovers no great smell of the musk, is nevertheless strongly impregnated with its virtues; a single drop of it communicates to a whole quart of wine a rich musky flavour. The degree of flavour which a tincture drawn from a known quantity of musk communicates to vinous liquors, is perhaps one of the best criteria for judging of the goodness of this commodity. Neumann informs us, that spirit of wine dissolves 10 parts out of 30 of musk, and that water takes up 12; that water elevates its smell in distillation, whilst pure spirit brings over nothing.

Musk is a medicine of great esteem in the eastern countries; among us, it has been for some time pretty much out of use, even as a perfume, on a supposition of its occasioning vapours, &c. in weak females and persons of a sedentary life. It appears, however, from late experience, to be, when properly managed, a remedy of good service even against those disorders which it has been supposed to produce. Dr Wall has communicated (in the Philosoph. Transac. n° 474.) an account of some extraordinary effects of musk in convulsive and other diseases, which have too often baffled the force of medicine. The doctor observes, that the smell of perfumes is often of disservice, where the substance, taken inwardly and in considerable quantity produces the happiest effects; that two persons, labouring under a *subsultus tendinum*, extreme anxiety, and want of sleep, from the bite of a mad dog,

dog, by taking two doſes of muſk, each of which was 16 grains, were perfectly relieved from their complaints. He likewiſe obſerves, that convulſive hiccups, attended with the worſt ſymptoms, were removed by a doſe or two of 10 grains; and that in ſome caſes, where this medicine could not, on account of ſtrong convulſions, be adminiſtered to the patient by the mouth, it proved of ſervice when injected as a glyſter. He likewiſe adds, that under the quantity of ſix grains, he never found much effect from it; but that, taken to 10 grains and upwards, it never fails to produce a mild diaphoreſis, without at all heating or giving any uneaſineſs: that, on the contrary, it eaſes pain, raiſes the ſpirits; and that, after the ſweat breaks out, the patient uſually falls into a refreſhing ſleep: that he never met with any hyſterical perſon, how averſe ſoever to perfumes, but could take it, in the form of a bolus, without inconvenience. To this paper is annexed an account of ſome farther extraordinary effects of muſk, obſerved by another gentleman. Repeated experience has ſince confirmed its efficacy in theſe diſorders. The doſe has ſometimes been increaſed, particularly in convulſive diſorders, to the quantity of a ſcruple or half a dram every three or four hours, with two or three ſpoonfuls of the muſk julep between. The julep is the only officinal preparation of it. It is combined with opium in tetanus, and with mercury in rabies canina.

Musk-Animal. See Moschus.

Musk-Ox. See Bos.

Musk-Rat, in zoology. 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 firelocks 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 an 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, tanjeebs, &c. Muſlin is now manufactured in Britain, and brought to very great perfection.

MUSONIUS, (Caius Rufus), a Stoic philoſopher of the ſecond century, was baniſhed into the iſland of Gyare, under the reign of Nero, for criticiſing the manners of that prince; but was recalled by the emperor Veſpaſian. He was the friend of Apollonius Tyanæus, and the letters that paſſed between them are ſtill extant.

MUSQUETOE. See Culex.

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*, *Muſleman*, or *Muſolman*. 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.

Some authors will have it, that the word Muſſulman ſignifies *ſaved*, that is, predeſtinated; and that the Mahometans give themſelves the appellation, as believing they are all predeſtinated to ſalvation.—Martininius is more particular as to the origin of the name; which he derives from the Arabic מסלם, *muſulem*, "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 has worked or fermented. See Wine.

Must of Rheniſh wine. This is a liquor that, tho' drank by ſome, is found extremely to affect the brain; for not having paſſed the natural effervescence which it would have been ſubject to, in the making of wine, its ſalts are locked up till the heat of the ſtomach ſetting them to work, they raiſe their effervescence there, and ſend up abundance of ſubtile vapours to the brain. The Rheniſh muſt is of two kinds, being made either with or without boiling. That made without boiling is only put up ſo cloſe in the veſſel that it cannot work; this is called *ſtumm-wine*. That by boiling is thus prepared: they take ſtrong veſſels not quite filled, and putting them into a cellar, they make a fire mild at firſt, but increaſed by degrees, and afterwards they gradually leſſen it again, that the boiling may ceaſe of itſelf. This operation is finiſhed in 36 or 40 hours, according to the ſize of the veſſel; and the wine-boilers, inſtead of common candles, which would melt by the heat, uſe thin pieces of ſplit beech-wood. Theſe alſo ſerve for a double purpoſe, not only lighting them, but giving them notice of the boiling being enough; before that time, the quantity of vapours thrown up make them burn dim; but as ſoon as it is finiſhed, the vapours aſcend in leſs quantity, and the lights burn briſk and clear. About ſeven or eight days after this boiling, the muſt begins to work, and after this working it is called *wine*. They have alſo another kind of Rheniſh muſt which is thus prepared: they boil the liquor to half the quantity, and put into it the medicinal ingredients they are moſt fond of; ſuch as orange-peel, elecampane-root, and juniper-berries, or the like; being thus medicated, the whole works much more ſlowly than it otherwiſe would.—If the boiled muſt by too violent an effervescence caſt out its lees, it will on this become vapid and dead, unleſs this ſeparation is ſtopped by ſome fatty ſub-

Muftard, Muftella.

ftance, fuch as frefh butter or the like: they put this in upon a vine leaf, or elfe apply hard to the mouth of the veffel.

A muft for artificial wine may be thus made. Take 20 pounds of fine fugar, five gallons of water, four ounces of white tartar finely pulverized, or cream of tartar, and boil them in a large veffel over a gentle fire.

MUSTARD. See Sinapi.

Mustard-Seed, is one of the ftrongeft of the pungent, ftimulating, diuretic medicines, that operate without exciting much heat. It is fometimes taken unbruifed, to the quantity of a fpoonful at a time, in paralytic, cachectic, and ferous diforders. It is applied alfo as an external ftimulant, to benumbed and paralytic limbs; to parts affected with fixed rheumatic pains; and to the foles of the feet, in the low ftage of acute difeafes, for raifing the pulfe; in this intention, a mixture of equal parts of the powdered feeds and crumbs of bread, with the addition fometimes of a little bruifed garlic, are made into a cataplafm with a fufficient quantity of vinegar. See Sinapism.

Muftard-feed yields upon expreffion, a confiderable quantity of oil, which is by fome recommended externally againft rheumatifms and palfies, though it has nothing of that quality by which the feeds themfelves prove ufeful in thofe diforders; the oil being mild and infipid as that of olives, and the pungency of the feed remaining entire in the cake left after expreffion; nor is any confiderable part of the pungent matter extracted by rectified fpirit. The bruifed feeds give out readily to water nearly the whole of their active matter: added to boiling milk they curdle it, and communicate their pungency to the whey. The powder of muftard-feed may be made into the confiftence of a loch with warm water, in which a little fea-falt has been diffolved. Of this a common fpoonful, fometimes two, diluted with tepid water, are given on an empty ftomach; it operates as well as an emetic, and proves an excellent remedy in moft nervous diforders, according to Dr Monro, in Med. Eff. Edinb. vol. ii. art 19. p. 303. note.

MUSTELA, the Otter and Weasel; a genus of quadrupeds of the order of feræ. There are fix cutting teeth in each jaw; thofe of the upper jaw, erect, fharp-pointed, and diftinct; of the lower jaw, blunter, huddled together, and two placed within the line of the reft: The tongue is fmooth.

Plate CCCXXXIII

1. The lutris, or fea-otter, having hairy feet and a hairy tail. The length from nofe to tail is about three feet long, and the tail is about 13 inches; the body and the limbs are black, except the fore-part of the head, which is white or grey; the largeft individual weighs from 70 to 80 pounds; the fur is very thick, long, black, and gloffy, fometimes varying to filvery, with a foft down beneath. The fea-otter inhabits the coafts of North weft America and Eaftern Afia, and the intermediate iflands. It lives moftly in the fea, and fwims with great facility; frequenting fhallows which abound in fea-weeds, and feeding on lobfters, fifh, *fepiæ* or cuttle-fifh, and fhell-fifh. It is a harmlefs animal; very affectionate to its young, infomuch that it will pine to death at the lofs of them, and die on the very fpot where they have been taken from it. Before the young can fwim, the dams carry them in their paws, lying in the water on their backs: they fwim often on their back, their fides, and even in a perpendicular pofture; are very fportive; embrace, and kifs each other: they breed but once a-year, and have but one young at a time, fuckle it for a year, and bring it on fhore. They are dull-fighted, but quick-fcented; and run very fwiftly on land. They are hunted for their fkins, which are of great value; being fold to the Chinefe for 70 or 80 rubles a-piece: each fkin weighs $3\frac{1}{2}$ lib. The young are reckoned very delicate meat, fcarce to be diftinguifhed from a fucking lamb. The cry of this creature is nearly fimilar to a young dog; and it is fometimes interrupted by another cry fimilar to that of the faki or fox-tailed monkey. It may be nourifhed with the flour of manioc diluted in water.

2. The lutra, or common otter, has naked feet, and the tail is about half the length of the body. It is in general about two feet long, from the tip of the nofe to the bafe of the tail. The fur is of a deep brown colour, with two fmall white fpots on each fide of the nofe, and one beneath the chin. This animal inhabits Europe, North America, and Afia as far fouth as Perfia. It frequents frefh water rivers, lakes, and fifh-ponds; and preys on fifh, frogs, and frefh-water cruftaceous animals, being exceedingly deftructive to fifh-ponds. The otter procreates in February, and the female brings forth three or four young ones in May; the male calls the female by a foft murmuring noife. The otter fhows great fagacity in forming its habitation: it burrows under ground on the banks of fome river or lake: it always makes the entrance of its hole under water; working upwards to the furface of the earth, and forming, before it reaches the top, feveral holes or lodges, that, in cafe of high floods, it may have a retreat: for no animal affects lying drier at top: it makes a minute orifice for the admiffion of air. It is further obferved, that this animal, the more effectually to conceal its retreat, contrives to make even this little air-hole in the middle of fome thick bufh. Our author alfo informs us, that the otter is capable of being tamed; that he will follow his mafter like a dog and even fifh for him, and return with his prey. Though the otter does not caft his hair, his fkin is browner, and fells dearer in winter than in fummer; and makes a very fine fur. His flefh has a difagreeable fifhy tafte. His retreats exhale a noxious odour from the remains of putrid fifhes; and his own body has a bad fmell. The dogs chace the otter fpontaneoufly, and eafily apprehend him when at a diftance from water or from his hole. But, when feized, he defends himfelf, bites the dogs moft cruelly, and fometimes with fuch force as to break their leg-bones, and never quits his hold but with life. The beaver, however, who is not a very ftrong animal, purfues the otters, and will not allow them to live on the fame banks with himfelf.

3. The lutreola, or fmall otter, has very broad hairy feet, and a white mouth; and feldom exceeds a foot in length. The body is of a tawny and dufky colour mixed together; the fur having two feries of hairs, the fhorter of which are yellowifh and the long black. This animal inhabits Poland, Finland, Ruffia, and Siberia; frequenting marfhy places, and preying on

Mustela. on fish and frogs. It is caught with dogs and traps, and is excessively fetid; but its fur is very valuable, being esteemed next in beauty to that of the sable.

Plate CCCXXXIII. 4. The canadensis, or Canadian otter, is of a black colour, and the fur is smooth. It has a long taper tail; and inhabits Canada and other parts of North America.

5. The guianensis, or small Guiana otter, with the hind-feet webbed, the toes of the fore-feet unconnected, and a long taper naked tail, inhabits Cayenne, and probably other parts of South America. It is only about seven inches long from the nose to the rump; the tail is near seven; the upper parts of the head and body are marked with large brownish black spots, exactly corresponding on both sides, and the intervals are of a yellowish grey colour; all the under parts of the body and head, and the fore-parts of the fore-legs, are white, and there is a white spot over each eye; the ears are large and round; and the mouth is garnished with long whiskers. Buffon informs us that there are three species of otters in Cayenne: 1st, Black, which weighs from 40 to 50 French pounds. 2d, Yellowish, weighing 20 or 25 pounds. 3d, The small greyish kind above described, which only weighs three or four pounds. The other two are not described; but they are said to appear in numerous troops, to be very fierce and dangerous, and to defend themselves against dogs, biting very cruelly: they litter in holes which they dig on the banks of rivers; are often tamed and brought up in houses.

The otters, of which there are several more species described by authors, are distinguished from the following tribe, the *weesels*, by having their feet palmated or webbed; whereas the latter have their toes separate, or unconnected by any web or membrane.

1. The galera, tayra, or Guinea weasel, is of an uniform dusky colour, the fur very rough. It is about the size of a rabbit, and is shaped like a rat. It inhabits Guinea; where it burrows in the ground by means of its fore-feet, which are strong and formed for digging. It is very common about the negro villages, and is exceedingly fierce and destructive to poultry.

2. The foina, or common martin, is of a blackish chesnut colour, with the throat and breast white: the head and body measure 18 inches in length, the tail 10. The martin inhabits Britain, Germany, France, and most parts of the south of Europe, and even the warmer parts of Russia. He lives in woods, and goes about during the night in quest of prey. He is a most elegant lively animal. His movements are all exceedingly nimble; he rather bounds and leaps than walks. He climbs rough walls with ease and alacrity; enters the pigeon or hen houses, eats the eggs, pigeons, fowls, &c. and the female often kills great numbers, and transports them to her young. He likewise seizes mice, rats, moles, and birds in their nests. M. Buffon kept one of these animals for a considerable time. He tamed to a certain degree, but never formed any attachment, and continued always so wild, that it was necessary to chain him. He made war against the rats, and attacked the poultry whenever they came in his way. He often got loose, though chained by the middle of the body. At first he went to no great distance, and returned in a few hours; but without discovering any symptoms of joy or affection to any particular person. He, however, called for victuals like a cat or a dog. Afterwards he made longer excursions; and at last he thought proper never to return. He was then about a year and a half old, seemingly the age at which nature assumes her full ascendency. He eat every thing presented to him, except sallad and herbs; was fond of honey, and preferred hemp-seed to every other grain. It was remarked that he drank very often; that he sometimes slept two days successively, and at other times would sleep none for two or three days; that, before sleeping, he folded himself in a round form, and covered his head with his tail; and that, while awake, his motions were so violent, so perpetual, and so incommodious, that, though he had not disturbed the fowls, it was necessary to chain him, to prevent him from breaking every thing. The same author informs us, that he has had in his possession several martins of a more advanced age, which had been taken in nets; but they continued to be totally savage, bit all who attempted to touch them, and would eat nothing but raw flesh. The character of this animal is somewhat differently given by Mr Pennant; who says "it is very *good-natured*, sportive, and capable of being *tamed*." The younger females bring three or four at a birth; when older, they produce six or seven. They breed in hollows of trees; and are often, in winter, found in magpies nests. The skin and excrements have a musky smell.

3. The martes, or pine-martin, has the body of a dark or blackish chesnut colour, the breast and throat yellow. It inhabits the north of Europe, Asia, and America; and is more rarely found in Britain, France, Germany, and Hungary; and as far as Tonquin and China. They live in large woods or forests, keeping in the day-time in the hollows of trees, occupying squirrels nests, especially for their young, and go about only by night. They prey on squirrels, mice, rats, and small birds; eat likewise berries, ripe fruit, and honey; and, in winter, go in quest of pigeons and poultry. They procreate in February; and the female is said, after nine months, to bring forth seven or eight young ones. The head of this species is shorter, and the legs are somewhat longer, than in the common martin. The fur is far superior in fineness to that of the common kind, and is a prodigious article in commerce: Those about Mount Caucasus, with an orange throat, are more esteemed by furriers than the rest.

4. The Guiana or South American martin, is of a dark brown colour, with a white forehead, and a long narrow stripe along the side of the neck. The body and head are near two feet long, and the tail is only about five inches. It inhabits Guiana.

5. The laniger, woolly weasel, or small Guiana martin, is covered with white woolly hair, and has a long taper tail: the body and head are near 16 inches long, and the tail near 9. It inhabits Cayenne.

6. The zibellina, or sable, has a great resemblance to the martin: from which it differs in having a longer head; longer ears, surrounded by a yellow margin; longer and more elegant fur; the feet more thickly clothed with hair; and the tail shorter than the hind-legs when extended, while that of the martin is much longer. The colour of the hair is cinereous at the bottom, and black at the tips; the chin is cinereous, sometimes white, yellowish, or spotted; the mouth is garnished with long whiskers; and the feet are large, with white claws. It inhabits the northern parts of Asia

Muſtela. Aſia and America, Siberia, Kamtſchatka, and the Kurile iſlands, and formerly in Lapland; being found in Aſia as low as 58°, and in America even to 40° of latitude. The ſables frequent the banks of rivers and the thickeſt parts of the woods; avoiding the rays of the ſun, which are ſaid in a ſhort time to change the colour of their hair. They live in holes of the earth, or beneath the roots of trees: ſometimes they will form neſts in the trees, and ſkip with great agility from one to the other: they are very lively, and much in motion during the night. Gmelin tells us, that after eating, they generally ſleep half an hour or an hour, when they may be puſhed, ſhaken, and even pricked, without awaking. During the night they are exceſſively active and reſtleſs. A tame one kept by Gmelin was accuſtomed to riſe upon its hind-legs on ſight of a cat, in order to prepare for the combat: In the woods they are much infeſted by wild cats. During ſummer the ſables prey on ermines, weaſels, and ſquirrels, but eſpecially on hares; in winter, on birds; in autumn, on whortleberries, cranberries, and the berries of the ſervice-tree: but during this laſt ſeaſon their ſkins are at the worſt; that diet cauſing their ſkins to itch, and to rub off their fur againſt the trees. They bring forth at the end of March or beginning of April; and have from three to five at a time, which they ſuckle for four or five weeks. In ſpring, after ſhedding the coat, the fur is ſometimes of a tawny caſt, and ſometimes varies to ſnowy whiteneſs. The blackeſt are reputed the beſt; and ſometimes ſell, even in Siberia, from one to ten pounds Sterling each. See the article Sable.

Plate CCCXXXIII. 7. The putorius, or pole-cat, is of a dirty yellow colour, with white muzzle and ears. He inhabits moſt parts of Europe, and in the temperate climates of Aſiatic Ruſſia; and has a great reſemblance to the martin in temperament, manners, diſpoſition, and figure. Like the latter, he approaches our habitations, mounts on the roofs, takes up his abode in hay-lofts, barns, and unfrequented places, from which he iſſues during the night only in queſt of prey. He burrows under ground, forming a ſhallow retreat about two yards in length, generally terminating under the roots of ſome large tree. He makes greater havock among the poultry than the martin, cutting off the heads of all the fowls, and then carrying them off one by one to his magazine. If, as frequently happens, he cannot carry them off entire, on account of the ſmallneſs of the entry to his hole, he eats the brains, and takes only the heads along with him. He is likewiſe very fond of honey, attacks the hives in winter, and forces the bees to abandon them. The females come in ſeaſon in the ſpring; and bring forth three, four, or five at a time. In the deſarts of Aſiatic Ruſſia, polecats are ſometimes found, eſpecially in winter, of a white colour; they are likewiſe found beyond lake Baikal with white or yellowiſh rumps, bounded with black. It is exceedingly fetid, like ſeveral other ſpecies of this genus, eſpecially the martin and ſable, giving out from the anus a moſt offenſive vapour when frightened. The male is moſtly of a yellowiſh tinge, having a whitiſh muzzle, while the muzzle of the female is commonly of a yellowiſh dirty white.

8. The furo, or ferret, has red and fiery eyes; the colour of the whole body is of a very pale yellow; the length from noſe to tail is about 14 inches, the tail five. In its wild ſtate it inhabits Africa: from thence it was brought into Spain, in order to free that country from multitudes of rabbits with which it was over-run; and from Spain the reſt of Europe has been ſupplied. This creature is incapable of bearing the cold, and cannot ſubſiſt even in France unleſs in a domeſtic ſtate. The ferret is not in our climates endowed with the ſame capacity of finding his ſubſiſtence as other wild animals, but muſt be carefully nouriſhed within doors, and cannot exiſt in the fields; for thoſe who are loſt in the burrows of rabbits never multiply, but probably periſh during the winter. Like other domeſtic animals, he varies in colour. The female ferret is leſs than the male; and when in ſeaſon, we are aſſured, ſhe is ſo extremely ardent, that ſhe dies if her deſires are not gratified. Ferrets are brought up in caſks or boxes, where they are furniſhed with beds of hemp or flax. They ſleep almoſt continually. Whenever they awake, they ſearch eagerly for food; and brawn, bread, milk, &c. are commonly given them. They produce twice every year; and the female goes ſix weeks with young. Some of them devour their young as ſoon as they are brought forth, inſtantly come again in ſeaſon, and have three litters, which generally conſiſt of five or ſix, and ſometimes of ſeven, eight, or nine. They are employed for hunting rabbits; and as in this country they are apt to degenerate, warreners are in uſe to croſs the breed, procuring an intercourſe between a female ferret and a male polecat, by leaving the former, when in ſeaſon, near the haunts of the latter: the produce is of a much darker colour than the ferret, having a great reſemblance to the polecat. This animal is by nature a mortal enemy to the rabbit. Whenever a dead rabbit is for the firſt time preſented to a young ferret, he flies upon it, and bites it with fury; but if it be alive, he ſeizes it by the throat or the noſe, and ſucks its blood. When let into the burrows of rabbits, he is muzzled, that he may not kill them in their holes, but only oblige them to come out, in order to be caught in the nets. If the ferret is let in without a muzzle, he is in danger of being loſt: for, after ſucking the blood of the rabbit, he falls aſleep; and even ſmoking the hole is not a certain method of recalling him; becauſe the holes have often ſeveral entries which communicate with each other, and the ferret retires into one of thoſe when incommoded with the ſmoke. Boys likewiſe uſe the ferret for catching birds in the holes of walls, or of old trees. The ferret, tho' eaſily tamed, and rendered docile, is extremely iraſcible: his odour is always diſagreeable; but when he is irritated, it becomes much more offenſive. His eyes are lively, and his aſpect is inflammatory; all his movements are nimble; and he is at the ſame time ſo vigorous, that he can eaſily maſter a rabbit, tho' at leaſt four times larger than himſelf.

9. The ſarmatica, or Sarmatian weaſel, is of a browniſh black colour, ſpotted and ſtriped irregularly with obſcure yellow, and is about 14 inches in length, excluſive of the tail, which is ſix inches in length. It reſembles the polecat, but has a narrower head, a more lengthened body, a longer tail, and ſhorter hair, except on the feet and tail; inhabits Poland, eſpecially Volhynia, in the deſerts of Ruſſia between the Volga and Tanais, the mountains of Caucaſus, Georgia, and Bucharia.

charia. This is a most voracious animal, which feeds on marmots, rats, mice, jerboas, birds, and other small animals. It procreates in spring, and after eight weeks the female, which has eight teats, brings forth from four to eight young ones It lives in holes, sometimes of its own burrowing, but mostly in those which have been made by other animals, and is exceedingly fetid.

Plate CCCXXXIII.

10. The vulgaris, or common weasel, foumart, or whitret, has the upper parts of the body of a pale reddish brown; the lower parts white. It inhabits the temperate and northern parts of Europe, Asia, and America, and as far to the southward as the northern provinces of Persia, and is said to be found even in Barbary. In the more northern parts of Russia and Sweden, particularly in Westbothnia, it becomes white in winter like the ermine; but even in this state it is easily distinguishable from the latter, being a great deal smaller; the body and head not exceeding seven inches long, and the tail two inches and a half. It is very destructive to young birds, poultry, and young rabbits; and is besides a great devourer of eggs. It does not eat its prey on the place; but, after killing it by one bite near the head, carries it off to its young, or to its retreat. It preys also on moles, as appears by its being sometimes caught in the mole-traps. It is a remarkably active animal; and will run up the sides of walls with such ease, that scarce any place is secure from it; and the body is so small, that there is scarce any hole but what is pervious to it.—This species is much more domestic than any of the rest, and frequents out-houses, barns, and granaries. It clears its haunt in a short time from mice and rats, being a much greater enemy to them than the cat itself. In summer, however, they retire farther from houses, especially into low grounds, about mills, along rivulets, concealing themselves among brush-wood, in order to surprise birds; and often take up their abode in old willows, where the female brings forth her young. She prepares for them a bed of straw, leaves, and other herbage, and litters in the spring, bringing from six to eight or more at a time. The young are born blind; but soon acquire sight and strength sufficient to follow their mothers. Their motion consists of unequal and precipitant leaps; and when they want to mount a tree, they make a sudden bound, by which they are at once elevated several feet high. They leap in the same manner when they attempt to seize a bird. These creatures, as well as the pole-cat and ferret, have a disagreeable odour, which is stronger in summer than in winter; and when pursued or irritated, their smell is felt at a considerable distance. They move always with caution and silence, and never cry but when they are hurt. Their cry is sharp, rough, and very expressive of resentment. As their own odour is offensive, they seem not to be sensible of a bad smell in other bodies. M. Buffon informs us, that a peasant in his neighbourhood took three new-littered weasels out of the carcase of a wolf that had been hung up on a tree by the hind-feet. The wolf was almost entirely putrefied, and the female weasel had made a nest of leaves and herbage for her young in the thorax of this putrid carcase. The weasel may be perfectly tamed, and rendered as caressing and frolicksome as a dog or squirrel. The method of taming them is to stroke them often and gently over the back; and to threaten, and even to beat them when they bite. In the domestic state their odour is never offensive but when irritated. They are fed with milk, boiled flesh, and water.

11. The erminea, or ermine, has the tail tipt with black, and has been distinguished by authors into two varieties, the *stoat* and the *white ermine*, though the difference seems chiefly to depend on climate and the season of the year; the stoat of a pale tawny brown or reddish yellow colour in summer, becoming the white ermine of winter in cold countries. They inhabit the north of Europe, Asia, and America, and as far as the northern parts of Persia and China; living in heaps of stones on the banks of rivers, in the hollows of trees, and particularly in forests, especially those of beech, preying on squirrels and lemmings. In manners and food this animal resembles the common weasel, but does not frequent houses, haunting chiefly in woods and hedges, especially such as border on brooks or rivulets. In general appearance it comes very near to the martin, but is shorter in the body, being scarcely ten inches long from nose to rump and the tail about five and a half; the hair is likewise shorter and less shining than in that animal. In the northern regions, the fur of the ermine becomes entirely white during winter, except the outer half of the tail, which remains black. The skin is reckoned valuable, and sells in Siberia from two to three pounds Sterling a-hundred; but in ancient times it was in much greater request than now. In summer, the upper part of the body is of a pale tawny brown colour; the edges of the ears, and ends of the toes, are yellowish white; the throat, breast, and belly are white; in winter, in the more temperate regions, it is sometimes mottled with brown and white; but in more severe winters becomes entirely white; the farther north and the more rigorous the climate, the white is the purer; those of Britain generally retain a yellowish tinge. In Persia and other more southern parts, it is brown the whole year In Siberia they burrow in the fields, and are taken in traps baited with flesh. In Norway they are either shot with blunt arrows, or taken in traps made of two flat stones, one being propped up with a stick, to which is fastened a baited string, which when the animals nibble, the stone falls down and crushes them to death. The Laplanders take them in the same manner, only instead of stones make use of two logs of wood.

There are about 12 other species of the weasel tribe described by authors.—A beautiful species of *weasel*, as it is called by some authors and universally considered by the Arabians, is described by Mr Bruce in his Appendix under the name of *El Fennec*. It is about ten inches long from the snout to the tail; the tail near five inches and a quarter, and about half an inch of it black at the tip. From the point of the fore-shoulder to the point of the fore-toe it is two inches and seven eighths; from the occiput to the point of the nose, two inches and a half; and the ears are three inches and three eighths in length; and about an inch and a half in breadth, with the cavities very large. They are doubled, and have a plait on the outside; the border of the inside is thick and covered with white soft hair, the middle part being bare and of a rose or pink colour. The pupil of the eye

Mustella.

Plate CCCXXXIII.

A. Bell Prin. Wal. Sculptor fecit.

eye is large and black, surrounded with a deep blue iris; the mustachoes are thick and strong; the tip of the nose is very sharp, black, and polished. There are four grinders on each side of the mouth, six fore teeth in each jaw, and the upper jaw projected beyond the lower one. The canine teeth are large, long, and very sharp pointed; the legs small, and the feet broad, with four toes armed with short, black, sharp retractile claws; those on the fore-feet being sharper than those behind. The whole body of the animal is of a dirty white, approaching to cream colour; the hair of the belly rather whiter, longer, and softer than the rest, with a number of paps upon it.

Mr Bruce obtained one of these animals for two sequins, by means of a janisary, who had it from a Turkish foot-soldier just returned from Biscara, a southern district of Mauritania Cæsariensis, now called the *Province of Constantina*. According to his account, they are not uncommon in this district, though more frequently to be met with in the neighbouring date-territories of Beni Mezab and Werglab, the residence of the ancient Melano-Gætuli. In the Werglab the animals are hunted for their skins, which are sold at Mecca, and afterwards exported to India. Mr Bruce kept this one for several months at his country-house near Algiers, that he might learn its manners. Its favourite food he tells us was dates or other sweet fruit, yet it is also very fond of eggs. It devoured those of pigeons and small birds with great avidity when first brought to him; but did not seem to know how to manage hen's eggs, though when they were broken to him he ate the contents with as great avidity as the others. When hungry, he would eat bread, especially with honey or sugar. His attention was greatly engrossed by the sight of any bird flying across the room where he was, or confined in a cage near him, and could not be diverted from viewing it by placing biscuit before him; so that it seems probable, that he preys upon them in his wild state. He was extremely impatient of having his ears touched; so that it was with much difficulty that they could be measured; and, on account of this impatience, it was found impossible to count the protuberances or paps on his belly. He seemed very much frightened at the sight of a cat; and endeavoured to hide himself, though he did not appear to meditate any defence. On this occasion also he lowered his ears, which at other times he kept erect. Notwithstanding his impatience, he would suffer himself, though with difficulty, to be handled in the day-time; but in the night he was extremely restless, always endeavouring to make his escape; and though he did not attempt the wire, yet with his sharp teeth he would soon have made his way through a wooden one, as two others which they attempted to bring along with him actually did. These animals are very swift of foot. They build their nests in trees, particularly the palms, of which they eat the fruit; feeding also on locusts and other insects, and perhaps sometimes preying upon small birds. Mr Bruce has a long criticism on Dr Sparmann for pretending that one Mr Brander was the discoverer of this animal, whereas he says that he himself gave it to Mr Brander. This is the same animal with that formerly described as a species of CANIS† under the name of *zerda*, and of which a figure is given in Plate CXX. Its exact place in the zoological system has not yet been ascertained.

† See *Canis*, n° xiv.

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 ordinarily distinguished into mutes and liquids, or semi-vowels. 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 *aspirates*. 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

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 grey complexion: they come for the most part from the kingdom of Golconda, the peninsula on this side the Ganges, the kingdoms of Assau, Aracan, Pegu, and Malabar. Those from the gulph 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.

Eunuchs who have been deprived only of their testicles, continue to feel a titillation in what remains, and to have the external sign even more frequently than other men. But the part which remains is very small, and continues almost in the same state in which it was when the operation was performed during childhood.

If the different kinds of eunuchs are examined with attention, it will be found almost universally, that castration and its consequences have produced greater or less changes on their shape and appearance, independent of its physical effects.

Eunuchs, says M. Withof, are timid, irresolute, fearful, suspicious, and unsteady: And this seems to hold generally, though not universally, or without exceptions; (see the article EUNUCH). The reason is, that their blood has not received all the necessary preparation in passing through the spermatic vessels. Thus being deprived of the properties of males, they participate of the dispositions of females, and their very soul is of an intermediate sex. They are not, however, without advantages: They become larger and fatter than other men; but they sometimes grow to a disgusting size. Though oily substances are more abundant in eunuchs, they are likewise less subject to gout and to madness than men who have a greater quantity of blood and of splenetic humours. The abundant circulation of oily liquor prevents roughness or inequalities in the trachea and palate. This, joined to the flexibility of the epiglottis and of the other organs of the voice, makes it so sonorous and extensive, and at the same time so sweet, that it is almost impossible for eunuchs to pronounce distinctly the letter R. Is this factitious advantage a sufficient consolation to these unhappy men for the barbarity of those who have dared to sacrifice nature at the shrine of avarice? It is impossible to reflect on all the motives for making eunuchs without a sigh of pity and regret; and yet it must not be supposed that this abominable cruelty is always infallibly attended with that advantage which is sometimes expected from it. 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 outcasts from both sexes, paralytic members in the community, an useless burden upon the earth, by which they are supported and nourished. 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, in zoology, a genus of animals belonging to the order of insecta hymenoptera. There are 10 species; the most remarkable of which is the occidentalis, or velvet ant, an inhabitant of North America. It has six legs, with short crooked antennæ; the abdomen large, with a black list crossing the lower part of it, and another black spot at the joining of the thorax; excepting which, the whole body and head resembles crimson-velvet. The trunk or shell of the body is of such a strong and hard contexture, that though trod upon by men and cattle they receive no harm. They have a long sting in their tails, which causes inflammation and great pain for half an hour to those who are stung by them; which usually happens to negroes and others that go barefooted. They are mostly seen running very nimbly on sandy roads in the hottest summer-weather; and always single. What they feed on, in what manner they breed, and where they secure themselves in winter, is unknown.

MUTINA (anc. geog.), 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 *Moline;* 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

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 on 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 Mutians, 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 a 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 (fab. hist.), a deity among the Romans, much the same as the Priapus of the Greeks. The Roman matrons, and particularly newly married women, disgraced themselves by the obscene ceremonies which custom obliged them to observe before the statue of this impure deity.

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, in zoology; a genus belonging to the order of vermes testacea, the characters of which are these. It has a bivalve shell gaping at one end; the hinge, for the most part, furnished with a thick, strong, and broad tooth, not inserted into the opposite valve. Its animal is an Ascidia. The most remarkable species are.

1. The declivis, or sloping mya, has a brittle half-transparent shell, with a hinge slightly prominent near the open, and sloping downwards. It inhabits the rivers of Europe. It is frequent about the Hebrides; the fish eaten there by the gentry. Plate CCCXXXV. fig. 1.

2. The mya pictorum has an oval brittle shell, with a single longitudinal tooth like a lamina in one shell, and two in the other; the breadth is a little above two inches, the length one. It inhabits rivers. The shells are used to put water colours in, whence the name. Otters feed on this and the other fresh-water shells. Fig. 2.

3 The margaritifera, or pearl mya, has a very thick, coarse, opaque shell; often much decorticated; oblong, bending inward on one side, or arcuated; black on the outside; usual breadth from five to six inches, length two and a quarter. It inhabits great rivers, especially those which water the mountainous parts of Great Britain.—This shell is noted for producing quantities of pearl. There have been regular fisheries for the sake of this precious article in several of our rivers. Sixteen have been found within one shell. They are the disease of the fish, analogous to the stone in the human body. On being squeezed, they will eject the pearl, and often cast it spontaneously in the sand of the stream. The river Conway was noted for them in the days of Cambden. A notion also prevails, that Sir Richard Wynne of Gwydir chamberlain to Catharine Fig. 3. & 4.

rine queen to Charles II. prefented her majefty with a pearl (taken in this river) which is to this day honoured with a place in the regal crown. They are called by the Welfh *cregin diluw*, or "deluge fhells," as if left there by the flood. The Irt in Cumberland was alfo productive of them. The famous circumnavigator, Sir John Hawkins, had a patent for fifhing in that river. He had obferved pearls plentiful in the Straits of Magellan, and flattered himfelf with being enriched by procuring them within his own ifland. In the laft century, feveral of great fize were got in the rivers of the counties of Tyrone and Donegal in Ireland. One that weighed 36 carats was valued at 40 l. but being foul, loft much of its worth. Other fingle pearls were fold for 4 l. 10 s. and even for 10 l. The laft was fold a fecond time to Lady Glenlealy, who put it into a necklace, and refufed 80 l. for it from the duchefs of Ormond. Suetonius reports, that Cæfar was induced to undertake his Britifh expedition for the fake of our pearls; and that they were fo large that it was neceffary to ufe the hand to try the weight of a fingle one. Mr Pennant fuppofes that Cæfar only heard this by report; and that the cryftalline balls called *mineral pearl*, were miftaken for them. We believe that Cæfar was difappointed of his hope: yet we are told that he brought home a buckler made with Britifh pearl, which he dedicated to, and hung up in, the temple of Venus Genetrix: a proper offering to the goddefs of beauty, who fprung from the fea. It may not be improper to mention, that notwithftanding the claffics honour our pearl with their notice, yet they report them to have been fmall and ill-coloured, an imputation that in general they are ftill liable to. Pliny fays, that a red fmall kind was found about the Thracian Bofphorus, in a fhell called *mya;* but does not give it any mark to afcertain the fpecies.

Linnæus made a remarkable difcovery relating to the generation of pearls in this fifh.—It is a fifh that will bear removal remarkably well; and it is faid, that in fome places they form refervoirs for the purpofe of keeping it, and taking out the pearl, which, in a certain period of time, will be again renewed. From obfervations on the growth of their fhells, and the number of their annular laminæ or fcales, it is fuppofed the fifh will attain a very great age; 50 or 60 years are imagined to be a moderate computation. The difcovery turned on a method which Linnæus found, of putting thefe fhell-fifh into a ftate of producing pearls at his pleafure; though the final effect did not take place for feveral years: He fays, that in five or fix years after the operation, the pearl would have acquired the fize of a vetch. We are unacquainted with the means by which he accomplifhed this extraordinary operation; but it was probably publifhed at the time, and confidered as important, fince it is certain that the author was rewarded with a munificent premium from the ftates of the kingdom on this account. We regret that we cannot fpeak more fully on this head; but may obferve, that it is probable, from a paper publifhed many years afterwards in the Berlin Acts, that the method confifted in injuring the fhell externally, perhaps by a perforation; as it has been obferved, that thefe concretions in fhell-fifh are found on the infide, exactly oppofite to perforations and injuries made from without by ferpulæ and other animals.

MYAGRUM, Gold of Pleasure, in botany: A genus of the filiculofa order, belonging to the tetradynamia clafs of plants; and in the natural method ranking under the 39th order, *Siliquofæ*. The filicula is terminated by an oblong ftyle; the cell generally monofpermous. There are five fpecies; but the only remarkable one is the fativum, which grows naturally in corn-fields in the fouth of France and Italy, and alfo in fome parts of Britain. It is an annual plant, with an upright ftalk a foot and an half high, fending out two or four fide-branches, which grow erect; the flowers grow in loofe fpikes at the end of the branches, ftanding upon fhort footftalks an inch long; they are compofed of four fmall yellowifh petals, placed in form of a crofs; thefe are fucceeded by oval capfules, which are bordered and crowned at the top with the ftyle of the flower, having two cells filled with red feeds — This is cultivated in Germany for the fake of the expreffed oil of the feeds, which the inhabitants ufe for medicinal, culinary, and œconomical purpofes. The feeds are a favourite food with geefe. Horfes, goats, fheep, and cows, eat the plant.

MYCALE, a city and mountain of Caria; alfo a promontory of Afia oppofite Samos, celebrated for a battle which was fought there between the Greeks and Perfians about the year of Rome 275. The Perfians were about 100,000 men, who had juft returned from the unfuccefsful expedition of Xerxes in Greece.—They had drawn their fhips to the fhore, and fortified themfelves ftrongly, as if determined to fupport a fiege. They fuffered the Greeks to difembark from their fleet without the leaft moleftation, and were foon obliged to give way before the cool and refolute intrepidity of an inferior number of men. The Greeks obtained a complete victory, flaughtered fome thoufands of the enemy, burned their camp, and failed back to Samos with an immenfe booty, in which were 70 chefts of money.

MYCENÆ (anc. geog.) a town of Argolus, in Peloponnefus. The kingdom of the Argives was divided into two portions by Acrifius and his brother Prœtus. Argos and Mycenæ were their capitals.—Thefe, as belonging to the fame family, and diftant only about 50 ftadia or fix 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 poffeffed, befides Mycenæ, the region about Corinth and Sicyon, and that called afterwards Achæa. On his return from Troy, he was flain with his companions at a banquet. Mycenæ then declined; and under the Heraclidæ was made fubject to Argos. (See Argos and Argeia.) The Mycenæans, fending 80 men, partook with the Lacedæmonians in the glory acquired at Thermopylæ. The jealoufy of the Argives produced the deftruction of their city, which was abandoned after a fiege, and laid wafte in the firft year of the 78th Olympiad, or 466 years before Chrift. Some part of the wall remained in the fecond century, with a gate, on which were lions, a fountain, the fubterraneous edifices where Atreus and his fons had depofited their treafures and, among other fepulchral monuments, one of Agamemnon, and one of his fellow-foldiers and fufferers.

MYCETITES discoides, in natural hiftory, a name

Mycone || Mycteria.

name given by Dr Woodward to those kinds of fossile coralloide bodies which the generality of writers had called, after Dr Plott, *porpitæ*. These are usually small, and of a roundish, but flatted figure; they are hollowed on one side with a sort of umbilicus, and striated on the other; they are found on the ploughed lands in Oxfordshire, and some other of our midland counties, and in other places, buried in the solid strata of stone; they are sometimes yellowish, sometimes brownish, and are from the breadth of an inch to a fourth part or less of that size; when broken, they are usually found to consist of a kind of spar, not unlike that of which the shelly coats of the echinitæ, or the lapides indici, and other spines of echini consist in their fossile state; and in some of them the ridges and striæ are thick set with little knobs and tubercles. The basis in some of these is flat, as it is in others rising in form of a circular elevation from the umbilicus, and others have a circular cavity in the same place.

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 on the island.—There are a great number of churches and chapels, with some monasteries. The dress of the women in this island is very remarkable, and as different from that of the other islands as that of those islanders is different from the dress of the other European ladies. Their heads are adorned with lively-coloured turbans; their garments are a short white shift plaited before and behind, which reaches to their knees; they have white linen-drawers, and red, green, yellow, or blue stockings, with various coloured slippers. An ordinary suit for the better sort will cost 200 crowns.

MYCONUS (anc. geog.) 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*, an island in the Archipelago. E. Long. 25° 6'. Lat. 37°.

Plate CCCXXXV.

MYCTERIA, the Jabiru, in ornithology; a genus of birds belonging to the order of grallæ. The bill is long, bending upwards, and acute; the nostrils are small and linear; there is no tongue; and the feet have four toes. There are two species: 1. The Americana, or American jabiru, is about the size of a turky. The bill is long, stout, and of a black colour: the whole plumage is white, except the head, and about two-thirds of the neck, which are bare of feathers and of a blackish colour; the remainder is also bare, and of a fine red; on the hind-head are a few greyish feathers; the legs are strong, of a great length, and covered with black scales; wings and tail even at the end. This bird is found in all the savannas of Cayenne, Guiana, and other parts of South America. It is migratory and gregarious. It makes its nest in great trees, which grow on the borders; lays two eggs, and brings up the young in the nest till they can descend to the ground. The colour of the young birds is grey; the second year it changes to rose-colour, and the third to pure white. They are very wild and voracious, and their food is fish, which they devour in great quantities. The flesh of the young birds is said to be good eating, but that of the old is hard and oily.

Mygdonia || Myagius.

2. The Asiatica, or Indian jabiru, is of a large size. The bill is dusky, almost straight above, and gibbous near the fore-head; the under mandible swelled beneath; and from the base of the bill there passes through and beyond the eye a black streak. The general colour of the plumage is white; the lower half of the back, the prime quills, and the tail, are black; the legs a pale red. This species inhabits the East Indies, and feeds on snails.

MYGDONIA (anc. geog.), a district of Macedonia, to the north of the Sinus Thermaicus, and east of the river Axius, which separates it from Bottiæis, 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, in botany: A genus of the tetragynia order, belonging to the tetrandria class of plants; and in the natural method ranking with those of which the order is doubtful. The calyx is quadripartite; the petals four; the fruit a globose plum.

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 the *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.

MYLAE (anc. geog.) 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.) Mylaeus, 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′. lat. 38. 36′.

MYLASA, or MYLASSA, (anc. geog.), a noble city of Caria in Asia Minor, situated at the distance of 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 intitled 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.*

MYNSICHT (Hadrian), physician to the duke of Mecklenburgh and several other German princes, was distinguished for his knowledge of chemistry, at the beginning of the 17th century. He published a work entitled *Armentarium Medico-Chymicum*, which has undergone various editions. In this work he gives a description of several medicines, about the virtues of which he is not always to be depended upon. To him we are indebted for a knowledge of the salt *de duobus* or the *Arcanum*, which is still in use.

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. See ANATOMY, *Table of the Muscles*.

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 idolators. 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 the monogynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 41st order, *Asperifoliæ*. The corolla is salver-shaped, quinquefid, and emarginated; the throat shut up by small arches. There are four species; of which the most remarkable is the scorpioides, or mouse-ear. This is a native of Britain, growing naturally in dry fields, and on the margins of springs and rills. It hath naked seeds, and the points of the leaves callous. It varies considerably in different situations. In dry places the plant and flowers are smaller; in moist ones both are larger, and sometimes hairy. The blossoms

 vary

Myosurus, Myoxus. vary from a full blue to a very pale one, and sometimes a yellow; and appear in a long spirally twisted spike. When it grows in the water, and its taste and smell is thereby rendered less observable, sheep will sometimes eat it; but it is generally fatal to them. Cows, horses, swine, and goats refuse it.

MYOSURUS, in botany: A genus of the polygynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 26th order *Multisiliquæ*. The calyx is pentaphyllous, the leaves cohering at the base; there are five subulated nectaria resembling petals: the seeds are numerous.

Plate CCCXVIII fig. 12. MYOXUS, the Dormouse, in zoology; a genus of quadrupeds belonging to the order of glires. There are two fore-teeth in each jaw; the upper ones cuneated, the under compressed: the whiskers are long; the tail is hairy and round, growing thicker towards the extremity; the fore and hind legs are of equal length, and the fore-feet have four toes.

1. The glis, or hoary dormouse, is of a pale ash-colour on the upper parts of the body, and whitish on the under; and is about the size of the common squirrel, but thicker in the body. It inhabits France and the south of Europe, and the south-west of Russia about the Volga of Samara. This animal, which is the ελειος of Aristotle, μυοξος of Oppian, and *glis* of Pliny, was held in great esteem among the Romans, as a luxurious delicacy; they were fed in places called *gliriaria*, constructed for the purpose, and they are still eaten by the modern Italians. It forms a nest in the hollow of some tree, in which it sleeps all day; feeds in the night on nuts, walnuts, the seeds of apples, &c. and grows very fat in autumn. About the month of October they gather in troops; and, retiring into subterranean burrows, remain torpid till near the end of May. The female has ten teats, six of which are situated on the breast, and four on the belly; and she brings from nine to twelve young ones at a litter.

Fig. 14. 2. The nitella, or garden dormouse, is of a tawny colour on the upper parts of the body, and whitish ash-tinged with yellow on the under; has a black circle round each eye, and a black spot behind each ear; and is five inches long, besides the tail which measures four It inhabits the south parts of Europe and Russia, where it lives chiefly in gardens, though it sometimes is found in houses. They are very destructive to fruit, particularly peaches, which they seem to prefer to every other kind. They also eat pease, apricots, and plums; and when soft fruits are not to be had, they will eat almonds, filberts, nuts, and even leguminous plants. Of these they carry off great quantities into their retreats, which they dig in the earth, and particularly in well cultivated gardens; for in old orchards they are often found in hollow trees, where they make beds of herbs, moss, and leaves. Eight or ten of them are frequently found in the same place, all benumbed, and rolled up in the midst of their provision of fruits and nuts. They copulate in spring, and bring forth in summer. The litter consists of five or six young, who grow very quickly, but are not fertile till the next year. Their flesh is not eatable, but has the same disagreeable odour with the domestic rat.

Fig. 3. 3. The muscardinus, or common dormouse, is about the size of the domestic mouse, but of a plumper appearance; the nose is more blunt; the head, sides, belly, and tail, are of a tawny red colour, the throat white. Dormice inhabit woods, or very thick hedges; forming their nests in the hollow of some low tree, or near the bottom of a close shrub: they form little magazines of nuts, and eat in an upright posture like the squirrel. The consumption of their hoard, however, during the rigour of the season is but small; for they sleep most of the time, retiring into their holes; at the approach of winter they roll themselves up, and become torpid. Sometimes they experience a short revival in a warm sunny day, when they take a little food, and relapse into their former state. These animals seldom appear far from their retreats, or in any open place; for which reason they seem less common in Britain than they really are. They make their nests of moss, grass, and dead leaves; and bring usually three or four young at a time.

Myrepsus ‖ Myrica. MYREPSUS (Nicolas), was a physician of Alexandria, to whom we are under great obligations for the pains he took to collect, into a kind of pharmacopœia, all the compound medicines which lie scattered in the works of the Greeks and Arabian writers. His work was accomplished before the beginning of the 14th century; and though written in barbarous Greek, continued for a long time to be the rule of pharmaceutical preparations in Europe. A translation of it into Latin by Leonard Fusch is entitled *Opus Medicamentorum, in Sectiones quadraginta octo digestum*. There are a great many editions of this work: the best is that of Hartman Beverus, Nuremberg, 1658, 8vo.

MYRIAD, a term sometimes used to denote ten thousand.

MYRICA, Gale, or Sweet-willow, in botany: A genus of the tetrandria order, belonging to the diœcia class of plants; and in the natural method ranking under the 5th order, *Amentaceæ*. The scale of the male catkin is in the form of a crescent, without any corolla. The scale of the female catkin the same: there is no corolla; but two styles, and a monospermous berry.

1. The gale, Dutch myrtle, or sweet-willow, grows naturally upon bogs in many places both of Scotland and England. It rises about four feet high, with many shrubby stalks, which divide into several slender branches, garnished with stiff spear-shaped leaves of a light yellowish green, smooth, and a little sawed at their points. The female flowers or catkins are produced from the sides of the branches, growing upon separate plants from the female, which are succeeded by clusters of small berries, each having a single seed. It flowers in July, and ripens in autumn. When transplanted into shrubberies, the moistest parts must be assigned to it

The leaves, flowers, and seeds, of this plant, have a strong fragrant smell, and a bitter taste. They are said to be used among the common people for destroying moths and cutaneous insects, being accounted an enemy to insects of every kind; internally, in infusions, as a stomachic and vermifuge; and as a substitute to hops for preserving malt liquors, which they render more inebriating, and of consequence less salubrious: it is said that this quality is destroyed by boiling.

The

2. The cerifera, wax-bearing myrica, or candleberry myrtle, is a native of North America. It is a fmall tree about ten or twelve feet high, with crooked ftems branching forth near the ground irregularly. The leaves grow irregularly on them all round; fometimes by pairs, fometimes alternately, but generally at unequal diftances. They are of a lanceolated figure; and fome are ferrated at the top, whilft others have their edges wholly entire. They ftand on very fhort footftalks; having their upper furface fmooth, and of a fhining green colour, whilft their under is of a more dufky hue. The branches of the old plants fhed their leaves in the autumn; but the young plants raifed from feeds retain them the greateft part of the winter, fo as during that feafon to have the appearance of an evergreen. But this beauty will not be lafting, for they fhed their leaves proportionally earlier as the plants get older. There are both male and female trees of this fort: The flowers are fmall, of a whitifh colour, and make no figure; neither does the fruit that fucceeds the female, which is a fmall, dry, blue berry, though produced in clufters, make any fhow: So that it is from the leaves this trees receives its beauty and value; for thefe being bruifed, as well as the bark of the young fhoots, emit the moft refrefhing and delightful fragrance, that is exceeded by no myrtle, or any other aromatic fhrub.

There is a variety of this fpecies of lower growth, with fhorter but broader leaves, and of equal fragrance. This grows commonly in Carolina; where the inhabitants collect from its berries a wax of which they make candles, and which occafions its being called the *candleberry tree*. It delights in a moiftifh foil. —The wax is procured in the following manner: In November and December, when the berries are ripe, a man with his family will remove from home to fome ifland or fand-bank near the fea, where thefe trees moft abound, taking with them kettles to boil the berries in. He builds a hut with palmetto leaves for the fhelter of himfelf and family during his refidence there, which is commonly four or five weeks. The man cuts down the trees, while the children ftrip off the berries into a porridge-pot; and having put water to them, they boil them till the oil floats, which is then fkimmed off into another veffel. This is repeated till no more oil appears. When cold, this hardens to the confiftence of wax, and is of a dirty green colour. Then they boil it again, and clarify it in brafs kettles; which gives it a tranfparent greennefs. Thefe candles burn a long time, and yield a grateful fmell. They ufually add a fourth part of tallow, which makes them burn clearer. Both the above forts may be propagated by feeds or layers. 1. The feeds of the candleberry-myrtle we receive from abroad; thofe of the fweet-gale from the bogs, where they grow in England or Scotland. The beft way is to fow them in boxes of earth from a rich pafture, well broken and fine. They fhould be fown about half an inch deep; and when the hot weather comes on, fhould be fet in the fhade. They will often remain until the fecond year before they come up, efpecially thofe feeds that come from abroad. If the boxes are fet in the fhade, and the plants come up, they will require no other trouble the firft fummer than keeping clean from weeds; in winter they fhould be removed to a warm hedge or wall, where they may enjoy the benefit of the fun. In the following fpring they will come up in plenty. In the beginning of May they fhould refume their fhady fituation; and this fummer they will require no other trouble than weeding and watering in dry weather. In the winter they fhould be removed into a well-fheltered place; and this may be repeated two years; when in the fpring they fhould be taken out of the boxes, and planted in the nurfery at about a foot afunder. 2. Thefe forts may be alfo eafily propagated by layers; for this operation being performed on the young wood in the autumn, will occafion them to fhoot good roots by the autumn following; many of which will be good plants, fit for any place. 3. Thefe plants may likewife be increafed by fuckers, for many of them often throw them out in vaft plenty; fo that thefe being taken out, the ftrongeft and beft-rooted may be finally fet out; whilft the weaker, and thofe with lefs root, may be planted in the nurfery.

There are five other fpecies, *viz.* the *nagi*, or Japan myrica, with lanceolate entire veinlefs leaves, and berries about the fize of a cherry: the *ethiopica*, or willow-leaved myrica, with the leaves flightly ferrated; a native of Ethiopia: the *quercifolia*, with oblong leaves, finuated or notched on the fides, like the leaves of the oak; of which there are two varieties, the fmooth and the hairy, natives of the Cape of Good Hope: the trifoliata, or trifoliate myrica, with ternate leaves toothed on the edges; and the cordifolia, or heart-leaved myrica, with fubcordated, fawed, feffile leaves; both alfo natives of the Cape. Thefe are all tender plants, kept as curiofities in the greenhoufe, and difficult of propagation.

MYRIOPHYLLUM, in botany: A genus of the polyandria order, belonging to the monœcia clafs of plants; and in the natural method ranking under the 15th order, *Inundatæ*. The male calyx is tetraphyllous; there is no corolla; the ftamina are eight in number. The female calyx is tetraphyllous; the piftils four; there is no ftyle; and four naked feeds.

MYRISTICA, the NUTMEG-TREE, in botany: A genus of plants belonging to the clafs diœcia, and order fyngenefia, in the *New Genera Plantarum* of Linnæus by *Shreber;* and of the natural order *Lauri*, in his fourth clafs *Monocotylidones*.—The male calyx is monophyllous, ftrong, and parted into three *lacinii* of an oval fhape, and ending in a point: it has no corolla. In the middle of the receptacle rifes 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 diftinct tree. The germen of an oval fhape; the ftyle fhort, with a bifid ftigma; the lacinii of which are oval and fpreading.— The fruit is of that fort called *drupa*. It is flefhy, roundifh, fometimes unilocular, fometimes bivalved, and burfts when ripe at the fide. The feed is enveloped with a flefhy and fatty membraneous fubftance, which divides into filaments (this, in one of the fpecies, is the mace of the fhops). The feed or nutmeg is round or oval fhaped, unilocular, and contains a fmall kernel, variegated on the furface by the fibres running in the form of a fcrew.

Species. There are five fpecies of this genus according

Myristica. cording to some authors; but several of these being only varieties, may be reduced to 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. See a figure in *Gaerner de Sem* and *Fruct.* T. 41. f. 3. 4.

2. The myristica sebifera, (*Virola Sibifera 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 œconomical and medical purposes, and that the natives make candles of it.

3. The myristica moschata, or nutmeg, attains the height of 30 feet, producing numerous branches which rise together in stories, and covered with bark, which of the trunk is 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 amongst the monodelphia.

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 *jausiband*, 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.—Sonnerat's account of the *muscadier* is still more erroneous; and the younger Linnæus was unfortunately misled by this author, placing the myristica in the class *Polyandria*, and describing the corolla as consisting of five petals. Thunberg, who examined the flower of the nutmeg, places it in the class *Monoecia;* and according to his description, the male flower has but one filament, surrounded at the upper part by the antheræ; and as the filaments are short and slender, and the antheræ united, this mistake might easily arise. M. De La Marck 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 Monf. Cere, director of the king's garden in that island, Monf. De La Marck has been enabled to describe and figure this and other species of the myristica with tolerable accuracy: and that we have profited by his labours, will appear from the annexed plate, of which the following is an explanation:

Plate CCCXXXIV. Fig. *a.* A sprig with fructification. The drupa of the natural size, and bursting open. Fig. *b.* The full-grown fruit cut lengthways. 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. Fig. 1. and 2. Sprigs of the *Myristica moschata* in flower, with a leaf of the natural size, and a representation of the calyx and column in the flower. Plate CCCXXXV.

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 sebacious matter is found swimming on the water; the decoction inspissated, gives an extract of an unctous, 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 rhind, 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 rhind 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. Mace must not be confounded with *macer*. See the word Macer.

The nuts, which are still covered with their ligneous shell, are for three days exposed to the sun, and afterwards

Myristica

afterwards dried before a fire till they emit a found when they are fhaken; they then beat them with fmall fticks in order to remove their fhell, which flies off in pieces. Thefe nuts are diftributed into three parcels; the firft of which contains the largeft and moft beautiful, which are deftined to be brought to Europe; the fecond contains fuch as are referved for the ufe of the inhabitants; and the third contains the fmalleft, which are irregular or unripe. Thefe are burnt; and part of the reft is employed for procuring oil by preffure. A pound of them commonly gives three ounces of oil, which has the confiftence of tallow, and has entirely the tafte of nutmeg. Both the nut and mace, when diftilled, afford an effential, tranfparent, and volatile oil, of an excellent flavour.

The nutmegs which have been thus felected would foon corrupt if they were not watered, or rather pickled, with lime-water made from calcined fhell-fifh, which they dilute with falt-water till it attain the confiftence of fluid pap. Into this mixture they plunge the nutmegs, contained in fmall bafkets, two or three times, till they are completely covered over with the liquor. They are afterwards laid in a heap, where they heat, and lofe their fuperfluous moifture by evaporation. When they have fweated fufficiently, they are then properly prepared, and fit for a fea-voyage.

In the ifland of Banda, the fruit of the nutmeg-tree is preferved entire in the following manner: When it is almoft ripe, but previous to its opening, it is boiled in water and pierced with a needle. They next lay it in water to foak for ten days, till it has loft its four and fharp tafte. They then boil it gently in a fyrup of fugar, to which, if they wifh it to be hard, a little lime is added. This operation is repeated for eight days, and each time the fyrup is renewed. The fruit when thus preferved is put for the laft time into a pretty thick fyrup, and is kept in earthen pots clofely fhut.

Thefe nuts are likewife pickled with brine or with vinegar; and when they intend to eat them, they firft fteep them in frefh water, and afterwards boil them in fyrup of fugar, &c.

Ufes. Nutmegs preferved entire are prefented as deferts, and the inhabitants of India fometimes eat them when they drink tea. Some of them ufe nothing but the pulp; others likewife chew the mace; but they generally throw away the kernel, which is really the nutmeg. Many who perform fea-voyages to the north chew this fruit every morning.

The medicinal qualities of nutmeg are fuppofed to be aromatic, anodyne, ftomachic, and reftringent; and with a view to the laft mentioned effects, it has been much ufed in diarrhœas and dyfenteries. To many people the aromatic flavour of nutmeg is very agreeable; they however fhould be cautious not to ufe it in large quantities, as it is apt to affect the head, and even to manifeft an hypnotic power in fuch a degree as to prove extremely dangerous. Bontius fpeaks of this as a frequent occurrence in India; and Dr Cullen relates a remarkable inftance of this foporific effect of the nutmeg, which fell under his own obfervation, and hence concludes, that in apoplectic and paralytic cafes this fpice may be very improper. He obferves, that a perfon by miftake took two drams or a little more of powered nutmeg: he felt it warm in his ftomach, without any uneafinefs; but in about an hour after he had taken it he was feized with a drowfinefs, which gradually increafed to a complete ftupor and infenfibility; and not long after he was found fallen from his chair, lying on the floor of his chamber in the ftate mentioned. Being laid a-bed he fell afleep; but waking a little from time to time, he was quite delirious; and he thus continued alternately fleeping and delirious for feveral hours. By degrees, however, both thefe fymptoms diminifhed; fo that in about fix hours from the time of taking the nutmeg he was pretty well recovered from both. Although he ftill complained of head-ach, and fome drowfinefs, he flept naturally and quietly the following night, and next day was quite in his ordinary health.

The officinal preparations of nutmeg are a fpirit and effential oil, and the nutmeg in fubftance roafted, to render it more aftringent. Both the fpice itfelf and its effential oil enter feveral compofitions, as the confectio aromatica, fpiritus amoniæ com. &c. Mace poffeffes qualities fimilar to thofe of the nutmeg, but is lefs aftringent, and its oil is fuppofed to be more volatile and acrid.

Remarks on the Trade of Nutmegs. Nutmeg-trees grow in feveral iflands in the eaftern ocean. The wood-pigeon of the Moluccas is unintentionally a great planter of thefe trees, and diffeminates them in places where a nation, powerful by its commerce, thinks it for its intereft that they fhould be rooted out and deftroyed. The Dutch, whofe unwearied patience can furmount the greateft obftacles, have appropriated to themfelves the crop of nutmeg, as well as that of cloves and cinnamon, growing in the iflands of Ternate, Ceylon, &c. either by right of conqueft or by paying fubfidies to the iflanders, who find thefe much more profitable than the former produce of their trees. It is neverthelefs 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 preferved only in the iflands of Amboina and Ternate, which are in a great meafure fubject 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 recompence him for the lofs of his clove-trees in the other Molucca iflands; and that they are moreover bound by treaty to take at 3¼d. a pound, all the cloves brought by the natives of Amboyna to their magazines. They have likewife fucceeded to deftroy the cinnamon every where except in the ifland of Ceylon, which is in their poffeffion. The fame is the cafe with white pepper, &c. fo that the trade of the whole of Europe, and of great part of Afia in this fpecies of commodity, paffes through their hands.

The Dutch have immenfe and very rich magazines of thefe precious aromatics, both in India and Europe. They have actually by them the produce of 16 years, and never fupply their neighbours with the laft, but always with the oldeft crop: in 1760 they fold what was laid up in 1744. It is commonly faid, that when the Dutch have too great a quantity of cloves, nutmeg, &c. in their magazines, they throw them into the fea; but the fact is, that they get rid of their fuperfluous aromatics by burning them. On

the

Myrmecophaga.

the 10th of June 1760, M. Beaumare 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 who had taken up some nutmegs which had rolled out of the fire, was, as M. Beaumare was informed, seized and condemned to immediate execution. We will only add, that notwithstanding the jealousy of the Dutch, and the pains they take to preserve the sale of cloves wholly to themselves, they have never been able to prevent their own officers in several parts of India from embezzling and selling considerable quantities of them. M. de Jaucourt informs us, that in order to defraud the company, they sell them to the vessels of other nations which they meet at sea, and moisten the remainder with water, that they may still have the number of quintals of which their cargo consisted. The quantity sold may amount to 10 quintals in 100 before it can be perceived by the clerks of the magazines at Batavia, where they are received.

We are informed by M. Romé de Lisle, who has lately arrived from India, that the English draw a great deal of cinnamon, pepper, and cloves, from the island of Sumatra. The staple for this commodity, which gives great offence to the Dutch, is at the factory of Bencoolen. We have likewise seen a specimen of pretty good cinnamon raised at Martinico — The French, to prevent the exportation of specie for these aromatic and exotic productions, have attempted to introduce the culture of them into some of their colonies. A great many plants of the clove and nutmeg-tree have been procured, and planted in the Isle of France, the island of Bourbon, and also at Cayenne, where they have a very promising appearance.

Plate cccxxxvi.

MYRMECOPHAGA, or Ant-bear, in zoology; a genus of quadrupeds, belonging to the order of bruta: There are no teeth in the mouth; the tongue is long and cylindrical; the head terminates in a long snout or muzzle; and the body is covered with pretty long hair. There are five species, viz.

1. The didactyla, or little ant-bear, hath a conic nose bending a little down; ears small, and hid in the fur; two hooked claws on the fore-feet, the exterior being much the largest; four on the hind-feet; the head, body, limbs, and upper part and sides of the tail, covered with long soft silky hair, or rather wool, of a yellowish brown colour: from the nose to the tail it measures seven inches and an half; the tail eight and an half, the last four inches of which on the under side are naked. It is thick at the base, and tapers to a point. It inhabits Guinea, climbs trees in quest of a species of ants which build their nests among the branches: has a prehensible power with its tail.

2. The tridactyla, tamandua-guaca, or tamanoir, has three toes on the fore-feet, five on the hind-feet, and long hair on the tail. This animal is about four feet long, and the head and snout about 15 inches: it is a native of the East Indies, and feeds on ants, &c. in the same manner as the former.

Myrmecophaga, Myrmelion.

3. The jubata, or great ant-bear, has a long slender nose, small black eyes; short round ears; a slender tongue two feet and an half long, which lies double in the mouth; the legs slender; four toes on the fore-feet, five on the hind-feet; the two middle claws on the fore-feet very large, strong, and hooked; the hair on the upper part of the body is half a foot long, black mixed with grey; the fore-legs are whitish, marked above the feet with a black spot; the tail is clothed with very coarse black hair a foot long: the length from the nose to the tail about four feet; the tail two feet and an half. This animal inhabits South America, and the kingdom of Congo in Africa. It covers itself with its tail when asleep and to guard against rain. Its flesh is eaten by the natives of America.

4. The tetradactyla, or middle ant-bear, has four toes on the fore-feet, and five on the hind, with a tail naked at the extremity; the length from the nose to the tail is one foot seven inches, and the tail ten inches. It inhabits South America.

5. The capensis, or Cape ant-bear, has four claws on the fore-paws; a long snout; large pendent ears; and a tail, which is shorter than the body, and taper at the point. It inhabits the country at the Cape of Good Hope.—This animal is much larger than the other species of the genus, so that Kolben compares it to the size of a hog, and asserts that it weighs 100 pounds. It burrows in the ground, sleeps during the day, and only goes abroad at night.

These animals have many properties in common with each other, both in their structure and manners. They all feed upon ants, and plunge their tongues into honey and other liquid or viscid substances. They readily pick up crumbs of bread, or small morsels of flesh. They are easily tamed, and can subsist for a long time without food. They never swallow all the liquor which they take for drink; for a part of it falls back through their nostrils. They run so slowly, that a man may easily overtake them in an open field.—Their flesh, though its taste be very disagreeable, is eaten by the savages. At a distance the great ant-eater has the appearance of a fox; and for this reason some travellers have given him the name of the *American fox*. He has strength sufficient to defend himself from a large dog, or even from the jaquar or Brasilian cat. When attacked, he at first fights on end, and, like the bear, annoys his enemy with the claws of his fore-feet, which are very terrible weapons.—He then lies down on his back, and uses all the four feet, in which situation he is almost invincible; and continues the combat to the last extremity. Even when he kills his enemy, he quits him not for a long time after. He is enabled to resist better than most other animals, because he is covered with long bushy hair; his skin is remarkably thick; his flesh has little sensation; and his principle of life is very tenacious.

MYRMELION, or Ant-lion, in zoology; a genus of insects of the nemoptera order. There are 15 species, of which the most remarkable is the formicarius, or ant-eater. The perfect insect is oblong, and of a brown colour. Its head is broad, with two large eyes on the sides, and two antennæ beneath. The neck is rather long, cylindrical, and narrower than the head. The thorax seems composed of two parts; one ante-

 rior,

Myrmelion, Myrmidons.

rior, whence arise the upper wings; and the other posterior, which gives birth to the under ones. The abdomen is of an oblong form, and consists of eight segments; the wings are diaphanous, adorned with a net-work of black fibres, charged with several blackish brown spots. The larva of this insect is very fond of ants, which it hunts after, whence its name. The larvæ proceed from the egg which the perfect insect had deposited in very fine dry sand, in a place sheltered from rain, either within a cleft of a wall or of the ground, or at the foot of a wall generally exposed to the south sun. There they are hatched, and make their usual abode. Their colour is grey, and their body, which is covered with small protuberances, is of an oval form. Its posterior extremity terminates in a point, and is of use to sink itself down into the sand; for it only walks retrogressively, though furnished with six feet. Before the head is placed a dentated forceps, sharp and hollow within, with which the creature catches and sucks flies and other insects, but especially ants. This forceps serves as a mouth or rostrum, as well as for an offensive weapon. The animal's retrograde march not allowing it to run after the insects on which it is to feed, it uses a stratagem. It dives down into the sand, and turning about in a circle, hollows out concentric furrows, gradually deeper and deeper, casting at a distance with its horns the sand it takes from that place. At length it manages to dig a hole in shape like a funnel, at the bottom of which it takes its station, concealed in the sand, nothing but the open extended forceps appearing above it. Mischief overtakes every insect that happens to fall into that hole. The myrmelio, who is apprized of it by the grains of sand rolling down to the bottom, overwhelms him with a shower of dust, which it ejects with its horns, then drags the insect to the bottom of the hole, where it seizes him with its forceps, and sucks its vitals. It does not even spare other myrmelions who in their motions to and fro chance to fall into it. When the larva is come to its full growth, it digs no more holes; it moves backwards and forwards, tracing irregular furrows on the sand, and at length spins itself a cod, shaped like a ball, the outward part of which is formed of the sand in which it lived, and the inward is lined with fine white silk. Within this cod it turns to a chrysalis, which is curved into a semicircle, and wherein may be distinguished all the parts of the perfect insect that is to issue from it. It is more oblong than the larva, but much shorter than the perfect insect. After a certain period, the chrysalis casts off its slough, turns to a winged insect, and breaks through the cod in order to take its flight. The perfect insect is very scarce, but is sometimes met with in sandy places, and near rivulets.

Barbut's Genera of Insects, p 223.

MYRMIDONS (MYRMIDONES), in antiquity; a people on 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 Asopus. 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 || Myroxylon.

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 Μορμυρος, 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, RETIARI, &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 a 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, in botany: A genus of the monogynia order, belonging to the decandria class of plants. The calyx is campanulated; the superior petal larger than the rest; the germ is longer than the corolla; the legumen monospermous. There is but one species, the peruiferum, a native of Peru and the warmer parts of America. It is this shrub that yields the balsam of Peru, which is said to be extracted from it by coction in water. This balsam, as brought to us, is nearly of the consistence of thin honey, of a reddish brown colour, inclining to black, an agreeable aromatic smell, and a very hot biting taste. Distilled with water, it yields a small quantity of a fragrant essential oil of a reddish colour, and in a strong fire, without addition, a yellowish red oil. Balsam of Peru is a very warm aromatic medicine, considerably hotter and more acrid than copaiva. Its principal effects are to warm the habit, to strengthen the nervous system, and attenuate viscid humours. Hence its use in some kinds of asthmas, gonorrhœas, dysenteries, suppressions of the uterine discharges, and other disorders proceeding from a debility of the solids or a sluggishness and inactivity of the juices. It is also employed externally, for cleansing and healing wounds and ulcers, and sometimes against palsies and rheumatic pains.—There is another sort of balsam of Peru of a white colour,

colour, and confiderably more fragrant than the former. This is very rarely brought to us. It is faid to be the produce of the fame plant which yields the common or black balfam, and to exfude from incifions made in the trunk, while the former is obtained by boiling. There is alfo a third kind, commonly called the red or dry. This is fuppofed to obtain a different ftate from the white, merely in confequence of the treatment to which it is fubjected after it is got from the tree. It is almoft as fragrant as the balfam of Gilead, held in fo high efteem among the eaftern nations. It is very rarely in ufe in Britain, and almoft never to be met with in our fhops.

MYRRH, a gummy-refinous concrete juice, obtained from an oriental tree of which we have as yet no certain account. It comes over to us in globes or drops, of various colours and magnitudes. The beft fort is fomewhat tranfparent, friable, in fome degree unctuous to the touch, of an uniform brownifh or reddifh-yellow colour, often ftreaked internally with whitifh femicircular or irregular veins; of a moderately ftrong, not difagreeable fmell; and a lightly pungent, very bitter tafte, accompanied with aromatic flavour, but not fufficient to prevent its being naufeous to the palate. There are fometimes found among it hard fhining pieces, of a pale yellowifh colour, refembling gum-arabic, of no tafte or fmell: fometimes maffes of bdellium, darker coloured, more opaque, internally fofter than the myrrh, and differing from it both in fmell and tafte: fometimes an unctuous gummy refin, of a moderately ftrong fomewhat ungrateful fmell, and a bitterifh very durable tafte, obvioufly different both from thofe of bdellium and myrrh: fometimes likewife, as Cartheufer obferves, hard compact dark-coloured tears, lefs unctuous than myrrh, of an offenfive fmell, and a moft ungrateful bitternefs, fo as, when kept for fome time in the mouth, to provoke reaching, though fo refinous, that little of them is diffolved by the faliva. Great care is therefore requifite in the choice of this drug.

We have, as already obferved, no certain information concerning the tree from which this fubftance flows; we are only told that the myrrh-tree, or plant, is a native of Abexim in Ethiopia, and is named *bedoins* by the Arabs. It is affirmed by fome, that the myrrh we have at prefent is not equal in quality to that of the ancients, and has not that exquifite fmell which all authors afcribe to the latter. They aromatized their moft delicious wines with it; and it was prefented as a very valuable perfume to our Lord while he lay in the manger (A). But to this it may be eafily anfwered, that there is no difputing about perfumes any more than about taftes and colours. Men are equally changeable with regard to fmells, of which we have ftriking examples in mufk and civet (B). The ancients reckoned two kinds of myrrh: the one liquid,

(A) It was this gum alfo which was mingled with the wine given him to drink at his paffion, to deaden his pains, and produce a ftupor (See Mark xv. 23.) The gall mentioned on the fame occafion by St Matthew is probably the fame with myrrh; for any thing bitter was ufually diftinguifhed by the name of gall. The Hebrews were accuftomed to give thofe that were executed fome ftupefying draught. The difficulty which arifes from the feeming difference betwixt the two evangelifts, by fome is folved by faying, that St Matthew, writing in Syriac, made ufe of the word *marra*, which fignifies "myrrh, bitternefs, or gall;" but the Greek tranflator has taken it for gall, and St Mark for myrrh. Others will have it, that our Saviour's drink was mingled with myrrh, as a ftupefying drug; but fuppofe that the foldiers, out of wanton cruelty and inhumanity, infufed gall; which was the reafon, fay they, why, when he had tafted, he refufed to drink.

(B) In the *Journal de Phyfique*, &c. *Suppl.* tom. xiii. 1778, we find fome remarks on myrrh, made by Mr Bruce while in Abyffinia, of which the following is a ftatement: The fame remarks have been fince publifhed in the Appendix to his Travels. The ancients, and particularly Diofcorides, who fpeak of myrrh, feem never to have feen it; or at leaft that which they have feen and defcribed is altogether unknown to modern phyficians and naturalifts. The Arabians, however, who form the intermediate link in the chain between the Greek phyficians and thofe of our days, among whom this fubftance grew, and from whom it received its name, afford an inconteftable proof that the myrrh with which we are acquainted is in no refpect different from that of the ancients, being produced in the fame countries from which the Greeks formerly procured theirs; that is, on the eaftern fhores of Arabia Felix; on the coafts of the Indian ocean; and on that part of Lower Abyffinia which lies to the fouth-eaft of the Red-fea, nearly between the 12th and 13th degrees of north latitude, bounded on the weft by a meridian running through the ifland of Maffovia, and on the eaft by one which paffes through Cape Guardfey in the ftraits of Babel mandel. This region the Greeks called *Troglodytria*, and muft be diftinguifhed from the country of the Troglodites, a nation different in every refpect, and inhabiting the forefts between Abyffinia and Nubia. The Abyffinian myrrh was always more valued than that of Arabia; and this preference it ftill retains to the prefent day. That part of Abyffinia being partly overflowed with water, and partly defert and over-run by a barbarous nation from the fouth, the Arabians have very little intercourfe with it except by means of fome Mahometan merchants, whofe defperate adventures, undertaken on chance, fometimes turn out well, but oftener prove very unfortunate. The ifland of Maffova is the common medium of exportation for the Troglodite myrrh; but fo little is brought from it in comparifon with what is fent from Arabia to Grand Cairo, that this is certainly the only reafon which can be affigned for the inferiority of our myrrh to that of the ancients, who received it from Abyffinia. Although thefe barbarians employ the gum, leaves, and bark of this tree in many difeafes to which they are fubject, as it is the moft common tree in the country, they neverthelefs cut it down and burn it for domeftic purpofes; and as they never plant new trees to replace thofe which they have cut down, it is probable that in a few years the quid, which they called *ſtacté* or *ſtarti;* the other was ſolid, and went by the name of *troglodite myrrh.* The ſtacte was procured by inciſion, and was received in veſſels very cloſely ſhut. Large pieces ſometimes preſent externally, or contain a kind of oily juice to which likewiſe the moderns give the name of *Stacté.* To prevent this juice from hardening, or at leaſt in a very ſmall degree, it is ſufficient to exclude it from the contact of the air immediately after its iſſuing from the tree; and by theſe means its aromatic nature will be much better preſerved (c).

The medical effects of this aromatic bitter are to warm

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the true Troglodite myrrh will be entirely loſt; and the erroneous deſcriptions of the ancient Greeks will lead poſterity, as it has done us, to form many miſtaken conjectures concerning the nature of the myrrh of the ancients.

Though the Troglodite myrrh was ſuperior to every ſpecies of Arabian myrrh, the Greeks plainly perceived that it was not all of the ſame quality. Pliny and Theophraſtus affirm, that this difference was owing to the trees, ſome of which were wild, and others meliorated by culture: but this is a mere conjecture; for the truth is that none of them are cultivated. The quality of the drug formerly depended, and muſt ſtill depend, on the age and ſoundneſs of the tree, on the way of making the inciſion, and on the ſeaſon of the year, and the temperature of the air when the myrrh is gathered. To have the firſt and moſt perfect kind of myrrh, the natives ſelect a young vigorous tree, free from moſs or any other plant adhering to the bark, and make a deep inciſion with a hatchet above the firſt large branches. What runs from this wound the firſt year, is myrrh of the firſt growth, and is never plentiful. This operation is performed ſome time after the rains have ceaſed, that is from April to June; and the myrrh is produced in July and Auguſt. At each return of the ſeaſon, the ſap continues to run in the courſe to which it has been accuſtomed; but the tropical rains, which are very violent, and which laſt for ſix months, convey ſo much filth and water into the inciſion, that by the ſecond year the tree begins to rot at that place; ſo that the myrrh is of a ſecondary quality, and at Cairo does not bring ſo great a price by a third as the myrrh of the firſt year. That which iſſues from inciſions near the roots and in the trunks of old trees is of the ſecond growth and quality, and ſometimes worſe; but it is reckoned good myrrh in the ſhops of Italy every where except Venice. It is of a red blackiſh colour, dirty, ſolid, and heavy. It loſes very little of its weight by being long kept, and can ſcarcely be diſtinguiſhed from that of Arabia Felix. The third and worſt kind is that which flows from old inciſions formerly made in old trees, or which not having been at firſt obſerved, has remained a whole year upon the tree. It is black, heavy, and of an earthy colour: it has little ſmell and bitterneſs, and is probably the *caucalis* of the ancients.

Myrrh newly gathered has always a ſtrong ſmell of rancid oil; and when put into water, globules of an oily ſubſtance are detached from it, which riſe and ſwim on the ſurface. This oilineſs does not ariſe from the myrrh, but from being put by the natives into goats ſkins, which they anointed with butter to make them pliant. It is kept in theſe ſkins, and thus carried to market: ſo that inſtead of being a fault, as ſome ſuppoſe, it is a proof that the myrrh is newly gathered; which is the beſt property that myrrh of the firſt kind can have. Beſides, this oily covering muſt have retained the volatile particles of the freſh myrrh, which eſcape in ſuch abundance as frequently to occaſion a conſiderable diminution in the weight.

(c) Pliny ſpeaks of the ſtarti as a recent or liquid myrrh: and Dioſcorides, chap. 67. ſays nearly the ſame thing. Mr Bruce is of opinion (but we think he is miſtaken), that the ancient Greeks and Romans, who lay at ſo great a diſtance, could never have it in that ſtate; becauſe he was aſſured by the natives, that it hardened on the tree as ſoon as it was expoſed to the air; and becauſe, though he was near the place where it grows, he never ſaw it ſofter than it is commonly found. Dioſcorides mentions likewiſe a ſpecies of myrrh, which, he ſays, is green, and has the conſiſtence of paſte. Serapio and the Arabians affirm, that ſtarti was a preparation of myrrh diſſolved in water: hence Mr Bruce conjectures, that this green unknown ſpecies was likewiſe a compoſition of myrrh and ſome other ingredient; and by no means a kind of Abyſſinian myrrh which they could never ſee either green or ſoft. The ſame author ſuppoſes, that *apocalbaſum*, or gum of Saſſa and myrrh, are one and the ſame ſubſtance; and he alleges, that Arabic myrrh may be diſtinguiſhed from myrrh of Abyſſinia in the following manner: A handful of the very ſmall pieces which are found at the bottom of the packet containing the myrrh, is thrown into a baſon with a ſufficient quantity of warm water to cover them. Here the myrrh remains for ſome time without any perceptible change, becauſe it diſſolves ſlowly; whereas the gum ſwells to five times its original ſize, and appears like ſo many white particles among the myrrh. But nothing can be inferred from this diſtinction. Does the Arabian myrrh diſſolve, and that of Abyſſinia ſwell? In that caſe the Arabian myrrh would act like pure gum Arabic, or acacia gum, and that of Abyſſinia like gum tragacanth. To us it appears, that Mr Bruce, of whoſe zeal and labours in other reſpects we entertain a high opinion, has not performed his experiments with ſufficient care; or if there was no miſtake in them, we muſt be allowed to think, that the ſuppoſed myrrhs which he employed were nothing but a mixture of Arabian gum acacia, and gum of Baſſora, or Egyptian tragacanth. We are more inclined to be of this opinion, when he ſays that the branches, leaves, and bark of the myrrh tree were brought to him by naked ſavages from the country of the Troglodites; and that he found that the leaves and bark bore a great reſemblance to the acacia vera. Among theſe leaves he obſerved ſome ſtraight prickles, about two inches in length. He likewiſe mentions, that he ſaw a ſaſſa tree which was a native of the myrrh country, and covered with beautiful crimſon-coloured flowers. We know that the ſhrub which produces the gum tragacanth is prickly, and has flowers ſomewhat of a purple colour.

warm and ſtrengthen the viſcera: it frequently occaſions a mild diaphoreſis, and promotes the fluid ſecretions in general. Hence it proves ſerviceable in languid caſes, diſeaſes ariſing from a ſimple inactivity, thoſe female diſorders which proceed from a cold, mucous, ſluggiſh indiſpoſition of the humours, ſuppreſſions of the uterine diſcharges, cachectic diſorders, and where the lungs and thorax are oppreſſed by viſcid phlegm. Myrrh is likewiſe ſuppoſed in a peculiar manner to reſiſt putrefaction in all parts of the body; and in this light ſtands recommended in malignant, putrid, and peſtilential fevers, and in the ſmall-pox; in which laſt it is ſaid to accelerate the eruption.

The preſent practice does not ſeem to expect any peculiar virtue from myrrh; and it is now perhaps leſs employed than formerly. Some late writers, however, and particularly Dr Simmons, in his treatiſe on Conſumptions, have beſtowed very high encomiums on it, even in caſes of tuberculous phthiſis; and although it can by no means be repreſented as a remedy much to be depended on, yet there is reaſon to believe that it has been ſerviceable in ſome caſes.

Rectified ſpirit extracts the fine aromatic flavour and bitterneſs of this drug, and does not elevate any thing of either in evaporation: the gummy ſubſtance left by this menſtruum has a diſagreeable taſte, with ſcarcely any of the peculiar flavour of the myrrh: this part diſſolves in water, except ſome impurities which remain. In diſtillation with water, a conſiderable quantity of a ponderous eſſential oil ariſes, reſembling in flavour the original drug. Myrrh is the baſis of an officinal tincture. It enters the pilulæ ex aloe et myrrha, the pilulæ e gummi, and pilulæ ſtomachicæ, and ſome other formulæ. But for obtaining its full effects, it muſt be given in doſes of half a dram or upwards: and it is thought to be advantageouſly united with a proportion of nitre, cream of tartar, or ſome other refrigerant ſalt.

MYRRHINE, or Murrine. See Murrine.

MYRSINE, in botany: A genus of the monogynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 18th order, *Bicornes*. The corolla is ſemiquinquefid and connivent; the germen filling the corolla; the berry quinquelocular and pentaſpermous.

MYRTIFORM, in anatomy, an appellation given to ſeveral parts, from their reſembling myrtle-berries.

MYRTIS, a Greek woman who diſtinguiſhed herſelf by her poetical talents. She flouriſhed about 500 years before the Chriſtian era, and inſtructed the celebrated Corinna in the ſeveral rules of verſification. Pindar himſelf, as ſome report, was alſo one of her pupils.

MYRTLE, in botany. See Myrtus.

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 (anc. geog.), 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 deſart 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, in botany, the *Myrtle*: A genus of the monogynia order, belonging to the icoſandria claſs of plants; and in the natural method ranking under the 19th order, *Heſperideæ*. The calyx is quinquefid, ſuperior; there are five petals; the berry is diſpermous or triſpermous. There are 14 ſpecies, of which the moſt remarkable are,

1. The communis, or common myrtle-tree, riſes with a ſhrubby, upright, firm ſtem, branching numerouſly all around into a cloſe full head, riſing eight or ten feet high; very cloſely garniſhed with oval-lanceolate, entire, moſtly oppoſite leaves, from half an inch to an inch and a half long, and one broad, on ſhort footſtalks; and numerous, ſmall, pale flowers from the axillas, ſingly on each footſtalk, having diphyllous involucrums; each flower ſucceeded by a ſmall, oval, dark-purple berry. The moſt material varieties are, broad-leaved Roman myrtle, with oval, ſhining, green leaves, an inch and an half long, and one broad; and which is remarkably floriferous. Gold-ſtriped broad-leaved Roman myrtle. Broad leaved Dutch myrtle, with ſpear-ſhaped, ſharp pointed, dark-green leaves, an inch long, and about three quarters of one broad. Double-flowered Dutch myrtle. Broad-leaved Jews myrtle, having the leaves placed by threes at each joint; by which particular circumſtance this ſpecies is in univerſal eſtimation among the Jews in their religious ceremonies, particularly in decorating their tabernacles; and for which purpoſe many gardeners about London cultivate this variety with particular care, to ſell to the above people, who are often obliged to purchaſe it at the rate of ſixpence or a ſhilling for a ſmall branch: for the true ſort, having the leaves exactly by threes, is very ſcarce, and is a curioſity; but by care in its propagation, taking only the perfectly ternate-leaved ſhoots for cuttings, it may be increaſed faſt enough; and is worth the attention of the curious, and particularly thoſe who raiſe myrtles for the London markets. Orange-leaved Spaniſh myrtle, with oval ſpear-ſhaped leaves, an inch and a half long or more, and one broad, in cluſters round the branches, and reſemble the ſhape and colour of orange-tree leaves. Gold-ſtriped leaved orange myrtle. Common upright Italian myrtle, with its branches and leaves growing more erect, the leaves oval, lanceolate-ſhaped, acute-pointed, and near an inch long and a half one broad. Silver-ſtriped upright Italian myrtle. White-berried upright Italian myrtle. Portugal acute-leaved myrtle, with ſpear-ſhaped, oval, acute-pointed leaves, about an inch long. Box-leaved myrtle, with weak branches, ſmall, oval, obtuſe, lucid-green, cloſely-placed leaves. Striped box-leaved myrtle. Roſemary-leaved myrtle, hath erect branches, ſmall, narrow, lanceolate, acute-pointed, ſhining, green, very fragrant leaves. Silver-ſtriped roſemary-leaved myrtle. Thyme-leaved myrtle, with very ſmall cloſely-placed leaves. Nutmeg-myrtle, with erect branches and leaves; the leaves oval, acute-pointed, and finely ſcented like a nutmeg. Broad-leaved nutmeg-myrtle. Silver-ſtriped leaved ditto. Criſtated or cock's-comb myrtle, frequently called *bird's-neſt myrtle*,

Myrtus. *myrtle*, hath narrow, ſharp-pointed leaves, criſtated at intervals. Theſe are all beautiful ever-green ſhrubs of exceeding fragrance; exotics originally of the ſouthern parts of Europe, and of Aſia and Africa, and conſequently in this country require ſhelter of a green houſe in winter: all of which, though rather of the ſmall-leaved kind, have their foliage cloſely placed, and remain all the year, and are very floriferous in ſummer; and when there is a collection of the different ſorts, they afford an agreeable ſource of variety with each other. They therefore claim univerſal eſteem as principal green houſe plants. eſpecially as they are all ſo eaſily raiſed from cuttings, and of ſuch eaſy culture, as to be attainable in every garden where there is any ſort of green-houſe, or garden-frames furniſhed with glaſſes for protecting them in winter from froſt: but ſome of the broad-leaved ſorts are ſo hardy as to ſucceed in the full ground, againſt a ſouth wall and other warm expoſures, all the year, by only allowing them ſhelter of mats occaſionally in ſevere froſty weather: ſo that a few of theſe ſorts may alſo be exhibited in a warm ſituation in the ſhrubbery: obſerving, however, all the ſorts are principally to be conſidered as green-houſe plants, and a due portion of them muſt always remain in pots to move to that department in winter.

Plate CCCXXXVI 2. The pimenta, pimento, Jamaica pepper, or all ſpice tree, grows above 30 feet in height and two in circumference; the branches near the top are much divided and thickly beſet with leaves, which by their continual verdure always gives the tree a beautiful appearance; the bark is very ſmooth externally, and of a grey colour; the leaves vary in ſhape and in ſize, but are commonly about four inches long, veined, pointed, elliptical, and of a deep ſhining green colour; the flowers are produced in bunches or panicles, and ſtand upon ſubdividing or trichotomous ſtalks, which uſually terminate the branches; the calyx is cut into four roundiſh ſegments; the petals are alſo four, white, ſmall, reflex, oval, and placed oppoſite to each other between the ſegments of the calyx; the filaments are numerous, longer than the petals, ſpreading, of a greeniſh white colour, and riſe from the calyx and upper part of the germen; the antheræ are roundiſh, and of a pale yellow colour; the ſtyle is ſmooth, ſimple, and erect; the ſtigma is obtuſe; the germen becomes a round ſucculent berry, containing two kidney-ſhaped flattiſh ſeeds. This tree is a native of New Spain and the Weſt India iſlands. In Jamaica it grows very plentifully; and in June, July, and Auguſt, puts forth its flowers, which, with every part of the tree, breathes an aromatic fragrance. The berries when ripe are of a dark purple colour, and full of a ſweet pulp. which the birds devour greedily, and muting the ſeeds, afterwards propagate theſe trees in all parts of the woods. It is thought that the ſeeds paſſing through them, in this manner, undergo ſome fermentation, which fits them better for vegetating than thoſe gathered immediately from the tree.

The pimento is a moſt beautiful odoriferous ever-green, and exhibits a fine variety in the ſtove at all ſeaſons. It was firſt introduced and cultivated in this country by Mr Philip Miller in 1739. With reſpect to flowering, all the varieties of the *myrtus communis* flower here in July and Auguſt, moſt of which are very floriferous; the broad-leaved Roman kind in particular is often covered with flowers, which in ſome of the ſorts are ſucceeded here by berries ripening in winter. The pimento alſo flowers in the ſtove with great beauty and luxuriance. The flowers of moſt of the ſorts are ſmall, but numerous; and are all formed each of five oval petals and many ſtamina. As all theſe plants require protection in this country, they muſt be kept always in pots, for moving to the proper places of ſhelter, according to their nature; the *myrtus communis* and varieties to the green-houſe in winter, the pimento and other delicate kinds to the ſtove, to remain all the year: therefore let all the ſorts be potted in light rich earth; and as they advance in growth, ſhift them into larger pots, managing the myrtles as other green-houſe ſhrubs, and the ſtove-kinds as other woody exotics of the ſtove.

Properties, &c. The leaves and flowers of *common* upright myrtle have an aſtringent quality, and are uſed for cleanſing the ſkin, fixing the teeth when looſened by the ſcurvy, and ſtrengthening the fibres. From the flowers and young tops is drawn a diſtilled water that is deterſive, aſtringent, coſmetic, and uſed in gargles. A decoction of the flowers and leaves is applied in fomentations. The berries have a binding deterſive quality; and the chemical oil obtained from them is excellent for the hair, and uſed in pomatums and moſt other external beautifiers of the face and ſkin. As an internal medicine, theſe berries have little or merit.

In the *Dictionnaire portatif d'Hiſtoire Naturelle*, a fact is related, which, if true, tends to ſhow the ſtrongly aſtringent quality of myrtle. "Myrtle (ſays he) is likewiſe the baſe of a pommade called *pommade de la Comteſſe*, and well known on account of an extraordinary hiſtorical fact. One of thoſe gay youths who flutter about the toilets of the fair, happened one day to be left alone in the ſtorehouſe of the graces. With eager curioſity he examined the perfumes, the ſmelling bottles, the perfumed powder, the eſſences, and the coſmetics. To give more of the vermilion and greater pliancy to his lips, and to remove ſome diſagreeable eruptions, he lightly ſpreads with his indiſcreet finger the fatal pommade, looks at himſelf in the glaſs, and contemplates his beauty with admiration. The lady enters; he wiſhes to ſpeak, but his lips contracted, and he could only ſtammer. The lady looked at him with aſtoniſhment; at length caſting her eyes on the toilet, ſhe diſcovered by the open pot the cauſe of the miſtake, and enjoyed a hearty laugh at the expence of her admirer, whoſe confuſion announced his indiſcretion."

Pimento berries are chiefly imported into Britain from Jamaica; whence the name *Jamaica pepper*. It is alſo called *all-ſpice*, from its taſte and flavour being ſuppoſed to reſemble thoſe of many different ſpices mixed together. It is one of the ſtaple articles of Jamaica; where the pimento walks are upon a large ſcale, ſome of them covering ſeveral acres of ground. When the berries arrive at their full growth, but before they begin to ripen, they are picked from the branches, and expoſed to the ſun for ſeveral days, till they are ſufficiently dried; this operation is to be conducted with great care, obſerving that on the firſt and ſecond day's expofure they require to be turned very often, and always to be preferved from rain and the evening dews. After this procefs is completed, which is known by the colour and rattling of the feeds in the berries, they are put up in bags or hogfheads for the market. This fpice, which was at firft brought over for dietetic ufes, has been long employed in the fhops as a fuccedaneum to the more coftly oriental aromatics: it is moderately warm, of an agreeable flavour, fomewhat refembling that of a mixture of cloves, cinnamon, and nutmegs. Diftilled with water it yields an elegant effential oil, fo ponderous as to fink in the water, in tafte moderately pungent, in fmell and flavour approaching to oil of cloves, or rather a mixture of cloves and nutmegs. To rectified fpirit it imparts, by maceration or digeftion, the whole of its virtue: in diftillation it gives over very little to this menftruum, nearly all its active matter remaining concentrated in the infpiffated extract. Pimento can fcarcely be confidered as a medicine: it is, however, an agreeable aromatic, and on this account is not unfrequently employed with different drugs, requiring fuch a grateful adjunct. Both the pharmacopœias direct an aqueous and fpirituous diftillation to be made from thefe berries, and the Edinburgh college order alfo the *oleum effentiale piperis Jamaicenfis*.

MYSIA, a country of Afia Minor, generally divided into Major and Minor. Myfia Minor was bounded on the north and weft by the Propontis and Bithynia, and Phrygia on the fouthern and eaftern borders. Myfia Major had Æolia on the fouth, Ægean on the weft, and Phrygia on the north and eaft. Its chief cities were Cyzicum, Lampfacus, &c. The inhabitants were once very warlike; but they greatly degenerated, and the words *Myforum ultimus* was emphatically ufed to fignify a perfon of no merit. The ancients generally hired them to attend their funerals as mourners, becaufe they were naturally melancholy and inclined to fhed tears. They were once governed by monarchs. They are fuppofed to be defcended from the Myfians of Europe, a nation who inhabited that part of Thrace which was fituated between Mount Hæmus and the Danube.

MYSON, a native of Sparta, one of the feven wife men of Greece. When Anacharfis confulted the oracle of Apollo, to know which was the wifeft man in Greece, he received for anfwer, he who is now ploughing his fields. This was Myfon.

MYSORE, or MYSOREAN DOMINIONS, a kingdom of Afia, in the Eaft Indies, confifting of the following territories ufurped or fubdued by the late Hyder Ali, and tranfmitted to his fon Tippoo Saib the prefent fultan.

1. Myfore Proper, or Seringapatam (from its capital), forming the independent ftate of a Hindoo rajah for near 200 years from its difmemberment, as a province of the Bejenagur empire, fell into the hands of Hyder Ali Khan about the year 1763, by cutting off the Dalaway, or regent ufurper of the government, and feizing the reins of adminiftration himfelf; but without leaving even the fhadow of any authority to a nominal rajah of his own creation, excepting in the formularies of juftice or finance, and preferving on one fide of the pagoda coin the impreffion of two fwamies or divinities of the Hindoos, while the other was made to bear the initial letter of his proper name Hyder. The whole country, now again reduced into the form of a province dependent on the new Myforean dominion of a muffulman in the perfon of Tippoo, is bounded on the weft by the Balagaut hills of Koork, and thofe called Anemally, bordering the whole coaft of Malabar; on the eaft it frontiers with the Carnatic Payengaut and its dependencies along the Coromandel coaft; and, on the north, with the pergunnahs of Serah, Bangalore, and Colar, belonging to the Carnatic-Balagaut-Bejapoury, in a longitudinal line little fhort of 200 Englifh miles. From this latter boundary, in a form nearly triangular, it ftretches 240 miles towards the fouth, where it terminates in a point at the extremity of Dindigul, near the pafs of Goodalore, through the Anemally hills, on the confines of Travancore, and within 100 miles of Cape Comorin. It partakes of the two great divifions of country known in the Decan by the terms Balagaut and Payengaut, or upper and lower region. The former, comprehending the diftricts immediately dependent on the capital, and 43 fubordinate forts, chiefly on eminences, is but indifferently watered by the feveral branches of the Caveri, at no great diftance from its fource; and muft therefore, as well as in confequence of an elevated fituation, precluded from foreign commerce, with fcarcely any internal induftry, be comparatively poor, as it is productive only of the fmaller grains of joary and bajary, or a fpecies of Indian corn, with the different kinds of vetches common to India; from all which, however, a nett revenue, in money or kind, of feven lacks of hoons or pagodas, being about 27 lacks of rupees, is computed to be forthcoming to the ftate, after defraying the ordinary charges of collection, which here, as in the reft of Hindoftan, confift chiefly of an eftablifhment of village peons or militia, reckoned 40,000 in number, for the whole province of Myfore, fuppofed to contain 15,400 fquare geographic miles. The latter, or Payengaut divifion, making fcarcely a third part of this extenfive area, is better known to us under the name of Coimbatore, including the diftricts of Caroor, Darampour, and Namcul, on both fides of the Caveri, with the valley of Dindigul on the fouth, and the great pafs of Palligautcherry towards Malabar on the weft: it is extremely fertile and well cultivated; therefore, in proportion to its extent, more productive of revenue than the Balagaut territory, being eftimated nett at 19 lacks of rupees. The rajahs of Koork, and other Pailygars among the Gauts, from Bidenore fouth to Dindigul, occupy independently a confiderable tract of country within the general defcription of Tippoo's dominions: but which being inacceffible to regular troops by hills or impervious woods, the Myforean power hath never been able to conquer, further than to facilitate the catching of a few elephants yearly, by means of the natives.

2. Bedenore, or Ikeri, now Hydernagur, on the diffolution of the Canarine empire, of which it was a part, became an independent ftate under its Naicks of the race of Vencataputty, after which it fell under the divided female government of different rannies or queens, and fo continued until conquered wholly by Hyder between the years 1763-5. This country is alfo divided into alagaut and Payengaut; the latter

Myſore. ſtretching 140 miles along the ſea-coaſt from Declah, or the river Cangrecora, being the northern frontier of Malabar, north to Honawar or Onore, on the confines of Soonda, in different breadths of plain territory, from 40 to 50 miles, but which may in all form an area of 3200 ſquare miles, ſtill retaining the ancient name of Canara, and including the ports of Mangalore, Barcelore, Onore, &c. The former or elevated diviſion beyond the Supramanny Gauts, and immediately dependent on the capital Bedenore, Hanampour, &c. is of great indefinite extent inland, on both ſides of the Tumbhudra; perhaps twice more conſiderable in ſize, though not proportionably ſo in value, to the maritime border. Both diviſions, however, allowing for a revenue eſtabliſhment of about 22,000 village peons, are aſſeſſed for ſeven lacks of Ikeri pagodas, which, at four rupees each, make a clear income to the exchequer of 28 lacks of rupees.

3. Soonda, in circumſtances of hiſtory or final conqueſt, might be placed under the preceding head; as alſo from a ſimilarity in its geographical deſcription, with only the difference of being on a much ſmaller ſcale. The Payengaut, from the diſtrict of Onore to the frontiers of Goa, along a ſea-coaſt of 60 miles, cannot comprehend above 1100 ſquare miles of territory, in which the port of Carwar may be conſidered the capital; while a much larger extent muſt be allowed for that portion of the diſtrict beyond the Gauts to the eaſtward. The whole revenue, however, of both diviſions, does not exceed two lacks of pagodas, or eight lacks of rupees.

4. Malabar. The country under this deſcription, and conquered by Hyder in 1765-6, excluſive of Koork, is altogether Payengaut; ſtretching along the ſhore from Declah ſouth to Cochin about 200 miles, and comprehending, in an area of perhaps 6000 ſquare miles, the Samery's territory of Calicut, with the petty ſtates of Cartinad, Cotiotie, Cheriea, or Canore, on the north, and the tributary kingdom of Cochin on the ſouth;—the whole rated at a revenue of five lacks of pagodas, or about 19 lacks of rupees, after allowing for the maintenance of 18,000 village peons.

5. Barah Mhal, or twelve pergunnahs, was one of the earlieſt conquered annexations of Hyder to the Myſorean dominion, though in the war of 1768 it was over-run and for a while in poſſeſſion of the company's troops. The whole circar or diſtrict of Jugdeo, compoſed of heights and valleys on the confines of the Balagaut and Payengaut Carnatics, being one of the ſeven dependencies of Ginjee ſubjected to the Mogul in 1698, was then ſubdivided into 17 pergunnahs, and aſſeſſed for a groſs revenue of 1,757,717 rupees. Of theſe ſubdiviſions, Amboor, Sautgur, &c. remain to the Payengaut: the reſt in the hands of Tippoo, may comprehend, excluſive of the poligarry of Shili Naick, about 1800 ſquare miles; but the nett revenue of the ſame territory, after defraying the ordinary expences of collection, does not exceed five lacks of rupees at preſent.

Theſe five provinces of the Myſorean empire, with the diſtricts of Bangalore, Colar, &c. of the Carnatic-Balagaut Bejapoory, formed the whole of Hyder's dominion in the war 1768; and were calculated then to yield in all a nett income of 119 lacks and an half of rupees, allowing an eſtabliſhment of 115,000 village peons to enforce the collections, and maintain internal peace. Myſore.

6. Petty ſtates of Hindoo rajahs, ſituated on the weſt and north of the Hendery and Tumbhudra rivers, to the confines of Goa, and the Merhatta territories of Toorgul, Raibaug, and Meritch, forming the jageer of Perſeram Bow beyond the ſouthern branch of the Kiſtnah. Some of theſe rajahſhips had been entirely conquered by the Mogul; but the moſt conſiderable of them never were ſubdued by any Muſſulman power until Hyder's conqueſt of them between the years 1774-7, though different diſtricts from each may have been diſmembered for a while by the Mogul deputies of the Carnatic-Balagaut Bejapoory, and therefore annexed in the accounts of the revenue of that circar. The frontier forts, and dependencies, of Goojunder-gur, Darwar, Badamy, &c. near the ſouthern branch of the Kiſtnah towards the Merhattah dominion, compoſed at one time the jageer of Ragenaut Row, and have frequently changed their maſters. They fell ultimately to Tippoo at the peace of 1784, but he was forced to pay chout for them to the Peſhwa. On the whole, all theſe ſtates, of great indefinite extent and extremely poor, yield only a precarious revenue of 16 lacks of rupees to the Myſorean.

7. Carnatic Balagaut Bejapoory, conſiſting, under the Mogul, of one circar of the ſame name, and of which the capital was Serah. It comprehended 51 pergunnahs, of which Bangalore, Colar, &c. on the ſouth, were ſeized by Hyder, immediately when he poſſeſſed himſelf of Myſore; but Anantpour, Penekonda, &c. on the north, with the reſt of the Merhattah ſtate of Gooty, did not fall into his hands until the year 1776, when he overcame and made priſoner the proprietor Morarow, who had rendered ſignal ſervice to the Engliſh in the preceding Myſorean war. The whole circar was rated at a jumma *kaumil*, or total groſs revenue on the king's books, of 43916,396 rupees: but the accuracy of this valuation is much to be doubted; becauſe it does not appear from the regiſters of the ſoubah of Bejapour that the Mogul government ever aſcertained the *dehatee* or village collections of either of the Carnatics, or went into greater detail than to fix the ſtandard aſſeſſment of the different pergunnahs; and becauſe the amount thus ſtated ſeems too large a receipt from a country naturally ſo poor and deſtitute of commerce, probably in all its dimenſions not exceeding 10,000 ſquare miles, and which was ſo liable to internal diſturbances or foreign invaſion, that notwithſtanding the number of ſtrong holds to be found in it, every town required and has its own particular fortification. However this may be, the revenue actually forthcoming to Hyder in 1778, after defraying charges of collection and an eſtabliſhment of about 30,000 village peons, was only 3,205,206 rupees.

8. Carnatic-Balagaut-Hydrabady, comprehending the five circars of Sidhout, Kahmam, Ganjecottah, Gooty, and Gorrumkonda, which were ſubdivided into 66 pergunnahs, rated by the Moguls kaumils 4,707,306 rupees: but from this amount is to be deducted the aggregate valuation of the pergunnahs or Chittoor, &c. now annexed to the Payengaut, together with the aſſeſſment of the diamond-mines of Ganjecottah,

Mysore. jecottah, which are no longer productive, making in all an object of two lacks of rupees. The whole country thus described, bounded by the circars of Adoni and Nundial on the north towards the Kistnah, the Guntour circar and Carnatic Payengaut on the east, with that of the Balagaut Bejapoury on the south and west, may in square dimensions be nearly equal to this last mentioned division of territory of about 10,000 square miles. It formed the inheritance for four generations of the Patan nabobs of Cuddapah, descended from a collateral branch of the Sanore family, until Gooty and Gorrumkonda were taken by the Merhattahs in 1758, and then ultimately, with the remainder of Helim Khan's possession, by Hyder in 1776-9. After deducting the amount of a few jageers and some charitable lands still left to the Mahomedans of this district, with the expence of an establishment at least of 23,000 village peons, the nett revenue of the whole province may be estimated at 29 lacks of rupees.

9. Adoni, or circar of Imtiazghur on both sides of the Hendery river, south of the Tumbhudra or Tungabudra river, as far as and inclusive of Bellary, together with a small portion of the circar of Ghazipour or Nundial, dismembered from the nabobship of Karnool, all situated in the soubah of Bejapour, comprehend the whole of Tippoo's conquests and annexation to the Mysorean empire, acquired since the death of Hyder, and subsequently to the treaty of Mangalore in 1784. In extent and revenue, this acquisition may be considered of little account. The former cannot exceed 5000 square miles, and the latter scarcely seven lacks of rupees, reckoning the petty zemindary of Bellary. But the fort of Adoni is of considerable importance, as being of the kind (on an insulated rock) thought the strongest in Hindostan, without excepting Dowlatabad or Gualior. It was ever the favourite ambitious object of conquest to Hyder, the Merhattas and Nizam; and preserved only through the cautious policy of its proprietor, Bassalut Jung. When it came by inheritance into the weak inexperienced hands of his son Mohabet Jung, it fell by treachery under the dominion of Tippoo; together with all its territorial dependencies, except the circar of Raichore, between the Kistnah and Tumbhudra.

The extent of Tippoo's dominion, according to the latest maps, has been computed at 80,000 square geographic miles, or 92,666 English. Thus considering it a triangle, of which the base runs nearly parallel to and not far south of the Kistnah, in a longitudinal line of 340 English miles, about the 16th degree of north latitude, or from the pagoda of Tripanti in the north-east angle to Kittoor in the north-west, towards the frontiers of Goa, of Bari, and the Merhattahs; then, one of its sides, along the Balagaut or mountainous ridge of the Malabar coast, will be found to stretch in a horizontal distance 500 miles southerly, to the extreme point and pass of Goodalore in that quarter; and its other side from thence northerly, touching the frontiers of the Carnatic Payengaut, 470 miles in a parallel direction to the Coromandel coast, until it reaches the further corner of the circar of Kahmam near the first mentioned point at the pagoda of Tripanti. Beyond these three lines, the plains bordering the shores of Canara and Malabar are the only exclusive territory of considerable extent belonging to Tippoo; and to balance it in some degree, within the area of the triangle described, it is to be remembered are situated the independent or environed states of Sanore, Koork, &c. if not also a part of Karnool and Raichore. As the whole face of the country is known to be rugged, in many parts desolate, badly watered, and generally rising abruptly near half a mile of perpendicular height above the level of the sea, it cannot be supposed that the soil is equally fertile with the lower lands of Hindostan. In fact, though every advantage of industry and population be allowed to a despotic government, which cherishes a numerous peasantry in exclusion of great intermediate landholders, yet the produce of the Balagaut altogether consists merely of the necessaries of life, and these of the coarsest kind; just enough to subsist the inhabitants, after making sufficient provision in pasture for the extraordinary number of horses and other cattle maintained there for the military establishment: while, in the Payengaut on the Malabar coast, some pepper, cardamums, sandal wood, and surplus grain beyond internal consumption, constitute the only commercial funds of natural growth within the whole circle of the Mysorean dominion. As to manufactures, except those of Salem and Bellary, if any exist in the country, they are not considerable enough to be known abroad.

From the foregoing view of the nature, produce, and revenues of the Mysorean empire, it may be concluded that we could have no lucrative prospects in our late contests with Tippoo Sultan; but were compelled, for the preservation of our own possessions in that quarter, to undertake his reduction as a restless, cruel, ambitious, and depredatory neighbour. This has accordingly been effected by the good conduct of Lord Cornwallis; who, in the issue of the war, has obliged him to cede half his dominions to the Company and its allies, adjacent to their respective boundaries, and subject to their selection.

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 edification 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 œconomy 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,

were, "delight in the light, 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 depoſit, 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; anything 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

3 Object of this article.

queſtion at preſent. 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 unintertaining 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 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.

5 The hypotheſis of Warburton ill founded.

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 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 quotation 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.

† *Divine Leg.*

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 ſee 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.* 5.

The divine Author of the Chriſtian œconomy, 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 aggrandiſe 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 dependence of 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 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,

(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.

(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.

inventions, &c. were intended to be immortalized by thofe inftitutions. Upon the whole, the myfteries were performed in fecret; they were intended to be communicated only to a few: of courfe, had they been inftituted with a view to immortalize the memory of heroes and great men, the authors would have acted the moft foolifh and inconfiftent part imaginable.—Inftead of tranfmitting the fame of their heroes with eclat to pofterity, they would by this procedure have configned it to eternal oblivion.

11 Our firft pofition fupported by the character of the priefts of Egypt.

We muft then recur to our firft pofition. The myfteries were the offspring of bigotry and priestcraft; they originated in Egypt, the native land of idolatry. In that country the priefthood ruled predominant. The kings were ingrafted into their body before they could afcend the throne. They were poffeffed of a third part * of all the land of Egypt. The facerdotal function was confined to one tribe, and was tranfmitted unalienably from father to fon. All the orientals, but more efpecially the Egyptians, delighted in myfterious and allegorical doctrines. Every maxim of morality, every tenet of theology, every dogma of philofophy, was wrapt up in a veil of allegory and myfticifm. This propenfity, no doubt, confpired with avarice and ambition to difpofe them to a dark and myfterious fyftem of religion. Befides, the Egyptians were a gloomy † race of men; they delighted in darknefs and folitude. Their facred rites were generally celebrated with melancholy airs, weeping, and lamentation. This gloomy and unfocial bias of mind muft have ftimulated them to a congenial mode of worfhip. In Egypt then we are to fearch for the origin of the myfteries. Both the nature of the inftitution and the genius of the people confirm this pofition; and hiftorians, both ancient and modern, are agreed in admitting the certainty of the fact.

* *Diodor. Sicul. Lib.* I.

† *Plutarch.*

12 The Ofiris and Ifis of Egypt the Bacchus and Ceres of Greece.

The Ofiris of Egypt, every body knows, was the original Bacchus; as the Ifis of the fame country was the Ceres of the Greeks. The rites of Ofiris were performed with loud fhrieks and lamentations when he was put into the coffin; and with the moft extravagant mirth, when he was in a manner raifed from the dead, or fuppofed to be found again. Their hymns were upon the whole always compofed in melancholy affecting ftrains; and confifted of lamentations for the lofs of Ofiris, the myftic flight of Bacchus, the wandering of Ifis, and the fufferings † of the gods. The Canaanites, who were a kindred tribe of the Mizraim or Egyptians, imitated them in their facred rites. At Byblus, Berytus, Sidon, and afterwards at Tyre, they ufed particularly mournful dirges for the death of Adonis or Tammuz †, who was the fame with the Egyptian Ofiris, *i. e.* the fun.

† *Plut. If. et Ofir.*

† *Ezek. Chap.* 8. *and Nonni Dionyf.*

13 Death of Ofiris and wanderings of Ifis.

The Egyptians, then, naturally inclined to gloom and fecrecy, inftituted a mode of worfhip congenial with their natural difpofition of mind. The recefs of the fun towards the fouthern hemifphere, was the death † of Ofiris; the wanderings of Ifis in fearch of her hufband and brother, allegorically imported the longings of the earth * for the return of the fructifying influences of the folar heat.

† *Macrob. Saturn.*

* *Plut. If. et Ofir.*

When that luminary returned towards the fummer folftice, and grain, trees, fruits, herbs, and flowers adorned the face of nature, another feftival was celebrated of a very different complexion from that of the former. In this feafon all Egypt was diffolved in the moft extravagant mirth and jollity. During the celebration of thofe feftivals, the priefts formed allegorical reprefentations of the fun and the earth (D). They perfonified the one and the other, and allegorized their motions, afpects, relations, fympathies, acceffes, receffes, &c. into real adventures, peregrinations, fufferings, contefts, battles, victories, defeats, and fo forth. Thefe, in procefs of time, were held up to the vulgar as real occurrences; and thefe in a few ages became the moft effential articles of the popular creed. From this fource were derived the conquefts of Dionyfus or Bacchus, fo beautifully exhibited by Nonnus in his Dionyfiacs; the wanderings of Io, wonderfully adorned by Æfchylus; and the labours of Hercules, afterwards ufurped by the Greeks.

14 The Egyptians deified departed heroes.

Whether the Egyptians deified mortal men in the earlieft ages has been much controverted. Jablonfki * has taken much pains to prove the negative. Diodorus ‡ affures us that they paid their monarchs a kind of divine adoration, even in their lifetime. Plutarch tells us plainly § that fome were of opinion that Ifis, Ofiris, Horus, Anubis, Typhon, were once mortal perfons, who were exalted into dæmons after their death. The Sicilian, in his hiftory of Ifis and Ofiris, Pan, Hermes, &c. plainly reprefents them as human perfonages; and informs us, that the Egyptians imagined, that after their deceafe they tranfmigrated into particular ftars. From thefe authorities, we are inclined to believe that the Egyptians, as well as the other pagans, did actually deify perfons who had diftinguifhed themfelves in their days of nature by prowefs, wifdom, ufeful arts, and inventions. This was a conftant practice among the Greeks, who probably learned it from the people in queftion.

* *Panth. Egypt.*

‡ *Lib.* i.

§ *If. et Ofir.*

15 Secrets refpecting the objects of worfhip revealed in the myfteries.

The exploits of thofe heroes had been difguifed by allegorical traditions and hieroglyphical reprefentations. They had been magnified beyond all dimenfions, in order to aftonifh and intimidate the vulgar. They had been interlarded with the moft extravagant fables, in order to gratify their propenfity towards the marvellous. All thefe fecrets were developed in the myfteries. The catechumens (E) were informed of every particular relating to the birth, the life, the exploits, the adventures, the misfortunes, and deceafe of thofe heroic perfonages, and when, and by what means, they had attained to the high rank of divinities. At the fame time we think it highly probable, that thofe demigods were reprefented in their ftate of exaltation and heavenly fplendour. The magicians of Egypt were abundantly qualified for exhibiting *angels in machines*. The fouls of virtuous men, who had not been eminent enough to merit the honour of deification, were fhown in all the perfection of Elyfian felicity; and perhaps the

(D) Ifis, among the Egyptians, fometimes fignified the moon, and fometimes the earth.

(E) Catechumens were pupils who were learning the elements of any fcience.

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 socerdotal 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 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 is 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 those 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

* Nardon, Shaw, Pococke, &c.

(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.

(I) See an excellent description of these subterraneous abodes, and of the process of probation carried on there, in a French romance, intitled *The Life of Sethos*.

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.

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 αοιδοι (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 Zorduſht, 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 Boeotia, 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 connection we imagine it was, that in later times moſt of the ſages of 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.

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. 21 Myſteries of Mithras, Bacchus, and Ceres, the moſt auguſt.

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 reſpectable an authority, we ſhould conjecture that it is a cognate of the Hebrew word *Muthir*, "excellentia, preſtantia." 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

* *Relig. vet. Perſarum.*

(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.

(O) Bacchus was the Oſiris of the Egyptians, and Ceres was the Iſis of the ſame people.

(P) Moſheim, in his notes on Cudworth's Intellectual Syſtem, page 330, has taken much pains to prove that Mithras was a deified mortal; but we cannot agree with that learned man in this point.

22 Account of the myſteries of Mithras.

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.

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 cloke. By his ſides are ſeen other human figures, with tiaras of the ſame faſhion on their heads, but without clokes. One of theſe figures commonly holds in his one hand a torch lifted up; in the other one turned downward. Sometimes over the cave is ſeen the chariots of the ſun and moon, and divers conſtellations, ſuch as cancer, ſcorpion, &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 thro' them. He was obliged to live a life of virtue and abſtinence for a 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 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 Mythriac 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.

* *Jul. Firmicus.*

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

(Q) Iſis and Oſiris, page 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. page 17. aſſerts that Zoroaſtres was initiated among the Egyptians.

(S) The month Mihr began September 30, and ended October 30.

(T) See Dr Hyde de Rel vet. Perſ. page 16, 17. Mr Bryant's Anal. vol. i. page 232. Porphyr. de autro Nymph, page 254. This philoſopher often mentions the cave of Mithras, and always attributes the inſtitution of his rites to Zoroaſter nign 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 inform 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.

* *Dial. cum Tryphone.*
‡ *De præscript. adver. Hæret.*

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 reflexion 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.

* *Solinus*, cap. 10.

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 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).

26
Mithras said to have sprung from a rock.

We shall conclude our account of the mysteries of Mithras with a passage from Mr 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 Abriman 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,

(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.

(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*.

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 connection with the preſent diſquiſition. The Greek name of that deity is plainly oriental, being compounded of *di*, "bright;" and *naſia* 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.

28 Bacchus the ſame with Oſiris.

§ *Lib.* 1.

* *Lib.* 2. *cap.* 144.

‖ *Theol. Egyp. lib.* 2. *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 is 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 the 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.

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. 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 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 every where 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. 29 Exploits of Oſiris.

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. 30 His death.

Iſis, in the mean time, diſconſolate and forlorn, attended

(B) See Macrob. lib. i. cap. 21. p 247. bottom. Diogenes Laert. in prœmio, par. 10. Martian. Capel. Lib. 2. Jablonſki, vol. i lib. ii. p. 415. par. 3. Plut. Iſis Oſir. *paſſim*.

(C) Men and women dreſſed in the habits of thoſe rural deities.

(D) Many have thought this expedition fabulous; but the numberleſs monuments of Egyptian architecture, ſculpture, ſtatuary, lately diſcovered in the eaſt, confirm it.

31 Wanderings of Iſis in ſearch of his body. tended 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 *taposſins* 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.

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* *. 33 Transferred to Byblus and Tyre, where Oſiris was called *Adonis* and *Bacchus*;

Orpheus the celebrated Thracian philoſopher had travelled into Egypt in queſt of knowledge; and from 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 34 And thence imported by Cadmus into Bœotia.

* *Diod. Sicul. Voſſius de Idol.*

(E) For the conqueſts and adventures of Oſiris and Iſis, we muſt ſend our learned readers to Diod. Sic. Bibli, l. i. and Plut. Iſis and 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. 8. ver. 14. *tammuz* is the name of one of the months of the Egyptian year.

(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 connection between Jupiter and Semele, as of little importance to our readers.

of 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 unintertaining (L). The Greeks commonly adopted some oriental personage as the hero of their mythological rhapsodies. Him they naturalised 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 meritricious 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.

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 day appointed. The votaries were to dress them- 37 Process of their celebration. selves 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

(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, *Geblin. 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 origia were called *Triteria*.

(O) According to Clem. Alexand. Cohort. pag. 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*.

(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.

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 more coarse and 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 fan (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 play-things; 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.

‡ *Clem. Alexand.*

§ *De Errore Prof. Gent.*

39 Human sacrifices.

* *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, Fans, and Silenuses, 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 Fawns, 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 and altars in form of vinesets 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

40 Total contempt of decency.

* *Ovid. Met.*

(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. l. i. pag. 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 *vanus* Jacchi. The fan, 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. pag. 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.

(X) The phallus was the symbol of the fructifying power of Nature. The Itophallus was the type of that power in act.

crecy 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, ecſtaſy, and enthuſiaſtic fury.

What ſecrets, religious, moral, political, or phyſical, were communicated to the votaries, it is impoſſible to determine with any degree of certainty.—

41 Doctrines inculcated in the orgia.

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 by 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. Ariſtophane Ranæ, Nonn Dionyſ. and among the moderns, to Ban. Mythol. Voſſ. de origi. Idol. Monſ. Fourmont, Reflexions ſur l'origine 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 hohour 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. 11.

§ Lib. 1.

43 On what occaſion introduced into Attica.

"In like manner with him (Cecrops), ſays that judious hiſtorian, they tell us, that Erectheus, 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. Erectheus, 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 tranferred 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 Erecthens, 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 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 Erectheus 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

elucidate this point, we must observe, that along with the grain imported from Egypt, Erectheus, 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.* 2.

‡ *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 (A). Ceres, says Diodorus, appeared thrice in Attica during the reign of Erectheus; which seems to import, that fleets loaded with corn had thrice arrived in that country from Egypt during that period.

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. Erectheus, in order to give equal importance to his patroness, had the address to institute the Eleusinian mysteries; and to accomplish his design laid hold on the opportunity above mentioned.

45 Contentions at Athens respecting Minerva and Neptune, the immediate cause of fixing the mysteries at Eleusis.

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.

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.

* *Apollod. Bibl. Lib.* 3. *cap.* 13.

46 Circumstances attending the first appearance of Ceres in Attica.

4

(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 Chaldiac 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."

(A) 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 plow;" a name naturally applicable to the goddess of husbandry.

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 (B), 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.

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.

47 Ceres and Bacchus, who they were.

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 propaganda 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 (C); the latter in the month Antheſterion (D). 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 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.

With

(B) Apollod. Bib. ubi ſupra. Clem. Alexand. Cahod. page 17. where the ſtory is told with very little reſerve.

(C) The third month of the Athenian year, anſwering to our September.

(D) The eighth month, anſwering to our February; but Meurſius makes it November.

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 expresly 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

55 The Mundus Cereris.

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.

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 porche, or outer part of this temple, the candidates were crowned with garlands of flowers,

56 Dress of the candidates.

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,

57 Care to keep the uninitiated at a distance.

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.

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 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 daduchus.

The next minister was the Daduchus, or torch-bearer; 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.

‖ *Lib.* 9.

* See *Eleusis*.

* *Prep. Evan.*

62 The curators, &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 Chiſtianity, 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.

† *Juſtin. Euſeb. Clem. Alex.*

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 repo-
63 The petroma. ſitory 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.

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; then 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 pine in her hand, which ſhe had lighted at mount Etna.

When the pageant of the goddeſs was ſuppoſed to arrive at Eleuſis, a ſolemn pauſe enſued, and a few
65 Queſtions put to the myſtæ. triſling 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 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. Thoſe 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

† *Div. Leg.*

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 connection with many other dogmas which he had the assurance to claim as his own.

69 Unity of the supreme Being maintained in the mysteries.

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 demi-gods, as beings 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.

70 Offices of the other gods.

71 Excellent plan for accomplishing the end 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 elogiums, 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 splendor 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 etherial 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 was 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 heros 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 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.

72 Private virtues inculcated in the mysteries, by the doctrine of a future state.

‡ *Lib.* 2.

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

73 Emblems of Elysium and Tartarus.

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 splendor; 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.

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.

74 The three laws of Triptolemus.

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 multa 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.

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. 76

76 Horrible spectres and pleasing scenes alternately exhibited.

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 Elensis "a kind of temple of the whole earth, and of all that man beholds done in the most dreadful and the most exhilerating 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 bore 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 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, was 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 Deo, jam magnus ab imis*
> "*Auditur fremitus terris, templumque remugit*
> "*Cecropidum.*"

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

77 A kind of baptismal ablution in the mysteries.

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. Those 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 principal 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 1.

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 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 de Myst. El.

79 Interestedness of the priests.

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,

(E) Act 1. near the beginning, and in many other places.

‡ Phædo. sion. Hence Plato introduces Socrates ‡ observing, "that the sages who instituted 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.

80 Remarks of Diogenes and Antisthenes.

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. Laert.

81 All the world crowd to Eleusis.

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 whether 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 Degeneracy of the mysteries.

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.

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 Erectheus, mantained 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.

83 Abolished by the emperor Theodosius.

84 Other mysteries among the pagans of less celebrity.

There were almost numberless other mysterious institutions among the ancient Pagans, of which these 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 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. ‡ Sanchoniathon and Herodotus.

MYSTICAL,

MYSTICAL, fomething myfterious or allegorical. Some of the commentators on the facred writings, befides a literal find alfo a myftical meaning. The fenfe of fcripture, fay they, is either that immediately fignified by the words and expreffions in the common ufe of language; or it is mediate, fublime, typical, and myftical. The literal fenfe they again divide into proper literal, which is contained in the words taken fimply and properly; and metaphorical literal, where the words are to be taken in a figurative and metaphorical fenfe. The myftical fenfe of fcripture they divide into three kinds: the firft correfponding to faith, and called *allegorical;* the fecond to hope, called *anagogical;* and the third to charity, called the *tropological fenfe.* And fometimes they take the fame word in fcripture in all the four fenfes: thus the word *Jerufalem*, literally fignifies the capital of Judea; allegorically, the church militant; tropologically, a believer; and anagogically, heaven. So that paffage in Genefis, *let there be light, and there was light*, literally fignifies corporeal light; by an allegory, the Meffiah; in the tropological fenfe, grace; and anagogically, beatitude, or the light of glory.

MYSTICS, *myftici*, a kind of religious fect, diftinguifhed by their profeffing pure, fublime, and perfect devotion, with an entire difinterefted love of God, free from all felfifh confiderations.

The myftics, to excufe their fanatic ecftacies and amorous extravagancies, alledge that paffage of St Paul, *The Spirit prays in us by fighs and groans that are unutterable.* Now if the Spirit, fay they, pray in us, we muft refign ourfelves to its motions, and be fwayed and guided by its impulfe, by remaining in a ftate of mere inaction.

Paffive contemplation is that ftate of perfection to which the myftics all afpire.

The authors of this myftic fcience, which fprung up towards the clofe of the third century, are not known; but the principles from which it was formed are manifeft. Its firft promoters proceeded from the known doctrine of the Platonic fchool, which was alfo adopted by Origen and his difciples, that the divine nature was diffufed through all human fouls, or that the faculty of reafon, from which proceed the health and vigour of the mind, was an emanation from God into the human foul, and comprehended in it the principles and elements of all truth, human and divine. They denied that men could by labour or ftudy excite this celeftial flame in their breafts; and therefore they difapproved highly of the attempts of thofe, who by definitions, abftract theorems, and profound fpeculations, endeavoured to form diftinct notions of truth, and to difcover its hidden nature. On the contrary, they maintained that filence, tranquillity, repofe, and folitude, accompanied with fuch acts as might tend to extenuate and exhauft the body, were the means by which the hidden and internal word was excited to produce its latent virtues, and to inftruct men in the knowledge of divine things. For thus they reafoned; thofe who behold with a noble contempt all human affairs, who turn away their eyes from terreftrial vanities, and fhut all the avenues of the outward fenfes againft the contagious influences of a material world, muft neceffarily return to God, when the fpirit is thus difengaged from the impediments that prevented that happy union. And in this bleffed frame they not only enjoy inexpreffible raptures from their communion with the Supreme Being, but alfo are invefted with the ineftimable privilege of contemplating truth undifguifed and uncorrupted in its native purity, while others behold it in a vitiated and delufive form.

The number of the myftics increafed in the fourth century, under the influence of the Grecian fanatic, who gave himfelf out for Dionyfius the Areopagite, difciple of St Paul, and probably lived about this period; and by pretending to higher degrees of perfection than other Chriftians, and practifing greater aufterity, their caufe gained ground, efpecially in the eaftern provinces, in the fifth century. A copy of the pretended works of Dionyfius was fent by Balbus to Lewis the Meek in the year 824, which kindled the holy flame of myfticifm in the weftern provinces, and filled the Latins with the moft enthufiaftic admiration of this new religion.

In the twelfth century, thefe myftics took the lead in their method of expounding fcripture; and by fearching for myfteries and hidden meaning in the plaineft expreffions, forced the word of God into a conformity with their vifionary doctrines, their enthufiaftic feelings, and the fyftem of difcipline which they had drawn from the excurfions of their irregular fancies. In the thirteenth century, they were the moft formidable antagonifts of the fchoolmen; and towards the clofe of the fourteenth, many of them refided and propagated their tenets almoft in every part of Europe. They had, in the fifteenth century, many perfons of diftinguifhed merit in their number: and in the fixteenth century, previous to the Reformation, if any fparks of real piety fubfifted under the defpotic empire of fuperftition, they were only to be found among the myftics.

The principles of this fect were adopted by thofe called *Quietifts* in the feventeenth century, and, under different modifications, by the Quakers and Methodifts.

MYSTRUM, a liquid meafure among the ancients, containing the fourth part of the Cyathus, and weighing two drams and an half of oil, or two drams two fcruples of water or wine. It nearly anfwers to our fpoonful.

MYTELENE. See Metylene.

MYTENS (Daniel), of the Hague, was an admired painter in the reigns of king James and king Charles. He had certainly (Mr Walpole fays) ftudied the works of Rubens before his coming over. His landfcape in the back grounds of his portraits is evidently in the ftyle of that fchool; and fome of his works have been taken for Vandyck's. The date of his arrival is not certain. At Hampton-court are feveral whole lengths of princes and princeffes of the houfe of Brunfwick-Lunenburgh, and the portrait of Charles Howard earl of Nottingham; at Kenfington is Mytens's own head. At Knowle, Lionel Cranfield earl of Middlefex, lord treafurer, with his white ftaff, whole length. At Lady Elizabeth Germain's at Drayton is a very fine whole length of Henry Rich earl of Holland, in a ftriped habit, with a walking ftick. At St James's is Jeffery Hudfon the dwarf, holding a dog by a ftring, in a landfcape, coloured warmly and freely like Snyder or Rubens. Mytens drew the fame figure in a very large picture of Charles I. and his

5 Queen,

Queen, which was in the poſſeſſion of the late earl of Dunmore. The picture of the Queen of Scots at St James's is a copy by Mytens. Mytens remained in great reputation till the arrival of Vandyck, who being appointed the king's principal painter, the former in diſguſt aſked his Majeſty's leave to retire to his own country; but the king learning the cauſe of his diſſatisfaction treated him with much kindneſs, and told him that he could find ſufficient employment both for him and Vandyck. Mytens conſented to ſtay, and even grew intimate, it is probable, with his rival, for the head of Mytens is one of thoſe painted among the profeſſors by that great maſter. Whether the ſame jealouſy operated again, or real decline of buſineſs influenced him, or any other cauſe, Mytens did not ſtay much longer in England. We find none of his works here after the year 1630. Yet he lived many years afterwards. Houbraken quotes a regiſter at the Hague dated in 1656, at which time it ſays Mytens painted part of the cieling of the town-hall there; the ſubject is, Truth writing hiſtory on the back of Fame.

MYTENS (Martin), painter of portraits and hiſtory, was born at Stockholm in 1695, and at 11 years of age ſhowed an extraordinary genius. When he had practiſed for ſome years, he determined to ſeek for improvement at Rome, and in his progreſs to examine every thing curious in other cities of Europe. His firſt excurſion was to Holland, and from thence he proceeded to London, where he practiſed miniature and enamel painting, to which he had always a ſtrong tendency, and by his performances in that way gained a ſufficiency to maintain himſelf, without being any incumbrance to his parents. In 1717 he viſited Paris, and proved ſo fortunate as to obtain the favour of the duke of Orleans, and to have the honour to paint the portrait of that prince, and alſo the portraits of Lonis XV. and the Czar Peter. In 1721 he arrived at Vienna, where he was graciouſly received; and having with great applauſe painted the portraits of the emperor, the empreſs, and the moſt illuſtrious perſons at that court, during a reſidence of above two years, he proceeded on his intended journey to Italy. Having viſited Venice, and ſpent two years at Rome, he went to Florence, where the grand duke Gaſton I. ſhowed him all poſſible marks of eſteem; and having engaged him for ſome time in his ſervice, he made him conſiderable preſents, and placed the portrait of Mytens among the heads of the illuſtrious artiſts in his gallery. He alſo received public teſtimonies of favour from the king and queen of Sweden, each of them having preſented him with a chain of gold and a medal, when he viſited that court, after his return from Italy. At laſt he ſettled at Vienna, where he obtained large appointments from the court; and lived univerſally eſteemed for his uncommon merit, and equally valued for his perſonal accompliſhments. He died in 1755.

There were ſome other painters of the name of *Mytens*, but of inferior note.

MYTHOLOGY.

1 Definition.

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 intreat the indulgence of our readers, if upon many occaſions we ſhould 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 Origin of fable.

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 rotine, 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.

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

3
Boldneſs of the oriental mythology.

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 fairyland. 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 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 monopoliſed 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 fairyland, 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, o 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

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.

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 inventions of men, fable and fiction began to prevail. The Egyptian *Thoth* or Thyoth, or Mercury Triſmegiſtus, and Mochus 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.

8 Fabulous coſmogonies, the firſt mythological details.

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 æra 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 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 *Zoroaſtres*; 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 birth of Confucius.

About 551 years before the Chriſtian æra, 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 Lao-kiun and his doctrines.

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 dæmons. 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 Introduction of the worſhip of *Fo*, and of the doctrine of the metempſichoſis into China.

The worſhip of the idol Fo, or Foe, was tranſplanted from India into China about the 56th year of the Chriſtian æra, 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 diſpatched into India, in order to inquire where the true religion

gion 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, *Talopoins*; by the Tartars, *Lamas*; by the Chinese, *Ho-chang*; and by the people of Japan, *Bonzes*. By this last appellation they are generally known in Europe.

14 The worshippers of Foe great mythologists.

An infinitude of fable 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, intrigues, exploits, and adventures, of the most villainous 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 disposed 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 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 has, 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 *ca'pa*, 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 dæmon *Hayagri-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 dæmons, 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

(A) He was Sovereign of the world. His name was *Mana*, or Statgavrata; his patronymic name was *Vaisvata*, or Child of the Sun.

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 complection, 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 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 on 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.

20 The incarnations of Viſhnou.

Foe is often called *Budha*, *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. Aquetil 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. 1. and 2.

The

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 character 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 atchievement 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 de 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 æra 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. l. 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

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 Fo-hi of the Chinese, and the Thyoth or Mercury 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 connection 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 the *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 connection 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, 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 renders 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. l. ii. Hyginus Poet. Astron. fab. 197. Pharnutus de Nat. Deor. Ovid. Metam. l. iv. Athen. in Apol. Izetzes Chil. ix. cap. 275. Seld. de Diis Syr. Syrit. ii. p. 183.

28 Little known of Arabian mythology.

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 Egyptian mythology.

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,

(B) *Adar* or *Hadar*, "*magnificus*;" and *Gad*, "*exercitus turmi.*"
(C) *Shem* or *Sem*, "a sign," and *ramah*, "high."

prefects, and reprefentatives of the fupreme Lord of the univerfe. They were vifible, they were beneficent; they dwelt nearer to the gods, they were near at hand, and always acceffible. Thefe were, of courfe, employed as mediators and interceffors between the fupreme Divinity and his humble fubjects of this lower world. Thus employed, they might claim a fubordinate fhare of worfhip, which was accordingly affigned them. In procefs of time, however, that worfhip, which was originally addreffed to the fupreme Creator by the mediation of the heavenly bodies, was in a great meafure forgotten, and the adoration of mankind ultimately terminated on thofe illuftrious creatures. To this circumftance, we think, we may afcribe the origin of that fpecies of idolatry called *Zabiifm*, or the worfhip of the hoft of heaven, which overfpread the world early and almoft univerfally. In Egypt this mode of worfhip was adopted in all its moft abfurd and moft enthufiaftic forms; and at the fame time the moft heterogeneous mythology appeared in its train. The mythology of the ancient Egyptians was fo various and multiform, fo complicated and fo myfterious, that it would require many volumes even to give a fuperficial account of its origin and progrefs, not only in its mother country, but even in many other parts of the eaftern and weftern world. Befides, the idolatry and mythology of that wonderful country are fo clofely connected and fo infeparably blended together, that it is impoffible to defcribe the latter without at the fame time developing the former. We hope, therefore, our readers will not be difappointed if, in a work of this nature, we touch only upon fome of the leading or moft interefting articles of this complicated fubject.

30 Origin of Zabiifm.

31 Reign of gods and demigods, &c. in Egypt.

The Egyptians confounded the revolutions of the heavenly bodies with the reigns of their moft early monarchs. Hence the incredible number of years included in the reign of their eight fuperior gods, who, according to them, filled the Egyptian throne fucceffively in the moft early periods of time. To thefe, according to their fyftem, fucceeded twelve demigods, who likewife reigned an amazing number of years. Thefe imaginary reigns were no other than the periodical revolutions of the heavenly bodies preferved in their almanacks, which might be carried back, and actually were carried back, at pleafure. Hence the fabulous antiquity of that kingdom. The imaginary exploits and adventures of thefe gods and demigods furnifhed an inexhauftible fund of mythological romances. To the demigods fucceeded the kings of the cynic cycle, perfonages equally chimerical with the former. The import of this epithet has greatly perplexed critics and etymologifts. 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 exifted, were more powerful and more highly revered than their fucceffors. After the princes of the cynic cycle comes another race, denominated *Nekyes*, a title likewife implying royal, fplendid, glorious. Thefe cycles figure high in the mythological annals of the Egyptians, and have furnifhed materials for a variety of learned and ingenious difquifitions. The wars and adventures of Ofiris, Orus, Typhon, and other allegorical perfonages who figure in the Egyptian rubric; the wanderings of Ifis, the fifter and wife of Ofiris; the transformation of the gods into divers kinds of animals; their birth, education, peregrinations, and exploits;—compofe a body of mythological fictions fo various, fo complicated, fo ridiculous, and often fo apparently abfurd, that all attempts to develope and explain them have hitherto proved unfuccefsful. All, or the greateft part, of thofe extravagant fables, are the offspring of hieroglyphical or allegorical emblems devifed by the priefts and fages of that nation, with a view to conceal the myfteries of their religion from that clafs of men whom they ftigmatized with the name of the uninitiated rabble.

32 Birth, exploits, and transformation of the gods.

33 Worfhip of brute animals, &c.

The worfhip of brute animals and of certain vegetables univerfal among the Egyptians, was another exuberant fource of mythological adventures. The Egyptian priefts, many of whom were likewife profound philofophers, obferved, or pretended to obferve, a kind of analogy between the qualities of certain animals and vegetables, and thofe of fome of their fubordinate divinities. Such animals and vegetables they adopted, and confecrated to the deities to whom they were fuppofed to bear this analogical refemblance; and in procefs of time they confidered them as the vifible emblems of thofe divinities to which they were confecrated. By thefe the vulgar addreffed their archetypes: in the fame manner, as in other countries, pictures and ftatues were employed for the very fame purpofe. The mob, in procefs of time, forgetting the emblematical character of thofe brutes and vegetables, addreffed their devotion immediately to them; and of courfe thefe became the ultimate objects of vulgar adoration.

After that thefe objects, animate or inanimate, were confecrated as the vifible fymbols of the deities, it foon became fafhionable to make ufe of their figures to reprefent thofe deities to which they were confecrated. This practice was the natural confequence of the hieroglyphical ftyle which univerfally prevailed among the ancient Egyptians. Hence Jupiter Ammon was reprefented under the figure of a ram, Apis under that of a cow, Ofiris of a bull, Pan of a goat, Thoth or Mercury of an ibis, Bubaftis or Diana of a cat, &c. It was likewife a common practice among thofe deluded people to dignify thefe objects, by giving them the names of thofe deities which they reprefented. By this mode of dignifying thefe facred emblems, the veneration of the rabble was confiderably enhanced, and the ardour of their devotion inflamed in proportion. From thefe two fources, we think, are derived the fabulous transformations of the gods, fo generally celebrated in the Egyptian mythology, and from it imported into Greece and Italy. In confequence of this practice, their mythological fyftem was rendered at once enormous and unintelligible.

34 Mercury Trifmegiftus the author of the Egyptian mythology.

Their Thoth, or Mercury Trifmegiftus, was, in our opinion, the inventor of this unhappy fyftem. This perfonage, according to the Egyptians, was the original author of letters, geometry, aftronomy, mufic, architecture; in a word, of all the elegant and ufeful arts, and of all the branches of fcience and philofophy. He it was who firft difcovered the analogy between the divine affections, influences, appearances, operations, and the correfponding properties, qualities, and inftincts 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 and 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 Sanchoniatho'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, Poseedon 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 were, in their 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 mythothology 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 irreconcileable 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 heterogeneous mixture of the mighty and the mean which chequers 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 Phaethon is clearly of oriental extraction, and alludes to an excessive drought which in the early periods

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 stigmatised 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 of 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.

[39] Roman mythology borrowed from Greece.

The Roman mythology was borrowed from the 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.

40 Mythology of the northern nations.

The mythology of the northern nations, *i. e.* of the Norwegians, Danes, Swedes, Icelanders, &c. are 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. 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 atchievements 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.

41 Odin or Woden.

42 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,

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.

43 The Voluspa.

The word *Voluspa* imports, "the prophecy of Vola or Fola." This was perhaps a general name for the prophetic ladies of the north, as Sybil 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 Sybil 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 *Spæ*, which has nearly the same signification.

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 their 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 fabrication of the work was a semipagan writer, much of the same complexion with the authors of the Sybilline oracles, and of some other apocryphal pieces which appeared in the world during the first ages of Christianity.

44 Mythology of Mexico and Peru.

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, was obliterated and lost. Clavigero has indeed enumerated a vast canaille of sanguinary gods worshipped by the 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 bigoted 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 no where 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 Cape 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.

MYTILUS, the Mussel, in ichthyology; a genus of animals, belonging to the order of vermes testacea. The animal is an ascidia: the shell bivalve; often affixed to some substance by a beard; the hinge without a tooth, marked by a longitudinal hollow line. Of these animals there are a great many species, some of them inhabiting the seas, others the rivers and ponds. Several of them are remarkable for the beauty of their internal shell, and for the pearls which are sometimes found in them.

1. The edulis, or edible mussel, has a strong shell, slightly incurvated on one side, and angulated on the other.

Mytilus. other. The end near the hinge is pointed; the other rounded. When the epidermis is taken off, it is of a deep blue colour. It is found in immenſe beds, both in deep water and above low-water mark. The fineſt muſſels in Britain are thoſe called *Hambleton hookers*, from a village called *Hambleton* in that county. They are taken out of the ſea, and placed in the river Wier, within reach of the tide, where they grow very fat and delicious. This ſpecies inhabits the European and Indian ſeas. Between the tropics it is largeſt, and ſmalleſt within the polar circle. It is ſaid to be hurtful if too often eat, or in too great quantities; and is even ſometimes poiſonous.

2. The modiolus, or great muſſel, with a ſtrong ſhell, blunted at the upper end; one ſide angulated near the middle; from thence dilating towards the end, which is rounded. It dwells in the Mediterranean, Indian, European, and American ſeas; and its fleſh, which is a deep orange colour, is eatable. It is the greateſt of the muſſels known in Britain; being from ſix to ſeven inches in length; it lies at great depths; often ſeizes the baits of ground-lines, and is taken up with the hooks.

3. The cygneus, or ſwan muſſel, with a thin brittle ſhell, very broad and convex, marked with concentric ſtriæ; attenuated towards one end, dilated towards the other; decorticated about the hinge; the colour a dull green; the length ſix inches, breadth three and a half. It is an inhabitant of the European rivers, frequenting chiefly their mouths.

4. The anatinus, or duck muſſel, has a ſhell more oblong and leſs convex than the laſt; is very brittle and ſemitranſparent; the ſpace round the hinges like the laſt; the length about five inches, breadth two. It is found in Europe in freſh waters. Both it and the cygneus are devoured by ſwans and ducks; whence their names: crows alſo feed on theſe muſſels, as well as on different other ſhell-fiſh; and it is diverting to obſerve, that when the ſhell is too hard for their bills, they fly with it to a great height, drop the ſhell on a rock, and pick out the meat when the ſhell is fractured by the fall.

5. The cryſtagalli, or cock's-comb muſſel, has the ſhell folded or plaited as it were, ſpiny, and both lips rugged. It makes its abode in the coral beds of the Indian ocean.

6. The margaritiferus, or pearl-bearing muſſel, has the ſhell compreſſed and flat, nearly orbicular, the baſe tranſverſe, and imbricated with dentated coats. It dwells in the ocean of either India. This is the *mater perlarum* of Rumphius, or mother-of-pearl ſhell. On the inſide it is exquiſitely poliſhed, and of the whiteneſs and water of pearl itſelf. It has alſo the ſame luſtre on the outſide after the external laminæ have been taken off by aquafortis and the lapidary's mill. Mother-of-pearl is uſed in inlaid works, and in ſeveral toys, as ſnuff-boxes, &c.

7. The lithophagus, or ſtone-eating muſſel, has the ſhell cylindric, the extremities both ways being rounded. It inhabits the Indian, European, and Mediterranean ſeas, penetrating and eating away marbles, corals, &c. The Indian ſhell is ſofter and nearly tough like leather, but the European is more brittle.

8. The violacea, or violet muſſel, has the ſhell longitudinally furrowed, the rim very obtuſe, ſomewhat formed like the mytilus edulis, but conſiderably larger and more flattened, of a beautiful violet colour. Inhabits the ſouthern ocean. There are about 50 other ſpecies.

Muſſels not only open and ſhut their ſhells at pleaſure, but they have alſo a progreſſive motion; they can faſten themſelves where they pleaſe; they reſpire water like the fiſhes; and ſome even flutter about on its ſurface ſo as to inhale air. If they lie in ſhallow places, a ſmall circular motion is ſeen above the heel of the ſhell; and a few moments after, they caſt out the water by one ſingle ſtroke at the other end of the ſhell. The mouth is ſituated near the ſharp angle of the animal, and is furniſhed with four floating fringes in the ſhape of muſtachios, which may perhaps anſwer the purpoſe of lips. The barbs which ſurround the edge of almoſt half the muſſel, are a wonderful web of hollow fibres which ſerve as fins or organs of reſpiration, as veſſels for the circulation of the fluids, and probably, as ſome philoſophers ſuppoſe, as wedges for opening their ſhells; for we obſerve two large muſcles or tendons for the purpoſe of ſhutting them; but we in vain look for their antagoniſts, or thoſe which are deſtined to open them. When the muſſel wiſhes to open itſelf, it relaxes the two muſcles or tendons, and ſwells the fringes, which act as wedges and ſeparate the ſhells. The animal ſhuts up itſelf by the contraction of two thick fibrous muſcles which are fixed internally to each end of the ſhells; and theſe ſhells are lined all around with a membrane or epidermis, which unites them ſo cloſely together when they are ſoaked in water, that not the ſmalleſt drop can eſcape from the muſcle. When muſſels chooſe to walk (A), they often contrive to raiſe themſelves on the ſharp edge of their ſhells, and put forth a fleſhy ſubſtance ſuſceptible of extenſion, which ſerves them as a leg to drag themſelves along, in a kind of groove or furrow which they form in the ſand or mud, and which ſupports the ſhell on both ſides. In ponds, theſe furrows are very obſervable. From the ſame member or leg hang the threads

(A) The common ſea or edible muſſel has, from its being for the moſt part found faſtened to the rocks, been ſuppoſed by many wholly incapable of progreſſive motion; but this M. Reamur has ſhown to be an erroneous opinion. It is a common practice in France, at ſuch ſeaſons of the year as do not afford ſun enough to make ſalt, to throw the common ſea-muſſels, which the fiſhermen catch about the coaſts, into the brine-pits. They have an opinion that this renders their fleſh the more tender and delicate, as the rain which falls at theſe ſeaſons makes the water of the pits much leſs ſalt than the common ſea-water. The muſſels are on this occaſion thrown careleſsly in, in ſeveral different parts of the pits; yet, at whatever diſtances they have been thrown in, the fiſhermen, when they go to take them out, always find them in a cluſter together; and as there is no current of water in theſe places, nor any other power of motion which can have brought the muſſels together, it ſeems

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threads by which the animals fasten (B) themselves to rocks or to one another.

According to the observations of M. Mery of the Paris Academy, and the subsequent experiments of other naturalists, mussels are all androgynous; and, from a peculiar generative organization, each individual is of itself capable of propagating its species, and annually does it without the intercourse of any other. This is altogether singular, and different from what takes place in snails, earth-worms, and other hydrogenous or hermaphroditical animals; for though each individual of these contains the parts of both sexes, yet there is always a congress of two animals for the propagation of the species. The parts of generation are two

seems very evident that they must voluntarily have marched from the places where they were at first, to have met thus together. This progressive motion is wholly performed by means of what we call the *tongue* of the mussel, from its shape; but, from its use in this case, appears rather to merit the name of a *leg*, or an *arm*, as by laying hold of any distant substance, and then forcibly contracting itself again, it draws along the whole body of the animal. The same part, when it has moved the animal to a proper place, serves also to fix it there, being the organ by which it spins the threads which we call its *beard*, by which it is held to a rock, or to another mussel. The motion of the mussel, by means of this part, is just the same with that of a man laid flat on his belly, who would draw himself along by laying hold of any thing with one hand, and then drawing himself to it.

(B) Mussels are well known to have a power of fastening themselves either to stones, or to one another's shells, in a very strong and firm manner; but the method of doing this was not well understood till the observations of Mr Reaumur explained it. Every one who opens and examines a common mussel, will find, that in the middle of the fish there is placed a little blackish or brownish body resembling a tongue. This in large mussels is near half an inch long, and a little more than a sixth of an inch in breadth, and is narrower at the origin than at the extremity: from the root of this tongue, or that part of it which is fastened to the body of the fish, there are produced a great number of threads, which, when fixed to any solid substance, hold the mussel firmly in its place: these threads are usually from an inch to two inches in length, and in thickness from that of a hair to that of a hog's bristle. They issue out of the shell in that part where it naturally opens, and fix themselves to any thing that lies in their way, to stones, to fragments of shells, or, which is the most common case, to the shells of other mussels; whence it happens that there are usually such large quantities of mussels found together. These threads are expanded on every side, and are usually very numerous, 150 having been found issuing from one shell: they serve the office of so many cables; and, each pulling in its proper direction, they keep the mussel fixed against any force that can be offered from whatever part it come. The filaments are well known to all who eat mussels, who ever carefully separate them under the name of the *beard;* and Mr Reaumur has found, that while the animal is living in the sea, if they are all torn away by any accident, the creature has a power of substituting others in their room: he found, that if a quantity of mussels were detached from one another and put into a vessel of any kind, and in that plunged into the sea, they in a little time fastened themselves both to the sides of the vessel and to one another's shells; the extremity of each thread seemed in this case to serve in the manner of a hand to seize upon any thing that it would fix to, and the other part, which was slenderer and smaller, to do the office of an arm in conducting it.

To know the manner of the mussels performing this operation, this diligent observer put some mussels into a vessel in his chamber, and covered them with sea water; he there saw that they soon began to open their shells, and each put forth that little body before described by its resemblance to a tongue, and at the root of which these threads grow; they extended and shortened this part several times, and thrust it out every way, often giving it not less than two inches in length, and trying before, behind, and on every side with it, what were the proper places to fix their threads at: at the end of these trials they let it remain fixed for some time on the spot which they chose for that purpose, and then drawing it back into the shell with great quickness, it was easy to see that they were then fastened by one of these threads to the spot where it had before touched and remained fixed for a few minutes; and in repeating this workmanship the threads are increased in number one at every time, and being fixed in different places they sustain the fish at rest against any common force.

The several threads were found to be very different from one another; the new formed ones being ever whiter, more glossy, and more transparent than the others: and it appeared on a close examination, that it was not, as might have been most naturally supposed, the office of the tongue to convey the old threads one by one to the new places where they were now to be fixed, but that these in reality were now become useless; and that every thread we see now formed, is a new one made at this time; and in fine, that nature has given to some sea fishes, as well as to many land-insects, a power of spinning those threads for their necessary uses; and that mussels and the like fish are under water, what caterpillars and spiders are at land.—To be well assured of this, however, Mr Reaumur cut off the beard or old threads of a muscle as close as he could, without injuring the part; and the proof of the opinion of their spinning new ones at pleasure was now brought to this easy trial, whether these mussels, so deprived of their old ones, could fix themselves as soon as others which were possessed of theirs, and could throw out their threads to as considerable distances.—The

Mytilus.

two ovaries and two seminal vesicles. Each ovary and vesicle has its proper duct. It is through those four channels that the eggs and the seed of the mussel are conveyed to the anus, where those two principles unite at their issue, which answers the purpose of generation. It is in the spring that mussels lay their eggs; there being none found in them but in winter. M. Lewenhoek, in several mussels which he dissected, discovered numbers of eggs or embryo mussels in the ovarium, appearing as plainly as if he had seen them by the naked eye, and all lying with their sharp ends fastened to the string of vessels by which they receive nourishment. The minute eggs, or embryos, are by the parent placed in due order, and in a very close arrangement on the outside of the shell, where, by means of a gluey matter, they adhere very fast, and continually increase in size and strength, till becoming perfect mussels, they fall off and shift for themselves, leaving the holes where they were placed behind them. This abundance the mussel shells very plainly show, when examined by the microscope, and sometimes the number is 2000 or 3000 in one shell: but it is not certain that these have been all fixed there by the mussel within; for these fish usually lying in great numbers near one another, the embryos of one are often affixed to the shell of another. The fringed edge of the mussel, which Lewenhoek calls the *beard*, has in every the minutest part of it such variety of motions as is inconceivable; for being composed of longish fibres, each fibre has on both sides a vast many moving particles.

Mytilus.

The mussel is infested by several enemies in its own element; according to Reaumur it is in particular the prey of a small shell-fish of the trochus kind. This animal attaches itself to the shell of the mussel, pierces it with a round hole, and introduces a sort of tube five or six lines long, which it turns in a spiral direction, and with which it sucks the substance of the mussel. Mussels are also subject to certain diseases, which have been supposed to be the cause of those bad effects which sometimes happen from the eating of them. These are stated by Dr Mœhring, in the 7th vol. of the German Ephemerides, to be the moss and the scab. The roots of the moss being introduced into the shell, the water penetrates through the openings, and gradually dissolves the mussel. The scab is formed by a sort of tubercles which are produced by the dissolution of the shell. Certain small crabs, which are sometimes found in mussels, likewise tend to make them unwholesome.

The

The experiment proved the truth of the conjecture; for those whose beards or old threads were cut off, fixed themselves as soon as those in which they were left, and spread their threads to as great a distance every way.

When the mechanism of this manufacture was thus far understood, it became a natural desire to inquire into the nature of the part by which it was performed. This has hitherto been mentioned under the name of the tongue, from its shape; but it is truly the arm of the fish; and whenever it happens to be loosened from its company, or fixed in a wrong place, it serves the animal to drag its whole body shell and all along, and to perform its several motions. It fixes itself to some solid body; and then strongly contracting its length, the whole fish must necessarily follow it, and be pulled toward the place where it is fixed. This is an use, however, that this part is so rarely put to, that it is not properly to be esteemed a leg or an arm for this; but, according to its more frequent employment, may much better be denominated the organ by which the threads are spun. Though this body is flat in the manner of a tongue for the greater part of its length, it is however rounded or cylindric about the base or insertion, and it is much smaller there than in any other part: there are several muscular ligaments fastened to it about the root or base, which hold it firmly against the middle of the back of the shell; of these ligaments there are four which are particularly observable, and which serve to move the body in any direction. There runs all along this body a slit or crack, which pierces very deeply into its substance, and divides it as it were into two longitudinal sections; this is properly a canal, and along this is thrown the liquor which serves to form the threads; and it is in this canal or slit that these threads are moulded into their form. Externally, this appears only a small crack or slit, because the two fleshy sections of the parts almost meet and cover it; but it is rounded and deep within, and is surrounded with circular fibres. This canal is carried regularly on from the tip of the tongue, as it is called, to its base, where it becomes cylindric; the cylinder in this part being no other than a close tube or pipe, in which this open canal terminates. The cylindric tube contains a round oblong body, of the nature of the threads, except that it is much larger; and from the extremity of this all the threads are produced, this serving as a great cable to which all the other little cordages dispersed towards different parts are fixed. The tube or pipe in which this large thread is lodged, seems the reservoir of the liquor of which the other threads are formed; all its internal surface being furnished with glands for its secretion.

The mussel, like many other sea-fishes, abounds in this liquor; and if at any time one touch with a finger the base of this spinning organ, one draws away with it a viscous liquor in form of several threads, like those of the caterpillar, spider, and the other spinning land-animals. The threads fix themselves with equal ease to the most smooth and glossy, as to rougher bodies; if the mussels are kept in glass-jars of sea-water, they as firmly fasten themselves to the glass as to any other body. Mussels, be they ever so young, have this property of spinning; and by this means they fasten themselves in vast numbers to any thing which they find in the sea. Mr Reaumur has seen them, when as small as millet-seeds, spin plentifully, though their threads, proportioned to their own weight, are much finer and smaller than those of larger mussels.

The eating of muffels has fometimes produced eryfipelatous inflammations, cutaneous eruptions, infupportable itching all over the body, great reftleffnefs and agitation; and though thefe complaints are eafily removed by oil, milk, and emetics, and have feldom or never proved mortal, yet they have an alarming afpect, and make the patient fuffer grievoufly. Thefe noxious effects have been fuppofed to be owing to the muffels or part of them having been difeafed. Some authors, however, have pretended that thofe effects never take place but between the vernal and autumnal equinox: and M. Beunie, phyfician at Antwerp, in a memoir on this fubject, feems inclined to adopt this opinion; for he recommends abftinence from muffels during the months of May, June, July, and Auguft. The caufe of thefe noxious effects in the muffel is, according to this author, altogether accidental. They are occafioned, he fays, by a kind of ftella marina, a little fea infect pretty common about the mouth of the Scheldt, which fometimes lodges itfelf in the muffel in queft of food; and whofe fpawn is fo cauftic and inflammatory, that, even when applied outwardly to the fkin, it produces itching and fwellings that are painful in a high degree. The itching occafioned by touching the fpawn of the ftella marina is removed by vinegar; and this known fact induced Dr Beunie to prefcribe the internal ufe of vinegar, after bleeding, evacuations, and emetics. His method confifts in recommending a large quantity of refrefhing beverage, and, every hour, three ounces of vinegar diluted in water. This remedy, however, feems rather to confirm the opinion of thofe who impute the diforder in queftion to an unperceived commencement of putrefaction in the muffel: as vinegar is known to be a powerful antifeptic, and there is no fort of putrefaction more noxious and offenfive than that of fifh.—Upon the whole, the edulis, or eatable muffel, though a rich food, is difficult of digeftion. In its beft ftate it is even noxious to fome conftitutions; and when affected by difeafe is in fome degree poifonous. Muffels are apt to do moft harm when eaten raw. They ought always to be boiled with onions, well wafhed with vinegar, and feafoned with pepper; and even thus qualified, they fhould not be eaten to excefs or too frequently.

Frefh-water muffels are not fo good eating as the fea-muffel. The river muffel, according to M. Poupart, fwims in the water, and fometimes appears to flutter on its furface. But we believe it more commonly creeps in the mud, where it remains almoft always at reft. The pond muffel is always larger than that which is found in rivers; and it is a more folitary animal. In its motion it makes tracks in the fand and mud, as already obferved; and it penetrates into it two or three inches, and fometimes more. Pearls of confiderable beauty are found in feveral river-muffels; of this kind are the Scots muffels, thofe of Valognes in Lorrain, of St Savinier, of Bavaria, and of the marfhes near Augfburg.

MYTTOTON, a coarfe kind of food, ufed by the labouring people among the Greeks, and fometimes among the Romans. It was made of garlic, onions, eggs, cheefe, oil, and vinegar, and reckoned very wholefome.

MYUS (anc. geog.), one of the twelve towns of Ionia; feated on the Meander, at the diftance of 30 ftadia from the fea. In Strabo's time it was incorporated with the Milefians, on account of the paucity of its inhabitants, from its being formerly overwhelmed with water; for which reafon the Ionians configned its fuffrage and religious ceremonies to the people of Miletus. Artaxerxes allotted this town to Themiftocles, in order to furnifh his table with meat: Magnefia was to fupport him in bread, and Lampfacus in wine. The town now lies in ruins.

MYXINE, the HAG; a genus of infects belonging to the order of vermes inteftini. It hath a flender body, carinated beneath; mouth at the extremity, cirrated; the two jaws pinnated; an adipofe or raylefs fin round the tail and under the belly. The only remarkable fpecies is the glutinofa, about eight inches long. It inhabits the ocean; enters the mouths of fifh when on the hooks of lines that remain a tide under water, and totally devours the whole, except fkin and bones. The Scarborough fifhermen often take it in the robbed fifh, on drawing up their lines. Linnæus attributes to it the property of turning water into glue.

N.

N, A liquid confonant, and the 13th letter of the Greek, Latin, Englifh, &c. alphabets.

The *n* is a nafal confonant: its found is that of a *d*, paffed through the nofe; fo that when the nofe is ftopped by a cold, or the like, it is ufual to pronounce *d* for *n*. M. l'Abbe de Dangeau obferves, that in the French, the *n* is frequently a mere nafal vowel, without any thing of the confonant in it. He calls it the Sclavonic vowel. The Hebrews call their *n nun*, which fignifies child, as being fuppofed the offspring of *m*; partly on account of the refemblance of found, and partly on that of the figure. Thus from the *m*, by omitting the laft column, is formed *n*; and thus from the capital N, by omitting the firft column, is formed the Greek minufcle ν. Hence for *biennies*, &c. the Latins frequently ufe *bimus*, &c. and the fame 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*; *in-rigo*,

rigo, *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 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, $\overline{\text{N}}$, 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*, (anc. geog.), 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 and poſt 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 of Dublin, in N. Lat. 53. 10. W. Long. 6. 50. It ſends two members to parliament ; and gives title of viſcount to the family of Burke. It has five fairs in the year.—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 anathematiſed 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 Nabataeorum, 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 deſart 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 ſhaik, who is ſubordinate to the pache 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 Δ. In the Septuagint and Vulgate, it is called *nablum*, *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 Jerom, " one that preſides over propheſy."

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 Chaldæans or Babylonians ; memorable for the Jewiſh æra 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 Chaldæans 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

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, 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 *lyconthropy*, 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 *næniæ*. 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 the United Provinces in 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 satyrical 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 rasor, 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 rasor 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 rasor, though believed by some writers, is treated as fabulous and improbable by Cicero, who himself had been an 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*. A large tumour depending from the skin is denominated *sarcoma*. These appear on any part of the body: some of them differ not in their colour from the rest of the skin; whilst others are red, black, &c. Their shapes are various; some resembling strawberries, others grapes, &c. Heister advises their removal by means of a ligature, a cautery, or a knife, as circumstances best suit.

As to the tumour called a *wen*, its different species are distinguished by their contents. They are encysted tumours; the matter contained in the first three following is inspissated lymph, and that in the fourth is only fat. Mons. Littre was the first who particularly described the fourth kind; and to the following purpose he speaks of them all. A wen is said to be of three sorts, according to the kind of matter it contains: those whose contents resemble boiled rice, or curds, or a bread-poultice, is called *atheroma*; if it resembles honey, it is named *meliceris*; and if it is like suet, it is denominated *steatoma*: but there is a fourth sort, which may be called *lipome*, because of its fat contents resembling grease. He says that he has seen one on the shoulders of a man, which was a thin bag, of a tender texture, full of a soft fat, and that it had all the qualities of common grease. And though the fat in the lipome resembles that in the steatoma, yet they cannot be the same: for the matter of the steatoma is not inflammable, nor does it melt; or if it does, it is with great difficulty and imperfectly; whereas it is the contrary with the lipome. When the man who had the above-named lipome was fatigued, or had drank freely of strong liquors, his lipome was inflamed for some days after, and its contents rarefying increased the size of the tumour.

The lipome seems to be no other than an enlargement of one or more of the cells of the adipose membrane, which is filled only with its natural contents. Its softness and largeness distinguish it in general from the other species, though sometimes the fatty contents will be so hard as to deceive. As this kind of wen does not run between the muscles, nor is possessed of any considerable blood-vessels, it may always be cut off with ease and safety.

As to the other kind of wens, their extirpation may or may not be attempted, according as their situation is with respect to adjacent vessels, the wounding of which would endanger the patient's life.

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. 25.

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 feated on the river Ravi. E. Long. 78. 10. N. Lat. 33. 12.

NAHUM, or the *Prophecy of* NAHUM, a canonical book of the Old Teftament.

NAHUM, the feventh of the 12 leffer prophets, was a native of Elkofhai, a little village of Galilee. The fubject of his prophecy is the deftruction of Nineveh, which he defcribes in the moft lively and pathetic manner; his ftyle is bold and figurative, and cannot be exceeded by the moft perfect mafters of oratory. This prophecy was verified at the fiege of that city by Aftyages, in the year of the world 3378, 622 years before Chrift.

NAIADES (fab. hift.), certain inferior deities who prefided over rivers, fprings, wells, and fountains. The Naiades generally inhabited the country, and reforted to the woods or meadows near the ftream over which they prefided. They are reprefented as young and beautiful virgins, often leaning upon an urn, from which flows a ftream of water. Ægle was the faireft of the Naiades, according to Virgil. Their name feems to be derived from ναειν, *to flow*. They were held in great veneration among the ancients; and often facrifices 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 ufed in blazoning fifhes, when borne in an horizontal pofture, as if fwimming.

NAIAS, in botany: A genus of the monandria order, belonging to the diœcia clafs of plants; and in the natural method ranking with thofe of which the order is doubtful. The male calyx is cylindrical and bifid; the corolla quadrifid; there is no filament; nor is there any female calyx or corolla; there is one piftil; and the capfule is ovate and unilocular.

NAID, the interior of the great defart of Arabia, inhabited by a few fcattered tribes of feeble and wretched Arabs. See ARABIA.

NAIL, UNGUIS, in anatomy. See there, n° 81.

NAILS, in building, &c. fmall fpikes of iron, brafs, &c. which being drove into wood, ferve to bind feveral pieces together, or to faften fomething upon them.

Nails were made ufe of by the ancient Hebrews for cancelling bonds: and the ceremony was performed by ftriking them through the writing. This feems to be alluded to in fcripture, where God is faid by our crucified Saviour to have "blotted out the handwriting of ordinances that was againft us, and to have taken it out of the way, nailing it to his crofs." Col. ii. 14. For the caufe and ceremony of driving the annual nail, or *clavus annalis*, among the Romans, fee *ANNALIS Clavus*.

NAIL, is alfo a meafure of length, containing the 16th part of a yard.

NAILING of Cannon. When circumftances make it neceffary to abandon cannon, or when the enemy's artillery are feized, and it is not however poffible to take them away, it is proper to nail them up, in order to render them ufelefs; which is done by driving a large nail or iron fpike into the vent of a piece of artillery, to render it unferviceable. There are various contrivances to force the nail out, as alfo fundry machines invented for that purpofe, but they have never been found of general ufe; fo that the beft method is to drill a new vent.

One Gafper Vimercalus was the firft who invented the nailing of cannon. He was a native of Bremen, and made ufe of his invention firft in nailing up the artillery of Sigifmund Malatefta.

NAIN (Lewis Sebaftian de), one of the moft learned and judicious critics and hiftorians France has produced, was the fon of a mafter of the requefts, and born at Paris in 1637. At ten years old he went to fchool at Port Royal, and became one of the beft writers of that inftitution. Sacy, his intimate friend and counfellor, prevailed with him in 1676 to receive the priefthood; which, it feems, his great humility would not before fuffer him to afpire to. This virtue he feems to have poffeffed in the extreme; fo that Boffuet, feeing one of his letters to father Dami, with whom he had fome little difpute, befought him merrily "not to be always upon his knees before his adverfary, but raife himfelf now and then up." He was folicited to pufh himfelf in the church, and Buzanval, bifhop of Beauvois, wifhed to have him for his fucceffor: but Nain, regardlefs of dignities, wifhed for nothing but retirement. In this he did indeed moft effectually bury himfelf; and, joining the mortifications of a religious life to an indefatigable purfuit of letters, he wore himfelf entirely out, fo as to die in 1698, aged 61, though he was formed for a longer life. His principal works are, 1. Memoirs on the ecclefiaftical hiftory of the fix firft ages of the church, 16 vols 4to. 2. The hiftory of the emperors, 6 vols 4to. Thefe works are deduced from original fources, and compofed with the utmoft fidelity and exactnefs.

NAIN, or NAIM, fituated at the bottom of mount Hermon on the north fide, was anciently a city of the tribe of Iffachar, in the province of Galilee. It was near the gates of this city that our Saviour reftored to life the only fon of a widow, and where he infpired Mary Magdalen to come and mourn for her fins at his feet. Thefe circumftances alone make this place worthy of notice; for at prefent Nain is only a hamlet inhabited by Chriftians, Mahometans, and Hebrews, where there is not a fingle monument to attract the curiofity of the traveller.

NAIRES, NAHERS, or NAYERS, in modern hiftory, a name which is given by the Malabarians to the military of their country, who form a very numerous clafs or tribe, out of which the fovereigns of Malabar choofe their body-guard.

NAIRN, a county of Scotland, comprehending the weft part of Murray. It is bounded on the north by Murray frith, on the weft and fouth by Invernefs, and on the eaft by Elgin. The length of it amounts to 20 miles, and the breadth to 14. The air is temperate and falubrious, and the winters are remarkably mild. The face of the country is rough and mountainous; yet there are fome fruitful ftraths, or valleys, which produce good crops of oats and barley; but in general the country is much better adapted for pafturage. Here are alfo large woods of fir, and other trees, that afford fhelter to the game, of which there is great plenty. A ftrath is a long, narrow valley, with a river running through the bottom. Of thefe, the moft

Naissant || Name.

remarkable 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, Stratherin, on both sides of Findhorne river. Nairn is well watered with streams, rivulets, and lakes, abounding with fish. In the southern part there is a small lake, called *Moy*, surrounding an island, on which there is a castle belonging to the laird of M'Intosh: but the greater part of the shire is peopled by the Frasers, a warlike Highland clan, whose chief, the Lord Lovat, lost his life on a scaffold for having been concerned in the late rebellion. 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 a title of *lord* to an ancient family, forfeited in the rebellion of 1715. The harbour, which opened in the Murray frith, is now choaked up with sand; and the commerce of the town is too inconsiderable to deserve notice. The people in general subsist by feeding sheep and black cattle. 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. In this neighbourhood we find a quarry of free-stone, and many signs of copper. About six miles to the north-west of Nairn, a new fort hath been lately built by order of the government, at a place called *Ardeseer*, a small isthmus upon the Murray frith, which it is intended to command.

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 (anc. geog.), a town of Dardania, a district of Mœsia Superior, said to be the birth-place of Constantine the Great, which seems probable from his often residing at that place. *Naissitani*, the people (Coin). Now called *Nissa*, a city of Servia. E. Long. 23° N. Lat. 43°.

NAKED SEEDS, in botany, those that are not inclosed 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 Cophtic churches and in the Mahometan processions.

NAMA, in botany: A genus of the digynia order, belonging to the pentandria class of plants; and, in the natural method, ranking under the 13th order, *Succulentæ*. The calyx is pentaphyllous, the corolla quinquepartite, the capsule unilocular and bivalved.

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.

Name.

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 *anonyme*, "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

Name.

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 *Archeptolemus,* 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 ſake. This holds not only among the Jews, Greeks, Latins, &c. but even the Turks; among whom, Abdalla 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 languages their ſignification may be loſt, that learned author thinks is to reproach our anceſtors; and that contrary to the ſenſe 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, & hujus ſit hominis 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 *Swineſnout.* 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 at firſt was 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 Turquinius 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.*

Toward 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, Nampt-wich || Nan-tchang-fou.

remonial, 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 Weever river, 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 gentlemens houses. The inhabitants drive a trade, not only by its large market on Saturday for corn and cattle, and its great thoroughfare to Ireland, but by its cheese and its fine white salt, which are made here to the greatest perfection; and by shoes made here and sent to London to the warehouses. It is governed by a constable, &c. who are guardians of the salt-springs. It is divided by the Weever into two equal parts, which is not navigable any farther than Winsford-bridge. The Chester canal, lately completed, terminates in a handsome broad 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. There are here three fairs.

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 Leige, 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 60,000 men in garrison. Namur is now a barrier-town, and has a Dutch 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 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 Jao-tcheou. 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 sufficient for the flocks.

Nani, Nan-king.

NANCI, a town of France, and capital of Lorrain, is 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 has 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.

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 his 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. 1678, 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 King-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 Nan-king 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 fince the fix grand tribunals have been transferred from hence to Peking, it is called *Kiang-ning* in all the public acts.

Nan-king has loft much of its ancient fplendour: it had formerly a magnificent palace, no veftige of which is now to be feen; an obfervatory at prefent neglected, temples, tombs of the emperors, and other fuperb monuments, of which nothing remains but the remembrance. A third of the city is deferted, but the reft is well inhabited. Some quarters of it are extremely populous and full of bufinefs; particularly the manufacture of a fpecies of cotton cloth, of which great quantities are imported into Europe under the name of *Nankin*. The ftreets are not fo broad as thofe of Peking; they are, however, very beautiful, well-paved, and bordered with rich fhops.

In this city refides one of thofe great mandarins called *Tfong-gtou*, who takes cognizance of all important affairs, not only of both the governments of the province, but alfo of thofe of the province of Kiang-fi. The Tartars have a numerous garrifon here, commanded by a general of their own nation; and they occupy a quarter of the city, feparated from the reft by a plain wall.

The palaces of the mandarins, whether Chinefe or Tartars, are in this city neither larger nor better built than thofe in the capital cities of other provinces. Here are no public edifices correfponding to the reputation of fo celebrated a city, excepting its gates, which are very beautiful, and fome temples, among which is the fomous porcelain tower. It is 200 feet high, and divided into nine ftories by plain boards within, and without by cornices and fmall projections covered with green varnifhed tiles. There is an afcent of 40 fteps to the firft ftory; between each of the others there are 21.

The breadth and depth of the river Yang-tfe-kiang formerly rendered the port of Nan-king very commodious; but at prefent large barks, or rather Chinefe junks, never enter it; whether it be that it is fhut up by fand-banks, or that the entrance of it has been forbid, in order that navigators may infenfibly lofe all knowledge of it.

In the months of April and May a great number of excellent fifh are caught in this river near the city, which are fent to court; they are covered with ice, and tranfported in that manner by barks kept entirely on purpofe. Although this city is more than 200 leagues from Peking, thefe boats make fuch expedition, that they arrive there in eight or nine days. This city, though the capital of the province, has under its particular jurifdiction only eight cities of the third clafs. The number of its inhabitants are faid to be 1,000,000, without comprehending the garrifon of 40,000 men. E. Long. 119. 25. N. Lat. 32. 46.

NANSIO, an ifland of the Archipelago, a little to the north of the ifland of Santorino, 16 miles in circumference; but has no harbour. The mountains are nothing but bare rocks, and there are not fprings fufficient to water the fields. There are a vaft number of partridges, whofe eggs they deftroy every year to preferve the corn, and yet vaft numbers of them are always produced. The ruins of the temple of Apollo are yet to be feen, and confift chiefly of marble columns. E. Long. 26. 20. N. Lat. 36. 15.

NANTES, an ancient, rich, and very confiderable town of France, in Bretagne, with a bifhop's fee, an univerfity, and a mint. It is one of the moft confiderable places in the kingdom; contains the richeft merchants; and was formerly the refidence of the dukes of Bretagne, where they built a very ftrong caftle on the fide of the river, and which is ftrongly fortified. There are feveral parifhes, and a great many religious houfes, and the cathedral contains the tombs of the ancient dukes. There are feveral fine bridges over the river Loire, which is navigable The fuburbs are fo large, on account of the number of people that come from all parts to fettle here, that they exceed the city. The Spaniards trade here with wine, fine wool, iron, filk, oil, oranges, and lemons; and they carry back cloth, ftuffs, corn, and hard-ware. The Dutch fend falt fifh, and all forts of fpices; and in return have wine and brandy. The Swedes bring copper; and the Englifh, lead, tin, and pit-coal. 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 almoft every confiderable city in Europe, very ftrongly fortified. Peter de Dreux, one of the dukes of Bretagne, furrounded it with walls, which have only been demolifhed within thefe few years. The bridge is an object of curiofity. It is near a mile and a half in length, being continued acrofs all the little iflands in the Loire, from north to fouth. The territory of Nantes lies on both fides the Loire, and feeds a great number of cattle. Large veffels can come no higher than Port Launai, which is 12 miles from Nantes. W. Long. 1. 31. N. Lat. 47. 13.

NANTUEIL (Robert), the celebrated defigner and engraver to the cabinet of Louis XIV. was born at Rheims in 1630. His father, though but a petty fhopkeeper, gave his fon a liberal education; who, having a tafte for drawing, cultivated it with fuch fuccefs, that he became the admiration of the whole town: but marrying young, and not being able to maintain his family, he took a journey to Paris, where he made his talents known by a ftratagem.—Seeing feveral abbés at the door of an eating-houfe, he afked the miftrefs for an ecclefiaftic of Rheims, whofe name he had forgot, but that fhe might eafily know him by a picture of him which he fhowed: the abbés crowding round, were fo charmed with it, that he feized the opportunity of offering to draw any of their pictures for a fmall matter. Cuftomers came fo faft, that he foon raifed his price, and brought his family to Paris, where his reputation was quickly eftablifhed. He applied himfelf particularly to taking portraits in crayons, which he afterwards engraved for the ufe of academical thefes; and in this way he did the portrait of the king, and afterwards engraved it as big as the life; a thing never before attempted. The king was fo pleafed with it, that he created the place of defigner and engraver to the cabinet for him, with a penfion of 1000 livres. He died in 1678; and an entire collection of his prints amounts to upwards of 240.

NANTWICH. See Namptwich.

NAPÆA, in botany: A genus of the polyandria order, belonging to the polydelphia clafs of plants; and in the natural method ranking under the 37th order, *Columniferæ*. The calyx is fingle and cylindric; the

Naphtha.

the arilli coalited and monofpermous. There are two fpecies; both of them with perennial roots, compofed of many thick flefhy fibres, which ftrike deep into the ground, and are connected at the top into large heads; the ftalks grow to feven or eight feet high, producing white flowers, tubulous at bottom, but fpreading open at top, and dividing into five obtufe fegments. Both thefe plants are natives of Virginia and other parts of North America: from the bark of fome of the Indian kinds a fort of fine hemp might be procured, capable of being woven into very ftrong cloth. They are eafily propagated by feed, which will thrive in any fituation.

NAPHTHA, an inflammable fubftance of the bituminous kind, of a light brown colour, and incapable of decompofition though frequently adulterated with heterogeneous mixtures. By long keeping it hardens in the air into a fubftance refembling a vegetable refin; and in this ftate it is always of a black colour, whether pure or mixed with other bodies. According to Mongez, there are three kinds of naphtha, the white, reddifh, and green or deep-coloured; and it is in fact a true petrol or rock oil, of which the lighteft and moft inflammable is called *naphtha*. It is faid to be of an extremely fragrant and agreeable fmell, though very different in this refpect from vegetable oils. It is alfo tranfparent, extremely inflammable, diffolves refins and balfams, but not gum-refins nor elaftic gum. It diffolves in the effential oils of thyme and lavender, but is infoluble in fpirit of wine and ether. It burns with a bluifh flame, and is as inflammable as ether; like which it alfo attracts gold from aqua-regia.

Naphtha, according to Cronftedt, is collected from the furface of fome wells in Perfia; but Mr Kirwan informs us, that it iffues out of white, yellow, or black clays, in Perfia and Media. The fineft is brought from a peninfula in the Cafpian Sea, called by Kempfer *okefra*. It iffues out through the earth into cifterns and wells, purpofely excavated for collecting it at Baku in Perfia. Different kinds of this fubftance are alfo found in Italy, in the duchy of Modena, and in Mount Ciaro, 12 leagues from Plaifance.

The formation of naphtha and petroleum is by moft naturalifts and chemifts afcribed to the decompofition of folid bitumens by the action of fubterraneous fires; naphtha being the lighteft oil, which the fire difengages firft; what follows gradually acquiring the colour and confiftence of petrol. Laftly, the petrolea, united with fome earthy fubftances, or altered by acids, affume the appearance of mineral pitch, piffafphaltum, &c. This opinion feems to be fupported by the phenomena attending the diftillation of amber; where the firft liquor that rifes is a true naphtha; then a petroleum of a more or lefs brown colour; and laftly, a black fubftance like jet, which being farther urged by the fire, leaves a dry friable matter, &c. It is further obferved, that nature frequently produces all the different kinds of petrolea near the fame fpot; of which we have an inftance at Mount Teftin in the duchy of Modena in Italy. Some, however, are of opinion, that thefe mineral oils or bitumens are formed from the vitriolic acid, and various oily and fat fubftances found in the bowels of the earth.

Naphthali, Napier.

NAPHTHALI, or NEPHTHALI (Jofh. xix.), one of the tribes of Ifrael; having Zabulon on the fouth, Afher on the weft, the Jordan on the eaft, and on the north Antilibanus.

NAPIER (John), baron of Merchifton in Scotland, inventor of the logarithms, was the eldeft fon of Sir Archibald Napier of Merchifton, and born in the year 1550. Having given early difcoveries of great natural parts, his father was careful to have them cultivated by a liberal education. After going through the ordinary courfes of philofophy at the univerfity 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 accomplifhments foon rendered him confpicuous, and might have raifed him to the higheft offices in the ftate; but declining all civil employments, and the buftle of the court, he retired from the world to purfue literary refearches, in which he made an uncommon progrefs, fo as to have favoured mankind with fundry ufeful difcoveries. He applied himfelf chiefly to the ftudy of mathematics; but at the fame time did not neglect that of the Holy Scriptures. In both thefe he hath difcovered the moft extenfive knowledge and profound penetration. His effay upon the book of the Apocalypfe, indicates the moft acute inveftigation, and an uncommon ftrength of judgment; though time hath difcovered, that his calculations concerning particular events had proceeded upon fallacious data. This work has been printed abroad in feveral languages; particularly in French at Rochelle in the year 1693, 8vo, announced in the title as revifed by himfelf. Nothing, fays 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 antichrift, which in this book he has endeavoured to fet forth with much zeal and erudition.—But what has principally rendered his name famous, was his great and fortunate difcovery of logarithms in trigonometry, by which the eafe and expedition in calculation have fo wonderfully affifted the fcience of aftronomy and the arts of practical geometry and navigation. That he had begun about the year 1593 the train of enquiry which led him to that great atchievement in arithmetic, appears from a letter to Crugerus from Kepler in the year 1624; wherein, mentioning the *Canon Mirificus*, he writes thus: "Nihil autem fupra Neperianam rationem effe puto: etfi Scotus quidem literis ad Tychonem, anno 1594, fcriptis jam fpem fecit Canonis illius mirifici;" which allufion agrees with the idle ftory mentioned by Wood in his *Athenæ Oxon.* and explains it in a way perfectly confonant to the rights of Napier as the inventor.

When Napier had communicated to Mr Henry Briggs, mathematical profeffor in Grefham college, his wonderful canon for the logarithms, that learned profeffor fet himfelf to apply the rules in his *Imitatio Nepeirea*; and in a letter to archbifhop Ufher in the year 1615, he writes thus: "Napier, baron of Merchifton, hath fet my head and hands at work with his new and admirable logarithms. I hope to fee him this fummer, if it pleafe God; for I never faw a book which pleafed me better, and made me more wonder." The following paffage from the life of Lilly the aftrologer is quoted by Lord Buchan as giving a picturefque resque view of the meeting betwixt Briggs and the inventor of the logarithms at Merchiston near Edinburgh. "I will acquaint 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 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 now 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 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 his 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 *Rabdology 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 published works 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), intitled. "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 for 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

Napier.

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 CCCXLIV.

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 in 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 (*ibid.* n° 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 roads 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 6 times the divisor, set 6 in the quotient.

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Naples.

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, Spoleto, 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.

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,

2 Arechis duke of Benevento revolts from Charlemagne.

Naples. 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 his son Grimoald and his daughter Adelgisa, with twelve others, as hostages for his fidelity: however, after many intreaties, Adelgisa was restored to her father.

3 Submits.

4 Revolts a second time.

Charles had no sooner left Italy, than Arechis forgot all his engagements, and began to negociate 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, intreating 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.—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 Spoleto, 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.

5 Grimoald continues for some time faithful to the Franks.

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 expences 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.

In the year 821, Grimoald was murdered by Radelchis count of Consia, and Sico gastald of Acerenta, 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, intreated 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.

6 Is murdered, and succeeded by Sico.

7 Naples besieged by Sico;

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 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

8 And by his successor Sicardo.

Naples.

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 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, Latiniano, Caſſano, Coſſenzo, Laino, Lucania, Conſia, Montella, Rota, Salerno, Sarno, Ciraterium, 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.

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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 Spoleto 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.

12 Unſucceſsful war with the Saracens.

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 Guaferius with his quota of troops, having ordered the eyes of Ademarius to be put out in his abſence. Lewis confirmed him in the principality, and marched with his army to Benevento, where Adelgiſe received

Naples. ceived 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

13 They are at laſt expelled, Lotharius, and the Greek emperor had ſent him a fleet of 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

14 But ſoon return. 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."

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 tempo-

15 The pope becomes their tributary. ral 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 *Gaideris*, 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 Spoleto, 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 Spoleto. 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 Spoleto, 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 Geeta 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 connection with the infidels. In this they at laſt proved ſucceſsful, and Athanaſius concluded an alliance with Guaimarius prince of Salerno;

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no; 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 the Greeks found an opportunity of making themselves masters of Benevento, and had well nigh become 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 invested 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.

16 The Saracens almost entirely cut off.

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.

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.

17 The Normans first known in Italy.

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.

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 Guiamarius, prince of Salerno, intreating 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

20 The Normans pass over into Sicily.

Naples. 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. Ardoin ſoon after obtained leave to return to Italy under 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.

21 Their conqueſts.

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. Naples.

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 Melſis 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.

22 Great numbers of them maſſacred.

23 They are confirmed by the pope in all their conqueſts.

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 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

24 Sicily conquered by Robert Guiſcard.

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 Corſu, 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 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, notwith-

25 And by the emperor of Germany.

ſtanding 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.

In 1254 the pope claimed the kingdom as a fief devolved on the church in conſequence of a ſentence of depoſition pronounced againſt king Frederic 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.

26 The French become 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 negociation 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, Bénizzano, 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 malcontents 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 malcontents. 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 conſpirator. 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. The 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.

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

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his preparations with great diligence, intending to put to ſea the following ſummer. Procida had returned to
27 They are maſſacred.
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 30th, 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 Moureale, about three miles without the city. While they were 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 that 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 malcontents. 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 Amalſi*, 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 Amalſi, 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 middling 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

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tween 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 dispatch, 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 malcontents, 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 eat 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 negociating 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;

33 Massaniello appointed captain-general.

accept; but yielded at length to the intreaties 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 ſeveral 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 was of very ſhort continuance; for his mind becoming diſtracted and delirious for two or three days, he committed a great many

34 Is aſſaſſinated.

mad and extravagant actions; and on the 18th of July was aſſaſſinated with the conſent of the viceroy.

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

35 The people return to their allegiance.

priſoner, the people returned to their allegiance; and thus all the attempts of the French on Naples were fruſtrated. Since 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.

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 thoſe of the Apennine, 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 acknowledgment 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 13,000 l. a year; a conſiderable number have fortunes of about half the value; and the annual revenue of many is not above 1000 l. or 2000 l. The inferior orders of the nobility are much poorer. Many counts and marquiſſes have not above 300 l or 400 l. 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

§ *View of Society, &c. in Italy.*

Naples. excessively fond of splendor and show, which appears in the brilliancy of their equipages, the number of their attendants, the richness of their dress, and the 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 ribbon 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 Epicureans, 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.

§ *Travels in the Two Sicilies.*

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, 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

Naples.

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 cloyſter 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 Uovo, 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 in 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 block-houſe 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 Saint 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 block-houſe 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, of 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 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 *lazzarani* 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 of the rabble are, who prefer begging or robbing, or running errands, to any fixed and permanent employmrnt. 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 above a quarter of a mile into the ſea, and at the extremity has a high lantern 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 theother *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. 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.

† See *Chemiſtry*, n° 800.

Naples ‖ Narbonne.

NARBO (anc. geog.), a town of the Volcæ 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 Decumani 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 the 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 Lower Languedoc, 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 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 the *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 commu-

 nication

Narcissus. nication 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 and the metropolitan church has a handſome ſteeple. E. Long. 2. 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 chace, 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, in botany: A genus of the monogynia order, belonging to the hexandria claſs of plants; and in the natural method ranking under the 9th order, *Spathaceæ*. There are ſix petals; the nectarium is funnel-ſhaped, and monophyllous; the ſtamina are within the nectarium. The moſt remarkable ſpecies are,

1. The baſtard narciſſus, or common yellow Engliſh daffodil, grows wild in great plenty in many of our woods and coppices, and under hedges in ſeveral parts of England. In the counties round London the herbfolks bring prodigious quantities in the ſpring of the year, when in bloom, root and all, and ſell them about the ſtreets. Its commonneſs renders it of but little eſteem with many; conſidered, however, as an early and elegant flower, of exceeding hardineſs and eaſy culture, it merits a place in every garden.

2. The bicolor, or two-coloured incomparable narciſſus, hath a large, oblong, bulbous root; crowned with long, narrow, dark-green leaves, 12 or 14 inches long; an upright flower-ſtalk, about 15 inches high, terminated by an uniflorous ſpatha, protruding one large flower with white petals, and a bell-ſhaped, ſpreading, golden nectarium, waved on the margin, and equal in length with the corolla; flowering in April. The varieties are, common ſingle-flowered—ſemi-double-flowered, with the interior petals ſome white and ſome yellow—with ſulphur-coloured flowers.

3. The poeticus, poetic daffodil, or common white narciſſus, is well known. Of this there are varieties with purple-cupped flowers—yellow-cupped flowers—double-flowered: all of them with entire white petals. It is the ancient celebrated narciſſus of the Greek and Roman poets, which they ſo greatly extol for its extreme beauty and fragrance.

4. The bulbocodium, hath a ſmall bulbous root, crowned with ſeveral narrow, ſubulate, ruſh-like leaves, ſix or eight inches long; amidſt them a ſlender, taper flower-ſtalk, ſix inches high, terminated by an uniflorous ſpatha, protruding one yellow flower, having the nectarium much larger than the petals, and very broad and ſpreading at the brim; flowering in April. From the large ſpreading nectarium of this ſpecies, which being three or four times longer than the petals, narrow at bottom, and widening gradually to the brim, ſo as to reſemble the ſhape of ſome old-faſhioned hoop-petticoats, it obtained the name *hoop-petticoat narciſſus*. Narciſſus.

5. The ſerotinus, or late-flowering ſmall autumnal narciſſus, hath a ſmall bulbous root; crowned with a few narrow leaves; amidſt them a jointed flower-ſtalk, eight or nine inches high, terminated by an uniflorous ſpatha, protruding one white flower, having a ſhort, ſix-parted, yellow nectarium; flowering in autumn.

6. The tazetta, or multiflorous daffodil, commonly called *polyanthus narciſſus*, hath a very large, roundiſh, bulbous root; long, narrow, plane leaves; an upright flower-ſtalk, riſing from 10 or 12 inches to a foot and a half high; terminated by a multiflorous ſpatha, protruding many large, ſpreading, white and yellow flowers, in a cluſter, having bell-ſhaped nectariums ſhorter than the corolla; flowering in February, March, and April, and is very fragrant. The varieties of this are very numerous, conſiſting of about eight or nine principal ſorts, each of which having many intermediate varieties; amounting in the whole greatly above an hundred in the Dutch floriſts catalogues, each variety diſtinguiſhed by a name according to the fancy of the firſt raiſer of it. They are all very pretty flowers, and make a charming appearance in the flower-borders, &c. they are alſo finely adapted for blowing in glaſſes of water, or in pots, to ornament rooms in winter.

7. The jonquilla, or jonquil, ſometimes called *ruſh-leaved daffodil*, hath an oblong, bulbous, brown root; ſending up ſeveral long, ſemi-taper, ruſh-like, bright-green leaves; amidſt them an upright green flower-ſtalk, a foot or 15 inches high; terminated by a multiflorous ſpatha, protruding many yellow flowers, often expanded like a radius, each having a hemiſpherical, crenated nectarium, ſhorter than the petals; flowering in April, and moſtly of a fine fragrance. The varieties are, jonquil minor with ſingle flowers—jonquil major with ſingle flowers—ſtarry flowered—yellow and white flowered—white-flowered—ſemi-double-flowered—double-flowered—and large double inodorous jonquil: all of them multiflorous, the ſingle in particular; but ſometimes the doubles produce only two or three flowers from a ſpatha, and the ſingles commonly ſix or eight. All the ſorts have ſo fine a ſhape, ſo ſoft a colour, and ſo ſweet a ſcent, that they are ſome of the moſt agreeable ſpring-flowers.

8. The calathinus, or multiflorous yellow narciſſus, hath a large bulbous root; crowned with long, narrow, plane leaves; and amidſt them an erect, robuſt flower-ſtalk, terminated by a multiflorous ſpatha, protruding many large, entire, yellow flowers, having a bell-ſhaped, ſlightly crenated nectarium, equal in length with the petals.

9. The odorus, odoriferous, or ſweet-ſcented ſtarry yellow narciſſus, hath a bulbous root; narrow leaves; erect flower-ſtalk, a foot or more high, terminated by a ſub-multiflorous ſpatha, protruding ſometimes but one,

Narcissus || Nardo.

one, and sometimes several entirely yellow flowers, having a campanulated, six-parted, smooth nectarium, half the length of the petals.

10. The triandrus, or triandrous rush-leaved white narcissus, hath a bulbous root; very narrow, rush-like leaves; erect flower-stalk, terminated by an uniflorous spatha, protruding one snowy-white flower, having a bell-shaped, crenated nectarium, half the length of the petals, and with mostly triandrous or three stamina.

11. The trilobus, or trilobate yellow narcissus, hath a bulbous root; narrow rush-like leaves; erect flower-stalks, terminated by a sub-multiflorous spatha, protruding sometimes but one or two, and sometimes several, yellow flowers, having a bell-shaped, three-lobed nectarium, half the length of the petals.

12. The minor, or yellow winter daffodil, hath a small bulbous root; plane leaves, eight or ten inches long, and more than half a one broad; an erect flower-stalk, terminated by an uniflorous spatha, protruding one nodding yellow flower, with spear-shaped petals, having an obconic, six-parted, waved nectarium, equal to the length of the corolla; flowering in winter, or very early in spring.

All these 12 species of narcissus are of the bulbous-rooted tribe, and universally perennial in root, but annual in leaf and flower-stalk; all of them rising annually in spring, immediately from the crown of the bulb, first the leaves, and in the midst of them the flower-stalk, one only from each root, entirely naked or leafless, each terminated by a spatha or sheath, which opens on one side to protrude the flowers, and then withers; the flowers, as before observed, are all hexapetalous, each furnished with a nectarium in the centre, and are universally hermaphrodite: they are large and conspicuous, appearing mostly in the spring-season, generally from March or April until June, succeeded by ripe seed in July; then the leaves and flower-stalks decay, and the roots desist from growing for some time; at which period of rest is the only proper time to take up or transplant the roots from one place to another, or to separate the offsets; for they all multiply abundantly by offset young bulbs from the main root, insomuch that a single bulb will in one or two years be increased into a large cluster of several bulbs, closely placed together, and which every second or third year should be taken up at the above period in order to be separated; and each offset so separated commences a distinct plant; which being planted again in autumn, produces flowers the following summer, alike in every respect to those of their respective parent bulbs. All the species are so hardy that they prosper in any common soil of a garden; observing, however, to allow the finer sorts of *polyanthus narcissus*, in particular, principally a warm dry situation; all the others may be planted any where in the open dry borders and flower-beds.

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.

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.

Nardus.

In this little city are 8000 inhabitants. The steeple of its cathedral is built in a very uncommon but showy style of Gothic architecture. Luca Giordano and Solimeni have adorned the church with some agreeable paintings. This place was 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, in botany: A genus of the monogynia order, belonging to the triandria class of plants; and in the natural method ranking under the 4th order, *Gramina*. There is no calyx; the corolla is bivalved.

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, where 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.*

The plant had a great character among the ancients as a medicine, both internally taken and externally applied. It has a place in the list of all antidotes from those of Hippocrates (given on the authority of Myrepsus and Nicholaus Alexandrinus) to the officinals which have kept their ground till lately, under the names of *Mithridate* and *Venice treacle*. Galen and Alexander Trallian recommend it in the dropsy and gravel; Celsus and Galen in pains of the stomach and bowels, both internally given and externally applied. Galen prescribed the oleum nardinum to the emperor Marcus Aurelius when afflicted with a cholera morbus. It was externally applied to the stomach on wool; and the success was so great, that he ever afterwards enjoyed the highest confidence of that emperor. In a work attributed to Galen, also, it is mentioned that a medicine composed of this and some other aromatics was found useful in long protracted fevers; and the natives of India at present consider it as a very efficacious remedy in fevers. Its sensible qualities, indeed, promise it to be of considerable efficacy in some cases, as it has a pungency of taste superior to contrayerva, and little inferior to serpentaria.

But though the name of this plant, with the uses and virtues of it, has long been familiar in the writings of botanists and physicians, the genus and species of the plant have only been ascertained very lately. In the Philosphical Transactions for 1790, Dr Blane gives an account of it from a letter sent him by his brother from Lucknow, dated in December 1786.—According to this gentleman's relation, being one day on on a hunting party with the nabob viſier, after croſſing the river Rapty, about 20 miles from the foot of the northern mountains, he was ſurpriſed to find the air perfumed with an aromatic ſmell, which, as he was told, proceeded from the roots of the graſs that were bruiſed or torn out of the ground by the nabob's elephants and horſes. The country was wild, uncultivated, and entirely covered with this kind of graſs, which grew in large tufts cloſe to each other, and from three to four feet long. As none of it was in flower, it being then the winter ſeaſon, and the graſs having beſides been burnt down by order of the nabob, our author cauſed ſome of the roots to be dug up, in order to plant it in his garden at Lucknow.—Here it proſpered exceedingly; and ſhot up ſpikes to the height of ſix feet. A ſpecimen was ſent to Sir Joſeph Banks, who found it to belong to the genus of andropogon, different from any ſpecies hitherto deſcribed by botaniſts. "There is great reaſon, however (ſays Dr Blane), to think that it is the true nardus Indica of the ancients; for, 1. The circumſtance of its diſcovery correſponds in a ſtriking manner with an occurrence related by Arrian in his Hiſtory of Alexander's Expedition into India. During the march of that hero through the deſarts of Gedroſia, the air was perfumed by the ſpikenard, which was trampled under foot by the army; and the Phœnicians, who accompanied them, collected great quantities of it, as well as of myrrh, to carry them into their own country to make merchandiſe of them. This laſt circumſtance ſeems further to aſcertain it to have been the true nardus; for the Phœnicians, who even in war appear to have retained their true genius for commerce, could no doubt diſtinguiſh the proper quality of this commodity. I am informed by major Rennel, that Gedroſia anſwers to the modern Mackran, or Kedgemackran, a maritime province of Perſia, ſituated between Kermon (the ancient Carmania), and the river Indus, being of courſe the frontier province of Perſia towards India; and that it appears from Arrian's account, and from a Turkiſh map of Perſia, that this deſart lies in the middle tract of country between the river Indus and the Perſian gulf, and within a few days march of the Arabian or Erythræan ſea. By this the ancients meant the northern part of the Ethiopic ocean, which waſhes the ſouthern coaſts of Arabia and Perſia; not what we now call the Red Sea, as its name would ſeem to imply, for this by the ancients was called the *Arabian Gulf*. 2. Though the accounts of the ancients concerning this plant are very defective, it is plain that it was of the natural order of gramina; for the term *ariſta*, ſo often applied to it, was appropriated by them to the fructification of grains and graſſes, and ſeems to be a word of Greek original, to denote the moſt excellent portion of thoſe plants, which are the moſt uſeful in the vegetable creation for the ſuſtenance of animal life; and nature has alſo kindly made them the moſt abundant in all parts of the habitable earth. Galen ſays, that though there are various ſorts of nardus, the term ναρδος ςαχυς, or *ſpikenard*, ſhould not be applied to any but the nardus Indica. It would appear that the nardus Celtica was a plant of a quite different habit, and is ſuppoſed to have been a ſpecies of valeriana.

"The deſcription of the Nardus Indica by Pliny does not indeed correſpond with the appearance of our ſpecimen; for he ſays it is *frutex radice pingui et craſſa*, whereas ours has ſmall fibrous roots. But as Italy is very remote from the native country of this plant, it is reaſonable to ſuppoſe that others more eaſily procurable uſed to be ſubſtituted for it; and the ſame author ſays, that there were nine different plants by which it could be imitated and adulterated. There is a *Nardus Aſſyria* mentioned by Horace; and Dioſcorides mentions the *Nardus Syriaca* as a ſpecies different from the *Indica*, which certainly was brought from ſome of the remote parts of India; for both Dioſcorides and Galen, by way of fixing more particularly the country from whence it came, call it the *Nardus Gangites*. 3. *Garcias ab Horto*, a Portugueſe who reſided many years at Goa in the 16th century, has given a figure of the roots, or rather of the lower parts of the ſtalks, which correſponds with our ſpecimen; and he ſays that there is but this one ſpecies of nardus known in India, either for the conſumption of the natives, or for exportation to Perſia and Arabia. 4. The ſenſible qualities of this are ſuperior to what commonly paſſes for it in the ſhops, being poſſeſſed both of more fragrancy and pungency, which ſeems to account for the preference given to it by the ancients.

"There is a queſtion, concerning which Matthiolus, the commentator of Dioſcorides, beſtows a good deal of argument, viz. whether the roots or ſtalks were the parts eſteemed for uſe, the teſtimony of the ancients themſelves on this head being ambiguous. The roots of this ſpecimen are very ſmall, and poſſeſs ſenſible qualities inferior to the reſt of the plant; yet it is mentioned in the account above recited, that the virtues reſide principally in the huſky roots. It is evident, that by the huſky roots muſt here be meant the lower parts of the ſtalks and leaves, where they unite to the roots; and it is probably a ſlight ambiguity of this kind that has given occaſion to the ambiguity that occurs in the ancient accounts."

The ſenſible qualities of this plant do not depend upon an eſſential oil, but on ſome fixed principle like thoſe of cardamoms or ginger. Dr Blane tried to extract its virtues with boiling water, maceration in wine or proof ſpirits; but it yielded them ſparingly and with difficulty to any of theſe menſtrua. The Indians gave an infuſion of it in hot water, with a ſmall quantity of black pepper as a febrifuge.

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 an 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

Narea, Narration.

valleys. The mountainous country of Caffa adjoins immediately to Narea, and is faid to be governed by a feparate prince; but the Galla having fettled themfelves in all the flat ground to the very edge of the marfhes, have in a great meafure cut off the communication with Abyffinia for a long time paft. The Nareans who inhabit the mountainous country have the lighteft complexion of any people in Abyffinia; but thofe who inhabit the borders of the marfhes are perfectly black, and have the features and woolly heads of negroes; but the mountaineers of Narea, and much more thofe of Caffa, are fair-complexioned, more fo than even the Neapolitans or Sicilians. It is faid that fnow has been feen to lie on fome of the mountains of Caffa; but Mr Bruce imagines this to be a miftake, and thinks that it muft have been hail.

Narea abounds with cattle, grain, and all kinds of provifions, both in the high and low country. The medium of commerce is gold, which they fell by weight; but the principal articles of trade are coarfe cotton cloths, antimony, beads, and incenfe, 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 prifoners taken in thefe fkirmifhes are fold to the Mahometan merchants at Gondar; and at Conftantinople, Cairo, or in India, the women are more efteemed than thofe of any other part of the world. Both fexes have a cheerful, kind difpofition, and attach themfelves inviolably to their mafters, if properly treated. The people of Narea and Caffa fpeak a language peculiar to themfelves.

NARRATION, in oratory, poetry, and hiftory, a recital or rehearfal of a fact as it happened, or as it is fuppofed to have happened. See ORATORY, n° 26. 123.

Concerning NARRATION *and Defcription*, we have the following rules and obfervations in the Elements of Criticifm.

1. The firft rule is, That in hiftory the reflections ought to be chafte and folid; for while the mind is intent upon truth, it is little difpofed to the operation of the imagination. Strada's Belgic hiftory is full of poetical images, which, being difcordant with the fubject, are unpleafant; and they have a ftill worfe effect, by giving an air of fiction to a genuine hiftory. Such flowers ought to be fcattered with a fparing 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 relifh them: in that ftate of mind, they are agreeable; but while we are fedate and attentive to an hiftorical chain of facts, we reject with difdain every fiction.

2. Vida, following Horace, recommends a modeft commencement of an epic poem; giving for a reafon, that the writer ought to hufband his fire. Befides, bold thoughts and figures are never relifhed till the mind be heated and thoroughly engaged, which is not the reader's cafe at the commencement. Homer introduces not a fingle fimile in the firft book of the Iliad, nor in the firft book of the Odyffey. On the other hand, Shakefpeare begins one of his plays with a fentiment too bold for the moft heated imagination:

Bedford. Hung be the heav'ns with black, yield day to night!
Comets, importing change of times and ftates,
Brandifh your cryftal treffes in the fky,
And with them fcourge the bad revolting ftars,
That have confented unto Henry's death!
Henry the Fifth, too famous to live long!
England ne'er loft a king of fo much worth.

Firft part Henry VI.

The paffage with which Strada begins his hiftory, is too poetical for a fubject of that kind; and at any rate too high for the beginning of a grave performance.

3. A third rule or obfervation is, That where the fubject is intended for entertainment folely, not for inftruction, a thing ought to be defcribed as it appears, not as it is in reality. In running, for example, the impulfe upon the ground is proportioned in fome degree to the celerity of motion; though in appearance it is otherwife, for a perfon in fwift motion feems to fkim the ground, and fcarcely to touch it. Virgil, with great tafte, defcribes quick running according to appearance; and raifes an image far more lively than by adhering fcrupuloufly to truth:

Hos fuper advenit Volfca de gente Camilla,
Agmen agens equitum et florentes ære catervas,
Bellatrix: non illa colo calathifve Minervæ
Fœmineas affueta manus; fed prælia virgo
Dura pati, curfuque pedum prævertere ventos.
Illa vel intactæ fegetis per fumma volaret
Gramina: nec teneras curfu læfiffet ariftas:
Vel mare per medium, fluctu fufpenfa tumenti,
Ferret iter: celeres nec tingeret æquore plantas.

Æneid. vii. 803.

4. In narration as well as in defcription, objects ought to be painted fo accurately as to form in the mind of the reader diftinct and lively images. Every ufelefs circumftance ought indeed to be fuppreffed, becaufe every fuch circumftance loads the narration; but if a circumftance be neceffary, however flight, it cannot be defcribed too minutely. The force of language confifts in raifing complete images, which have the effect to tranfport the reader as by magic into the very place of the important action, and to convert him as it were into a fpectator, beholding every thing that paffes. The narrative in an epic poem ought to rival a picture in the livelinefs and accuracy of its reprefentations: no circumftance muft be omitted that tends to make a complete image; becaufe an imperfect image, as well as any other imperfect conception, is cold and uninterefting. We fhall illuftrate this rule by feveral examples, giving the firft place to a beautiful paffage from Virgil:

Qualis *populeâ* mœrens Philomela fub umbrâ
Amiffos queritur fœtus, quos durus *arator*
Obfervans nido *implumes* detraxit.

Georg. lib. 4. *l.* 511.

The poplar, plowman, and unfledged young, though not effential in the defcription, tend to make a complete image, and upon that account are an embellifhment.

Again:

Narration. 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. 1. *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. 3. *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 three-pence bow'd would hire me, old as I am, to queen it.
Henry VIII. act 2. *sc.* 5.

In the following passage, the action, with all its material 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, b. 1.

The following passage from Shakespeare falls not much short of that now mentioned in particularity of description:

O you hard hearts! you cruel men of Rome!
Knew you not Pompey? Many a time and oft
Have you climb'd up to walls and battlements,
To tow'rs 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 shores?
Julius Cæsar, act 1. *sc.* 1.

The following passage is scarce 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. 4. l. 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 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.

Narration.

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* 2. *sc*. 3.

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 4. *sc*. 2.

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. 3. *sc*. 10.

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 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. 1. *sc*. 2.

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 good a 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 shoot. 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*. 3. *sc*. 3.

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*. 4. *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* 3. *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* 2. *sc*. 9.

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 in 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;

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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, l.* 30.

The following examples are of abſurdities.

"Alii pulſis e tormento catenis diſcerpti ſectique, dimidiato corpore pugnabant ſibi ſuperſtites, ac peremptæ partis ultores." *Strada, dec.* 2. *l.* 2.

> Il povér 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* 5.

Having diſcuſſed what obſervations occurred upon the thoughts or things expreſſed, we proceed to what more peculiarly concerns the language or verbal dreſs.

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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. lib.* 1. *ſat.* 1. *l.* 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 ſerver ſes deſſeins,
> Ne ſous le ciel brûlant des plus noirs Affricains.
>
> *Bajacet, act* 3. *ſc.* 8.

> Les ombres 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.
>
> *Phedra, act* 1. *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 2. *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* 1. *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* 3.

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, èn des

Narration. des appareils si divers, et pour des causes si differentes, &c." *p.* 6.

"Grande reine, je satisfais à vos plus tendres desirs, quand je célébre ce monarque; et son cœur qui n'a jamais vêcu qui pour lui, se eveille, tout poudre qu'il est, et devient sensible, même sous ce drap mortuaire, au nom d'un epoux si cher" *p.* 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 été jusqu' à ce moment immobile et transportée de plaisir en écoutant les avantures de Télémaque, l'interrompit pour lui faire prendre quelque repôs. Il est tems, lui dit-elle, que vous alliez goûter la douceur du sommeil apprés tant de travaux. Vous n'avez rien à craindre ici; tout vous est favorable. Abandonnez vous donc à la joye. 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'ouvira les portes dorées de l'Orient, et que le chevaux du soleil sortans 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 it lies open to the same censure; but the force of authority is great:

At regina gravi jamdudum saucia cura
Vulnus alit venis, et cæco 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 wo distracts my aching breast,
My heart the subject of corroding care:
From haunts of men with wandring steps and slow
I solitary steal, and soothe my pensive wo.

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* 3. *sc.* 1.

Orlando.

Narration.

Orlando.———Whate'er you are
That, in the desart 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 eye-lids wip'd a tear,
And know what 'tis to pity, and be pity'd;
Let gentleness my strong inforcement 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 mens 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 ministred.

As you like it.

With the conversing I forgot 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
Glistring 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 4. *l.* 634.

"What mean ye, that ye use this proverb, The fathers have eaten sour grapes, and the childrens 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 doeth 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 sors aut virtus: temerè, proviso, ob iram, ob prædam, jussu, et aliquando ignaris ducibus." *Annal. lib.* 12. § 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 be 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 v. 5.

Strength and omnipotence invest thy throne.

Ibid. viii. 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 ev'ry 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

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 vanquiſh'd, 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* 1. *l.* 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 bury'd 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 3. *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, b.* 2. *l.* 666.

——————Now ſtorming fury roſe,
And clamour ſuch as heard in heaven till now
Was never: arms on clamour 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 vollies flew,
And flying vaulted either hoſt with fire.
So under fiery cope together ruſh'd
Both battles main, with ruinous aſſault
And inextinguiſhable rage: all heaven
Reſounded, and had earth been then, all earth
Had to her centre ſhook. *Ibid. book* 6. *l.* 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* 1. *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* 5. *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

tical 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 atchieve 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 Alemanni; 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 S. W. of Wiburg, and 172 N. E. of Riga. E. Long. 29. 0. N. Lat. 59. 8.

NARWAL, in ichthyology. See MONODON.

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 rix-dollars six kruitzers and a half each term. The revenue of this principality is estimated at 100,000 rix-dollars.

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, 50 rix-dollars six and a half kruitzers, each term. His revenue from this principality is computed at above 130,000 florins.

NASSAU-Hadamar, a county 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 con-

Smith's Wealth of Nations.

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consistent with that order which we are apt to consider as inseparably connected with good œconomy, 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.

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 thro' 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 manufacturers, 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.

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 connections 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 Austia, 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

Blackst. Comment.

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 L. 60,000 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. 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 ſeamens 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 L. 21,515,742 : 13 : 8½; at the ſame time, in 1714, they were L. 53,681,076, 5s. 6 $\frac{1}{12}$d. In 1755, before the breaking out of the war, they amounted to L. 72,289,673; and on the 5th of January 1763, at the concluſion of the peace, they had accumulated to L. 122,603,336 : 8 : 2¼ of funded debt, and of unfunded L. 13,927,589 : 2 : 2 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 an 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.

† See *Revenue*.

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 L. 100 *per annum;* and he is ſo far indebted to B, that he pays him L. 50 *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 no where elſe; and the debtor is only a truſtee to his creditor for one half

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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 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 incumbrances 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. See Funds.

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 incumbrance to a commercial country. Some, we are aware, think it of vast utility; but this opinion is too eccentric, 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.

It is neither our business nor intention (even if the limits prescribed to the article did not prevent it) to be minute on the subject, or to propose any schemes for alleviating the burdens of the nation. That indeed has been already done by far abler hands than we profess to be: we must therefore refer such as wish for farther information on this interesting topic to those (and they are not a few) who have treated of it at full length. Smith's Wealth of Nations, and Sir John Sinclair's History of the Revenue, go to the bottom of the matter. 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 late pamphlet by William Morgan, intitled, 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 seas of Marmora, the straits of Galipoli 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 botany, the name given by Rivinius to a genus of plants nearly allied to the anonis, and comprehended with it in one genus by Linnæus, under the name of anonis. See *Rest-harrow*.

Natrix, in zoology, the name of the common or water-snake, called also *torquata*, from the ring about its neck. It is not a water animal, properly speaking, but a land one, which being able to swim very well, often takes the water to hunt about for frogs, which are its principal food. It grows to be much longer and larger than the viper, and does not bring forth live young ones, but great numbers of eggs, which it lays in dung-

Natrum || Natural.

dunghills to be hatched by the warmth of the place, or by the heat of the sun.

NATRUM, the nitre of the ancients, in natural history, is a genuine, pure, and native salt, extremely different from our nitre, and indeed from all the other native salts, it being a fixed alkali, plainly of the nature of those made by fire from vegetables, yet capable of a regular crystallization, which those salts are not. It is found on the surface of the earth, or at very small depths within it; and is naturally formed into thin and flat cakes or crusts, which are of a spungy or cavernous substance, very light and friable, and, when pure, of a pale brownish white; but as its spungy texture renders it very subject to be fouled by earth received into its pores, it is often met with of a deep dirty brown, and not unfrequently reddish.

Natrum, whether native or purified, dissolves in a very small quantity of water; and this solution is, in many parts of Asia, used for washing; where it is also made into soap, by mixing it with oil. Natrum reduced to powder, and mixed with sand or flints, or with any other stone of which crystal is the basis, make them readily run into glass. Gold heated red-hot, and sprinkled with a small quantity of this salt, melts in the same manner; as does also iron, copper, and the regulus of antimony; which melt much more easily than they otherwise would do. Mercury cannot be mixed with it by any art, and indeed will not amalgamate with metals if only a little of this salt be added. 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 had an abstersive quality, so that it was used in baths and in washing things. 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.

NATTER-JACK, in zoology, a species of RANA.

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.

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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,

† Dr Percival's *Moral and Literary Dissertations*.

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

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regard to its influence on the paſſions and affection, '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 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 agoniſing 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 humaniſes, 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

Natural. the moralift, and it has been frequently his bufinefs, to point out and recommend fuch pleafures as are highly gratifying, and are yet perfectly innocent. The Spectator, whofe works will be admired as long as the language in which they are written is underftood, recommends ftrongly and elegantly the pleafure of a garden; and a later writer*, of no common degree of merit, and of very confiderable fame, has an effay on the fame fubject, from which we fhall felect a few obfervations, and fo conclude the article. "Not he alone (fays this elegant writer) is to be efteemed a benefactor to mankind, who makes an ufeful difcovery; but he alfo who can point out and recommend an innocent pleafure. Of this kind are the pleafures arifing from the obfervation of nature; and they are highly agreeable to every tafte uncorrupted by vicious indulgence. Rural fcenes of almoft 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 folicits no paffion. The darkeft habitation in the dirtieft ftreet of the metropolis, where money can be earned, has greater charms with many than the groves of Hagley.

* Dr Knox.

"The patron of refined pleafure, the elegant Epicurus, fixed the feat of his enjoyment in a garden. He was of opinion, that a tranquil fpot, furnifhed with the united fweets of art and nature, was the beft adapted to delicate repofe. And even the feverer philofophers of antiquity were wont to difcourfe in the fhade of a fpreading tree, in fome cultivated plantation. It is obvious, on intuition, that nature often intended folely to pleafe the eye in her vegetable productions. She decorates the flowret that fprings beneath our feet in all the perfections of external beauty. She has clothed the garden with a conftant fucceffion of various hues. Even the leaves of the tree undergo a pleafing viciffitude. The frefh verdure which they exhibit in the fpring, the various fhades which they affume in fummer, the yellow and ruffet tinge of autumn, and the nakednefs of winter, afford a conftant pleafure to a lively imagination. From the fnow-drop to the mofs-rofe, the flower garden difplays an infinite variety of fhape and colour. The tafte of the florift has been ridiculed as trifling; yet furely without reafon. Did nature bring forth the tulip and the lily, the rofe and the honeyfuckle, to be neglected by the haughty pretender to fuperior reafon? To omit a fingle focial duty for the cultivation of a polyanthus were ridiculous as well as criminal; but to pafs by the beauties lavifhed before us, without obferving them, is no lefs ingratitude than ftupidity. A bad heart finds little amufement but in a communication with the active world, where fcope is given for the indulgence of malignant paffions; but an amiable difpofition is commonly known by a tafte for the beauties of the animal and the vegetable creation." In fhort, fince the world was made for our ufe, fince the beauties of nature are alike difplayed before all men, and fince they are unqueftionably an inexhauftible fund of innocent amufement; that fubject muft be of vaft importance which enables us to relifh them properly.

NATURAL HISTORY.

NATURAL HISTORY, in its moft extenfive fignification, denotes a knowledge and defcription of the whole univerfe. Matters of fact refpecting the heavens, meteors, the atmofphere, the earth, refpecting all the phenomena, indeed, which occur in the world, and even of the external parts and actions of man himfelf, as far as reafon can difcover them, belong to the province of natural hiftory; but when we leave the fimple recital of effects, and endeavour to inveftigate the caufes of fuch and fuch phenomena, we then leave natural hiftory, and enter on philofophy. The object of our article, therefore, in the fenfe we have here given it, is as extenfive as nature itfelf. But, in its more appropriated fenfe, it is well known that its province only extends to the furface of the earth, the works on it, and the inhabitants of it. It treats of thofe fubftances of which, as far as our refearches have led us, the earth is compofed, and of thofe organized bodies, whether vegetable or animal, which adorn its furface, which rife into the air, or live in the bofom of the waters.—But as a fcience fo various and comprehenfive could neither with propriety nor advantage be completely difcuffed under the general title, we have to refer the reader to the article KINGDOMS *(in Natural Hiftory)*, where he will be directed to the different articles which conftitute either the branches or the objects of the fcience, and which are all treated under their refpective names. In the prefent article it is propofed to give a general and philofophical view of the fubject: To fet forth, in a fummary way, whatever curious, worthy to be known, or not obvious to every obferver, occurs in the three kingdoms of nature: with their conftitution, laws, and œconomy; or, in other words, that all-wife difpofition of the Creator in relation to natural things, by which they are fitted to produce general ends and reciprocal ufes.

SECT. I. *Of the Terraqueous Globe in general, and its changes.*

THE world, or the terraqueous globe, which we inhabit, is every-where furrounded with elements, and contains in its fuperficies the three KINGDOMS *of Nature*, as they are called: the foffil, which conftitutes the cruft of the earth; the vegetable, which adorns the face of it, and draws the greateft part of its nourifhment from the foffil kingdom; and the animal, which is fuftained by the vegetable kingdom. Thus, then, thefe three grand divifions, or, as they are commonly called, kingdoms; cover, adorn, and vary, the furface of the earth.

As to the STRATA of the EARTH and MOUNTAINS, as far as we have hitherto been able to difcover, the upper parts confift of rag-ftone; the next of flate; the third of marble filled with petrifactions; the fourth again, of flate; and laftly, the loweft of free ftone.—

 The

Of the Terraqueous Globe.

The habitable part of the earth, though it is ſcooped into various inequalities, yet is every-where high in compariſon with the water; and the farther it is from the ſea it is generally higher. Thus the waters in the lower places are not at reſt, unleſs ſome obſtacle confines them, and by that means form lakes and marſhes.

The SEA ſurrounds the continent, and takes up the greateſt part of the earth's ſurface, as geographers inform us. Nay, that it once ſpread over much the greateſt part, we may be convinced by its yearly decreaſe, by the rubbiſh left by the tides, by ſhells, ſtrata, and other circumſtances.

The ſea-ſhores are uſually full of dead teſtaceous animals, wreck, and ſuch like bodies, which are yearly thrown out of the ſea. They are alſo covered with ſand of various kinds, ſtones, &c. It happens, moreover, that while the more rapid rivers ruſh through narrow valleys, they wear away the ſides; and thus the friable and ſoft earth falls in, and its ruins are carried to diſtant and winding ſhores; whence it is certain, that the continent gains no ſmall increaſe, as the ſea ſubſides.

The CLOUDS collected from exhalations, chiefly from the ſea, but likewiſe from other waters, and moiſt grounds, and condenſed in the lower regions of the ATMOSPHERE, ſupply the earth with RAIN; but ſince they are attracted by the mountainous parts of the earth, it neceſſarily follows, that thoſe parts muſt have, as is fit, a larger ſhare of water than the reſt. SPRINGS, which generally ruſh out at the foot of mountains, take their riſe from this very rain-water, and vapours condenſed, that trickle through the holes and interſtices of looſe bodies, and are received into caverns.

Theſe afford a pure WATER purged by ſtraining; and rarely dry up in ſummer, or freeze in winter, ſo that animals never want a wholeſome and refreſhing liquor.

The chief ſources of RIVERS are fountains and rills growing by gradual ſupplies into ſtill larger and larger ſtreams; till at laſt, after the conflux of a vaſt number of them, they find no ſtop, but falling into the ſea with much rapidity, they there depoſit the united ſtores they have gathered, along with foreign matter, and ſuch earthy ſubſtances as they tore off in their way. Thus the water returns in a circle whence it firſt drew its origin, that it may act over the ſame ſcene in continued ſucceſſion.

Marſhes ariſing from water retained in low grounds, are filled with moſſy tumps, which are brought down by the water from the higher parts, or are produced by putrified plants.

We often ſee new meadows ariſe from marſhes dried up. This happens ſooner when the *ſphagnum* (a kind of moſs) has laid a foundation; for this in proceſs of time changes into a very porous mould, till almoſt the whole marſh is filled with it. After that the ruſh ſtrikes root, and along with the cotton-graſſes conſtitutes a turf, raiſed in ſuch a manner that the roots get continually higher, and thus lay a more firm foundation for other plants, till the whole marſh is changed into a fine and delightful meadow; eſpecially if the water happens to work itſelf a new paſſage.

Hillocks, that abound in low grounds, occaſion the earth to increaſe yearly, more than the countryman would wiſh, and ſeem to do hurt: but in this the great induſtry of nature deſerves to be taken notice of. For by this means the barren ſpots become ſooner rich meadow and paſture-land. Theſe hillocks are formed by the ant, by ſtones and roots, and the trampling of cattle: but the principal cauſe is the force of the winter-cold, which in the ſpring raiſes the roots of plants ſo high above the ground, that being expoſed to the air, they grow, and periſh; after which the golden maidenhairs fill the vacant places.

Mountains, hills, valleys, and all the inequalities of the earth, though ſome think they take away much from its beauty, are ſo far from producing ſuch an effect, that on the contrary they give a more pleaſing aſpect, and confer great advantages. For thus the terreſtrial ſuperficies is larger; different kinds of plants thrive better, and are more eaſily watered; and the rain-waters run in continual ſtreams into the ſea; not to mention many other uſes in relation to winds, heat, and cold. Alps are the higheſt mountains, that reach to the ſecond region of the air, where trees cannot grow erect. The higher theſe Alps are, the colder they are *cæteris paribus*. Hence the Alps in Sweden, Siberia, Swiſſerland, Peru, Braſil, Armenia, Aſia, Africa, are perpetually covered with ſnow, which becomes almoſt as hard as ice. But if by chance the ſummer heats be greater than ordinary, ſome part of theſe ſtores melts, and runs through rivers into the lower regions, which by this means are much refreſhed.

It is ſcarcely to be doubted, but that the rocks and ſtones diſperſed over the globe were formed originally in, and from, the earth; but when torrents of rain have ſoftened, as they eaſily do, the ſoluble earth, and carried it down into the lower parts, we imagine it happens, that theſe ſolid and heavy bodies, being laid bare, ſtick out above the ſurface. We might alſo take notice of the wonderful effect of the tide, ſuch as we ſee happen from time to time on the ſea-ſhore, which being daily and nightly aſſaulted with repeated blows, at length gives way, and breaks off. Hence we ſee in moſt places the rubbiſh of the ſea, and ſhores.

The winter by its froſt prepares the earth and mould, which thence are broken into very minute particles, and thus, being put into a mouldering ſtate, become more fit for the nouriſhment of plants; nay, by its ſnow it covers the ſeeds and roots of plants, and thus by *cold* defends them from the *force of cold*. We muſt add alſo, that the piercing froſt of the winter purifies the atmoſphere and putrid waters, and makes them more wholeſome for animals.

The perpetual ſucceſſion of heat and cold with us renders the ſummers more pleaſing: and tho' the winter deprives us of many plants and animals, yet the perpetual ſummer within the tropics is not much more agreeable, as it often deſtroys men and other animals by its immoderate heat; though it muſt be confeſſed, that thoſe regions abound with exquiſite fruits. Our winters though very troubleſome to a great part of the globe on account of their vehement and intenſe cold, yet are leſs hurtful to the inhabitants of the northern parts, as experience teſtifies. Hence it happens, Of the Seasons.

pens, that we may live very conveniently on every part of the earth, as every different country has different advantages from nature.

The seasons, like every thing else, have their vicissitudes; their beginnings, their progress, and their end.

The age of man begins from the cradle; pleasing childhood succeeds; then active youth; afterwards manhood, firm, severe, and intent upon self-preservation; lastly, old age creeps on, debilitates, and at length totally destroys our tottering bodies.

The seasons of the year proceed in the same way. Spring, the jovial, playful infancy of all living creatures, represents childhood and youth; for then plants spread forth their luxuriant flowers, fishes exult, birds sing, every part of nature is intent upon generation. The summer, like middle age, exhibits plants, and trees every where cloathed with green; it gives vigour to animals, and plumps them up; fruits then ripen, meadows look cheerful, every thing is full of life. On the contrary, autumn is gloomy; for then the leaves of trees begin to fall, plants to wither, insects to grow torpid, and many animals to retire to their winter-quarters.

The day proceeds with just such steps as the year. The morning makes every thing alert, and fit for business: the sun pours forth his ruddy rays; the flowers, which had as it were slept all night, awake and expand themselves again; the birds with their sonorous voices and various notes make the woods ring, meet together in flocks, and sacrifice to Venus. Noon tempts animals into the fields and pastures; the heat puts them upon indulging their ease, and even necessity obliges them to it. Evening follows, and makes every thing more sluggish; flowers shut up *, and animals retire to their lurking places. Thus the spring, the morning, and youth, are proper for generation; the summer, noon, and manhood, are proper for preservation; and autumn, evening, and old age, are not unfitly likened to destruction.

* See Vigils *of Plants.*

In order to perpetuate the established course of nature in a continued series, the Divine Wisdom has thought fit that all living creatures should constantly be employed in *producing* individuals; that all natural things should contribute and lend a helping hand towards *preserving* every species; and lastly, that the *death* and *destruction* of one thing should always be subservient to the production of another. Hence the objects of our present inquiry fall to be considered in a threefold view, that of *propagation*, *preservation*, and *death* or *destruction*.

Sect. II. *The Fossil Kingdom.*

I. Propagation.

It is agreed on all hands, that stones are not organical bodies, like plants and animals; and therefore it is as clear that they are not produced from an egg, like the tribes of the other kingdoms. Hence the variety of fossils is proportionate to the different combinations of coalescent particles; and hence the species in the fossil kingdom are not so distinct as in the other two. Hence also the laws of generation in relation to fossils have been in all ages extremely difficult to explain; and lastly, hence have arisen so many different opinions about them, that it would be endless to enumerate them all. We therefore, for the present, shall content ourselves with giving a very few observations on this subject.

Fossil Kingdom.

Some people suppose that clay is the sediment of the sea; and observation so far seems to go along with this opinion, for great plenty of it is generally found along the coasts. Seamen who have been so accurate as to keep journals, have observed, that a very minute sand covers the bottom of the ocean; and seem to think that it is daily crystallized from the water. It is now generally acknowledged, that testaceous bodies and petrifactions resembling animals were once real animals or vegetables. It has been supposed indeed, that shells, being of a calcareous nature, changed the adjacent clay, sand, or mould, into the same kind of substance. Hence it appears certain, that marbles may be generated from petrifactions; and therefore it is often full of them. Rag-stone, the common matter of our rocks, appears to be formed from a sandy kind of clay; most frequently, however, this appears to happen where the earth is impregnated with iron. Free-stone seems to be the product of sand; and the deeper the bed where it is found, the more compact it becomes; and the more dense the sand, the more easily it concretes. But if an alkaline clay chances to be mixed with the sand, the freestone is generated more readily, as in that called *cos friatilis particulis argillo-glarensis*. The flint is almost the only kind of stone, certainly the most common, in chalky mountains.—It would appear therefore from this to be produced from chalk: but whether it can be reduced to chalk again, is left for others to enquire.

Stalactites, or drop-stone, is composed f calcareous particles, adhering to a dry, and generally a vegetable body, and is deposited by dropping water; from which circumstance it seems to have derived its vulgar name.

Incrustations (Syst. Nat. 32. 5. 6. 7. 8.) are, in general, it appears, generated where a vitriolic water connects clayey and earthy particles together.

Slate, by the vegetables that are often inclosed in it, seems to take its origin from a marshy mould.

Metals vary according to the nature of the matrix in which they adhere; *e. g.* the pyrites cupri Fahlumenus contains frequently sulphur, arsenic, iron, copper, a little gold, vitriol, alum, sometimes lead-ore, silver, and zinc. Thus gold, copper, iron, zinc, arsenic, pyrites, vitriol, come out of the same vein. That very rich iron-ore at Normark in Vermilandia, where it was cut transversely by a vein of clay, was changed into pure silver. The number therefore of species and varieties of fossils, each serving for different purposes according to their different natures, will be in proportion as the different kinds of earths and stones are variously combined.

II. Preservation.

As fossils are destitute of life and organization, are hard, and not obnoxious to putrefaction; so they last longer than any other kind of bodies. How far the air contributes to this duration, it is easy to perceive; since air hardens many stones upon the sur-

Fossil Kingdom.

face of the earth, and makes them more solid, compact, and able to resist the injuries of time. Thus it is known from vulgar observation, that lime that has been long exposed to the air becomes hardened. The chalky marl which they use in Flanders and about Bath for building houses, as long as it continues in the quarry is friable; but when dug up and exposed to the air it grows gradually harder.

However ignorant we may be of the cause why large rocks are every-where to be seen split, whence vast fragments are frequently torn off; yet we may observe, that fissures are closed up by water, which gets between them, and is detained there; forming crystal and spar. Hence we scarcely ever find any crystal, but in those stones which have retained for some time in its chinks, water loaded with stony particles. In the same manner crystal fills the cavities in mines, and concrete into quartz or a debased crystal.

It is manifest that stones are not only generated, augmented, and changed perpetually, from incrustations brought upon moss, but are also increased by crystal and spar. Not to mention that the adjacent earth, especially if it be impregnated with iron particles, is commonly changed into a solid stone.

It is said, that the marble quarries in Italy, from whence fragments are cut, grow up again. Ores grow by little and little, whenever the mineral particles, conveyed by the means of water through the clefts of mountains, are retained there; so that, adhering to the homogeneous matter a long while, at last they take its nature, and are changed into a similar substance.

III. Destruction.

Fossils, although they are the hardest of bodies, yet are found subject to the laws of destruction, as well as all other created substances. For they are dissolved in various ways by the elements exerting their force upon them; as by water, air, and the solar rays; as also by the rapidity of rivers, violence of cataracts, and eddies, which continually beat upon, and at last reduce to powder the hardest rocks. The agitations of the sea, and lakes, and the vehemence of the waves, excited by turbulent winds, pulverise stones, as evidently appears by their roundness along the shore. Nay, as the poet says,

> The hardest stone insensibly gives way
> To the soft drops that frequent on it play.

So that we ought not to wonder that these very hard bodies moulder away into powder, and are obnoxious like others to the consuming tooth of time.

Sand is formed of free-stone, which is destroyed partly by frost, making it friable; partly by the agitation of water and waves, which easily wear away, dissolve, and reduce into minute particles what the frost had made friable.

Chalk is in general supposed to be formed of rough marble, which the air, the sun, and the winds have dissolved. The slate earth, or humus schisti, (Syst. Nat. 512.) owes its origin to slate, showers, air, and snow melted.

Ochre is formed of metals dissolved, and presents the very same colours which we always find the ore tinged with when exposed to the air. Vitriol in the same manner mixes with water from ore destroyed.

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The muria saxatilis (Syst. Nat. 14. 6), a kind of talky stone, yielding salt in the parts that are turned to the sun, is dissolved into sand, which falls by little and little upon the earth till the whole is consumed; not to mention other kinds of fossils. Lastly, from these there arise new fossils, as we mentioned before; so that the destruction of one thing serves for the generation of another.

Testaceous worms ought not to be passed over on this occasion, for they eat away the hardest rocks. That species of shell-fish called the *razor-shell* bores through stones in Italy, and hides itself within them; so that the people who eat them are obliged to break the stones before they can come at them. The cochlea, (*Faun. Suec.* 1299.) a kind of snail that lives on craggy rocks, eats and bores through the chalky hills, as worms do through wood. This is made evident by the observations of the celebrated de Geer.

It ought to be observed here, that there are often found dead insects in the hearts of the hardest rocks, without any visible trace of the manner of their getting there; from whence many have supposed that stones were originally fluid. Concerning such matters, about which we have but little data, there will always be a great diversity of opinions. It is not our business, at least in this place, to give an opinion on a doubtful subject: the fact is so; of the cause let others judge.

Sect. III. *The Vegetable Kingdom.*

1. Propagation.

Anatomy abundantly proves, that all plants are organic and living bodies; and that all organic bodies are propagated from an egg has been sufficiently demonstrated by the industry of modern writers. We therefore the rather, according to the opinion of the skilful, reject the equivocal generation of plants; and the more so, as it is certain that every living thing is produced from an egg. Now the seeds of vegetables are called *eggs*; these are different in every different plant, that the means being the same, each may multiply its species, and produce an offspring like its parent. We do not deny, that very many plants push forth from their roots fresh offsets for two or more years. Nay, not a few plants may be propagated by branches, buds, suckers, and leaves, fixed in the ground, as likewise many trees. Hence their stems being divided into branches, may be looked on as roots above ground; for in the same way the roots creep under ground, and divide into branches. And there is the more reason for thinking so, because we know that a tree will grow in an inverted situation, *viz.* the roots being placed upwards, and the head downwards, and buried in the ground; for then the branches will become roots, and the roots will produce leaves and flowers. The lime-tree will serve for an example, on which gardeners have chiefly made an experiment. Yet this by no means overturns the doctrine, that all vegetables are propagated by seeds; since it is clear, that in each of the foregoing instances nothing vegetates but what

was

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was the part of a plant, formerly produced from seed; so that, accurately speaking, without seed no new plant is produced

Thus again plants produce seeds; but they are entirely unfit for propagation, unless fecundation precedes, which is performed by an intercourse between different sexes, as experience testifies. Plants therefore must be provided with organs of generation; in which respect they are analogous to animals.—Since in every plant the flower always precedes the fruit, and the fecundated seeds visibly arise from the fruit; it is evident that the organs of generation are contained in the flower, which organs are called *antheræ* and *stigmata*, and that the impregnation is accomplished within the flower. This impregnation is performed by means of the dust of the antheræ falling upon the moist stigmata, where the dust adheres, is burst, and sends forth a very subtle matter, which is absorbed by the style, and is conveyed down to the rudiments of the seed, and thus renders it fertile. When this operation is over, the organs of generation wither and fall, nay a change in the whole flower ensues. We must, however, observe, that in the vegetable kingdom one and the same flower does not always contain the organs of generation of both sexes, but oftentimes the male organs are on one plant and the female on another. But that the business of impregnation may go on successfully, and that no plant may be deprived of the necessary dust, the whole most elegant apparatus of the antheræ and stigmata in every flower is contrived with wonderful wisdom.

For in most flowers the stamina surround the pistils, and are of about the same height: but there are many plants in which the pistil is longer than the stamina; and in these it is wonderful to observe, that the Creator has made the flowers recline, in order that the dust may the more easily fall into the stigma, *e g.* in the campanula, cowslip, &c. This curious phenomenon did not escape the poetical eye of Milton, who describes it in the following enlivened imagery:

With cowslips wan, that hang the pensive head.

But when the fecundation is completed, the flowers rise again, that the ripe seeds may not fall out before they are dispersed by the winds. In other flowers, on the contrary, the pistil is shorter, and there the flowers preserve an erect situation; nay, when the flowering comes on, they become erect, though before they were drooping, or immersed under water. Lastly, whenever the male flowers are placed below the female ones, the leaves are exceedingly small and narrow, that they may not hinder the dust from flying upwards like smoke; as we see in the pine, fir, yew, sea-grape, juniper, cypress, &c. And when in one and the same species one plant is male and the other female, and consequently may be far from one another, there the dust, without which there is no impregnation, is carried in abundance by the help of the wind from the male to the female; as in the whole diœcious class. Again, a more difficult impregnation is compensated by the longevity of the individuals, and the continuation of life by buds, suckers, and roots; so that we may observe every thing most wisely disposed in this affair. Moreover, we cannot without admiration observe, that most flowers expand themselves when the sun shines forth; whereas when clouds, rain, or the evening comes on, they close up, lest the genital dust should be coagulated or rendered useless, so that it cannot be conveyed to the stigmata. But what is still more remarkable and wonderful, when the fecundation is over, the flowers, neither in rain nor on the approach of night close themselves up. Hence when rain falls in the flowering time, the husbandman and gardener foretel a scarcity of fruits. To mention only one particular more: The organs of generation, which in the animal kingdom are by nature generally removed from sight, in the vegetable are exposed to the eyes of all; and that when their nuptials are celebrated, it is wonderful what delight they afford to the spectator by their most beautiful colours and delicious odours. At this time bees, flies, and other insects, suck honey out of their nectaries, not to mention the humming bird; and that from their effete dust the bees gather wax. All the experiments that have hitherto been made seem to confirm the hypothesis above unfolded; although it has lately been controverted by the author of the *Philosophy of Natural History*.

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Vid. a treatise published in *Amæn. Acad.* vol. i. intitled *Sponsalia Plantarum.*

As to the dissemination of seeds after they come to maturity, it being absolutely necessary, since without it no crop could follow, the Author of nature has wisely provided for this affair in numberless ways. The stalks and stems favour this purpose; for these raise the fruit above the ground, that the winds, shaking them to and fro, may disperse far off the ripe seeds. Most of the pericarpies are shut at top, that the seeds may not fall before they are shaken out by stormy winds. Wings are given to many seeds, by the help of which they fly far from the mother-plant, and oftentimes spread over a whole country. These wings consist either of a down, as in most of the composite-flowered plants; or of a membrane, as in the birch, alder, ash, &c. Hence woods, which happen to be consumed by fire or any other accident, will soon be restored again by new plants disseminated by this means. Many kinds of fruits are endued with a remarkable elasticity, by the force of which the ripe pericarpies throw the seeds to a great distance; as the wood-sorrel, the spurge, the phyllanthus, the dittany. Other seeds or pericarpies are rough, or provided with hooks; so that they are apt to stick to animals that pass by them, and by this means are carried to their holes, where they are both sown and manured by nature's wonderful care: and therefore the plants of these seeds grow where others will not; as hounds-tongue, agrimony, &c.

Berries and other pericarpies are by nature allotted for aliment to animals; but with this condition, that while they eat the pulp they shall sow the seeds: for when they feed upon it, they either disperse them at the same time; or, if they swallow them, they are returned with interest, for they always come out unhurt. It is not therefore surprising, that, if a field be manured with recent mud or dung not quite rotten, various other plants, injurious to the farmer, should come up along with the grain that is sowed. Many have believed that barley or rye has been changed into oats, although all such kinds of metamorphoses are repugnant to the laws of generation; not considering, that there is another cause of this phenomenon, *viz.* that the ground perhaps has been manured with horse-dung, in which the seeds of oats, coming entire from the

horse,

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horse, lie hid and produce that grain. The misletoe always grows upon other trees, because the thrush that eats the seeds of it, casts them forth with its dung; and as bird-catchers make their bird-lime of this same plant, and daub the branches of trees with it, in order to catch the thrush, the proverb hence took its rise:

> The thrush, when he befouls the bough,
> Sows for himself the seeds of wo.

It is not to be doubted, but that the greatest part of the junipers also, that fill our woods, are sown by thrushes, and other birds, in the same manner; as the berries, being heavy, cannot be dispersed far by the winds. The cross-bill that lives on the fir-cones, and the hawfinch that feeds on the pine-cones, at the same time sow many of their seeds; especially when they carry the cone to a stone, or trunk of a tree, that they may more easily strip it of its scales. Swine likewise, by turning up the earth, and moles by throwing up hillocks, prepare the ground for seeds in the same manner as the ploughman does.

We pass over many other things which might be mentioned concerning the sea, lakes, and rivers, by the help of which oftentimes seeds are conveyed unhurt to distant countries. A variety of other ways in which nature provides for the dissemination of plants, has been pointed out by Linnæus in an *Oration concerning the augmentation of the habitable earth*. As there is something very ingenious and quite new in the treatise here referred to, we shall, for the sake of those who cannot read the original, add a short abstract of it. His design is to show, that there was only one pair of all living things, created at the beginning. According to the account of Moses, says the author, we are sure that this was the case in the human species; and by the same account we are informed that this first pair was placed in Eden, and that Adam gave names to all the animals. In order therefore that Adam might be enabled to do this, it was necessary that all the species of animals should be in paradise; which could not happen unless also all the species of vegetables had been there likewise. This he proves from the nature of their food; particularly in relation to insects, most of which live upon one plant only. Now had the world been formed in its present state, it could not have happened that all the species of animals should have been there. They must have been dispersed over all the globe, as we find they are at present; which he thinks improbable for other reasons which we shall pass over for sake of brevity. To solve all the phenomena, then, he lays down as a principle, That at the beginning all the earth was covered with the sea, unless one island large enough to contain all animals and vegetables. This principle he endeavours to establish by several phenomena, which makes it probable that the earth has been and is still gaining upon the sea, and does not forget to mention fossil shells and plants every where found, which he says cannot be accounted for by the deluge. He then undertakes to show how all vegetables and animals might in this island have a soil and climate proper for each, only by supposing it to be placed under the equator, and crowned with a very high mountain. For it is well known that the same plants are found on the Swiss, the Pyrenean, the Scots Alps, on Olympus, Lebanon, Ida, as on the Lapland and Greenland Alps. And Tournefort found at the bottom of mount Ararat the common plants of Armenia, a little way up those of Italy, higher those which grow about Paris, afterwards the Swedish plants, and lastly on the top the Lapland Alpine plants; and I myself, adds the author, from the plants growing on the Dalecarlian Alps could collect how much lower they were than the Alps of Lapland. He then proceeds to show how from one plant of each species the immense number of individuals now existing might arise. He gives some instances of the surprising fertility of certain plants; *v. g.* the elecampane, one plant of which produced 3000 seeds; of spelt, 2000; of the sun-flower, 4000; of the poppy, 3200; of tobacco, 40,320. But supposing any annual plant producing yearly only two seeds, even of this, after 20 years, there would be 1,048,576 individuals. For they would increase yearly in a duple proportion, *viz.* 2, 4, 8, 16, 32, &c. He then gives some instances of plants brought from America, that are now become common over many parts of Europe. Lastly, he enters upon a detail of the several methods which nature has taken to propagate vegetables, which is extremely curious, but too long to insert in this place.

II. Preservation.

1. The great Author and Parent of all things decreed, that the whole earth should be covered with plants, and that no place should be void, none barren. But since all countries have not the same changes of seasons, and every soil is not equally fit for every plant; he therefore, that no place should be without some, gave to every one of them such a nature, as might be chiefly adapted to the climate: so that some of them can bear an intense cold, others an equal degree of heat; some delight in dry ground, others in moist, &c. Hence the same plants grow only where there are the same seasons of the year, and the same soil.

The Alpine plants live only in high and cold situations; and therefore often on the Alps of Armenia, Switzerland, the Pyreneans, &c. whose tops are equally covered with eternal snows as those of the Lapland Alps, plants of the same kind are found, and it would be in vain to seek for them any where else. It is remarkable, in relation to the Alpine plants, that they blow, and ripen their seeds very early, lest the winter, should steal upon them on a sudden, and destroy them.

Our northern plants, although they are extremely rare everywhere else, yet are found in Siberia, and about Hudson's Bay; as the arbutus, bramble, wintergreen, &c.

Plants impatient of cold live within the torrid zones; hence both the Indies, though at such a distance from one another, have plants in common. The Cape of Good Hope, we know not from what cause, produces plants peculiar to itself; as all the mesembryanthema, and almost all the species of aloes. Grasses, the most common of all plants, can bear almost any temperature of air: in which the good providence of the Creator particularly appears; for all over the globe, they above all plants are necessary for the nourishment of cattle; and the same thing is seen in relation to our most common grains.

Thus neither the scorching sun, nor the pinching cold, hinders any country from having its vegetables. Nor

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Nor is there any soil which does not bring forth many kinds of plants. The pond-weeds, the water-lily, lobelia, inhabit the waters. The fluviales, fuci, conservæ, cover the bottoms of rivers, and sea. The sphagna * fill the marshes. The brya † clothe the plains. The driest woods, and places scarce ever illuminated by the rays of the sun, are adorned with the hypna. Nay, stones and the trunks of trees are not excepted, for these are covered with various kinds of liverwort.

* A kind of moss.
† Another kind of moss.

The desart and most sandy places have their peculiar trees and plants; and as rivers or brooks are very seldom found there, we cannot without wonder observe that many of them distil water, and by that means afford the greatest comfort both to man and beast that travel there. Thus the tillandsia ‡, which is a parasitical plant, and grows on the tops of trees in the desarts of America, has its leaves turned at the base into the shape of a pitcher, with the extremity expanded; in these the rain is collected, and preserved for thirsty men, birds, and beasts.

‡ A kind of misletoe.

The water-tree in Ceylon produces cylindrical bladders, covered with a lid; into these is secreted a most pure and refreshing water, having the taste of nectar. There is a kind of cuckow-pint in New France, that if you break a branch of it will afford you a pint of excellent water. How wise, how beautiful, is the agreement between the plants of every country, and its inhabitants, and other circumstances!

2. Plants oftentimes by their very structure contribute remarkably both to their own preservation and that of others. But the wisdom of the Creator appears no where more than in the manner of the growth of trees. For as their roots descend deeper than those of other plants, provision is thereby made, that they shall not rob them too much of nourishment; and what is still more, a stem not above a span in diameter often shoots up its branches very high; these bear perhaps many thousand buds, each of which is a plant, with its leaves, flowers, and stipulæ. Now if all these grew upon the plain, they would take up a thousand times as much space as the tree does; and in this case there would scarcely be room in all the earth for so many plants as at present the trees alone afford. Besides, plants that shoot up in this way are more easily preserved from cattle by a natural defence; and farther, their leaves falling in autumn cover the plants growing about against the rigour of the winter; and in the summer they afford a pleasing shade, not only to animals, but to plants, against the intense heat of the sun. We may add, that trees, like all other vegetables, imbibe the water from the earth; which water does not circulate again to the root, as the ancients imagined, but being dispersed, like small rain, by the transpiration of the leaves, moistens the plants that grow around. Again, many trees bear fleshy fruits of the berry or apple kind, which, being secure from the attack of cattle, grow ripe for the use of man and other animals, while their seeds are dispersed up and down after digestion. Lastly, the particular structure of trees contributes very much to the propagation of insects; for these chiefly lay their eggs upon the leaves, where they are secure from the reach of cattle.

Ever-green trees and shrubs in the northern parts are chiefly found in the most barren woods, that they may be a shelter to animals in the winter. They lose their leaves only every third year, as their seeds are sufficiently guarded by the mosses, and do not want any other covering. The palms in the hot countries perpetually keep their leaves, for there the seeds stand in no need of any shelter whatever.

Many plants and shrubs are armed with thorns, *e. g.* the buckthorn, sloe, carduus, cotton-thistle, &c. that they may keep off the animals which otherwise would destroy their fruit. These at the same time cover many other plants, especially of the annual kind, under their branches. Nay, it has frequently been observed upon commons where furze grows, that wherever there was a bush left untouched for years by the commoners, some tree has sprung up, being secured by the prickles of that shrub from the bite of cattle. So that while the adjacent grounds are robbed of all plants by the voracity of animals, some may be preserved to ripen flowers and fruit, and stock the parts about with seeds, which otherwise would be quite extirpated.

All herbs cover the ground with their leaves, and by their shade hinder it from being totally deprived of that moisture which is necessary to their nourishment. They are moreover an ornament to the earth, especially as leaves have a more agreeable verdure on the upper than the under side.

The mosses which adorn the most barren places, at the same time, preserve the lesser plants when they begin to shoot, from cold and drought; as we find by experience in our gardens, that plants are preserved in the same way. They also hinder the fermenting earth from forcing the roots of plants upwards in the spring; as we see happen annually to trunks of trees, and other things put into the ground. Hence very few mosses grow in the warmer climates, as not being so necessary to that end in those places.

The English sea mat-weed, or marram, will bear no soil but pure sand, which nature has allotted to it. Sand, the produce of the sea, is blown by winds oftentimes to very remote parts, and deluges, as it were, woods and fields. But where this grass grows, it frequently fixes the sand, gathers it into hillocks, and thrives so much, that by means of this alone at last an entire hill of sand is raised. Thus the sand is kept in bounds, other plants are preserved free from it, the ground is increased, and the sea is repelled by this wonderful disposition of nature. This seems to be the same plant which is called in Scotland *bent*, and is particularly useful for the purpose above mentioned, and only grows among sand along the sea-coast.

How solicitous nature is about the preservation of grasses is abundantly evident from hence, that the more the leaves of the perennial grasses are eat, the more they creep by the roots, and send forth offsets. For the Author of nature intended that vegetables of this kind, which have very slender and erect leaves, should be copious, and very thick set, covering the ground like a carpet; and thus afford food sufficient for so vast a quantity of grazing animals. But what chiefly increases our wonder is, that although the grasses are the principal food of such animals, yet they are forbid as it were to touch the flower and seed-bearing stems, that so the seeds may ripen and be sown.

The caterpillar or grub of the moth, although it feeds upon grasses, to the great destruction of them in

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in meadows, yet it seems to be formed in order to keep a due proportion between these and other plants; for grasses, when left to grow freely, increase to that degree, that they exclude all other plants; which would consequently be extirpated, unless this insect sometimes prepared a place for them. Hence always more species of plants appear in those places where this caterpillar has laid waste the pastures the preceding year than at any other time.

III. Destruction.

Daily experience teaches us, that all plants, as well as all other created things, must submit to death.

They spring up, they grow, they flourish, they ripen their fruit, they wither, and at last, having finished their course, they die, and return to the dust again, from whence they first took their rise. Thus all black mould, which every where covers the earth, for the greatest part is owing to dead vegetables. For all roots descend into the sand by their branches, and after a plant has lost its stem the root remains; but this too rots at last, and changes into mould. By this means this kind of earth is mixed with sand, by the contrivance of nature, nearly in the same way as dung thrown upon fields is wrought into the earth by the industry of the husbandman. The earth thus prepared offers again to plants from its bosom what it has received from them. For when seeds are committed to the earth, they draw to themselves, accommodate to their nature, and turn into plants, the more subtile parts of this mould by the co-operation of the sun, air, and rains; so that the tallest tree is, properly speaking, nothing but mould wonderfully compounded with air and water, and modified by a virtue communicated to a small seed by the Creator. From these plants, when they die, just the same kind of mould is formed as gave birth to them originally; whence fertility remains continually uninterrupted. Whereas the earth could not make good its annual consumption, unless it were constantly recruited by new supplies.

The crustaceous liverworts are the first foundation of vegetation; and therefore are plants of the utmost consequence in the œconomy of nature, though so despised by us. When rocks first emerge out of the sea, they are so polished by the force of the waves, that scarce any herb can find a fixed habitation upon them; as we may observe every where near the sea. But the very minute crustaceous liverworts begin soon to cover these dry rocks, although they have no other nourishment but that small quantity of mould and imperceptible particles which the rain and air bring thither. These liverworts dying at last turn into a very fine earth; on this earth the imbricated liverworts find a bed to strike their roots in. These also die after a time, and turn to mould; and then the various kinds of mosses, *e. g.* the hypna, the brya, polytricha, find a proper place and nourishment. Lastly, these dying in their turn, and rotting, afford such plenty of new-formed mould, that herbs and shrubs easily root and live upon it.

That trees, when they are dry or are cut down, may not remain useless to the world, and lie as it were melancholy spectacles, nature hastens on their destruction in a singular way: first, the liverworts begin to strike root in them; afterwards the moisture is drawn out of them; whence putrefaction follows. Then the mushroom kinds find a fit place for nourishment on them, and corrupt them still more. The beetle called *dermestes* next makes himself a way between the bark and the wood. The musk-beetle, the copper talc-beetle, and the caterpillar or cossus 812 (*S. N.*) bores an infinite number of holes through the trunk. Lastly, the woodpeckers come, and, while they are seeking for insects, wear away the tree already corrupted; till the whole passes into earth. Such industry does nature use to destroy the trunk of a tree! Nay, trees immersed in water would scarcely ever be destroyed, were it not for the worm that eats ships, which performs this work; as the sailor knows by sad experience.

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Thistles, as the most useful of plants, are armed and guarded by nature herself. Suppose there were a heap of clay, on which for many years no plant has sprung up; let the seeds of the thistle blow there, and grow, the thistles by their leaves attract the moisture out of the air, send it into the clay by means of their roots, will thrive themselves, and afford a shade. Let now other plants come hither, and they will soon cover the ground.

All succulent plants make ground fine, of a good quality, and in great plenty; as sedum, crassula, aloe, algæ. But dry plants make it more barren, as heath, pines, moss; and therefore nature has placed the succulent plants on rocks and the driest hills.

Sect. IV. *The Animal Kingdom.*

I. Propagation.

1. The generation of animals holds the first place among all things that raise our admiration when we consider the works of the Creator; and chiefly that appointment by which he has regulated the conception of the fœtus, and its exclusion, that it should be adapted to the disposition and way of living of each animal, is most worthy of our attention.

We find no species of animals exempt from the stings of love, which is put into them to the end that the Creator's mandate may be executed, *Increase and multiply:* and that thus the egg, in which is contained the rudiment of the fœtus, may be fecundated; for without fecundation all eggs are unfit to produce an offspring.

Foxes and wolves, struck with these stings, every where howl in the woods; crowds of dogs follow the female; bulls show a terrible countenance, and very different from that of oxen. Stags every year have new horns, which they lose after rutting time. Birds look more beautiful than ordinary, and warble all day long through lasciviousness. Thus small birds labour to outsing one another, and cocks to outcrow. Peacocks spread forth again their gay and glorious trains. Fishes gather together, and exult in the water; and grasshoppers chirp, and pipe, as it were, amongst the herbs. The ants gather again into colonies, and repair to their citadels. We pass over many other particulars which this subject affords, to avoid prolixity.

2. The fecundated egg requires a certain and proportionate degree of heat for the expansion of the stamina

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stamina of the embryo. That this may be obtained, nature operates in different manners; and therefore we find in different classes of animals a different way of excluding the fœtus.

The females of quadrupeds have an uterus, contrived for easy gestation, temperate and cherishing warmth, and proper nourishment of the fœtus, as most of them live upon the earth, and are there fed.

Birds, in order to get subsistence, and for other reasons, are under a necessity of shifting place; and that not upon their feet, but wings. Gestation therefore would be burthensome to them. For this reason they lay eggs, covered with a hard shell. These they sit upon by a natural instinct, and cherish till the young one comes forth.

The ostrich and cassowary are almost the only birds that do not observe this law; these commit their eggs to the sand, where the intense heat of the sun excludes the fœtus.

Fishes inhabit cold waters, and most of them have cold blood; whence it happens that they have not heat sufficient to produce the fœtus. The all-wise Creator therefore has ordained, that most of them should lay their eggs near the shore; where, by means of the solar rays, the water is warmer, and also fitter for that purpose; and also because water-insects abound more there, which afford the young fry nourishment.

Salmon, when they are about to lay their eggs, are led by instinct to go up the stream, where the water is fresh and more pure.

The butterfly-fish is an exception, for that brings forth its fœtus alive.

The fish of the ocean, which cannot reach the shores by reason of the distance, are also exempt from this law. The Author of nature has given to this kind eggs that swim; so that they are hatched amidst the swimming fucus, called *sargazo* *.

* Flor. Zeyl. 389.

The cetaceous fish have warm blood; and therefore they bring forth their young alive, and suckle them with their teats.

Many amphibious animals bring forth live fœtuses, as the viper and the toad, &c. But the species that lay eggs, lay them in places where the heat of the sun supplies the warmth of the parent.

Thus the rest of the frog kind, and the lizard kind, lay their eggs in warm waters; the common snake in dunghills, and such like warm places; and give them up to nature, as a provident nurse, to take care of them. The crocodile and sea-tortoises go ashore to lay their eggs under the sand, where the heat of the sun hatches them.

Most of the insect kind neither bear young nor hatch eggs: yet their tribes are the most numerous of all living creatures; insomuch, that if the bulk of their bodies were proportionate to their quantity, they would scarce leave room for any other kinds of animals. Let us see therefore with what wisdom the Creator has managed about the propagation of these minute creatures. The females by natural instinct meet and copulate with the males; and afterwards lay their eggs: but not indiscriminately in every place. For they all know how to choose such places as may supply their offspring in its tender age with nourishment, and other things necessary to satisfy their natural wants: for the mother, soon after she has laid her eggs, dies; and were she to live, she would not have it in her power to take care of her young.

Butterflies, moths, some beetles, weevils, bugs, cuckow-spit insects, gall-insects, tree-bugs, &c. lay their eggs on the leaves of plants, and every different tribe chooses its own species of plant. Nay, there is scarce any plant which does not afford nourishment to some insect; and still more, there is scarcely any part of a plant which is not preferred by some of them. Thus one insect feeds upon the flower; another upon the trunk; another upon the root; and another upon the leaves. But we cannot help wondering particularly, when we see how the leaves of some trees and plants, after eggs have been let into them, grow into galls; and form dwellings, as it were, for the young ones. Thus when the gall-insect has fixed her eggs in the leaves of an oak, the wound of the leaf swells, and a knob like an apple arises, which includes and nourishes the embryo.

When the tree-bug has deposited its eggs in the boughs of the fir-tree, excrescences arise shaped like pearls. When another species of the tree-bug has deposited its eggs in the mouse-ear chickweed or the speedwell, the leaves contract in a wonderful manner into the shape of a head. The water-spider excludes eggs either on the extremities of the juniper, which from thence forms a lodging, that looks like the arrow-headed grass; or on the leaves of the poplar, from whence a red globe is produced. The tree-louse lays its eggs on the leaves of the black poplar, which turn into a kind of inflated bag; and so in other instances. Nor is it upon plants only that insects live and lay their eggs. The gnats commit theirs to stagnating waters. The water-insect called *monoculus* often increases so immensely on pools, that the red legions of them have the appearance of blood. Others lay their eggs in other places: *e. g.* the beetle, in dunghills; the dermestes, in skins; the flesh fly, in putrified flesh; the cheese-maggot, in the cracks of cheese, from whence the caterpillars issuing forth, oftentimes consume the whole cheese, and deceive many people, who fancy the worms are produced from the particles of the cheese itself, by a generation called *equivocal*, which is extremely absurd. Others exclude their eggs upon certain animals. The mill-beetle lays its eggs between the scales of fishes: the species of gad-fly, on the back of cattle; the species 1025 (*S. N.*) on the back of the rein-deer; the species 1026, in the noses of sheep. The species 1028 lodges during the winter in the intestinal tube, or the throat of horses, nor can it be driven out till the summer comes on. Nay, insects themselves are often surrounded with the eggs of other insects, insomuch that there is scarcely an animal to be found which does not afford food for other animals. Almost all the eggs of insects, when laid, are ordained to undergo, by a wonderful law of nature, various metamorphoses, *e. g.* the egg of the butterfly, being laid in the cabbage, first of all becomes a caterpillar, that feeds on the herb, crawls, and has 16 feet. This afterwards changes into a nymph, that has no feet, is smooth, and eats nothing; and lastly, this bursts into a butterfly that flies, has variety of colours, is hairy, and lives upon honey. What can be more worthy of admiration than that one and the same animal should appear on the stage of life under so many characters,

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as if it were three diſtinct animals. Linnæus (*Amœn. Academ.* tom. ii.) in a treatiſe on the wonders relating to inſects, ſays, "As ſurpriſing as theſe transformations may ſeem, yet much the ſame happens when a chicken is hatched; the only difference is, that this chicken breaks all three coats at once, the butterfly one after another."

The laws of generation of worms are ſtill very obſcure; as we find they are ſometimes produced by eggs, ſometimes by offsets, juſt in the ſame manner as happens to trees. It has been obſerved with the greateſt admiration, that the polypus or hydra (*S. N.* 221) lets down ſhoots and live branches, by which it is multiplied. Nay more, if it be cut into many parts, each ſegment, put into the water, grows into a perfect animal; ſo that the parts which were torn off are reſtored, and form a complete and perfect animal like that from which it was torn.

3. The multiplication of animals is not tied down to the ſame rules in all; for ſome have a remarkable power of propagating, others are confined within narrow limits in this reſpect. Yet in general we find, that nature obſerves this order, that the leaſt animals, and thoſe which are uſeful and ſerve for nouriſhment to the greateſt number of other animals, are endued with a greater power of propagating than others.

Mites, and many other inſects, will multiply to a thouſand within the compaſs of a very few days; while the elephant ſcarcely produces one young in two years.

The hawk-kind generally lay not above two eggs, at moſt four; while the poultry kind produce from 50 to 100.

The diver, or loon, which is eaten by few animals, lays alſo two eggs; but the duck kind, the moor-game, partridges, &c. and ſmall birds, lay a very large number.

If you ſuppoſe two pigeons to hatch nine times a-year, they may produce in four years 14,760 young. They are endued with this remarkable fertility, that they may ſerve for food, not only for man, but for hawks and other birds of prey. Nature has made harmleſs and eſculent animals fruitful. She has forbid the bird kind to fall ſhort of the number of eggs allotted to each ſpecies: and therefore, if the eggs which they intend to ſit upon be taken away a certain number of times, they preſently lay others in their room, as may be ſeen in the ſwallow, duck, and ſmall birds.

II. Preservation.

1. Preſervation follows generation: this appears chiefly in the tender age, while the young are unable to provide for their own ſupport. For then their parents, though otherwiſe ever ſo fierce in their diſpoſition, are affected with a wonderful tenderneſs or ſenſe of love towards their progeny, and ſpare no pains to provide for, guard, and preſerve them; and that not by an imaginary law, but one given by the Lord of nature himſelf.

Quadrupeds give ſuck to their tender young, and ſupport them by a liquor perfectly eaſy of digeſtion, till nature enables them to digeſt what is more ſolid. Nay, their love toward them is ſo great, that they endeavour to repel with the utmoſt force every thing which threatens danger or deſtruction to them. The ewe, which brings forth two lambs at a time, will not admit one to her teats unleſs the other be preſent and ſuck alſo; leſt one ſhould famiſh, while the other grows fat.

Birds build their neſts in the moſt artificial manner, and line them as ſoft as poſſible, for fear the eggs ſhould get any damage. Nor do they build promiſcuouſly in any place, but there only where they may quietly lie concealed and be ſafe from the attacks of their enemies.

The hanging bird makes its neſt of the fibres of withered plants, and the down of the poplar ſeeds, and fixes it upon the bough of ſome tree hanging over the water, that it may be out of reach.

The diver places its ſwimming neſt upon the water itſelf, amongſt the ruſhes. We deſignedly paſs over many inſtances of the like kind.

Again, birds ſit on their eggs with ſo much patience, that many of them chooſe to periſh with hunger, rather than expoſe the eggs to danger by going to ſeek for food.

The male rooks and crows, at the time of incubation, bring food to the females.

Pigeons, ſmall birds, and other birds which pair, ſit by turns; but where polygamy prevails, the males ſcarcely take any care of the young.

Moſt of the duck kind pluck off their feathers in great quantity, and cover their eggs with them, leſt they ſhould be damaged by the cold when they quit their neſts for the ſake of food; and when the young are hatched, who knows not how ſolicitous they are in providing for them till they are able to fly and ſhift for themſelves?

Young pigeons would not be able to make uſe of hard ſeeds for nouriſhment, unleſs the parents were to prepare them in their crops, and thence feed them.

The owl called the *eagle-owl* makes its neſt on the higheſt precipices of mountains, and in the warmeſt ſpot, facing the ſun; that the dead bodies brought there may by the heat melt into a ſoft pulp, and become fit nouriſhment for the young.

As an exception indeed to this foſtering care of animals, may be mentioned the cuckow, which lays its eggs in the neſt of other ſmall birds, generally the wag-tail, yellow hammer, or white-throat, and leaves the incubation or preſervation of the young to them. This cuſtom of the cuckow is ſo extraordinary, and out of the common courſe of nature, that it would not be credible were it not for the teſtimony of the moſt knowing and curious natural-hiſtorians, ſuch as Ray, Willoughby, Geſner, Aldrovandus, Ariſtotle, &c. But this ſeeming want of inſtinct is accounted for from the ſtructure and ſituation of its ſtomach, which diſqualifies it for incubation †; and its inſtinctive care is ſtill conſpicuous in providing a proper, though a foreign, nidus for its eggs

† See the article *Cucubus*.

Amphibious animals, fiſhes, and inſects, which cannot come under the care of their parents, yet owe this to them, that they are put in places where they eaſily find nouriſhment.

2. As ſoon as animals come to maturity, and want no longer the care of their parents, they attend with the utmoſt labour and induſtry, according to the law and œconomy appointed for every ſpecies, to the preſervation

servation of their lives. But that so great a number of them, which occur every-where, may be supported, and a certain and fixed order may be kept up amongst them, behold the wonderful disposition of the Creator, in assigning to each species certain kinds of food, and in putting limits to their appetites. So that some live on particular species of plants, which particular regions and soils only produce: some on particular animalcula; others on carcases; and some even on mud and dung. For this reason, Providence has ordained that some should swim in certain regions of the watery element; others should fly: some should inhabit the torrid, the frigid, or the temperate zones; and others should frequent desarts, mountains, woods, pools, or meadows, according as the food proper to their nature is found in sufficient quantity. By this means there is no terrestrial tract, no sea, no river, no country, but what contains and nourishes various kinds of animals. Hence also an animal of one kind cannot rob those of another kind of its aliment; which, if it happened, would endanger their lives or health: and thus the world at all times affords nourishment to so many and so large inhabitants, at the same time that nothing which it produces is useless or superfluous.

It will not be here amiss to produce some instances by which it will appear how providentially the Creator has furnished every animal with such cloathing as is proper for the country where they live, and also how excellently the structure of their bodies is adapted to their particular way of life; so that they seem to be destined solely to the places where they are found.

Monkeys, elephants, and rhinoceroses, feed upon vegetables that grow in hot countries, and therefore therein they have their allotted places. When the sun darts forth its most fervid rays, these animals are of such a nature and disposition, that it does them no manner of hurt; nay, with the rest of the inhabitants of those parts, they go naked; whereas, were they covered with hairy skins, they must perish with heat.

On the contrary, the place of rein-deer is fixed in the coldest part of Lapland, because their chief food is the liverwort, which grows no-where so abundantly as there; and where, as the cold is most intense, the rein-deer are clothed, like the other northern animals, with skins filled with the densest hair, by the help of which they easily defy the keenness of the winter. In like manner the rough legged partridge passes its life in the very Lapland Alps, feeding upon the seeds of the dwarf birch; and, that they may run up and down safely amidst the snow, their feet are feathered.

The camel frequents the sandy and burning desarts, in order to get the barren camel's-hay. How wisely has the Creator contrived for him! he is obliged to go through the desarts, where oftentimes no water is found for many miles about. All other animals would perish with thirst in such a journey: but the camel can undergo it without suffering; for his belly is full of cells, where he reserves water for many days. It is reported by travellers, that the Arabians, when in travelling they want water, are forced to kill their camels, and take water out of their bellies that is perfectly good to drink, and not at all corrupted.

The pelican likewise lives in desart and dry places; and is obliged to build her nest far from the sea, in order to procure a greater share of heat to her eggs. She is therefore forced to bring water from afar for herself and her young; for which reason Providence has furnished her with an instrument most adapted to this purpose: She has a very large bag under her throat, which she fills with a quantity of water sufficient for many days; and this she pours into the nest, to refresh her young, and teach them to swim.

The wild beasts, lions, and tygers, come to this nest to quench their thirst, but do no hurt to the young.

Oxen delight in low grounds, because there the food most palatable to them grows.

Sheep prefer naked hills, where they find a particular kind of grass called the *festuca*, which they love above all things.

Goats climb up the precipices of mountains, that they may browse on the tender shrubs; and in order to fit them for it, they have feet made for jumping.

Horses chiefly resort to woods, and feed upon leafy plants.

Nay, so various is the appetite of animals, that there is scarcely any plant which is not chosen by some, and left untouched by others. The horse gives up the water-hemlock to the goat. The cow gives up the long-leaved water-hemlock to the sheep. The goat gives up the monks-hood to the horse, &c.; for that which certain animals grow fat upon, others abhor as poison. Hence no plant is absolutely poisonous, but only respectively. Thus the spurge, that is noxious to man, is a most wholesome nourishment to the caterpillar. That animals may not destroy themselves for want of knowing this law, each of them is guarded by such a delicacy of taste and smell, that they can easily distinguish what is pernicious from what is wholesome; and when it happens that different animals live upon the same plants, still one kind always leaves something for the other, as the mouths of all are not equally adapted to lay hold of the grass; by which means there is sufficient food for all. To this may be referred an œconomical experiment well known to the Dutch, that when eight cows have been in a pasture, and can no longer get nourishment, two horses will do very well there for some days; and when nothing is left for the horses, four sheep will live upon it.

Swine get provision by turning up the earth; for there they find the succulent roots, which to them are very delicious.

The leaves and fruits of trees are intended as food for some animals, as the sloth, the squirrel; and these last have feet given them fit for climbing.

Besides myriads of fishes, the castor, the sea calf, and others, inhabit the water, that they may there be fed; and their hinder-feet are fit for swimming, and perfectly adapted to their manner of life.

The whole order of the goose-kind, as ducks, merganser, &c. pass their lives in water, as feeding upon water-insects, fishes, and their eggs. Who does not see, that attends ever so little, how exactly the wonderful formation of their beaks, their necks, their feet, and their feathers, suit their kind of life; which obser-

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observation ought to be extended to all other birds.

The way of living of the sea-swallow deserves to be particularly taken notice of; for as he cannot so commodiously plunge into the water, and catch fish, as other aquatic birds, the Creator has appointed the sea-gull to be his caterer, in the following manner: When this last is pursued by the former, he is forced to throw up part of his prey, which the other catches; but in the autumn, when the fishes hide themselves in deep places, the merganser supplies the gull with food, as being able to plunge deeper into the sea.

The chief granary of small birds is the knot grass, that bears heavy seeds, like those of the black bind-weed. It is a very common plant, not easily destroyed, either by the road-side by trampling upon it, or anywhere else; and is extremely plentiful after harvest in fields, to which it gives a reddish hue by its numerous seeds. These fall upon the ground, and are gathered all the year round by the small birds. To which we may add, that many small birds feed upon the seeds of plantain, particularly linnets. It is generally known that the goldfinch lives upon the seed of thistles, from which he has its name in Latin and French. Thus bountiful nature feeds the *fowls of the air.*

The Creator has taken no less care of some amphibious animals, as the snake and frog kind; which, as they have neither wings to fly, nor feet to run swiftly and commodiously, would scarcely have any means of taking their prey, were it not that some animals run, as it were, of their own accord, into their mouths. When the rattle-snake, a native of America, with open jaws fixes his eyes upon a bird, fly, or squirrel, sitting on a tree, they fly down his throat, being rendered stupid, and giving themselves up as destitute of all refuge. How dreadful this serpent is to other animals will appear by an account we have in a treatise entitled, *Radix Senega.* Where the author (*Amœn. Academ.* tom. 2.) says, one of these terrible serpents got clandestinely into the house of governor Blake at Carolina; where it would have long lain concealed, had it not been that all the domestic animals, as dogs, hogs, turkeys, and fowls, admonished the family by their unusual cries, equally showing their horror and consternation, their hair, bristles, and crests, standing up on end. On the other hand, we cannot but adore the Creator's great goodness towards man, when we consider the rattle which terminates this serpent's tail: for by means of that we have an opportunity of guarding against this dreadful enemy; the sound warning us to fly; which if we were not to do, and we should be wounded by him, the whole body would be turned into a putrid corruption in six hours, nay sometimes in half an hour.

The limits of this article will not permit us to produce more examples of this kind. But whoever will be at the pains to take ever so slight a view of the wonderful works of the Author of nature, will readily see how wisely the plan, order, and fitness of things with divine ends, are disposed.

3. We cannot without the utmost admiration behold how providentially the Creator has acted as to the preservation of those animals which, at a certain time of the year, are by the rigour of the season excluded from the necessaries of life. Thus the bear in the autumn creeps into the moss which he has gathered, and there lies all winter; subsisting upon no other nourishment but his fat, collected during the summer in the cellulous membrane, and which without doubt, during his fast, circulates through his vessels, and supplies the place of food; to which perhaps is added that fat juice which he sucks out of the bottom of his feet.

The hedge-hog, badger, and mole, in the same manner fill their winter-quarters with vegetables, and sleep during the frosts. The bat seems cold and quite dead all the winter. Most of the amphibious animals get into dens, or to the bottom of lakes and pools.

In the autumn, as the cold approaches, and insects disappear, swallows migrate into other climes in search of food and a temperature of air more friendly to their constitution: though the latter hatches, or those young birds which are incapable of distant flights, seek for an asylum against the violence of the cold in the bottom of lakes amongst the reeds and rushes; from whence, by the wonderful appointment of nature, they come forth again. See the article Hirundo. The peristaltic motion of the bowels ceases in all these animals while they are obliged to fast; whence the appetite is diminished, and so they suffer the less from hunger. To this head may be referred the observation of the celebrated Lister concerning those animals, That their blood, when let into a vessel, does not coagulate, as that of all other animals; and so is no less fit for circulation than before.

The moor-fowls work themselves out walks under the very snow. They moult in the summer; so that about the month of August they cannot fly, and are therefore obliged to run into the woods; but then the moor-berries and bilberries are ripe, from whence they are abundantly supplied with food. Whereas the young do not moult the first summer; and therefore, though they cannot run so well, are able to escape danger by flight.

The rest of the birds who feed upon insects migrate every year to foreign regions, in order to seek for food in a milder climate; while all the northern parts, where they live well in the summer, are covered with snow.

By these migrations, birds also become useful to many different countries, and are distributed overalmost all the globe. And it must excite our admiration that all of them exactly observe the times of coming and going, and that they do not mistake their way.

Insects in the winter generally lie hid within their cases, and are nourished by the surrounding liquor like the fœtus of other animals; from whence, at the approach of spring, they awake, and fly forth, to the astonishment of every one.

However, all animals which lie hid in winter do not observe these laws of fasting. Some provide storehouses in summer and autumn, from which they take what is necessary; as mice, jays, squirrels, bees.

III. Destruction.

1. We have observed above, that all animals do not live upon vegetables, but that there are some which feed

feed upon certain animalcula. Nay, there are some which subsist only by rapine, and daily destroy numbers of the peaceable kind.

These animals are destroyed, but in such a manner that the weaker generally are infested by the stronger in a continued series. Thus the tree-louse lives upon plants. The fly called *musca aphidivora* lives upon the tree-louse; the hornet and wasp-fly, upon the musca aphidivora; the dragon fly, upon the hornet and wasp-fly; the spider, on the dragon-fly; the small birds on the spider; and lastly, the hawk kind on the small birds

In like manner, the monoculus delights in putrid waters, the gnat eats the monoculus, the frog eats the gnat, the pike eats the frog, the sea-calf eats the pike.

The bat and goat-sucker make their excursions only at night, that they may catch the moths, which at that time fly about in vast quantities.

The woodpecker pulls out the insects which lie hid in the trunks of trees.

The swallow pursues those which fly about in the open air.

The mole pursues worms. The large fishes devour the small. Nay, we scarcely know an animal which has not some enemy to contend with.

Amongst quadrupeds wild beasts are most remarkably pernicious and dangerous to others, as the hawk kind among birds. But that they may not, by too atrocious a butchery, destroy a whole species, even these are circumscribed within certain bounds. First, as to the most fierce of all, it deserves to be noted how few they are in proportion to other animals. Secondly, the number of them is not equal in all countries. Thus France and England breed no wolves, and the northern countries no tigers or lions. Thirdly, these fierce animals sometimes fall upon and destroy one another. Thus the wolf devours the fox. The dog infests both the wolf and fox; nay, wolves in a body will sometimes venture to surround a bear. The tiger often kills its own male whelps Dogs are sometimes seized with madness, and destroy their fellows, or with the mange destroy themselves.

Lastly, wild beasts seldom arrive at so great an age as animals which live on vegetables. For they are subject, from their alkaline diet, to various diseases, which bring them sooner to an end.

But although all animals are infested by their peculiar enemies, yet they are often able to elude their violence by stratagems and force. Thus the hare often confounds the dog by her windings.

When the bear attacks sheep and cattle, these draw up together for mutual defence. Horses join heads together, and fight with their heels. Oxen join tails, and fight with their horns.

Swine get together in herds, and boldly oppose themselves to any attack, so that they are not easily overcome; and it is worth while to observe, that all of them place their young, as less able to defend themselves, in the middle, that they may remain safe during the battle.

Birds, by their different ways of flying, oftentimes escape the hawk. If the pigeon had the same way of flying as the hawk, she would hardly ever escape his claws.

It deserves also to be remarked, how much some animals consult their safety by night. When horses sleep in woods, one by turn remains awake, and, as it were, keeps watch. When monkeys in Brasil sleep upon trees, one of them keeps awake, in order to give the sign when the tiger creeps towards them; and in case the guard should be caught asleep, the rest tear him to pieces. Hence rapacious animals are not always successful in their hunting, and are often obliged to labour for a whole day to no purpose. For this reason the Creator has given them such a nature, that they can bear fasting a long time. Thus the lion lurks in his den many days without famishing; and the wolf, when he has once well satisfied his hunger, can fast many weeks without any difficulty.

If we consider the end for which it pleased the Supreme Being to constitute such an order of nature, that some animals should be, as it were, created only to be miserably butchered by others, it seems that his Providence not only aimed at sustaining, but also keeping a just proportion amongst all the species; and so prevent any one of them from increasing too much, to the detriment of men and other animals. For if it be true, as it most assuredly is, that the surface of the earth can support only a certain number of inhabitants, they must all perish if the same number were doubled or trebled.

There are some viviparous flies which bring forth 2000 young. These in a little time would fill the air, and like clouds intercept the rays of the sun, unless they were devoured by birds, spiders, and many other animals.

Storks and cranes free Egypt from frogs, which, after the inundation of the Nile, cover the whole country. Falcons clear Palestine of mice. Bellonius on this subject says as follows: "The storks come to Egypt in such abundance, that the fields and meadows are white with them. Yet the Egyptians are not displeased with this sight; as frogs are generated in such numbers there, that did not the storks devour them, they would over-run every thing. Besides, they also catch and eat serpents. Between Belba and Gaza, the fields of Palestine are often desart on account of the abundance of mice and rats; and were they not destroyed by the falcons that come here by instinct, the inhabitants could have no harvest"

The white fox is of equal advantage in the Lapland Alps; as he destroys the Norway rats, which are generated there in great abundance, and thus hinders them from increasing too much in proportion, which would be the destruction of vegetables.

It is sufficient for us, that nothing is made by Providence in vain; and that whatever is made, is made with supreme wisdom For it does not become us to pry too boldly into all the designs of God. Let us not imagine, when these rapacious animals sometimes do us mischief, that the Creator planned the order of nature according to our private principles of œconomy: for the Laplanders have one way of living; the European husbandman another; the Hottentots and savages a third; whereas the stupendous œconomy of the Deity is one throughout the globe; and if Providence does not always calculate exactly according to our way of reckoning, we ought to consider this affair in the same light, as when different fea-

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men wait for a fair wind, every one with respect to the part he is bound to, who we plainly see cannot all be satisfied.

2. The whole earth would be overwhelmed with carcases and stinking bodies, if some animals did not delight to feed upon them. Therefore, when an animal dies, bears, wolves, foxes, ravens, &c. do not lose a moment till they have taken all away. But if a horse *e. g.* dies near the public road, you will find him, after a few days, swoln, burst, and at last filled with innumerable grubs of carniverous flies, by which he is entirely consumed, and removed out of the way, that he may not become a nusance to passengers by his poisonous stench.

When the carcases of fishes are driven upon the shore, the voracious kinds, such as the thornback, the hound-fish, the conger-eel, &c. gather about and eat them. But because the flux and reflux soon change the state of the sea, they themselves are often detained in pits, and become a prey to the wild beasts that frequent the shores. Thus the earth is not only kept clean from the putrefaction of carcases, but at the same time, by the œconomy of nature, the necessaries of life are provided for many animals. In the like manner many insects at once promote their own good, and that of other animals. Thus gnats lay their eggs in stagnant, putrid, and stinking waters, and the grubs that arise from these eggs clear away all the putrefaction: and this will easily appear, if any one will make the experiment by filling two vessels with putrid water, leaving the grubs in one, and taking them all out of the other; for then he will soon find the water that is full of grubs pure and without any stench, while the water that has no grubs will continue stinking.

Lice increase in a wonderful manner in the heads of children that are scabby; nor are they without their use, for they consume the redundant humours.

The beetle kind in summer extract all moist and glutinous matter out of the dung of cattle, so that it becomes like dust, and is spread by the wind over the ground. Were it not for this, the vegetables that lie under the dung would be so far from thriving, that all that spot would be rendered barren.

As the excrements of dogs is of so filthy and septic a nature that no insect will touch them, and therefore they cannot be dispersed by that means, care is taken that these animals should exonerate upon stones, trunks of trees, or some high place, that vegetables may not be hurt by them.

Cats bury their dung. Nothing is so mean, nothing so little, in which the wonderful order and wise disposition of nature do not shine forth.

Lastly, all these treasures of nature, so artfully contrived, so wonderfully propagated, so providentially supported throughout her three kingdoms, seem intended by the Creator for the sake of man. Every thing may be made subservient to his use, if not immediately, yet mediately; not so to that of other animals. By the help of reason man tames the fiercest animals; pursues and catches the swiftest; nay, he is able to reach even those which lie hid in the bottom of the sea.

By the help of reason, he increases the number of vegetables immensely; and does that by art, which nature, left to herself, could scarcely effect. By ingenuity he obtains from vegetables whatever is convenient or necessary for food, drink, cloathing, medicine, navigation, and a thousand other purposes.

He has found the means of going down into the abyss of the earth, and almost searching its very bowels. With what artifice has he learned to get fragments from the most rocky mountains, to make the hardest stones fluid like water, to separate the useful metal from the useless dross, and to turn the finest sand to some use! In short, when we follow the series of created things, and consider how providentially one is made for the sake of another, the matter comes to this, that all things are made for the sake of man; and for this end more especially, that he, by admiring the works of the Creator, should extol his glory, and at once enjoy all those things of which he stands in need, in order to pass his life conveniently and pleasantly.

Besides general natural histories, which we have here given a specimen of, as those of Pliny, &c. there are likewise particular ones; and those of two kinds. The first, those which only consider one kind of things; such as the History of Shells, by Dr Lister; of Fishes, by Willughby; that of Birds, by the same; that of Plants, by Ray; those of Insects, by Swammerdam and Mouffet; that of Animals, by Gesner; that of Fossils, by Agricola, Mercatus, &c.

The second, those which consider the several kinds of natural things found in particular countries or provinces: as, the Natural History of Dauphiné, by Chorier; the Natural History of the Antilles, by F. Du Tertre, and M. Lonvillers De Poincy; that of Oxfordshire and Staffordshire, by Dr Plott; that of Lancashire, by Leigh; of Northamptonshire, by Morton; that of the Western Islands, by Martin, &c.

The natural history only of one particular place, is a subject very extensive in its materials, and not to be set about without great care and circumspection. Mr Boyle has favoured the world with a list of the heads under which to arrange things, and what to enquire after on such an occasion.

The general heads under which he comprehends the articles of this history are four; the things which regard the heavens, the air, the waters, and the earth.

To these general heads Mr Boyle imagines should be added, inquiries into traditions in the country, of any thing relating to it, whether peculiar to it, or only more common there than elsewhere; and where these require learning or skill in the answerer, the utmost care is to be taken to put the people in a way to give their accounts in a satisfactory manner; for a false or bad account of any thing is always much worse than no account at all.

This subject concerning the works of nature, a very small part of which we have been able to touch upon, is of such importance and dignity, that if it were to be properly treated in all its parts, men would find wherewithal to employ almost all the powers of the mind: nay, time itself would fail before, with the most acute human sagacity, we should be able to discover the amazing œconomy, laws, and exquisite structure, even of the least insect; since, as Pliny observes, nature nowhere appears more herself than in her most minute works.

Summary

Summary as it is, however, the preceding view, as it were in a map, of the feveral parts of nature, their connections and dependencies, may at leaft, perhaps, convey an ufeful leffon, and fuch an one as the beft of us often need to have inculcated.

From a partial confideration of things, we are very apt to criticife what we ought to admire; to look upon as ufelefs what perhaps we fhould own to be of infinite advantage to us, did we fee a little farther; to be peevifh where we ought to give thanks; and at the fame time to ridicule thofe who employ their time and thoughts in examining what we were (*i. e.* fome of us moft affuredly were) created and appointed to ftudy. In fhort, we are too apt to treat the Almighty worfe than a rational man would treat a good mechanic, whofe works he would either thoroughly examine or be afhamed to find any fault with. This is the effect of a partial confideration of nature; but he who has the candour of mind and leifure to look farther, will be inclined to wonder and adore, and even to cry out with the poet,

How wond'rous is this fcene! where all is form'd
With number, weight, and meafure! all defign'd
For fome great end! where not alone the plant
Of ftately growth; the herb of glorious hue,
Or food-full fubftance; not the labouring fteed;
The herd, and flock, that feed us; not the mine
That yields us ftores for elegance and ufe;
The fea that loads our table, and conveys
The wanderer man from clime to clime; with all
Thofe rolling fpheres, that from on high fhed down
Their kindly influence: not thefe alone,
Which ftrike ev'n eyes incurious; but each mofs,
Each fhell, each crawling infect, holds a rank
Important in the plan of Him who fram'd
This fcale of beings; holds a rank, which loft
Would break the chain, and leave behind a gap
Which nature's felf would rue. Almighty Being,
Caufe and fupport of all things, can I view
Thefe objects of my wonder, can I feel
Thefe fine fenfations, and not think of thee?
Thou who doft thro' th' eternal round of time,
Doft thro' th' immenfity of fpace exift
Alone, fhalt thou alone excluded be
From this thy univerfe? Shall feeble man
Think it beneath his proud philofophy
To call for thy affiftance, and pretend
To frame a world, who cannot frame a clod?—
Not to know thee, is not to know ourfelves——
Is to know nothing—nothing worth the care
Of man's exalted fpirit—All becomes,
Without thy ray divine, one dreary gloom,
Where lurk the monfters of fantaftic brains,
Order bereft of thought, uncaus'd effects,
Fate freely acting, and unerring Chance.
Where meanlefs matter to a chaos finks,
Or fomething lower ftill: for without thee
It crumbles into atoms void of force,
Void of refiftance—it eludes our thought.
Where laws eternal to the varying code
Of felf-love dwindle. Intereft, paffion, whim,
Take place of right and wrong: the golden chain
Of being melts away, and the mind's eye
Sees nothing but the prefent. All beyond
Is vifionary guefs—is dream—is death.

THOMSON.

We fhall add to this article the following defcription of a mufeum: The windows ought to be in the two longeft fides of the building, that it may be equally lighted during the whole day.

On one wing of the mufeum muft be placed eleven preffes, with fhelves fupported on wooden brackets. Thefe preffes are intended for containing the eleven following claffes of the *mineral kingdom* (a kingdom which forms the original bafis of every thing pertaining to this globe: minerals have neither organization nor life), *viz.*

1. Waters.	7. Semimetals.
2. Earths.	8. Metals.
3. Sands.	9. Bitumens and fulphurs.
4. Stones.	10. Volcanic productions.
5. Salts.	11. Petrifactions, foffils, and *lufus naturæ*.
6. Pyrites.	

We at once perceive the advantage of fuch an arrangement, where every thing is diftinct and diftributed in the manner moft advantageous for the infpection of the ftudent. The preffes muft be provided with a wire grate, or covered with glafs; and each of them muft have a title on the cornice, indicating the clafs which it contains. Befides this, each fhelf in the prefs ought to have a fmall title on the edge, fpecifying the kind of fubftances which are placed on it; and thefe fhould be kept in clear glafs-bottles, well fealed and furnifhed with proper titles alfo. In them are to be feen earths, clays, turfs, ochres, chalks, marls, lapis ollaris, and micaceous ftones, calcareous or limeftones, fpars, congelations, ftony refidua, ftalactites, alabafter, gypfum or plafter-ftone, flints, rock-ftones, rock and mineral cryftals, falts, and pyrites fubject to efflorefcence, coals and other bituminous bodies, lava, and the drofs of volcanoes. In the bottom of each prefs two fpaces may be referved and furnifhed with a confiderable number of fmall femicircular fhelves, where pieces much efteemed, and in complete prefervation, may be placed by themfelves or on very fmall pedeftals; fuch as tranfparent mineral falt, collections of coloured pyrites, the ftone called the *Inca's*-ftone, beautiful fpecimens of cobalt, bifmuth, zinc, antimony, ore of fluid, quickfilver, and cinnabar in cryftals: the whole properly titled and arranged according to their claffes.

The prefs for *metals* ought to prefent us in the fame order with felect and rare fpecimens of the ores of white, green, &c lead, the ore of nickel, collections of cryftallifed tin, the *flos-ferri*, beautiful needles of hematite, a powerful rough loadftone, with fome platina, the filky copper of China, and a collection of malachite; likewife virgin filver in vegetation and red filver, together with a collection of golden ore. Thefe fubftances form a fpectacle equally varied and inftructive: in this department of her works nature is as rich and brilliant as in the various kinds of ftones.

The prefs for *bitumens* may in like manner contain fpecimens of jet polifhed on one fide; amber of different colours (which when it is tranfparent, and contains infects, ought to be polifhed on the two oppofite furfaces); a beautiful fpecimen of ambergris, together with pieces of tranfparent red and yellow fulphur.

In the prefs for *petrifactions* or for *foffils*, we muft likewife place, on femicircular fhelves, the rareft and the

the best preserved pieces; such as lilium lapideum, madrepores, transparent belemnites, fossil urchins, the articulated nautilus, cornua ammonis sawed and polished, hysterolite, lapis lenticularis, gryphites calculi or bezoars, turquoises, loadstones, glossopetræ; in short, all kinds of figured stones, and also petrified wood.

In the press for *stones*, which has a similar apparatus of shelves, we see different kinds of crystals, and all the precious stones in their matrix. Those which are detached and uncut are placed in cases or watch-glasses; but those which have been cut and set are to be put in a jewel-box or open case for rings. The same is to be observed with regard to pieces, cups, cisterns, or polished plates of agate, cornelian, jade, sardonyx, onyx, chalcedony, jasper, porphyry, granite, lapis lazuli, marble, alabaster, and Iceland crystal. Here likewise are to be placed the Bologna stone, the Labrador stone, the serpentine stone, talc, amianthus, zeolite, basaltes, touch-stone, together with Egyptian and English flints. With regard to impressed petrifactions, large arborizations, and Florence stones, if they are in good preservation: they should be framed and suspended by hooks on the pilasters which connect the presses of the mineral kingdom. These presses are of an uniform height; but their breadth is proportioned to the size or number of the materials composing the class which it contains, and they are supported, as well as those which are placed all around, on a chest of drawers breast high. These drawers must correspond to the presses above them, and contain substances of the same class. This methodical arrangement is a great help to the memory; because it occasionally supplies the place of a numbered catalogue, and because in a great multitude of objects it is the only means of finding at once what we want.

In the mineral kingdom, these drawers are very useful for containing earths, belemnites, entroches, astroites, and other polymorphous fossils, univalve, bivalve, and multivalve shells, polished petrifactions of bones and pieces of wood, collections of marbles and polished flints, collections of silex, sands, and amber, together with pieces procured from the melting of ores, such as regulus, dross, &c. Some parts of the mineral kingdom, such as the earths and certain stones, make not a brilliant figure in a museum; they are notwithstanding the most scientific parts of it, and the most interesting to those who prefer the solid satisfaction of tracing nature in her most important productions, and her fundamental operations, to the empty spectacle of gaudy colours and agreeable figures.

Minerals in general require to be kept with great care, and so as not to be intermixed. Some of them, such as the salts, easily dissolve; and others, as the pyrites, are subject to efflorescence. Vegetables and animals are likewise more or less liable to corruption; and to prevent this inconvenience, great pains must be taken in preserving certain pieces which are subject to speedy decay.

On the *second* wing of the cabinet are to be placed ten presses, distributed like those of the mineral kingdom, and intended for containing the ten following divisions of the *vegetable kingdom*. Vegetables are organised bodies, but they possess not, like animals, spontaneous motion or feeling.

1. Roots.
2. Barks.
3. Woods and stalks.
4. Leaves.
5. Flowers.
6. Fruits and seeds.
7. Parasite plants, also agarics and mushrooms.
8. The juices of vegetables; such as balsams and solid resins, resinous gums, and gums properly so called.
9. Extracted juices, sugars, and dregs.
10. Marine plants, and plants growing on the shores of the sea.

In this kingdom, the same order of presses, the same symmetry and arrangement, are to be observed as in the mineral kingdom. The semicircular shelves in the bottom of the presses are here very useful for containing in small square phials China varnish, essential oils, and other peculiar aromatics, whether of Arabia or India; together with the roots of cumbou, mandragora, certain fruits, either monstrous or natural, which grow in the East Indies, and which the natives ripen in large bottles with narrow necks, preserved in spirits, such as the cashew-nut, &c. Here likewise are placed a number of fruits, remarkable for their rarity or great size; as cocoa nuts, gourds, the fruit of the bastard locust-tree, the fruit of the sand-box-tree, banana figs, pine-apples, coloquintida apple, dogsbane, vegetable tumors or wens, and a branch of *bois de dentelle*, in which the three parts of the bark, especially the *liber*, are distinctly separated.

As the number of vegetables greatly exceeds that of minerals, we seldom put any thing in bottles but the dried parts of exotic plants, which are used either in medicine or in the arts, and those likewise which we cultivate merely from curiosity. With regard to indigenous plants, an *herbal* is formed of land and sea plants, pasted or laid between leaves of paper collected into the shape of a book, and arranged according to the system of the best botanists. To make this herbal as convenient as possible, it is proper to put the dried plants between two folds of dry paper, and, arranging them according to their families, genera, and species, to pile them one above another, either openly on the shelves or in large band-boxes. On the back of the band-boxes must be a title indicating the family, at the extremity another with the name of the genus, and on each leaf the name of the species which it contains: the paper must be loose, that they may be changed at pleasure. The drawers are useful partly for holding different kinds of woods with the bark, cut in such a manner as that the grain and contexture of it may easily be distinguished, and for containing a collection of the woods of both Indies in small polished pieces with proper titles. One part of the drawers has several divisions within for the purpose of holding seeds; and a small title is inscribed on each of these divisions.

Sea-weeds, and small marine plants of an elegant shape, which from their colour and variety form agreeable pictures, may be framed and suspended by hooks to the pilasters of the presses. In the animal kingdom, particularly insects, it is well known, are attended with irreparable devastations. Butterflies, still

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still more than the most beautiful birds, are not only subject to destruction in this way, but are also exposed to great danger from the rays of the sun, either direct or reflected, which alter their colour, make them lose all their splendor, and, in some species, render it impossible to distinguish them. In general, we cannot prevent the destruction of vegetables and animals, but by drying them as much as possible, or by putting them in prepared liquors, which must not be allowed to evaporate. But dried animals and vegetables require still greater care: a great multitude of insects which are bred in the month of April feed upon them, and destroy them internally before they are perceived: they ought to be carefully watched during the continuance of this plague, which is about five months. In like manner, the moisture of winter and the heat of summer make it necessary that the presses of muſæums should be kept carefully shut, except perhaps those which front to the north. Besides, the vapour of sulphur in combustion will kill these destructive insects either before or after they become perfect ones: the fumigations must be carefully performed during dry weather, and in a box made on purpose, into which only the specimens attacked are introduced.

On the third wing of the cabinet are placed presses for containing the ten following divisions of the *animal kingdom* (a kingdom which derived the substance necessary to its existence either mediately or immediately from the vegetable kingdom.——Animals possess feeling and spontaneous motion.)

1. Lithophytes.
2. Zoophytes.
3. Testaceous animals.
4. Crustaceous animals.
5. Insects.
6. Fishes.
7. Amphibious animals, reptiles, and oviparous quadrupeds.
8. Birds, with their nests and eggs.
9. Viviparous quadrupeds.
10. Man.

In these presses the same external decoration and distribution may be observed as in the preceding ones.

The press for the *lithophytes* must be arranged in such a manner as to present at one view the history of lithophytes, mandreporæ, and coral either rough or stript of its covering; the whole placed on small wooden pedestals, blackened or gilded. Corallines, as well as fuci, may be pasted on a bit of paper, and put into a frame: such pictures, when suspended by hooks to the outside of the pilasters, always attract the attention of the spectators. If we have a considerable collection of them, it will be necessary to make a kind of herbal of them.

The press for *zoophytes* contains sponges, the marine jet d' eau, the penna marina, holothuriæ, and all those substances which are called *animal plants*, molluscæ, worms, &c. These productions must be preserved in rectified spirit of wine, which will be sufficiently weakened by the water contained in them. Upon the sides are sea-stars, both prickly and smooth, with several rays, a Medusa's head, &c.

The *testaceous* animals are preserved in bottles among spirits. On the semicircular shelves at the bottom of the press are placed large shells, and small ones with their marine covering.

The press for *crustaceous* animals consists almost entirely of semicircular shelves; and contains crabs, cray-fish, &c. Small lobsters, squillæ, and all small crustaceous animals, excepting the hermit crab, are put in frames.

Two kinds of insects are found in the press destined for them. The first kind, after being dried, are put in small wooden frames, which are varnished and glazed on two sides, that we may have it in our power to examine the insect on both sides: of this kind are flies, mantes, beetles, butterflies with their nymphæ or chrysalides, &c. (These animals form the most brilliant part of the cabinet, while the press for birds is the most striking; but great pains must be used in their preservation.) Other insects, such as grasshoppers, scolopendræ, scorpions, salamanders, spiders, tarantulas, caterpillars, and especially all soft insects, must be preserved in spirits, and placed on semicircular shelves at the bottom of the press. Here also are deposited honey-combs, wasps nests, and branches furnished with the nests of those insects which produce the gum-lac.

In the press for *fishes* are to be seen bottles containing foreign fishes, which are always sent home in spirits. The soft fishes of our own country are preserved in the same manner. The skin of large fishes, whether found in salt or fresh water, is taken off and pasted on a bit of paper: the two parts are sometimes sewed together, and the colours are renewed by means of varnish. The flying fish must be suspended about the top of the press; and armed fishes, with ostracia, on the shelves below.

The press for *amphibious* animals contains, in bottles full of spirit of wine diluted with alum water, serpents, vipers, adders, frogs, toads, lizards, small land or water turtles, and a small tortoise with its shell. The lower shelves are furnished with a small rattle-snake, a cameleon, a crocodile, a beaver, a sea-lion, a sea-calf, &c.

The press for *birds* is filled with animals of that class, both foreign and natives, stuffed and provided with glass eyes. The skin covered with the feathers may be preserved perfect and dry by being fitted to a mould of tree-moss, or filled with cotton, and sprinkled on the inside with pepper, camphire, and corrosive sublimate, to defend it from the attack of moths, grubs, wood-lice, and dermestes. The spring and autumn are the best seasons for this operation; the moulting-time is very improper, because it is unfavourable to the beautiful colour and the preservation of the feathers, which moreover are then full of blood. The birds, when thus prepared, and when the brain has been taken out, are then placed on their supports.—Some females may be placed in their nests in the attitude of incubation; those which are accustomed to perch may be placed on artificial trees; a wooden supporter, covered with moss, turf, or artificial reeds, may be given to those which live among such plants.—Swimming birds are placed on the lowermost shelves, which must be covered with pieces of mirrors or silver gauze, in imitation of water. We must be careful to give each animal the most picturesque attitude; to preserve the proportions, together with the natural position of the legs, wings, head, body, and feathers; to observe an equilibrium in those which are at rest, and to avoid it in those which have a fighting attitude.—We must characterize the animal, represent his genius,

dispositions,

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dispositions, graces, boldness, or timidity. In short, we must endeavour to express that beautiful *tout ensemble* which gives the appearance of life and motion to the whole. The deception ought to be such, that those who examine the particulars of the collection may apply to each what was said on another occasion—*Nature is dead, but Art is alive.* These observations on birds are equally applicable to the other animals; but all of them must be arranged in a methodical order, which possesses the advantage necessary in such collections of uniting pleasure with instruction.

The lower shelves contain the eggs and nests of birds; and a collection of feathers is made in a book in the same manner as an *herbal.*

The press for *quadrupeds* contains, preserved in bottles, small animals, such as mice, rats, the opossum, &c. Other animals are stuffed, such as the cat, the squirrel, the hedge-hog, the porcupine, the armadillo, the Guinea pig, the wolf, the fox, the roe-buck, the hare, the dog, &c.

The press containing the *history of man* consists of a complete myology, of a head separately injected, of a brain and the organs of generation in both sexes, of a neurology, an osteology, embryos of all different ages, with their after-births, monstrous fœtuses, and an Egygtian mummy. Here likewise are put beautiful anatomical pieces in wax or wood, and stony concretions extracted from the human body.

The preservation of subjects in bottles with spirit of wine does not always succeed, because they spoil as the spirit of wine evaporates, unless particular care be taken to examine the vessels wherein they are contained, which requires time and pains, and is attended with expence. Mr Lewis Nicola, in the Philadelphia Transactions for the year 1771, recommends, after using the different methods pointed out by M. Reaumur, of putting subjects intended for preservation in bottles filled with spirit of wine, to wipe well the neck of the bottle, and put a layer of putty, two lines thick, over the piece of skin or bladder which covers it. The bottle is then reversed in a wooden cup, which they fill with melted tallow, or with a mixture of tallow and wax, to prevent the spirit of wine from evaporating.

The drawers under the presses of the *animal kingdom* contain small detached parts of animals, such as teeth, small horns, jaw-bones, claws, beaks, nails, vertebræ, hairs, scales, balls of hair, and a collection of bones remarkable for blôws, fractures, deformities, and diseases.

To decorate a cabinet to the greatest advantage, and to make one complete whole, the walls must be furnished throughout their whole extent. For this purpose the tops of the presses are commonly ornamented with shells of a very great size, foreign wasps-hives, the horn of a rhinoceros, an elephant's trunk, the horn of an unicorn, urns and busts of alabaster, jasper, marble, porphyry, or serpentine stone. Here likewise are placed figures of antique bronze, large lithophytes, animals made of shells, bouquets made of the wings of Scarabæub gourds cut into two, painted, and made into bowls, plates, vases, and as they are used by savages; little trunks of bark, books made of the leaves of the palm-tree, globes, spheres, &c. The multiplicity and singularity of the objects never fail to arrest the attention of the spectator.

The circumference of the cabinet being furnished in the manner we have described, the floor may likewise be paved with different kinds of common stones which are susceptible of a polish.

The cieling, which must be very white, is divided into three spaces, furnished with hooks and brass wires. Here may be distributed in order different vegetable and animal productions, which are of too great a size to be contained in the presses; such as,

1. The sugar-cane, a branch of the palm-tree, together with that called the *Chinese fan*, large cocoas, both simple and with a double lobe, the leaf of the banana-tree, Indian and European sticks, remarkable for the knots, tubercles, and spiral wreaths, which cover their whole length, a bamboo root divided longitudinally into two parts, and the different species of reed-canes.

2. The skins of large animals; also stuffed animals, such as lizzards, whether a crocodile or caiman and scaly lizard, a shark, a sword-fish, a sea-calf, a sea-tortoise, large and long serpents, the horns of deer, wild goats, roe-bucks, and rein-deer.

3. The third space is filled with Indian rackets, hammocks, dresses, and tufts of feathers; with calumets or pipes; with quivers, bows, and arrows; with head-pieces, caps with feathers, aprons, necklaces, Chinese necessaries, fans made of the leaves of the palm-tree, a gargoulette of Indostan, a Polish whip, Indian canoes, Chinese musical instruments, lances, weapons, Indian furniture and utensils; and in short, various curiosities from nations ancient and modern, if they can be found; various furniture and utensils of different nations, ancient and modern.

As the great extent of a fine collection requires that there be no empty space, stands may be placed in different parts of the room, especially at the corners, for supporting large vertebræ, the head of a sea-cow, very large madrepores, or considerable collections either of rock chrystal or of minerals.

In the middle of the room is placed a receptacle for shells, which is a large table or bureau with raised edges. The surface of this table is divided into 27 separate cases, of different sizes, and proportioned to the 27 families of marine shells to be deposited in them. These divisions are made with wood or pasteboard painted blue, and are sometimes in the form of shelves; the bottom is covered with blue cotton or green sattin, or, what is still simpler, with white linen, sufficiently rough to keep the shells in their place. In some cabinets, these shelves are covered with mirrors on all their different surfaces, which shows the objects double, and gives us an opportunity of viewing them on the two opposite sides. In other cabinets, the cases for each family are distributed into a number of smaller divisions, for containing the several species separate from each other. The sea-shells, contained in the receptacle for shells, are all cleaned, and present, in the variety of their figure and colours, together with their inequality, an agreeable and enchanting picture, so much the more charming that it unites a methodical distribution to a symmetrical order. The upper part of this table is shut by a net-

work

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work of brass wire covered with serge, or, what is still better, by a glass frame, to defend the shells from dust. We must not omit to mention, that in the middle of the table there is a long elevated square box, containing land and river shells. From the middle of each compartment, or at each family of shells, arises a small pyramidal wooden pillar, on the top of which is an horizontal piece of pasteboard, or sort of sign, denoting the kind of shells belonging to that division. Each family is distinguished from the adjoining one by those kind of ornaments of silk called *caterpillars*. By means of the different tints, we perceive the limits and extent of each family in the same manner as the colours in a geographical map enable us to distinguish the several provinces of the same empire. An exhibition of this kind was to be seen from 1768 to 1774, in a museum belonging to the prince of Condé at Chantilly.

Under the table for shells, on the side of the windows, is a glazed cage, large enough to contain the skeletons of an animal belonging to each class, to wit, a fish, an amphibious animal, a reptile, a lizard, a bird, and a quadruped. When to these we can add, for the sake of the comparative osteology, the skeletons of the intermediate individuals of these animals, together with those which make the nearest approaches to man, such as the *monkey* and the *bear*, we greatly increase both the pleasure and instruction. Below this table are likewise placed the best books connected with the different branches of natural history, especially such as have illuminated plates. The difficulty of acquiring the most valuable objects, and of preventing their destruction when once acquired, obliges us to have recourse to figures, in order to preserve a representation of them. This is an infallible method of communicating, not only to our cotemporaries, but also to posterity, the discoveries of the age in which the work was composed. Here also may be deposited the *herbal* and the collection of *feathers*, arranged in the form of books.

The space above the door is furnished with a large frame, filled with the skins of rare fishes, which are dried, varnished, and pasted on paper.

The piers of the windows are furnished with one or two presses, which are provided with shelves, and contain different kinds of instruments employed in physics, such as an air-pump, a burning mirror, a perspective glass, a magnifier, a microscope, a telescope, magnets both natural and artificial, &c.

On the semicircular shelves below are placed stones formerly used by savages for hatchets. Some curious pieces of lacker work, Indian pagodas, trinkets belonging to the savages of the north and to the Chinese, which are made of ivory or yellow amber, or of coral mounted with gold, silver, porcelain-clay, *kriacks* of Siam, and Turkish *cangiars*, which are a kind of poniards, Indian curiosities of silver, and the galians which the Turks and Persians use in smoking tobacco and aloes.

The drawers under this press contain a collection of medals, china ink, lachrymatory phials, and the most beautiful engraved stones of Europe, or an impression of them in wax or sulphur, counters, cameos, antiques, talismans, ancient weights and measures, idols, urns, lamps, instruments of sacrifice, and false jewels.

Last of all, the embrasures of the windows must be furnished with pictures of stone in connected pieces. Here likewise, as well as in the embrasures and pannels of the door, may be put tubes hermetically sealed, containing rare reptiles preserved in proper liquors.

The reader will by this time have some idea of the prodigious extent of the science of natural history; so extensive is it, indeed, that the longest life is far from being sufficient to enable us to acquire a perfect knowledge of it: it is important beyond dispute, because its business is with the works of God. In all the articles connected with the present, as forming particular parts of it, and to which we refer, we have made great use of the works of the celebrated Linnæus, who it is well known arranged the three kingdoms into regular systems, of which botany is the most complete. The world in general seems to have been most dissatisfied with the animal kingdom: he himself, in the course of a variety of editions, made many important alterations. Some men of considerable note, for example Buffon, have written on this subject without any regard to systematic arrangement. Dr Berkenhout's works on this part of science are very useful; in a particular manner, because he translates Latin names, &c. Bomare's new edition of his Natural History, in 15 vols. octavo, a work of considerable importance, was published in 1791.

The most complete system, however, of natural history which has been yet given to the public, is undoubtedly that of Linnæus, in his *Systema Naturæ*, of which a new and improved edition is actually publishing by —— Gmeling. A short view of this elaborate work will, we presume, not be unacceptable to the reader, as it will present him, in a very small compass, an abstract of whatever is at present known in the six first classes of natural history.

Class I. *Mammalia*.

Ord.	Gen.	Sp.
Primatis	4	88
Bruta	7	25
Feræ	10	186
Glires	10	129
Pecora	8	90
Bellucæ	4	25
Cete	4	14
7	47	557

Class II. *Aves*.

Ord.	Gen.	Sp.
Accipitus	4	271
Picæ	23	663
Anseres	13	314
Grallæ	20	326
Gallinæ	10	129
Passeres	17	983
6	87	2686

Class III. *Amphibia*.

Ord.	Gen.	Sp.
Reptilia	4	147
Serpentes	6	219
2	10	366

Class IV.

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Class IV. *Pisces.*

Ord.	Gen.	Sp.
Apodes	10	37
Tugulares	6	52
Thoracici	19	452
Abdominales	16	2[illegible]2
Branchiostegi	10	81
Condropterygii	5	65
6	66	839

Class V. *Insectæ.*

Ord.	Gen.	Sp.
Coleoptera	55	4048
Hemyptera	14	1464
Lepidoptera	3	2600
Neuroptera	7	174
Hymenoptera	15	1239
Diptera	12	692
Aptera	15	679
7	121	10896

Class VI. *Vermes.*

Ord.	Gen.	Sp.
Inteſtina	21	384
Molluſca	31	438
Teſtacea	36	2525
Zoophita	15	498
Infuſoria	15	191
5	118	4036

In the new French *Encyclopédie par oidre de Matieres*, the editors promiſed to give a deſcription of more than 18,000 plants. Dr Berkenhout, in the laſt edition of his Synopſis, ſays, that in Great Britain and Ireland there are about 54 ſpecies of the mammalia, 200 of birds, 50 of the amphibia, 600 of inſects, 150 of fiſhes, and 1600 ſpecies of plants: but in every claſs he is probably much within the number.

NAT

Natural Philoſophy.

Natural Philoſophy, is commonly defined to be that art or ſcience 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, it has often been ſaid, and it 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 turn up, 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 philoſophiſing 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 ſub-divided into various parts. Modern diſcoveries have added, however, two more parts to the number, viz. magnetiſm and electricity, whoſe properties and effects, &c. have been wonderfully unfolded of late years. — 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

Naturalization. || Nature.

must therefore refer our readers to each particular article, where they will find them treated at considerable length—See *Experimental Philosophy*.

NATURALIZATION, in law, the act of naturalizing an alien, or putting him into the condition of a natural born subject, and intitling 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 intitled 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.

Nature || Naval.

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 those 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, (anc. geog.) 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 v. 436. Iliad ".

Then, to secure the camp and naval powers,
They rais'd embattled walls with lofty tow'rs:
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 ἑλκειν, the Romans *subducere*. Around the ships the soldiers disposed their tents, as appears every where 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, post, and fair 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 cannons, 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, with figures in alto relievo; and the present barrack for one troop of horse is built on the site of the abbey. Navan sends two members to parliament; patronage in the Preston family. Here are four fairs held.

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 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 Cordone, 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 twenty companies of infantry, consisting of Gascons, Biscayans, and the inhabitants of the Pyrenee 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 castle of Œuf. 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 castle of Œuf. 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 Sainte-Marie-le-Neuve at Naples, where they had been interred without any funeral honours.

Navarre (surnamed Martin Azpilcueta), 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-penetentiary. 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 display 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.

NAUCLERUS (John), descended of a noble family of Suabia, was provost of the church of Suringia, and professor of law in the university of that city.—His original name was *Vergeau;* but this name, which in German signifies "sailor," he changed into Nauclerus, a word of the same signification in Greek.—He was alive in 1501. We have from him a Latin Chronicle from Adam to the year 1500, of which Baselius wrote a continuation down to 1514, and Surius to 1564. It possesses greater accuracy than any historical compilation which had appeared prior to his time; but still it is only a compilation. It is chiefly valued for what regards the occurrences of the 15th century. It was printed at Cologne in folio in 1564 and 1579.

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 deposit its cargo. It gave birth to Athenæus.

NAUCRATITES Nomos (anc. geog.), Pliny; a division of the Delta, so called from the town *Naucratis;* though Ptolemy comprises it under the Nomos Saites.

NAUCYDES, a statuary who lived about four centuries before the Christian era.

NAUDE (Gabriel), was descended of a reputable family, and born at Paris, February 12th, 1600.—His parents observing his fondness for reading and inclination to letters, resolved to breed him in that way; and accordingly sent him to a religious community, to learn the first rudiments of grammar and the principles of Christianity. Thence he was removed to the university, where he applied himself with great success to classical learning; and having learned philosophy, was created master of arts very young.—As soon as he had finished his course in philosophy, he remained some time at a stand what profession to choose, being advised by his friends to divinity; but his inclination being more turned to physic, he fixed at length upon that faculty. However, this choice did not prevent him from indulging his genius in other branches of learning: in reality, the plan of his studies was very extensive, suited to his comprehensive talents and indefatigable industry: and he soon distinguished himself therein so much, that Henry de Mesmes, president à mortier, hearing his character, made him keeper of his library, and took him into his family. Naude was the more pleased with this post, as it gave him an opportunity of gratifying his bookish taste in general, and at the same time furnished him both with means and leisure to improve himself as he could wish, in the science which he had embraced in particular. He quitted it in 1626, in order to go to Padua to perfect himself therein: but he did not continue long in that university, the death of his father and his domestic affairs calling him back to Paris before the expiration of the year.

In 1628 the faculty of physic appointed him to make the customary discourse on the reception of licentiates; which performance entirely answered their expectations from him, and was made public. In 1631, Cardinal Bagni made him his librarian and Latin secretary, and carried him with him to Rome in the spring of that year. Naude continued in this service till the death of the cardinal, which happened July 24. 1641; and in the interim made an excursion to Padua, to take his doctor of physic's degree, in order to support with a better grace the quality with which he had been honoured by Louis XIII. who had made him his physician. The ceremony of this appointment was performed March 25. 1633, and we have the speech he pronounced on the occasion. After the death of his patron, he had thoughts of returning to France; but was detained in Italy by several advantageous offers made to him by persons of consideration in that country. Among these he preferred those of Cardinal Barberini, and closed with his eminence. However, as soon as Cardinal Richelieu sent for him to be his librarian, he immediately returned to Paris; but he happened not to be long in the service of the prime minister, if it be true that he arrived at Paris in March 1642, since Cardinal Richelieu died in December following: notwithstanding, he succeeded to the like post under Mazarine, for whom he formed

formed a most rich library, which he raised from the first volume in the space of seven years to the number of 40,000.

His design was nearly completed before the Cardinal gave him two small benefices, a canonry of Verdun and the priory of Artige in the Limosin: and we know how much this ungenerosity affected him, from a letter of Patin to Charles Spon, dated March 22. 1648, where he writes thus of our librarian: "I have seen one thing in him which I am very sorry for; especially as I have known him all along hitherto at a great distance from such a disposition: it is, that he begins to complain of his fortune, and of his master's avarice, from whom he had never received any more than 1200 livres a year in benefices; not forbearing to declare, that his life was sacrificed for too small a matter. I think (continues Patin) what grieves him is, the apprehension of dying before he has raised something for his brothers and his nephews, of whom he has a great number." However that be, Naude had the grief to see this library, which he had collected with so much pains and care, totally dispersed. Upon the disgrace of Mazarine it was sold; and Patin, in a letter of March 5. 1651, observes, that Naude had bought all the books in physic for 3500 livres. Christina queen of Sweden, who set herself to draw into her dominions all the literati of Europe, procured a proposal to be made to Naude of being her library keeper; and as he was then out of all employ, he accepted the proposal, and went to Cop.— But he soon grew out of humour with his residence in Sweden: the manners of the people, so very different from his, gave him great disgust; and seeing France become more quiet than it had been, he resolved to return. Accordingly he quitted Sweden loaded with presents from the queen, and several persons of distinction: but the fatigue of the journey threw him into a fever, which obliged him to stop at Abbeville; and he died there July 29. 1653.

As to his character, he was very prudent and regular in his conduct, sober, never drinking any thing but water. Study was his principal occupation, and he was indeed a true *Helluo librorum*; so that he understood them perfectly well. He spoke his mind with great freedom, and that freedom sometimes showed itself upon religious subjects, in such a manner as might have occasioned some disadvantageous thoughts of him; but the Christian sentiments in which he died left room to believe that his heart was never corrupted, and had no share in the free expressions which sometimes escaped from him; especially in the philosophical railleries which passed sometimes between him, Guy Patin, and Gassendi. He wrote a great number of books, a catalogue of which may be seen in Niceron's Memoires, tom. ix. Voltaire says, that "of all his books, the *Apologie des grands Hommes accusés de Magie* is almost the only one which continues to be read."

NAVE, in architecture, the body of a church, where the people are disposed, reaching from the balluster, 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, p. 725.

Navel-Wort, in botany. See COTYLEDON.

NAVEW, in botany. See BRASSICA, of which it is a species.

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 Æginets, the Phœnicians, Tyrians, and the ancient inhabitants of Britain. Some will have it, 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 the good man underwent on account of his enterprise shows evidently enough 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 to 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 opulency 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 in 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 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 merchandizes 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 ordinarily looked on 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 of 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 gulph, 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 parts 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 their 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 thereof, 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 reasons of commerce's passing successively from the Venetians, Genoese, and Hanse-towns, to the Portuguese and Spaniards, and from these again to the English and Dutch, is 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 hath 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 the

the 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 Judæa, 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 do agree that the mariner's compaſs is a modern invention, it hath 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, Roderic 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.

* See *Mariner's Compaſs*.

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 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 of cross-staff and an instrument called the *nautical quadrant*; which last was much praised by William Cuningham, 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, intitled 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, 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 *flower-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

lemy 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 bear 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 only been 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 croſs-ſtaff. 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 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 intitled, *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 confines 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 co-ſines, 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 co-ſines, equivalent to the geometrical mean between the co-ſines 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

ways 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 intitled, *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 intitled, *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, intitled, *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 intitled, *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, 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 tortoises: 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.

dius. 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 $\frac{1}{60}$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 Kalendar, 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, intitled, *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, intitled, *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 1744 and 1756, by Mr William 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 thro' 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 later 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.

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 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, hath 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 only can 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 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 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. Bouquer 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 $\frac{1}{175}$ 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 can seldom be done without considerable difficulty. 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 advisable 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 or 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 latitude 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 I. 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.

Example II. 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 and Longitude

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.

Example I. 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.

Example II. 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.

Example I. Required the difference of longitude between Edinburgh and New York, their longitude 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

Example II. What is the difference of longitude between Markelyne's Isles, in longitude 167° 59′ E. and Olinde, in longitude 35° 5′ W?

Longitude of Markelyne'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 different names, 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.

Example I. 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.

Example II. 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.

Tides.

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.

Example I. Required the time of new moon at Salonique in May 1793?

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

Example II. 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

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

Tides.

ter 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.

Example I. 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.	0	2	20
Equat. from the Tab. to $1^d\ 12^h\ 36'$	0	7	0
Time of high water at Leith		9	20 P.M.
Time of H. W. at Leith at full & change		2	20
Equat. to $1^d\ 12^h\ 36'-12^h=1^d\ 0^h\ 36'$		6	22
High water at Leith, Dec. 11th, at		8	42 A.M.

The time of high water found by the common method is about an hour and a half ſooner.

Example II. Required the time of high water at Funchal, 15th November 1793?

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, -	17d	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.	0	10	29
Reduced time of full moon, -	17	7	38
Interval, - -	1	11	9
Time of high water at full and change,	0	12	4
Equation to 1d 11h before full moon,	0	0	56
Time of high water, - -	0	11	8 PM.

Equation to 1 d. 11 h.+12 h.=1 d. 23 h. is 1 h. 15′, and 12 h. 4′—1 h. 15′=10 h. 49′=time of high water in the forenoon.

Example III. 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,		1ch	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

Ship's Run.

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.

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.

Example I. 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.

Example II. 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

Plane Sailing.

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.

Example I. 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

Example II. 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
Second run by the glaſs =	33)40068(121.4= true diſtance.

Chap. II. *Of 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 every where 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.

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. Plate CCCXXXVII.

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, is to be 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′ N. 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 *mn*, and make it equal to the rhumb of 3 points, and through *e* 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

Plane Sailing.

By Calculation.

To find the difference of latitude.

As radius - -		10.00000
is to the co-ſine 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.

Latitude St Helena	=	15° 55′ N.
Difference of latitude	-	2 11 S.
Latitude come to	-	13 44 N.

Prob. II. Given the courſe and difference of latitude, to find the diſtance and departure.

Example. A ſhip from St George's, in latitude 38° 45′ north, ſailed SE¾S; 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.

Plate cccxxxvii. 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 *m n*, which make equal to the rhumb of 3½ points: through A*e* 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 pts.	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 3½ points; oppoſite to which, in a diſtance column, is 282 miles; and in a departure column is 178.9 m.

Plane Sailing.

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 *m n*, which make equal to the rhumb of 3 points, the complement of the courſe; draw a line through C*e*, 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

Plane Sailing.

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 *m n*, 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 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, failed 260 miles between the ſouth and weſt, and made 190 miles of departure: Required the courſe and latitude come to?

By Conſtruction.

Plate cccxxxvii. 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 it, and join AC. Now deſcribe an arch from the centre A with the chord of 60°, and the portion *m n* 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 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, failed 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 failed from -	7° 56′ S.
Latitude in by obſervation	12 3 S.
Difference of latitude -	4 7=247.

By Conſtruction.

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 ; 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

Traverse Sailing.

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 sails 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 several 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 latitude 38° 32′ N, sailed as follows: ESE 163 miles, SW $\frac{1}{4}$ 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. N	Diff. of Latitude. S	Departure. E	Departure. W
ESE	163	—	62.4	150.6	—
SW$\frac{1}{4}$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	271.1	
			66.7	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 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 respectively.

Plate CCCXXXVII.

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

Traverse Sailing.

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. N	Diff. of Latitude. S	Departure. E	Departure. W
NW*b*N	43	35.8	—	—	23.9
WNW	78	29.9	—	—	72.1
SE*b*E	56	—	31.1	46.6	—
WSW½W	62	—	18.0	—	59.3
N¾E	85	84.1	—	12.5	—
		149.8	49.1	59.1	155.3
		49.1			59.1
N 44° W	139	100.7=1° 41′			96.2
Latitude left		-	1 38 S.		
Latitude come to		-	0 3 N.		

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 ½ 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. N	Diff. of Latitude. S	Departure. E	Departure. W
SSE	36	—	33.3	13.8	—
S	12	—	12.0	—	—
NW½W	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 to the May is SW ¼ S, distance 58 miles; from the May to the Staples S*b*E ¾ 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. N	Diff. of Latitude. S	Departure. E	Departure. W
SW ¼ S	58	—	43.0	—	38.9
S*b*E ¾ 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 S 1° E, and distance 110 miles.

Parallel Sailing.

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 where 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 part of the earth, the arch ABP being part of a meridian; CA the equatorial; and CP the polar semiaxis. Also let B be the situation of any given place on the earth; and join BC, which will be equal to CA or CP (A). 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. Plate CCCXXXVII.

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

(A) 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.

Parallel Sailing.

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.

EXAMPLE I. Required the number of miles contained in a degree of longitude in latitude 55° 58′?

By Construction.

Plate CCCXXXVII. 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.

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 deg. in a 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 intitled *chords*, and contains the several degrees of latitude: The other, marked M. L. signifying *miles of longitude*, is the *line of longitude*, and shows the number of miles in a degree of longitude in each parallel. The use of these lines is therefore obvious.

EXAMPLE II. 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.

Draw the straight line AB (fig. 11.) equal to the given distance 342 miles, and make the angle BAC equal 42° 52′, the given latitude: from B draw BC perpendicular to AB, meeting AC in C; then AC applied to the scale will measure 466½, 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 466½ on the line of numbers.

Longitude 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′, the 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°⅔, the required latitude.

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 178′.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′.

Parallel Sailing

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 parts 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.

Plate CCCXXXVII. Draw the lines CB, CE (fig. 13.), making angles 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; and 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 latitude 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 abstracted, gives 139′.8, 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.

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

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

Middle Latitude Sailing.

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 change 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

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.

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,

Middle Latitude Sailing.

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 failed from or on that come to, but on ſome intermediate parallel 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.

In order to illuſtrate the computations in middle latitude ſailing, let the triangle ABC (fig. 17.) repreſent a figure in plain 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 there the unknown parts of the other triangle will be eaſily obtained.

Plate CCCXXXVII.

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 37 W
Longitude Naze of Norway	-	7 27 E
Difference of longitude	-	10 4 = 604′

By Conſtruction.

Draw the right line AD (fig. 18.) to repreſent the meridian of the May; with the chord of 60° deſcribe the arch *m n*, 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 AC: 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.

By Calculation.

To find the courſe (B).

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 on table marked 6½ points at the bottom, which is the coſine; and the correſponding diſtance 85¾ multiplied by 4 gives 343 miles, the diſtance.

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 lines 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 o the Naze of Norway is 73 N, 24 E, or ENE¼E nearly; but as the variation at the May is 2¼ points weſt,

(B) 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.

weſt, therefore the courſe *per* compaſs from the May is E¾S.

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 SW¾W 238 miles. Required the latitude and longitude come to?

By Conſtruction.

Plate CCCXXXVII 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 47° 12′; and DC being meaſured, will be the difference of longitude: hence the longitude come to is

By Calculation,

To find the difference of latitude,

As radius - - -		10.00000
is to the co-ſine 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 (D).

As the co-ſine 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 41W.
Longitude come to -	-	9 11W.

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, ½ N, till by obſervation her latitude is found to be 28° 34′N. Required the diſtance ſailed, and longitude come to?

Middle Latitude Sailing.

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.

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 diſtance -	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	3¼ 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 18W.
Longitude come to -	-	33 43W.

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 NE ½ N. till her departure is 216 miles. Required the diſtance run, and latitude and longitude come to?

By Conſtruction.

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

(D) This proportion is obvious, by conſidering the whole figure as an oblique angled triangle.

Middle Latitude Sailing.

By Calculation.

To find the distance.

As the sine of the course	$3\frac{1}{2}$ points	9.80236
Is to radius	- - -	10.00000
So is the departure	216	2.33445
To the distance -	340.5	2.53209

To find the difference of latitude.

As the tangent of the course	$3\frac{1}{2}$ 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 12N.
Latitude come to	30 53N. 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 $3\frac{1}{2}$ points, and opposite to 108 half the departure, the distance is 170, and difference of latitude $131\frac{1}{2}$; 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 $3\frac{1}{2}$ 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 $4\frac{1}{2}$ 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′	24 12
	Middle latitude	42 6

By Construction.

Plate CCCXXXV 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 $4\frac{1}{2}$ 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 miles, the distance to 156, the difference of latitude on numbers, will reach from 90° to about $39°\frac{1}{3}$, the complement of the course on the line of sines: and the extent from 48°, the complement of the middle latitude, to $50°\frac{2}{3}$, 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	55 18
	Middle latitude	27 39

By Construction.

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 $36°\frac{2}{3}$, and the distance and difference of longitude, measured on the line of equal parts, are 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

Middle Latitude Sailing.

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 find the difference of longitude.

As radius		10.00000
is to the secant of the 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 46 W.
Longitude come to		24 48 W.

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 $27°\frac{2}{3}$, 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 $36°\frac{2}{3}$ the course on tangents; and the extent from $53°\frac{1}{3}$ the complement of the course to 90° on sines, will reach from 1126 to 1403 the distance on numbers. Lastly, the extent from $62°\frac{1}{3}$ 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 latitude and longitude, come to?

By Construction.

Plate CCCXXXVII. With the given distance and departure mark the triangle ABC (fig. 23.) Now the course being measured on the line of chords is about $34°\frac{1}{6}$, 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 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 Bourdeaux	44° 50′ N		44° 50′
Difference of latitude	5 9 N	half	2 35
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 middle latitude	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

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 56° 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 $54\frac{1}{3}$.

By Calculation.

To find the middle latitude.

As the departure	220	2.34242
is to the difference of longitude	396	2.59769
so is radius		10.00000

Middle Latitude Sailing.

to the ſecant of the middle latitude	56° 15′	10.25527
Double the middle latitude	112 30	
Latitude left	54 56	
Latitude come to	57 34	
Difference of latitude	2 38 = 158	

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°$\frac{1}{3}$ on tangents; and the extent from the complement of the courſe 35°$\frac{2}{3}$ 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$\frac{1}{4}$S 438 miles, and differed her longitude 7° 28′. Required the latitude ſailed from, and that come to?

By Conſtruction.

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′.

Plate CCCXXXVII.

By Calculation.

To find the difference of latitude.

As radius		10.00000
is to the coſine of the courſe	3$\frac{1}{4}$ 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$\frac{1}{4}$ pts.	9.82708
to the coſine of the middle 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$\frac{1}{4}$ points, and half the diſtance 219 miles, the departure is 147.0, and difference of latitude 162.2; which doubled is 324.4. 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$\frac{3}{4}$ 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. Given the courſe, difference of latitude, and difference of longitude; to find both latitudes and diſtance.

Example. From a port in ſouth latitude a ſhip ſailed SW$\frac{1}{2}$W, and has made 690 miles of difference of latitude, and 20° 38′ of difference of longitude.—Required both latitudes and diſtance?

By Conſtruction.

Conſtruct the triangle ABC (fig. 26.) with the given courſe and difference of latitude, and make CD equal to 1228 the difference of longitude. Then AC applied to the ſcale will meaſure 1088 miles; and the middle latitude BCD will meaſure 46° 47′. Hence the latitude left is 41° 2′, and the latitude come to 52° 32′.

By Calculation.

To find the diſtance.

As radius		10.00000
is to the ſecant of the courſe	4$\frac{1}{2}$ pts.	10.19764
ſo is the difference of latitude	690	2.83885
to the diſtance	1088	3.03649

To find the middle latitude.

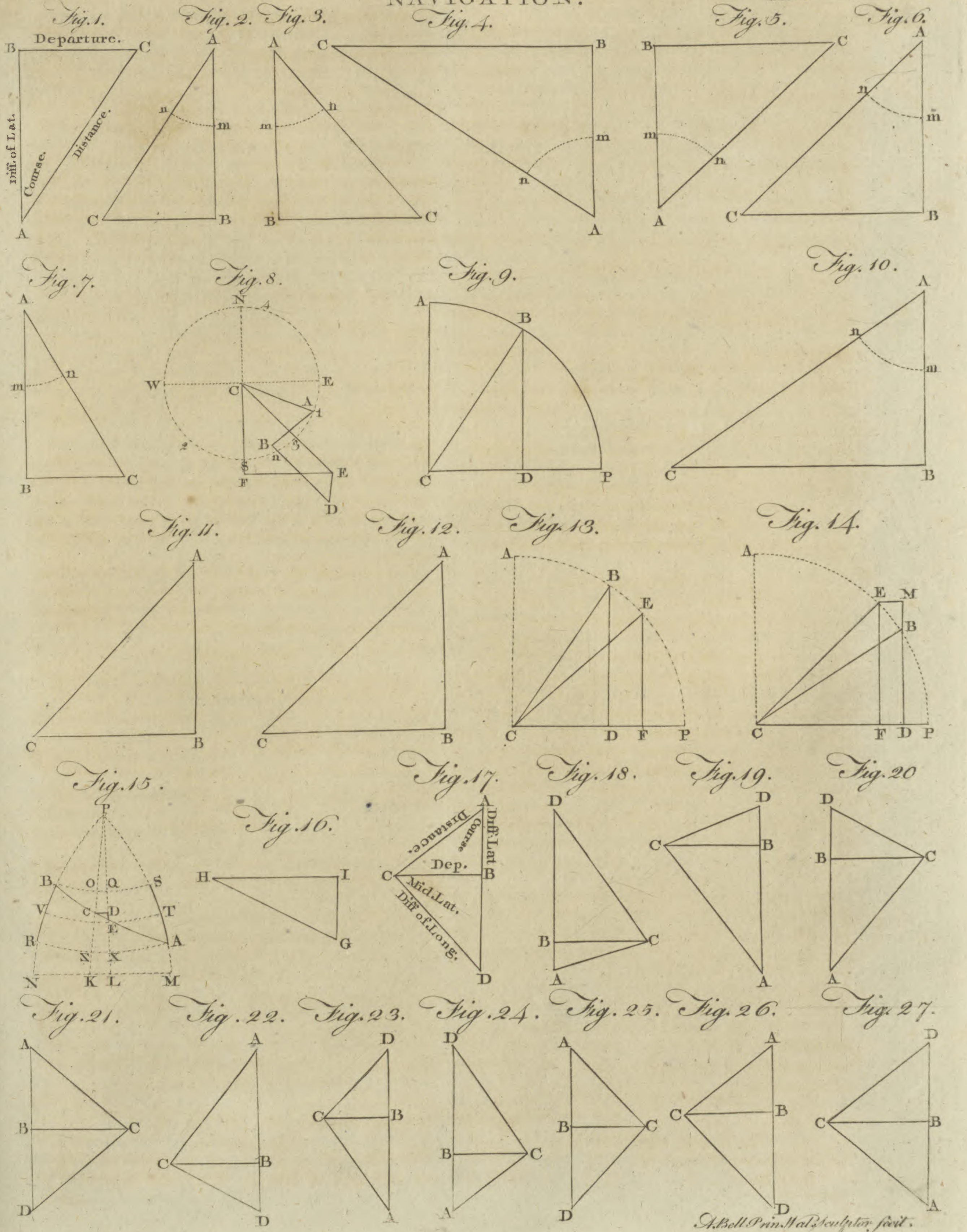
As the difference of longitude	1228	3.08920
is to the diſtance	1088	3.03649
ſo is the ſine of the courſe	4$\frac{1}{2}$ pts.	9.88819
to the coſine of the middle latitude	46° 47′	9.83548
Half difference of latitude	5 45	
Latitude ſailed from	41 2	
Latitude come to	52 32	

By Inſpection.

To the courſe 4$\frac{1}{2}$ points, and one-fourth of the given difference of latitude 172.5 the departure is 210.2

NAVIGATION.

Plate CCCXXXVII.



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210.2, and distance 272, which multiplied by 4 is 1088.

Now the middle latitude answering to the difference of longitude 1228, and departure 840.8, or their aliquot parts, will be found as in last problem to be 46° 47′. Hence the latitudes are 41° 2′ and 52° 32′ respectively.

By Gunter's Scale.

The extent from the complement of the course 3½ points to 8 points on sine rhumbs, will reach from the difference of latitude 690 to the distance 1088 miles on numbers; and the extent from the difference of longitude 1228 to the distance 1088 on numbers, will reach from the course 50° 38′ to the complement of the middle latitude 43° 13′ on the line of sines.—Hence both latitudes are found as before.

Prob. XI. Given the distance sailed, difference of latitude, and difference of longitude, to find both latitudes and course.

Example. In north latitude, a ship sailed 458 miles on a direct course between the north and west; and then was found to have differed her latitude 296 miles, and longitude 7° 17′. Required both latitudes and course?

By Construction.

Plate CCCXXXVII.

With the distance and difference of latitude construct the triangle ABC (fig. 27.) and make CD equal to the difference of longitude 437; then the course BAC will be found to measure 49° 44′, and the middle latitude BCD 36° 54′: Hence the latitude left is 34° 26′, and that come to 39° 22′.

By Calculation.

To find the course.

As the difference of latitude	296	2.47129
is to the distance	458	2.66086
so is radius		10.00000
to the secant of the course	49° 44′	10.18957

To find the middle latitude.

As the difference of longitude	437	2.64048
is to the distance	458	2.66086
so is the sine of the course	49 44	9.88255
to the cosine of the middle latitude	36 54	9.90293
Half difference of latitude	2 28	
Latitude left	34 26	
Latitude come to	39 22	

By Inspection.

To half the distance 229 the difference of latitude is 150.2 at 49°, and 147.2 at 50°.

Then, as 3.0 : 2.2 : : 60′ : 44′

Therefore the course is 49° 44′

Also the departure is 172.8 at 49°, and 175.4 at 50°.

Hence, as 3.0 : 2.2 : : 2.6 : 1.9

And 172.8 + 1.9 = 174.7 = half the departure.

Now to half the difference of longitude 218.5 in a distance column, the difference of latitude is 176.8 at 36°, and 174.5 at 37°.

Then, as 2.3 : 2.1 : : 60′ : 54′.

Hence the middle latitude 36° 54′; and therefore the latitude sailed from is 34° 26′, and that come to 39° 22′.

By Gunter's Scale.

The extent from the distance 458 to the difference of latitude 296 on numbers, will reach from 90° to 40° 16′ the complement of the course on sines; and the extent from the difference of longitude 437 to the distance 458 on numbers, will reach from the course 49° 44′, to the complement of the middle latitude 53° 6′ on the line of sines: Hence the latitudes are 34° 26′ and 39° 22′ respectively.

Prob. XII. Given the distance, middle latitude, and difference of longitude, to find both latitudes and course.

Example. The distance is 384 miles between the south and east, the middle latitude 54° 6′, and difference of longitude 6° 36′. Required both latitude and course?

By Construction.

Plate CCCXXXVIII.

With the middle latitude 54° 6′, and difference of longitude 396, construct the triangle BCD (fig. 28.) and make AC equal to the given distance 384 miles. Then the course BAC will be found to measure 37° 12′, and the difference of latitude AB 306 miles—Hence the latitude sailed from is 56° 39′, and that come to 51° 33′.

By Calculation.

To find the course.

As the distance	384	2.58433
is to the difference of longitude	396	2.59769
so is the cosine of middle latitude	54° 6′	9.76817
to the sine of the course	37 12	9.78153

To find the difference of latitude.

As radius		10.00000
is to the cosine of the course	37° 12′	9.90120
so is the distance	384	2.58433
to the difference of latitude	305.9	2.48553
Middle latitude	54° 6′	
Half difference of latitude	2 33	
Latitude sailed from	56 39 N	
Latitude come to	51 33 N	

By Inspection.

To the middle latitude 54°, and half the difference of longitude 198 in a distance column, the number in a latitude column is 116.4. Now half the distance 192 and 116.4 in a departure column, are found to agree nearly under the course 37°, and the corresponding difference of latitude 153; which doubled is 306 miles. Hence the latitude left is 56° 39′ N, and latitude come to 51° 33′ N.

By Gunter's Scale.

The extent from the distance 384 to the difference of longitude 396 on the line of numbers, will reach from 35° 54′, the complement of the middle latitude, to 37° 12′, the course on the line of sines: And the extent from 90° to 52° 48′ the complement of the course on sines, will reach from the distance 384 to the difference of latitude 306 on numbers. Hence the latitudes are known.

Prob. XIII. To determine the difference of longitude made good upon compound courses, by middle latitude sailing.

Middle Latitude Sailing.

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:—SWbS 34 miles, WbN 63 miles, NNW 48 miles, and NE½E 85 miles. Required the latitude and longitude come to?

Courses.	Dist.	Diff. of latitude N	Diff. of latitude S	Departure. E	Departure. W
SWbS	54	—	44.9	—	30.0
WbN	63	12.3	—	—	61.8
NNW	48	44.4	—	—	18.4
NE½E	85	53.9	—	65.7	—
		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 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 on longitude will be equal to 240 × secant 61° − secant 57° = 29.6 × secant 57°.

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

Ex. A ship from Halliford in Iceland, in lat. 64° 30′ N, long. 27° 15′ W, sailed as follows: SSW 46 miles, SW 61 miles, SbW 59 miles, SEbE 86 miles, SbE½E 76 miles. Required the lat. and long. come to?

Traverse Table.

Courses.	Dist	Diff. of Lat. N	Diff. of Lat. S	Departure E	Departure W
SSW	46	—	42.5	—	17.6
SW	61	—	43.1	—	43.1
SbW	59	—	57.9	—	11.5
SbE	86	-	47.8	71.5	—
SEb½E	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.

Longitude Halliford - 27 15 W

Longitude in - - 16 29

The Error of comm. method, in this Ex. is 12′.

Longitude Table.

Successive Latitudes.	Sums.	Middle Latitude.	Diff. of Longitude. E	Diff. of Longitude. 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

Mercator's Sailing.

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, encreaſe with the diſtance of the parallel from the equator. The parts of the meridian thus encreaſed 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 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, $\frac{\text{ſecant latitude}}{\text{part of meridian,}} = \frac{R}{\text{part of parallel.}}$

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,

$$\frac{\text{ſecant } 1'}{\text{part of mer. } a} = \frac{\text{ſecant } 2'}{\text{part of mer. } b} = \frac{\text{ſecant } 3'}{\text{part of mer. } c.}\ \&c$$

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 mer. $a+b+c$, &c.

That is, the meridional parts of any given latitude is equal to the ſum of the ſecants of the minutes in that latitude (D).

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

$$\text{Hence LK} = \frac{\text{ED} \times \text{ſec LD} \times \text{tang. CED}}{R^2} = \frac{\text{ED} \times \text{ſec. LD}}{R} \times \frac{\text{tang CED}}{R}.$$

But $\frac{\text{ED} \times \text{ſec. LD}}{R}$ is the enlarged portion of the meridian anſwering to ED. Now the ſum of all the quantities $\frac{\text{ED} \times \text{ſecant LD}}{R}$ 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.

Whence MN = mer. diff. of lat. × tangent $\frac{\text{CED}}{R.}$

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. 29. 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 CCCXXXVIII

It is ſcarce 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.

Example 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.

Draw the ſtraight line AD (fig. 29.) 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 diſtance 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

(D) 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.

Mercator's Sailing.

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 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.

Plate CCCXXXVIII. With the course and distance sailed construct the triangle ABC (fig. 30.); 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 lat.	293

To find the difference of longitude.

As radius - -		10.00000
is to the 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 3 points on tangent rhumbs, will reach from the meridional difference of latitude 293 to the difference of longitude 196 on numbers.

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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 ¾ S, 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	Mer. diff. lat. 338
	246	

By Construction.

Make AB (fig. 31.) equal to 246, and AD equal to 338; draw AE, making an angle with AD equal to 3¼ 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,	3¼ 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,	3¼ 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 - -	55 49 W

By Inspection.

Under the course 3¼ 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 4¾ 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 3¼ 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*W ½ W, and departure 420 miles. Required the

Mercator's Sailing.

the distance run, and the latitude and longitude come to?

By Construction.

With the course and departure construct the triangle ABC (fig. 32); now AC and AB being measured, will be found equal to 476 and 224 respectively: 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 therefore is 14° 56′ W.

Plate CCCCXXXVIII.

By Calculation.

To find the distance.

As radius - - -		10.00000
is to the cosecant of the course,	$5\frac{1}{2}$ 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,	$5\frac{1}{2}$ 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	
Latitude 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	$5\frac{1}{2}$ 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 $5\frac{1}{2}$ 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 $5\frac{1}{2}$ 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 $2\frac{1}{2}$ 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 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. 33.) equal to 780, and AD equal to 1081; draw BC, DE perpendicular to AD; make AC equal to 1162 m. 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.

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 $4\frac{1}{2}$ 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° 9′ 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	mer. diff. of lat. 382
	217.	

By

Mercator's Sailing.

Plate cccxxxviii.

By Conſtruction.

With the difference of latitude 217m. and departure 146m. conſtruct the triangle ABC (fig. 34.), make 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° 9' W
Difference of longitude		4 17 E
Longitude come to - -		2 8 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.

With the diſtance and departure make the triangle ABC (fig. 35.) 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 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°⅓ on ſines; and the ſame extent that will reach from the complement of the courſe 46°⅔ on ſines will reach to the difference of latitude on numbers.—Again, the extent from 45° to 43°⅓ 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.

Mercator's Sailing.

Plate CCCXXXVIII

By Construction.

Make the right angled triangle ADE (fig. 36.) 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 these 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 38° 45′ N	Mer parts	2526
	Mer. diff. of lat.	835
Latitude come to 48 46 N.	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 latitude 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. N	Diff. of Lat. S	Departure. E	Departure. 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	282.3	
			13.3		
S 72° E	297		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; 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, which place in the fourth or fifth columns, according as the course 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.

Example I. 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?

Tra-

Traverse Table.					
Courses.	Dist.	Diff. of Lat. N	Diff. of Lat. S	Departure. E	Departure. 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		342.5
			58.2		
W 1° S	343		5.0		

Longitude Table.				
Successive Latitudes.	Merid. Parts.	Merid. Diff. Lat.	Diff. of Longitude. E	Diff. of Longitude. 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.

EXAMPLE II. A ship from latitude 78° 15′ N, longitude 28° 14′ E. sailed the following courses and distances. The latitude come to is requred, 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 N	Diff. of Latitude S	Departure. E	Departure. W
WNW	154	58.9	—	—	142.3
SW	96	—	67.9	—	67.9
NW¼W	89	56.4	—	—	68.8
N*b*E	110	107.9	—	21.5	—
NW¾N	56	45.0	—	—	33.4
S*b*E¾E	78	—	73.4	26.3	—
		268.2	141.3	47.8	312.4
		141.3			47.8
		126.9			264.6

By Rule 1st.

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 latit.	687	-	2.83696
so is the departure	264.6	-	2.42256
to difference 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	Diff. of Longitude. 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. The constant quantity 12.633114 (G) is to the difference or sum of the logarithmic tangents of half the co-latitudes of two places, according as these latitudes are of the same, or a contrary denomination; as the tangent of the course is to the difference of longitude.

Demonst. Let CABP, Plate CCCXXXVIII. fig 37. be a section of one fourth of the earth in the plane of the meridian; and let AC be the radius of the equator, and B any given place whose latitude is therefore AB. Draw BD perpendicular to AC, and BE parallel to it; and let B*b* be a very small portion of the meridian, as one minute.——Now put CA $= r$, DB $= y$, BE $= x$, and $z =$ meridional parts answering to the arch AB.

Then, $x : r :: bn : \frac{r}{x} \times bn$

but, $x : r :: \frac{r}{x} \times bn : \frac{r^2}{x^2} \times bn =$ correspondent portion of the enlarged meridian. Now these being put into fluxions, we have,

$$\dot{z} = \frac{r^2}{x^2} \times \dot{y} = \frac{\dot{y}}{r^2 - y^2}$$

Of which the fluent is,

$$z = \frac{2.302585 \times r}{2} \times \log. \frac{r+y}{r-y}$$

$$= 2.302585 \times r \times \log. \sqrt{\frac{r+y}{r-y}}$$

Now as the meridional parts are expressed in parts of the equator, this equation becomes,

$$z = \frac{2.302585 \times 180° \times 60'}{3.15149} \times \log. \sqrt{\frac{r+y}{r-y}} = \frac{1}{.0001263314} \times \log. \sqrt{\frac{r+y}{r-y}},$$

$$\text{But log. } \sqrt{\frac{r+y}{r-y}} = \log. \sqrt{\frac{r + \text{sine AB})}{r - \text{sine AB})}} = \log. \sqrt{\frac{\text{tan. } (45 + \frac{1}{2}\text{AB})}{\text{tan. } (45 - \frac{1}{2}\text{AB})}}$$

$$\text{And the tang. } (45 - \tfrac{1}{2}\text{AB}) = \frac{1}{\text{tan. } (45 + \frac{1}{2}\text{AB})}$$

$$\text{Therefore } z = \frac{1}{.00012633114} \times \log. \sqrt{\text{tan. } (45 + \tfrac{1}{2}\text{AB})^2} =$$

$$= \frac{\text{log. tang. } (45 + \frac{1}{2}\text{AB})}{.00012633114.} = \frac{\text{log. tang. half co-latitude.}}{.00012633114, \text{ \&c.}}$$

Hence the meridional parts answering to any given latitude, is found by dividing the difference between the log. of the radius and the log. tangent of half the complement of latitude, by the constant quantity .00012633114, &c.; and the meridional difference of latitude is obtained by dividing the difference or sum of the logarithmic tangents of half the co-latitudes, according as they are of the same or a contrary name, by the above quantity.

And the meridional difference of latitude multiplied by the tangent of the course, is equal to the difference of longitude. Hence the proposition is manifest.

This method shall be illustrated with examples performed by calculation: the other methods of solution are purposely omitted.

PROB. I. Given the latitudes and longitudes of two places, to find the course and distance between them.

EXAMPLE. Required the bearing and distance of Ostend, in lat. 51° 14′ N.; long. 2° 56′ E from Aberdeen, in latitude 57° 9′ N. and longitude 2° 9′ W.?

Long. Aberdeen,	2°	9 W.
Long. Ostend,	2	56 E.
Diff. longitude	5	5=305

Lat. 57° 9′	comp. 32° 51′	half 16° 25½	tangent 9.46951
Lat. 51 14	comp. 38 46	half 19 23	tangent 9.54633
Diff. Lat. 5 55=355			Difference 7682

To find the course.

As the difference of the log. tang. 7682		3.88547
is to the constant logarithm	-	11.10151
so is the diff. of longitude	305	2.48430
to the tangent of the course	26° 38′	9.70034

To find the distance.

As radius - - -		10.00000
is to the secant of the course	26° 38′	10.04871
so is the difference of latitude	355	2.55023
to the dift nce -	397.1	2.59894

PROB. II. Given the latitudes and bearing of two places; to find the distance and differ. of longitude.

EXAMPLE. Two days ago we were in latitude 23° 18′ S. longitude 16° 54′ W.; and having run upon a direct course, which corrected was S. 53° E. we were found to be in latitude 26° 26′ S. Required the distance sailed, and longitude come to?

Lat. left, 23° 18′	comp. 66° 42′ half 33° 21′	tang. 9.81831
Lat. come to, 26 26	comp. 63 34 half 31 47	tang. 9.79213
Diff. of Lat. 3 8=188m.		Difference 2618

(G) In this case the tangent is to consist of five figures besides the index; but if the table extends to 6 or 7 figures, the above number will be 126.33, &c. or 1263.3, &c.

Method of resolving the Problems of Mercator's Sailing.

To find the distance.

As radius - - -		10.00000
is to the secant of the course	53°	10.22054
so is the difference of latitude	188	2.27416
to the distance	312.4	2.49470

To find the difference of longitude.

As the constant logarithm - -		11.10151
is to the tangent of the course	53°	10.12289
so is the diff. of log. tangents	2618	3.41797
to the difference of longitude	275	2.43935
Longitude left, - -		16° 54 W.
Difference of longitude, .		4 35 E.
Longitude in . '		12 19 W.

Prob. III. Given the latitudes of two places, and the distance between them; to find the course and difference of longitude.

Example. A ship from latitude 48° 10′ N. longitude 15° 12′ W. failed on a direct course between the south and west 284 miles, and is then in latitude 44° 52′ N. Required the course and longitude come to?

Lat. left, 48° 10′ N. comp. 41° 50′ half 20° 55′ tang. 9.58229
Lat in, 44 52 N. comp. 45 8 half 22 34 tang. 9.61865

Diff. of lat. 3 18=198m Difference 3636

To find the course.

As the distance -	284	2.45332
is to the difference of latitude	198	2.29666
so is radius - - -		10.00000
to the cosine of the course	45° 48′	9.84334

To find the difference of longitude.

As the constant logarithm -		11.10151
is to the tangent of the course	45° 48′	10.01213
so is the diff. of logarithm tangents	3636	3.36062
to the difference of longitude	186.7	2.27124
Longitude left, - -		15° 12 W.
Difference of longitude - -		3 7 W.
Longitude come to - -		18 19 W.

Prob. IV. Given both latitudes and departure, to find the course, distance, and difference of longitude.

Example. A ship from latitude 18° 24′ S, longitude 3° 25′ E failed between the north and west upon a direct course, till by observation she is in latitude 12° 42′ N. and has made 970 miles of departure.—Required the course, distance, and longitude come to?

Lat. left, 18° 24′ S. comp. 71° 36′ half 35° 48′ cotan. 0.14193
Lat. come to, 12 42 N. comp. 77 18 half 38 39 cotan. 0.09706

Diff. of lat. 31 6=1866 Sum 0.23899

To find the course.

As the difference of latitude	1866	3.27091
is to the departure -	970	2.98677
so is radius - - -		10.00000
to the tangent of the course,	27° 28′	9.71586

To find the distance.

As radius - -		10.00000
is to the secant of the course	27° 28′	10.05194
so is the difference of latitude	1866	3.27091
to the distance -	2103	3.32285

To find the difference of longitude.

As the constant logarithm - -		11.10151
is to the tangent of the course	27° 28′	9.71586
so is the sum of the log. tangents	23899	4.37838
to the difference of longitude	983.4	2.99273
Longitude left - -		3° 25′ E.
Difference of longitude -		16 23 W.
Longitude come to -		12 58 W.

Prob. V. Given one latitude course and distance; to find the other latitude and difference of longitude.

Example. From Scarborough, in latitude 54° 20′ N. longitude 0° 10′ W. a ship failed NE¾E 210 miles. Required the latitude and longitude come to?

To find the difference of latitude.

As radius - - -		10.00000
is to the cosine of the course	4¾ points	9.77503
so is the distance -	210	2.32222
to the difference of latitude	125	2.09725

Lat. left, 54° 20′ N. comp. 35° 40′ half 17° 50′ tang. 9.50746
Diff. of lat. 2 5 N.

Lat. in, 56 25 N. comp 33 35 half. 16 47½ tang. 9.47964

Difference 2782

To find the difference of longitude.

As the constant logarithm -		11.10151
is to the tangent of the course	4¾ pts.	10.12980
so is the difference of log. tang.	2782	3.44436
to the difference of longitude	296.9	2.47265
Longitude of Scarborough -		0 10 W.
Difference of longitude -		4 57 E.
Longitude come to, - -		4 47 E.

Prob. VI. Given one latitude, course, and departure, to find the other latitude, distance, and difference of longitude.

Example. A ship from latitude 32° 58′ N. longitude 16° 28′ W. failed SE½S, and made 164 miles of departure. Required the distance run, and latitude and longitude come to?

To find the distance.

As the sine of the course	3½ pts.	9.80236
is to radius - -		10.00000
so is the departure -	164	2.21484
to the distance -	258.5	2.41248

To find the difference of latitude.

As the tangent of the course	3½ pts.	9.91417
is to radius - -		10.00000
so is the departure	164	2.21484
to the difference of latitude	199.8	2.30067

Lat. left, - 32° 58′ N. comp. 57° 2′ half 28° 31′ tang. 9.73507
Diff. of lat. 3 20 S

Lat. come to, 29 38 N. comp. 60 22 half 30 11 tang. 9.76464

Difference 2957

To find the difference of longitude.

As the constant logarithm -		11.10151
is to the tangent of the course	3½ pts.	9.91417
so is the difference of log. tangents	2957	3.47085
to the difference of longitude	192.1	2.28351

Longitude

Longitude left, - - 16° 28 W.
Difference of longitude, - - 3 12 E.

Longitude in, - - 13 16 W.

Prob. VII. Given one latitude, diſtance, and departure; to find the other latitude, courſe, and difference of longitude.

Example. A ſhip from Cape Voltas, in latitude 28° 55′S. longitude 15° 53′E. ſailed 286 miles between the ſouth and weſt, and made 238 miles of departure. Required the courſe, the latitude and longitude come to?

To find the courſe.

As the diſtance - 286 2.45637
is to the departure - 238 2.37658
ſo is radius - - 10.00000

to the ſine of the courſe 56° 19′ 9.92021

To find the difference of latitude.

As radius - - - 10.00000
is to the coſine of the courſe 56° 19′ 9.74398
ſo is the diſtance - 286 2.45637

to the difference of latitude 158.6 2.20035

Lat. Cape Voltas, 28° 55′ S. comp. 61° 5′ half 30° 32½′ tang. 9.77087
Diff. of Lat. 2 39 S.

Latitude in, 31 34 S. comp. 58 26 half 29 13 tang. 9.74762

Difference 2325

To find the difference of longitude.

As the conſtant logarithm - 11.10151
is to the tangent of the courſe 56° 19′ 10.17620
ſo is the diff. of log. tangents 2325 3.36642

to the difference of longitude 276.1 2.44111
Longitude Cape Voltas, - 15° 53′E.
Difference of longitude, - 4 36 W.

Longitude come to, - 11 17 E.

Prob. VIII. Given one latitude, courſe, and difference of longitude, to find the other latitude and diſtance.

Example. A ſhip from latitude 16° 54′N. longitude 62° 16′.W. ſailed upon a NW. by N. courſe, until her longitude by obſervation is 68° 10′W. Required the diſtance run, and latitude come to?

Longitude left, - 62° 16′W.
Longitude come to, - 68 10 W.

Difference of longitude, - 5 54 = 354

To find the latitude come to.

As the tangent of the courſe 3 pts. 9.82489
is to the conſtant logarithm, - 11.10151
ſo is the difference of longitude 354 2.54900

to the difference of log. tangents, 6693 3.82562

Lat. left, 16° 54′ comp. 73° 6′ half 36° 33′ tang. 9.87000
Diff. log. tang. 6693

Lat. in, 25 8 64 52 32 26 tang. 9.80307

Diff. of lat. 8 14 = 494m.

To find the diſtance.

As radius - - - 10.00000
is to the ſecant of the courſe 3 points. 10.08015
ſo is the difference of latitude 494 2.69373

to the diſtance - 594.1 2.77388

Prob. IX. 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, and 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 of latitude is found as formerly.

Table A.

Arc.	10°	20°	30°	40°	50°	60°	70°	80°	90°
1°	3′	1′	1′	1′	0′	0′	0′	0′	0′
2	12	6	4	2	2	1	1	0	0
3	27	13	8	6	4	3	2	1	0
4	47	23	14	10	7	5	3	1	0
5	74	36	23	16	11	8	5	2	0
6	107	52	33	22	16	11	7	3	0
7	145	70	44	30	21	15	9	4	.0
8	190	92	58	40	28	19	12	6	0

Table B.

Lat.	
0°	$\frac{1}{3}$
10	$\frac{1}{3}$
20	$\frac{1}{6}+\frac{1}{7}$
30	$\frac{1}{6}+\frac{1}{8}$
40	$\frac{1}{8}+\frac{1}{15}$
50	$\frac{1}{4}$
60	$\frac{1}{5}$
70	$\frac{1}{6}+\frac{1}{55}$
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
Dif. of longitude 300 log. 2.47712
Latitude - 50° coſine 9.80807

Approximate courſe 41 41 ſine 9.82279

To lat. 50°, and half diff. long. 150, the 1ſt
Corr. in a dep. column is 115 +1 55

Method of reſolving the Problems of Mercator's Sailing.

In table A to co. courſe 48° and 1ſt corr. 1° 55′, the ſecond correction is	—0 2
To courſe 41° and diff. long 5°, the number is 6′, of which $\frac{1}{5}$ (Tab. B) being taken gives - - - -	—0 1
True courſe	S. 43 33 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

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 ſemiaxis 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 which might probably err more from the 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.

EXAMPLE I. At 11ʰ A. M. the Girdleneſs bore W NW, and at 2ʰ P. M. it bore NW*b*N; the courſe during the interval S*b*W 5 knots an hour. Required the diſtance of the Ship from the Neſs at each ſtation?

By Conſtruction.

Plate cccxxxviii

Deſcribe the circle NE.SW (fig. 38.) 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 Girdleneſs. 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, FH.

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 -	9 points -	9.99157
ſo is the diſtance CH	15 miles -	1.17609
to the diſtance FH -	26.48 -	1.42292

Oblique Sailing.

EXAMPLE II. 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 ſaid point from the iſland of Brehaut?

By Conſtruction.

Deſcribe a circle, (fig. 39.) 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 $34\frac{1}{2}$ miles, and the inclination of BI to the meridian will be found equal to $63°\frac{1}{3}$.

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 diſtance 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 N63 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

EXAMPLE III. 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. 40) 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 $26\frac{1}{2}$ miles; and the inclination of DB to the meridian will be found equal to N $79°\frac{1}{4}$ W.

By Calculation.

In the triangle DBC 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

Oblique Sailing.

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 difference	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 Beachy-head from Dungeneſs will be W ¼ S nearly.

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

Example IV. Running up Channel E*b*S *per* compaſs at the rate of 5 knots an hour. At 11h A. M. the Eddiſtone light-houſe bore N*b*E¼E and the Start point NE*b*E¼E; and at 4 P. M. the Eddiſtone bore NW*b*N, and the Start N ¾ E. Required the diſtance and bearing of the Start from the Eddiſtone, the variation being 2¼ points W?

By Conſtruction.

Plate cccxxxviii. Let the point C (fig. 41) repreſent the firſt ſtation, from which draw the N*b*E¼E line CA, the NE*b*E¼E 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 N¾E 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°⅓.

By Calculation.

In the triangle CAD are given CD equal to 25 miles, the angle CAD equal to 4¼ points, the diſtance between N*b*E¼E 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	4¼ 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 4½ points the interval between NE*b*E¼E and N¾E; and CDB 7¾ points, the diſtance between W*b*N and N¾E; to find the diſtance CD.

As the ſine of CBD -	4½ points -	9.88819
is to the ſine of CDB	7¾ 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*E¼E and NE*b*E¼E; 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 ESE½E; and the variation 2¼ points being allowed to the left of ESE½E, gives E¾N, the true bearing of the Start from the Eddiſtone.

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	1.359 4

Example V. 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. 42.) 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°¼. 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°⅕ E; and the other ſhip's courſe, or angle BAM, will be 67°⅘, 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.

By

Oblique Sailing.

By Calculation.

In the triangles ADE, ABC, are given AD equal to 87, DE equal to 41, and AB equal to 48; to find the angle BAC and diftance 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
fo is radius	-	-	10.00000
to the tangent of the bearing	25° 14′		9 67326

To find the diftance of the ports.

As radius	-	-	10.00000
is to the fecant of the bearing -	25° 14′	-	10.04355
fo is the diff. of latitude	48	-	1.68124
to the diftance -	53.06	-	1.72479

In the triangle AMC, the three fides are given to find the angles.

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			
Half -	117.53	-	log. -	2.07015
Difference -	35.53	-	log. -	1.55059
				19.89597
	27 29	-	cofine	9.94798
Angle ACM	54 58			
Angle BAC	25 14			
Southernmoft fhip's courfe	N80 12 E			

To find the angle MAC.

As AM - - -	82	-	1.91381
is to MC - - - -	100	-	2.00000
fo is the fine of ACM -	54 58	-	9.91319
to the fine of MAC -	93 3	-	9.99938
Angle BAC -	25 14		
Northernmoft fhip's courfe -	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 cofine of the courfe -	67° 49′	-	9.57700
fo is the diftance -	82	-	1.91381
to the diff. of lat.	30.96	-	1.49081
Latitude of northernmoft 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 courfe -	67° 49′	-	10.38960
fo 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 E	

Windward Sailing.

Chap. IX. *Of Windward Sailing.*

Windward failing is, when a fhip by reafon of a contrary wind is obliged to fail on different tacks in order to gain her intended port; and the object of this failing is to find the proper courfe and diftance to be run on each tack.

Example I. A fhip 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 fhip can lie within 6 points of the wind. Required the courfe and diftance on each tack?

By Conftruction.

Plate CCCXXXVIII.

Draw the SSW line CB (fig. 43.) equal to 48 miles. Make the angles ACB, ABC, each equal to 6 points. Hence the firft courfe will be W, and the fecond SE: alfo the diftance CA, or AB, applied to the fcale will meafure 62¾ miles, the diftance to be failed on each board.

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 diftance AC.

As radius -	-	-	10.00000
is to the fecant of C -	6 points	-	10.41716
fo is CD -	24 miles	-	1.38021
to CA -	62 7	-	1.79737

Example II. The wind at NW, a fhip bound to a port 64 miles to the windward, propofes to reach it on three boards; two on the ftarboard, and one on the larboard tack, and each within 5 points of the wind. Required the courfe and diftance on each tack?

By Conftruction.

Draw the NW line CA (fig. 44.) equal to 64 miles; from C draw CB W*b*S, and from A draw AD parallel thereto, and in an oppofite direction; bifect 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 fcale will meafure 36¼ miles, and BD=2CB=72½ miles

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 fecant of BCF, -	5 points		10.25526
fo is CF - -	16 m.		1.20412
to CB - -	36.25		1.55938

Example III. A fhip 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

Windward Sailing.

reach on four boards, the first being on the larboard tack. Required the course and distance on each?

By Construction.

Plate CCCXXXVIII.

Draw the NEbN line CA (fig. 45.) equal to 36 miles, and bisect it in B; from C and B draw lines parallel to the E$\frac{1}{2}$S rhumb; and from A and B draw lines parallel to the SSE$\frac{1}{2}$E 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.

By Calculation.

From E draw EF perpendicular to AC; and in the triangle CFE are given CF=9 m. and the angle FCE =5$\frac{1}{2}$ points, to find CE

As radius	-	-	10.00000
is to the secant of FCE	-	5$\frac{1}{2}$ points	10.32661
so is CF	-	9 miles	0.95424
to the distance CE	-	19.1 miles	1.28085

Example IV. A ship bound to a port bearing NbW distant 40 miles, with the wind at NbE$\frac{1}{2}$E, intends to reach it on two boards. Required the course and distance on each tack, the ship lying within 5$\frac{1}{2}$ points of the wind?

By Construction.

Draw the NbW line CA (fig. 46.) equal to 40 miles; and because the wind is NbE$\frac{1}{2}$E, and the ship can lie within 5$\frac{1}{2}$ points of the wind, the course on the larboard tack will be EbN, and on the starboard NW. Therefore, from the centre C draw the EbN 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

Example V. A ship close hauled within 5 points of the wind, and making one point of lee-way, is bound to a port bearing SSW, distant 54 miles, the wind being SbE: 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.

Draw the SSW line CA (fig. 47.) equal to 54 m. and as the wind is SbE, and the ship makes her course good within 6 points of the wind, therefore the course on the larboard tack will be SWbW, and on the starboard EbS: hence from C draw the SWbW line CB, and from A draw AD parallel thereto; bisect CA in E, and draw BED parallel to the EbS 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	

Example VI. A ship plying to the windward, with the wind at NNE, after sailing 51 miles on each of two tacks, 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. 48.) 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.

By Calculation.

In the triangles CAB, BCD, are given AB equal to 36m. 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

Example VII. A ship that makes her way good within 6$\frac{1}{2}$ points of the wind, reaches her port on two boards; the first being on the larboard tack 25 miles, and the other on the starboard tack 38 miles; and the difference of latitude is 21 miles north. Required the bearing of the port, and direction of the wind?

By Construction.

With the given distances 25 and 38 miles, and the included angle equal to $16-2\times6\frac{1}{2}=3$ points, construct the triangle BCD (fig. 49.); hence CB will be known. Draw CA equal to 21 miles, the given difference of latitude; from A draw AB perpendicular to CA, and make CB equal to what it was before determined; make DE=DC, and draw the line CE, which will represent the direction of the wind, and the angle ACB is the bearing of the port: now ACE will be found equal to 52$\frac{1}{2}$°, and ACB 18°.

By Calculation.

In the triangle BCD are given BC=25m. BD=38 m. and the angle D=3 points, to find the angle BCD, and distance CB.

To

Windward Sailing.

To find the angle BCD.

Diſtance BD=38		Angle BDC	33° 45′
——— BC=25			
		BCD+CBD	146 15
Sum	63	$\frac{BCD+CBD}{2}$	=73 $7\frac{1}{2}$
Difference	13		

As the ſum of the ſides	63	1.79934
is to the difference of the ſides	13	1.11394
ſo is the tang. of half ſum angles	73° $7\frac{1}{2}$′	10.51806
to the tang. of half diff. angles	34 $13\frac{1}{2}$	9.83266
Angle BCD	107 21	

To find the diſtance BC.

As the ſine of BCD	107° 21′	9.97978
is to the ſine of BDC	33 45	9.74474
ſo is the diſtance BD	38	1.57978
to the diſtance BC	22.12	1.34474

To find the angle ACB, the bearing of the port.

As the diſtance BC	22 12	1.34474
is to the diſtance AC	21.	1.32222
ſo is radius		10.00000
to the coſine of ACB	18° 17′	9.97748
Angle BCD	107 21	
——ACD	125 38	
——DCE	73 7	
Direction of the wind	N 52 31 E	

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 in 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.

Example I. 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?

Current Sailing.

Plate CCCXXXIX.

By Conſtruction.

Draw the NNE-line CA (fig. 50). equal to 18×8 =144 miles; and from A draw AB parallel to the NW*b*W rhumb, and equal to 18×$2\frac{1}{2}$=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	$\frac{B+C}{2}$	39 $22\frac{1}{2}$
Diff.	99		

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 E	

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

Example II. 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.

Draw the S*b*W$\frac{1}{2}$W line CA (fig. 51.) 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

Fig. 28.

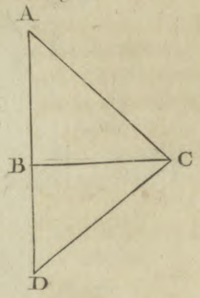


Fig. 29.

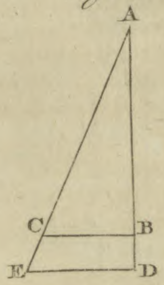


Fig. 30.

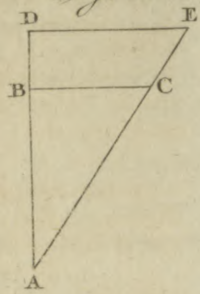


Fig. 31.

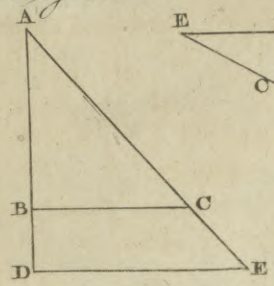


Fig. 32.

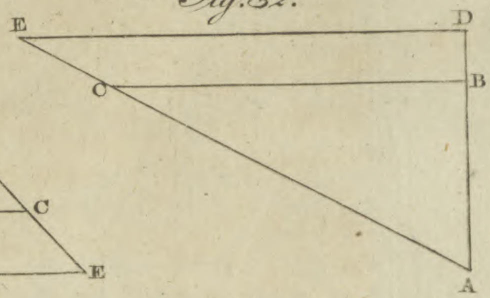


Fig. 33.

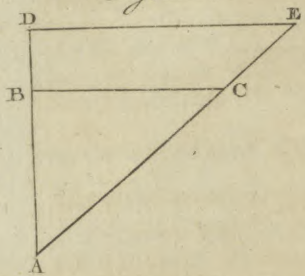


Fig. 34.

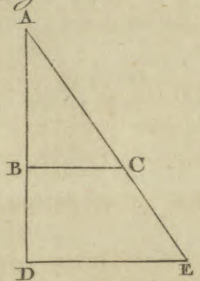


Fig. 35.

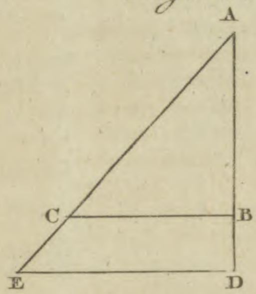


Fig. 36.

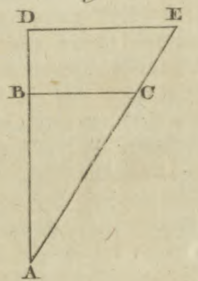


Fig. 37.

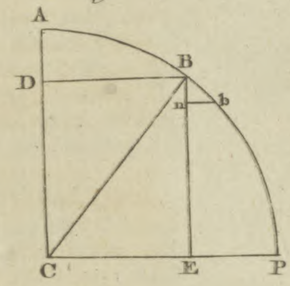


Fig. 38.

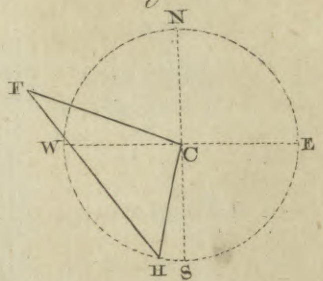


Fig. 39.

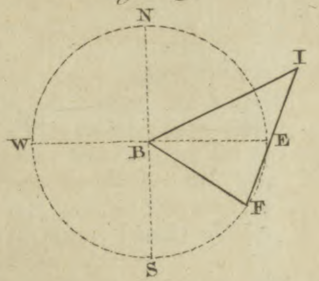


Fig. 40.

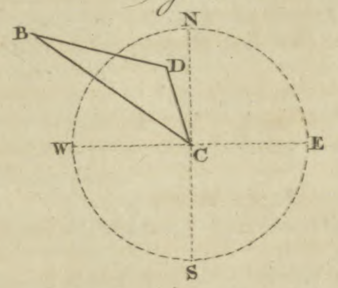


Fig. 41.

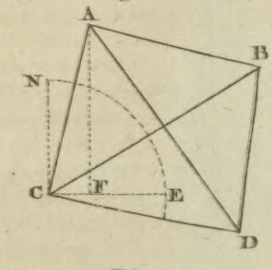


Fig. 42.

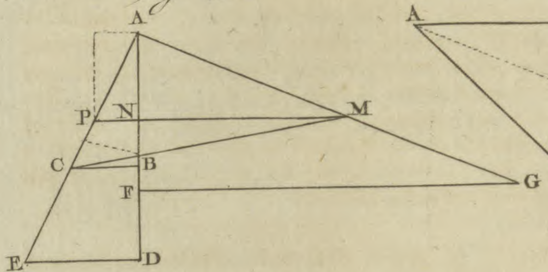


Fig. 43.

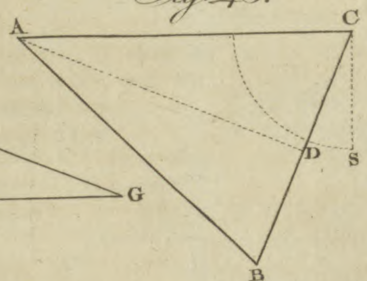


Fig. 44.

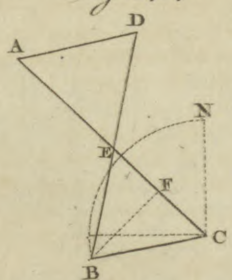


Fig. 45.

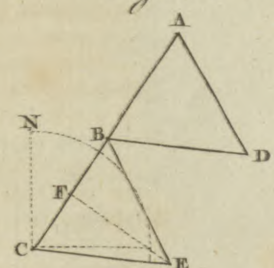


Fig. 46.

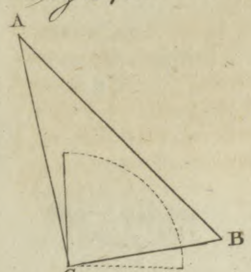


Fig. 47.

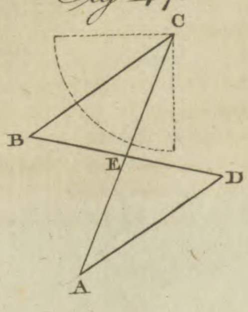


Fig. 48.

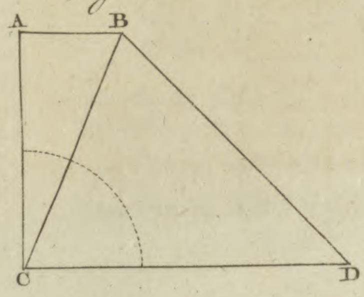
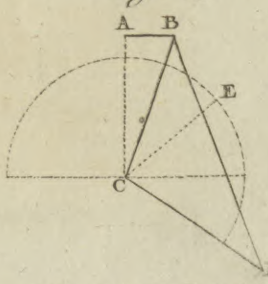


Fig. 49.



A. Bell. Prin. Wal. Sculptor. fecit.

Pra

Curr
Sail

Current Sailing.

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	$\frac{\text{CAD+CDA}}{2}$ $5\frac{3}{4}$=64°41′	
Difference	9.13		

As the ſum of the ſides	43.13	-	1.63478
is to the difference of the ſides	9.13	-	0.96047
ſo is the tang. of half ſum angles	64° 41′	-	10.32509
to the tang. of 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 currt. AD	20.2	-	1.30539

Hence the hourly rate of the current is $\frac{20.2}{7}=2.9$ knots.

Example III. A ſhip, from latitude 38° 20′ N, failed 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.

Plate CCCXXXIX.

Make CE (fig. 52.) equal to 22 miles, the difference of latitude by D, R, and EA=44 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 $41°\frac{1}{4}$.

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	-	1.20412
to AF	10.69		1.02901
Departure by account EA	44.		
True departure	EF=DB=33.31		

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

Example IV. 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 SE of 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.

From A (fig. 53.) draw the SE*b*S line AB=20, which will repreſent the ſhip's apparent tract 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 $64°\frac{1}{3}$.

By Calculation.

In the triangle ABC, given AB=20 m. AC=22 m. 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	$\frac{B+C}{2}=6\frac{1}{2}p=73.7\frac{1}{2}$	
Difference	2		
As the ſum of the ſides	42	-	1.62325
is to the difference of the ſides	2	-	0.30103
ſo is the tangent of half ſum angles	73° 7′$\frac{1}{2}$	-	10.51806
to the tangent of half diff. angles	8. 55$\frac{1}{4}$	-	9.19584

Setting of the current S 64 12 W, or SW*b*W$\frac{3}{4}$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 current BC	12 34	-	1.09137

and $\frac{12.34}{4}=3.1$, its hourly rate.

Example V. A ſhip bound from Dover to Calais, lying

Current Sailing.

lying 21 miles to the SE*b*E½E, and the flood tide setting NE½E 2½ 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.

Plate cccxxxix.

In the position of the SE*b*E½E rhumb, draw DC =21 miles (fig. 54.); draw DE NE½E=2½ 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 SE½S.

By Calculation.

In the triangle DBF, given DE=2½ miles, EF =6 miles, and the angle EDF=6 points; to find the angle DFE=CBD.

As the hourly rate of sailing	6 m.	0.77815
is to the hourly rate of the current -	2½ 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=5½ points =	61 52	
Course SDB - -	39 14=SE½S.	

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.	19.4 m.	1.28785

Example VI. A ship at sea in the night has sight of Scilly light, bearing NE*b*N, distant 4 leagues, it being then flood tide, setting ENE 2 miles an hour. What course and distance must the ship sail to make the Lizard, which bears from Scilly E½S, distance 17 leagues?

By Construction.

Draw the NE*b*N line AS=12 miles (fig. 55.); hence S will represent Scilly; from S draw SL=51 miles, and parallel to the E½S rhumb, then L will represent the Lizard; draw LC parallel to the ENE rhumb, and equal to 2 miles, and make CD=5 miles; from A draw AB parallel to CD, meeting LC produced in B; then AB will be the distance, and the angle SAB the course: the first of these applied to the scale will measure 41.9 miles, and the course will be S 88° E.

By Calculation.

In the triangle SAL are given the sides AS, SL =12 and 51 miles respectively, and the angle ASL =10½ points; to find the other parts.

To find the angles.

Distance SL=51 m.	Angle ASL=10½ points.	
——— AS=12 m.	SAL+SLA= 5½	
Sum - 63 m.	$\frac{\text{SAL}+\text{SLA}}{2}$ = 2¾=30°56′	
Difference 39 m.		
As the sum of the sides	63 -	1.79934
is to the diff. of the sides	39 -	1.59106
so is the tangent of half sum angles -	30° 56′ -	9.77763
to the tang. of half their difference -	20 21 -	9.56935
Angle SAL -	= 51 17	
NAS=3 points	33 45	
NAL - -	85 2	
LAE=FLA	4 58	
FLB=2 points	22 30	
ALB=DLC -	17 32	

To find the distance AL.

As the sine of SAL -	51° 17′	-	9.89223
is to the sine of ASL	10½ points		9.94543
so is the distance SL -	51 miles		1.70757
to the distance AL -	57.64	-	1.76077

Again, in the triangle DLC, are given the side DC=5 miles, the ship's run in an hour; LC=2 miles, the current's drift in the same time; and the angle DLC=17° 32′; to find the angle LDC=LAB.

As the dist. -	DC=5 miles	-	0.69897
is to the distance	LC=2 miles	-	0.30103
so is the sine of	DLC=17° 32′	-	9.47894
to the sine of -	LDC 6 55	-	9.08100
Angle NAL - -	85 2		
NAB -	91 57		
Course - -	S 88 3 E		

In the triangle ABL, the side AL, together with the angles, are given, to find the distance AB.

As the sine of ABL -	155° 33′	-	9.61689
is to the sine of ALB	17 32	-	9.47894
so is the distance AL	57.64		1.76077
to the distance AB -	41.96		1.62282

Instruments to solve Problems in Sailing, independent of Calculation.

Chap. XI. *Instruments proposed to solve the various Problems in Sailing, independent of Calculation.*

Various methods, beside 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 And. Mackay, A. M. F. R. S. E.

I. *Of* Cooke's *Triangular Instrument.*

Description. The stock *a b c d* (fig. 56.) 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

Instruments to solve Problems in Sailing, independent of Calculation.

of the surface of the cylinder contained; the edge dc 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 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 ab, 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 il which is parallel to the centre of the semicircle m; il 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; opn 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 cd; mq 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 qm, 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 dc, which is perpendicularly under the centre of the semicircle. Fig. 57. is a view of the back part of the instrument.

Plate CCCXXXIX.

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 is 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

Instruments to solve Problems in Sailing, independent of Calculation.

ed SSW½W 24 miles, S*b*W 36 miles, and S½E 40 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 45° 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 40° 30′ will be shown by the index on the semicircle.

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° 50′ 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 Middle Latitude Sailing.

To find the distance and departure.

Move the semicircle and perpendicular to the given atitudes, and the index to the course; then the perpendicular will show the departure 128 miles, and the

Fig. 50.

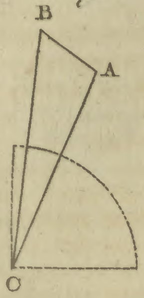


Fig. 51.

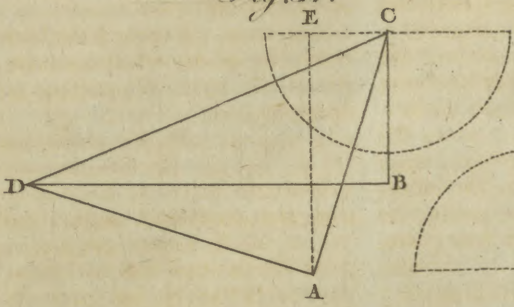


Fig. 52.

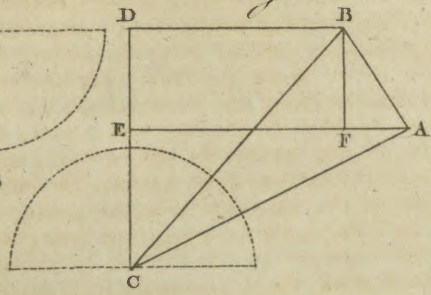


Fig. 53.

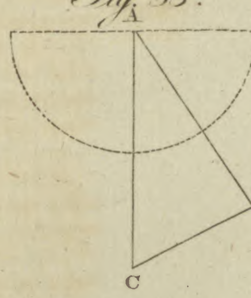


Fig. 54.

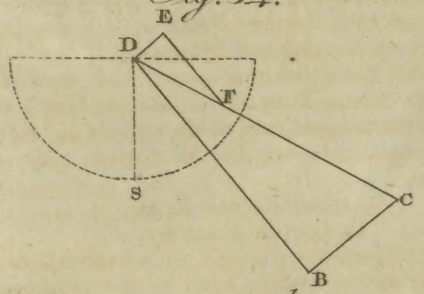


Fig. 55.

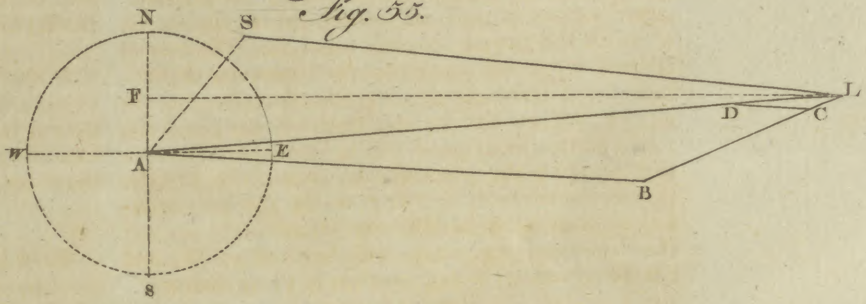


Fig. 56.

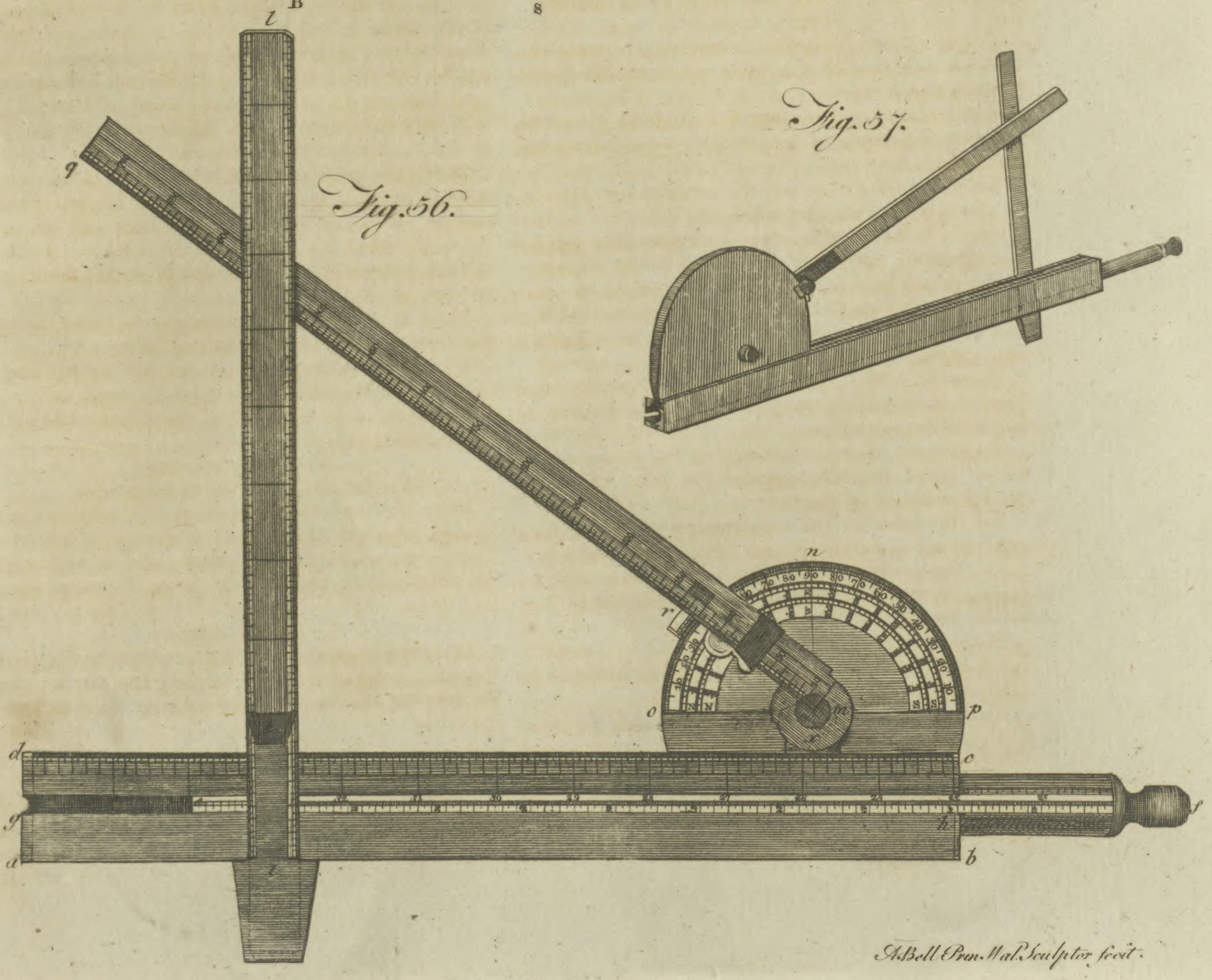


Fig. 57.

A.Bell Prin. Wal. Sculptor fecit.

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Instruments to solve Problems in Sailing, independent of Calculation.

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 latitudes (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 SSE¾E nearly on the semicircle.

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, 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

(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, independent of Calculation.

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.

Plate CCCXL.

II. *Of* Mackay's *Rectangular Inſtrument.*

Deſcription. Fig. 58. 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. 59. 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.

Plane Sailing.

Prob. I. The courſe and diſtance ſailed given, to find the difference of latitude and departure.

Example. Let the courſe be NE ½ N, diſtance 44 miles. Required the difference of latitude and departure?

Move the index until the graduated edge be over 3½ 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 2¼ 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 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

(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, independent of Calculation.

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 latitude 375 on the side column, and its parallel will intersect the index at 438, the distance

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 ½ W. and distance 500 miles. Required the latitude and longitude come to?

By Mercator's Sailing.

Put the index to the course 2½ points, and find the distance 500 miles thereon; then the corresponding difference of latitude will be 441 miles, and the departure 235½ 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 235½ 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.

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 ¾ 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 3¼ 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,

Instruments to solve Problems in Sailing, independent of Calculation.

parture, will interfect the index at 230, the difference of longitude.

Prob. V. Both latitudes and diftance given, to find the courfe and difference of longitude.

Example. The diftance failed is 500 miles between the north and weft; the latitude and longitude left are 40° 10′N, and 9° 20′W. refpectively, and the latitude in is 46° 40′N. Required the courfe and longitude in?

By Mercator's Sailing.

Bring the diftance 500 on the index to interfect the horizontal parallel of the difference of latitude 390; then the courfe 38° 44′ is found on the line of degrees by the edge of the index, and the vertical parallel of the above point of interfection is that anfwering 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 interfect the vertical parallel of 431, the difference of longitude, by the edge of the index, it being in the fame pofition as before. Hence the longitude in is 16° 31′W.

By Middle Latitude Sailing.

The courfe 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 interfect the index at 431, the difference of longitude.

Prob. VI. Both latitudes and departure given, to find the courfe, diftance, and difference of longitude.

Example. Let the latitude failed from be 42°52′N. long. 9° 17′W, the departure 250 miles W, and the latitude come to 36° 18′N. Required the courfe and diftance failed, and the longitude come to?

By Mercator's Sailing.

Find the point of interfection 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 correfponding divifion thereon will be 467 miles, and the courfe on the fcale 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 courfe and diftance are to be found in the fame manner as above. Then bring the index to 39° 35′, the middle latitude, and the horizontal parallel of 250 will interfect the edge of the index at 324½, the difference of longitude.

Prob. VII. Given one latitude, diftance, and departure, to find the other latitude, courfe, and difference of longitude.

Example. A fhip from latitude 32° 38′ N. longitude 17° 6′ W. failed 586 miles between the fouth and weft, and made 336 miles of departure:—Required the courfe, and the latitude and longitude come to?

Great Circle Sailing.

By Mercator's Sailing.

Move the index till the diftance 586 interfects the vertical parallel of the departure 336; then the correfponding horizontal parallel will be 480, the difference of latitude, and the courfe 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 courfe 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 interfect the index at 383, the difference of longitude.

It feems unneceffary to enlarge any further on the ufe of this inftrument, as the above will make it fufficiently underftood.

Chap. XII. *Of Great Circle Sailing.*

The application of fpherical trigonometry to the folution of triangles formed upon the furface of the earth, is called *Great Circle Sailing*.

The earth being fuppofed an exact fphere, the fhorteft diftance between two places is the arch of a great circle intercepted between them; and therefore the diftance failed upon a direct courfe from one place to another, will always be longer than the arch of a great circle contained between them, except when the rhumb line coincides with a great circle, which can only happen when the fhip fails on a meridian or on the equator.

Although it is impoffible to make a fhip defcribe an arch of a great circle, yet fhe may be kept fo near it as to make the error almoft infenfible.

The terms that enter into this failing are, the latitudes of the places, their difference of longitude and diftance, and the angles contained between the diftance and the meridians of the places, called the *angles of pofition.*

Prob. I. Given the common latitude of two places on the fame parallel, and their difference of longitude, to find the diftance and angle of pofition (k).

Example. Required the diftance between St Mary's, in latitude 36° 57 N, longitude 25° 9′ W. and Cape Henry, in latitude 36° 57′ N, and longitude 76° 27′ W.

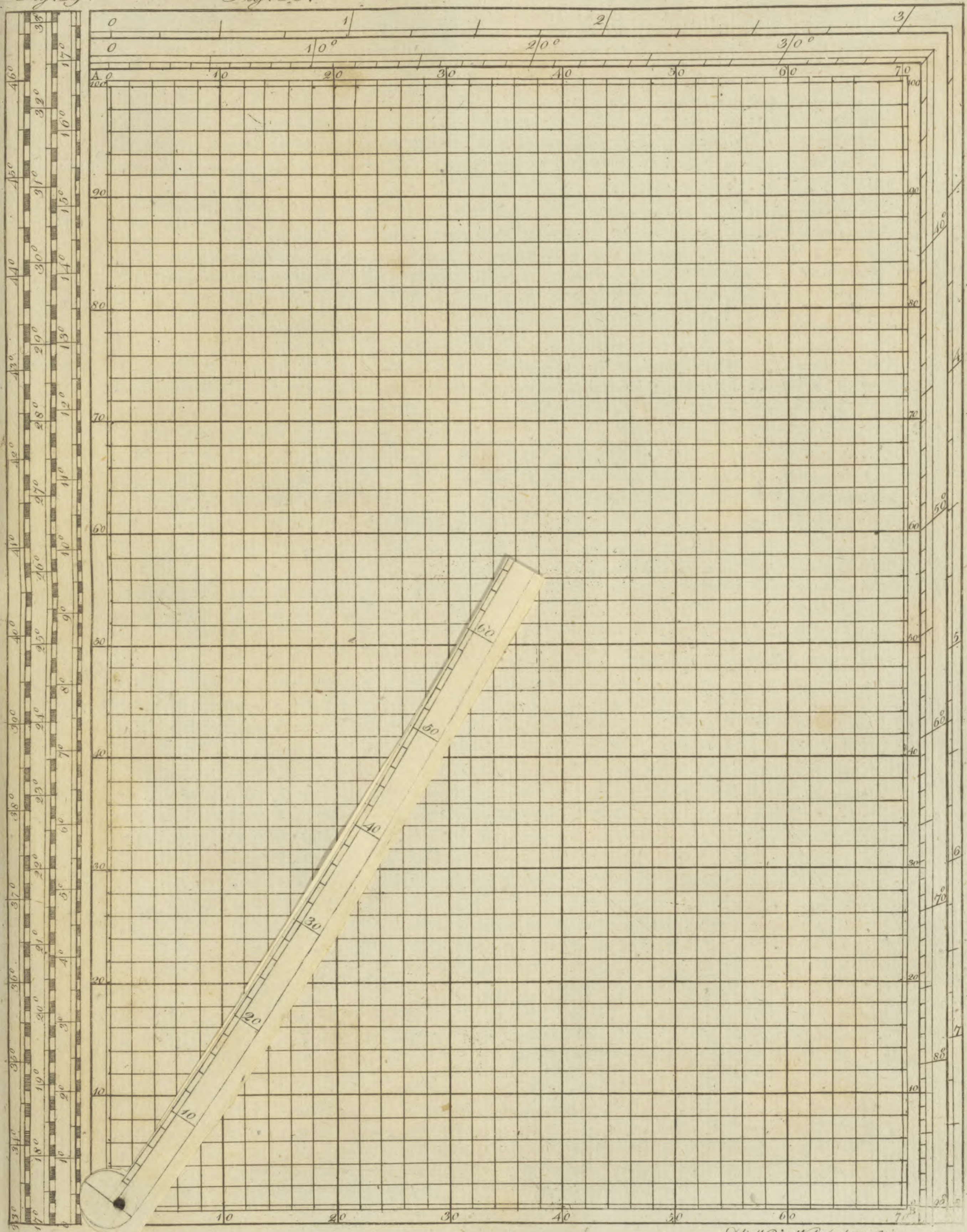
By Conftruction.

Defcribe the circle EPQS (fig. 60.) to reprefent the meridian of one of the places; draw the equator EQ and the earth's axis PS at right angles thereto; make ED, QA, each equal to the chord of 36° 57′, the

Plate CCCXLI.

(k) This problem may be expreffed thus:——Two places lying on the fame parallel, and of thefe four, the latitude, difference of longitude, diftance, and angle of pofition, any two being given to find the other two.——Now this problem contains four different cafes, the moft ufeful of which is given above. The others ferve rather as exercifes in fpherical trigonometry than of any real utility in navigation, and are therefore omitted. The fame is to be underftood of the following problems.

Fig. 59. Fig. 58.



Great Circle Sailing.

the given latitude, and draw the parallel of latitude ABD, the radius of which is the tangent of 53° 3′, the co-latitude; deſcribe the meridian PBS with the ſecant of 51° 18′, the difference of longitude; then A and B will be the two places Draw the diameter AF, and through the points ABF deſcribe a great circle; then the arch AB will be the diſtance, and the angle PAB the angle of poſition. Now theſe being meaſured by the rules given in *ſpherics*, will be found equal to 40° 28′ and 73° 54′ reſpectively.

By Calculation.

From P draw PG perpendicular to AB, by deſcribing the arch with the ſecant of half the difference of longitude; then, in the right-angled ſpherical triangle AGP, are given AP = 53° 3′, the complement of latitude, and the angle APG = 25° 39′, half the difference of longitude; to find AG half the diſtance, and PAG the angle of poſition.

1. To find the diſtance.

As radius - - -		10.00000
is to the ſine of AP	53° 3′	9.90263
ſo is the ſine of APG	25 39	9.63636
to the ſine of AG	20 14	9.53899
	2	
Diſtance AB	40 28	

2. To find the angle of poſition.

As radius - - -		10.00000
is to the coſine of AP	53° 3′	9.77896
ſo is the tangent of APG	25 39	9.68142
to the cotangent of PAG	73 54	9.46038

Prob. II. Given the latitude of a place, and the difference of longitude between it and a place on the equator, to find the diſtance between them, and the angles of poſition.

Example. Required the ſhorteſt diſtance between the iſland of St Thomas, in latitude 0° 0′, longitude 1° 0 E, and Port St Julian, in latitude 48° 51′ S, and longitude 65° 10′ W?

By Conſtruction.

Plate CCCXLI. Deſcribe the circle EPQS (fig. 61.), to repreſent the meridian of one of the places; draw the equator EQ, and axis PS; make EB equal to the chord of 48° 51′, and B will repreſent Port St Julian; make CA equal to the ſemitangent of the complement of the difference of longitude; draw the diameter BF, and through the points BAF draw the great circle BAF; then AB will be the diſtance, ABE the angle of poſition at Port St Julian, and BAE the complement of that at St Thomas. Theſe being meaſured by the rules given in ſpherics, will be found equal to 74° 35′, 71° 36′, and 51° 22′, reſpectively.

By Calculation

In the right-angled ſpherical triangle AEB, AE, and EB are given, to find AB and the angles A and B.

1. To find the diſtance.

As radius - - -		10.00000
is to the coſine of AE	66° 10′	9.60646
ſo is the coſine of EB	48 51	9.81825
to the coſine of AB	74 35	9.42471

Now 74° 35′ = 4475 miles, which is 57 miles leſs than the diſtance found by Mercator's Sailing.

2. To find the angle of poſition at St Thomas.

As radius - -		10.00000
is to the ſine of AE	66° 10′	9.96129
ſo is the cotangent of EB	48 51	9.94146
to the tang. ang. of poſition	38 38	9.90275

3. To find the angle of poſition at Port St Julian.

As radius - -		10.00000
is to the ſine EB	48° 51′	9.87679
ſo is the cotangent of AE	66 10	9.64517
to the cotangent of ABE	71 36	9.52196

Hence a ſhip from St Thomas to Port St Julian muſt firſt ſteer S 38° 38′ W, and then by conſtantly altering her courſe towards the weſt, ſo as to arrive at Port St Julian on a courſe S 71° 36′ W, ſhe will have ſailed the ſhorteſt diſtance between thoſe places.

Prob. III. Given the latitudes and longitudes of two places, to find the diſtance between them, and the angles of poſition.

Example. What is the ſhorteſt diſtance between the Lizard, in latitude 49° 57′ N, longitude 5° 15′ W, and Bermudas, in latitude 32° 35′ N, and longitude 63° 28 W?

By Conſtruction.

Deſcribe the primitive circle (fig. 62.) to repreſent the meridian of one of the places; make EA = 32° 35′, and A will repreſent Bermudas; make E *a*, Q *b* each equal to 49° 57′; then with the tangent of the co-latitude 40° 3′ draw the parallel of latitude of the Lizard, and with the ſecant of 58° 13′, the given difference of longitude, draw the oblique circle PBS, interſecting the parallel of latitude in B; which will be the poſition of the Lizard. Draw the diameter AF, and through the points A, B, F, deſcribe a circle; and the arch AB will be the diſtance, and the angles A and B the angles of poſition, which are meaſured as before.

By Calculation.

In the oblique-angled ſpherical triangle APB are AP, BP, the co-latitudes, and the angle APB the difference of longitude; to find the diſtance AB, and the angles of poſition PAB, PBA.

1. To find the diſtance.

Difference of long.	58° 13′	verſed ſine	9.67513
AP -	57 25	ſine	9.92563
BP -	40 3	ſine	9.80852
Difference	17 22	nat. v. ſine 04559	
		25661	9.40928
Diſtance AB	45 45	nat. v. ſine 30220*.	

2. To find the angle of poſition at the Lizard.

As the ſine of AB	45° 45′	9.85510
is to the ſine of AP	57 25	9.92563
ſo is the ſine of P	58 13	9.92944
to the ſine of B	89 20	9.99997

3. To find the angle of poſition at Bermudas.

As the ſine of AB	45° 45′	9.85510
is to the ſine of BP	40 3	9.80852
ſo is the ſine of P	58 13	9.92944
to the ſine of A	49 47	9.88286

The ſhorteſt diſtance between the Lizard and Bermudas is 45° 45′ or 2745 miles, which is 56 miles leſs than

* See *Mackay's Treatiſe on the Longitude*, where a complete Table of Nat. Verſed Sines is given.

Great Circle Sailing.

than the diſtance found by Mercator's ſailing. And a ſhip to deſcribe the ſhorteſt tract muſt ſail from the Lizard S. 89° 20′ W, and gradually leſſen the courſe, ſo as to arrive at Bermudas on the rhumb bearing S. 49° 47′ W. The direct courſe by Mercator's ſailing is S. 68° 10′ W.

From the preceding examples, it is evident that in order to ſail on the arch of a great circle, the ſhip muſt continually alter her courſe. But as this is a difficulty too great to be admitted into the practice of navigation, it has been thought ſufficiently exact to effect this by a kind of approximation; the principle of which is, that in ſmall arches the difference between the arch and its chord or tangent is ſo ſmall, that the one may be ſubſtituted for the other in any nautical operations.

Upon this principle, the great circles on the earth are ſuppoſed to be made up of ſhort right lines, each of which is a ſegment of a rhumb line: and on this ſuppoſition the ſolution to the following problem is founded.

Prob. IV. Given the latitudes and longitudes of two places, to find the ſeveral points in a great circle paſſing through them, which alter in longitude from either of the places by a given quantity; together with the courſes and diſtances between thoſe points.

Rule. Compute the diſtance of the places, and their angles of poſition, by one of the preceding problems; find alſo the perpendicular from the pole to the great circle, paſſing through the given places, and the ſeveral angles at the pole made by the given alterations of longitude between the perpendicular and the ſucceſſive meridians come to.

With this perpendicular, and the polar angles ſeverally, find as many correſponding latitudes by the following analogy:

As rad. : co-tan. perp. : : coſ. 1ſt pol. ang. : tang. 1ſt lat.
: : coſ. 2nd pol. ang. : tang. 2nd lat.
&c. &c.

Now having the latitudes of the ſeveral points in the great circle, and the difference of longitude between each, find the ſeveral courſes and diſtances between them; and theſe will be the courſes and diſtances the ſhip muſt run to keep nearly on the arch of a great circle.

Example I. A ſhip from a place in latitude 37° 0′ N, longitude 23° 0′ W, bound to a place in the ſame latitude, and in longitude 76° 27′ W, intends to ſail as near the arch of a great circle as ſhe can, by altering her courſe at every five degrees of longitude. Required the latitude of each point where the courſe is propoſed to be altered, and alſo the courſes and diſtances between thoſe points?

Great Circle Sailing.

Plate CCCXLI.

The triangle APB (fig. 63.) being deſcribed, and the computation made as in Problem I. the diſtance will be found equal to 42° 6′, and the angle of poſition A or B = 73° 9′.—Now the triangle APB being iſoſceles, the perpendicular PI falls in the middle of AB; and the latitudes, courſes, and diſtances being known in the half BI, thoſe in the half IA will alſo be known.

Let the points a, b, c, d, &c. be the points arrived at on each alteration of five degrees of longitude; then will the arches Pa, Pb, Pc, Pd, &c. be the reſpective co-latitudes of thoſe places, and are the hypothenuſes of the right-angled ſpherical triangles PIa, PIb, PIc, PId, &c.

Now in the triangle PIB, given PB = 53° 0′, the angle PBI = 73° 9′, to find PI.

As radius		10.00000
is to the ſine of PBI	73° 9′	9.98094
ſo is the ſine of PB	53 0	9.90235
to the ſine of PI	49 51	9.88329

The angle $IPB = \left(\frac{53° 27'}{2}\right) 26° 43'\frac{1}{2}$, angle IP$a$ = 21° 43′½, IPb = 16° 43′½, IPc = 11° 43′½, IPd = 6° 43′½, are the ſeveral polar angles.

To find the latitude of the point a.

As radius		10.00000
is to the cotangent of PI	49° 51′	9.92612
ſo is the coſine firſt polar angle	21 43½	9.96800
to the tangent of 1ſt latitude	38 5	9.89412

By continuing the operation with the other polar angles, the ſucceſſive latitudes from a to I will be 38° 56′, 39° 33′, 39° 57′.

Now with the ſeveral latitudes, and reſpective differences of longitude, compute the courſes and diſtances. The reſults are entered in the following Table; the calculations being performed on a piece of waſte paper.

Polar Angles.	Succeſſive Long.	Diff. Long.	Succeſſive Lat.	Diff. Lat.	Meridian Parts.	Merid. diff. lat.	Courſes.	Diſtances.
IPB = 26° 43½′	23° 0′		37° 0′		2392.6			
IPa = 21 43½	28 0	300	38 5	65	2474.6	82.0	74° 43′	246.6
IPb = 16 43½	33 0	300	38 56	51	2539.8	65.2	77 44	240.2
IPc = 11 43½	38 0	300	39 33	37	2587.6	47.8	80 57	235.3
IPd = 6 43½	43 0	300	39 57	24	2618.8	31.2	84 4	231.9
	49 43½	403.5	40 9	12	2634.5	15.7	87 46	309.1
								1263.1

The courſes, and the firſt diſtance, are found by Mercator's Sailing: but as the other courſes are near the parallel, the diſtances cannot be very exactly found by this method; another method is therefore uſed. The ſum of the diſtances is 1263.1, which doubled is 2526.2, agreeing with the diſtance found as before. It may be obſerved, that the diſtance found by this method cannot be leſs than the laſt diſtance, or that given by Great Circle Sailing, as ſome authors have found it.

Examxle II. A ſhip from the Lizard, in latitude 49° 57′ N, longitude 5° 15′ W, bound to a place in latitude 32° 25′ N, and longitude 66° 39′ W, propoſes to ſail on a great circle, and to alter her courſe at every

Great Circle Sailing.

every five degrees of longitude. Required the latitudes of the places where the ship is to alter her course, and also the course and distance between each?

Plate CCCXLI.

Having described the triangle (fig. 64.) and performed the computation as in Problem III. the distance AB is found =47° 54′, the angle of position PBA at the Lizard 87° 15, and that at the place bound to 49° 35′.

Draw PI at right angles to AB, and in the equator lay off from the centre the tangents of 5, 10, 15, 20, &c. to 55 degrees, and these will be the centres of the arches of co-latitude to every 5° of difference of longitude.

To find the perpendicular PI.

As radius		10.00000
is to the sine of PAB	49° 35′	9.88158
so is the sine of PA	57 35	9.92643
to the sine of PI	40 0	9.80801

To find the polar angle API.

As radius		10.00000
is to the cosine of AP	57° 35′	9.72922
so is the tangent of PAB	49 35	10.06978
to the co-tangent of API	57 49	9.79900

Now the polar angle API, or the difference of longitude between the perpendicular and the meridian of the place bound to, 57° 49′, being taken from 61° 24′, the whole difference of longitude, leaves 3° 35′ for the difference of longitude between the Lizard and the perpendicular; also 5°, the proposed alteration of longitude, being subtracted as often as it can be from 57° 49′, leaves the several polar angles; with which and the perpendicular PI the several latitudes arrived at are found as in the preceding example: then with these latitudes and the differences of longitude between them, find the successive courses and distances. The several results are placed in the following Table; the calculations being performed on a piece of waste paper.

Polar Angles.	Successive Longs.	Diff. Long.	Successive Lats.	Diff. Lat.	Meridian Parts.	Merid. diff. lat.	Courses.	Distances.
	5° 14′		49° 57′		3469.8			
IPB = 3° 35′	8 49	215	50 0	3	3474.5	4.7	88° 45′	138.3
IP*a* = 2 49	11 38	169	49 58	2	3471.4	3.1	88 57	108.7
IP*b* = 7 49	16 38	300	49 45	13	3451.2	20.2	86 9	193.8
IP*c* = 12 49	21 38	300	49 18	27	3409.6	41.6	82 6	196.6
IP*d* = 17 49	26 38	300	48 37	41	3347.2	62.4	78 15	201.4
IP*e* = 22 49	31 38	300	47 42	55	3264.7	82.5	74 37	207.3
IP*f* = 27 49	36 38	300	46 31	71	3160.4	104.3	70 50	216.3
IP*g* = 32 49	41 38	300	45 3	88	3034.2	126.2	67 10	226.8
IP*h* = 37 49	46 38	300	43 17	106	2886.4	147.8	63 46	239.8
IP*i* = 42 49	51 38	300	41 10	127	2714.9	171.5	60 15	255.9
IP*k* = 47 49	56 38	300	38 41	149	2520.5	194.4	57 3	273.9
IP*l* = 52 49	61 38	300	35 46	175	2300.7	219.8	53 46	296.1
	66 38	300	32 25	201	2058.0	242.7	51 2	319.6
								2874.5

As the four first courses are near the parallel, the corresponding distances were not found by Mercator's Sailing. The sum of the distances 2874.5 agrees very well with, and is not less than, 47° 54′, or 2874 miles, the shortest distance between the places.

Sea-Charts.

Chap. XIII. *Of 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 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° 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 ¾ W. and the distance 13°¼ 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

Sea-Charts.

rallel 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 SWbW 160 miles from Cape Palmas; then by proceeding as above, it will be found that ſhe is in latitude 2° 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.

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.

Method of finding the Latitude and Longitude at Sea.

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, 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. 65 repreſents a quadrant of the common conſtruction, of which the following are the principal parts. Plate CCCXLI.

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 L M, 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.

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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.

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. 65. but when the back-observation is used, they are removed to N. Plate CCCXLI.

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 mirror.

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, immediately 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.

Method I. 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 II. This is performed by means of the two adjusting tools fig. 66, 67, which are two wooden frames, having two lines on each, exactly at the same distance from the bottom.

Place the quadrant in an 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,

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ther. 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.

In order to illustrate this, let R I H E (fig. 68.) 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. Plate CCCXLII.

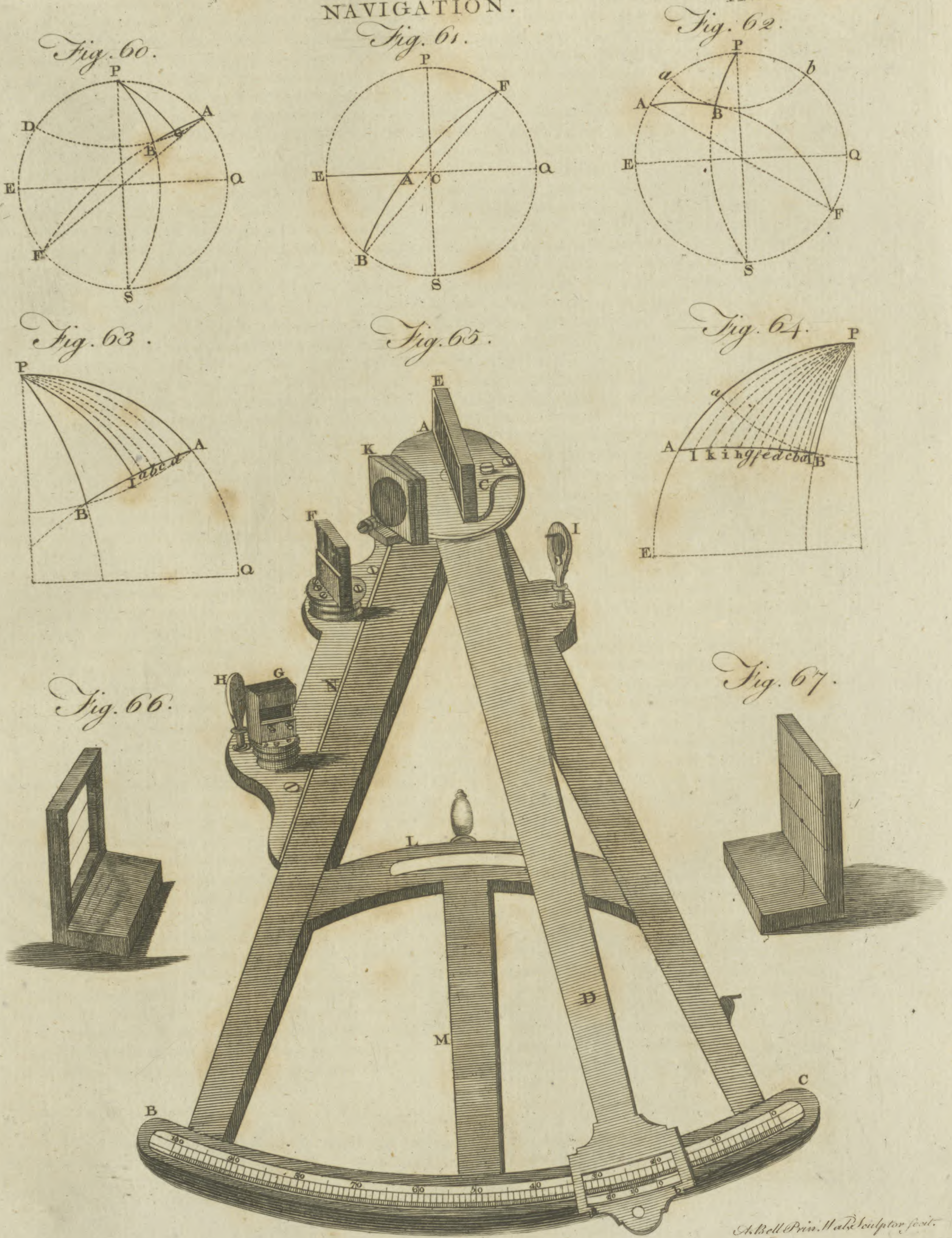
When this coincidence is perfect, and the object R so very distant as to make the angle IRH insensible, the position of the speculums I and H will differ insensibly from parallelism; that is, the quadrant will be adjusted for the fore observation. Now it is from the ease and accuracy with which this 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 back-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

NAVIGATION.

Plate CCCXLI.



A. Bell Prin. Wal. Sculptor fecit.

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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 an 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 space, 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 sceeen 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.

Plate CCCXLII.

Fig. 69. 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 $\frac{7}{10}$ of an inch broad. The bottom part is covered in front by the brass frame, and the reflecting surface is $\frac{7}{16}$ 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 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. 73.) 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. 70.) 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. 70. 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. 71. 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.

In fig. 72. 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.

In fig. 73. 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

(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.

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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. 70.

To adjust the Quadrant for the Back-observation.

Plate CCCXLII.

Fasten the index to 90° on the limb; loosen the screw H (fig. 70.), 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. 71.: 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. 72.: 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. 69.) 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.

To observe the Sun's Altitude by the Back-observation.

Remove the coloured glasses to G (fig. 69.), 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

quently 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 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 it 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 appears 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 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

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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.

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.

Example I. Required the sun's declination at noon 15th April 1793, in longitude 84° W?

Sun's declination at noon at Greenwich		10° 1'.8 N
Number from Table IX.	-	+ 5.0
Reduced declination	- -	10 6.8 N

Example II. Required the sun's declination at noon 22d March 1793, in longitude 151° E?

Sun's declination at noon at Greenwich		0° 56' N
Equation from table	- -	— 10
Reduced declination	-	0 46 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 Problem I.; then the sum or difference 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.

Example I. October 17th 1792, 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. 17. Oct. noon.	9° 37' S
Semidiameter	+0 16	Equation Table IX.	— 2
Dip and refraction	—0 5	Reduced declination	9 35 S
True alt. sun's centre	49 4 S	Zenith distance	40 56 N
		Latitude	31 21 N

Example II. November 16th 1793, 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° 57' S
Semidiameter	+0 16	Equation table	+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 15 S

Example III. December 19th 1793, 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 27 S
Latitude	- - -	62 34 N

Example

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Example IV. Auguſt 23d 1793, 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 20 N
Latitude - - -	17 45 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.

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.

Example I. December 1ſt 1793, 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 27 S
Latitude - -	13 47 N

Example II. February 17th 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 45 N
Latitude - - -	13 3 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, page 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.

Example I. December 10th 1792, 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 - - -	7 26 N
Latitude - - -	13 56 S

Example II. April 16th 1793, the meridian altitude of Jupiter was 81° 5′ S, height of the eye 18 feet. Required the latitude?

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.

† *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.

Example I. December 24th 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, Tab. IX.	= 14° 53 N
Eq. to time from midnight -	—0 4
Reduced declination - -	14 49 N
Moon's hor. par. - -	55′ 25″

Moon's

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Moon's ſemidiameter - -	15 6
Augmentation - -	+0 14
Aug. ſemidiameter - -	15 20
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

Example II. October 17th 1793, in longitude 8° W, the altitude of the moon's upper limb was 40° 27′ S, and height of the eye 20 feet. Required the latitude?

Time of paſſ. over mer. Greenwich	$=$ 10h 52′
Equation to long. - -	0 0
Time of paſſ. over mer. ſhip -	10 52
Longitude in time - -	0 32
Reduced time - -	11 24
Moon's dec. at midnight -	=0° 3′ N
Eq. to time from midnight -	−0 3
Reduced declination - -	0 0
Moon's hor. parallax - -	60′ 29″
Moon's ſemidiameter - -	16 29
Augmentation - -	+0 12
Aug. ſemidiameter - -	16 41
Obſerved altitude moon's lower limb -	40° 27′ S,
Semidiameter and dip - -	−0 21
Apparent altitude moon's centre -	40 6
Correction - -	+0 45
True altitude moon's centre -	40 51 S
Zenith diſtance - -	49 9 N
Declination - -	0 0
Latitude - - -	49 9 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.

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Example I. July 1ſt 1793, 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

Example II. December 1ſt 1798, the altitude of the pole ſtar below the pole was 52° 20′ N, height of the eye 12 feet. Required the latitude?

Obſerved altitude, pole ſtar -	52° 20′ N.
Dip and refraction - -	−0 4
True altitude - -	52 16 N.
Complement of declination -	1 46
Latitude - -	54 2 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 the 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 (L).

Example I. June 4th 1795, in latitude by account

(L) 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 an 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 an half. The obſervations muſt be taken ſtill nearer to noon, if the latitude exceeds the zenith diſtance in a greater proportion. See *Maſkelyne's. Britiſh Mariner's Guide, and Requiſite Tables*, 2d Ed.

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count 37° 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.			

Example II. October 17th 1793, 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 32 Secant	0.00604
2 46	24 49	41972	Logarithm ratio		0.14476
2 8	Differ.	16924	Log.		4.22850
1 4			Half elapsed time		0.55966
1 41 30″			Middle time		4.93292
37 30			Rising		3.12570
				Log. ratio	0.14476
Natural number				957	2.98094
Greatest altitude		36° 5′	N. sine	58896	
Mer. zen. distance		53 14	N. cosine	59853	
Declination		9 32			
Latitude		43 42 N.			

Example III. August 25th 1793, in latitude 57° N. by account, in the morning the altitude of the sun's lower limb was 34° 22′, and 1h 46′ after the altitude of the lower limb was 42° 12½′, the height of the eye 14 feet. Required the latitude?

First altitude	34° 22′	Second altitude	42° 12½′
Sun's semidiameter	+0 16	Semidiameter	+0 16
Dip and refraction	—0 5	Dip and refract.	—0 4½
Corrected altitude	34 33	Corrected altit.	42 24

Interval of time.	Altit.	N. Sines.			
			Lat. by acc.	57° 0′ Secant.	0.26389
	34° 33′	56713	Declination	10 33 Secant.	0.00741
	42 24	67430	Logarithm ratio		0.27130
1h 46′	Difference	10717	Log.		4.03007
53 0″			Half elapsed time		0.63978
1 43 30			Middle time.		4.94115
50 30			Rising		3.38343
				Log. ratio	0.27130
Natural number				1295	3.11213
Greatest altitude		42° 24′	N. sine	67430	
Mer. zen. distance		46 35	N. cosine	68725	
Declination		10 33			
Latitude		57 8 N.			

The greatest altitude was observed 50′½ before 12 or at 11h 9′½; hence the first altitude was observed at 9h 23½ A. M.

Example IV. 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.				

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

Method of finding the Latitude and Longitude at Sea.

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.

Example I. July 6th 1793, in latitude 58° 14′ N. by account, and longitude 16° E. at 10^h 54′ A. M. *per* watch, the altitude of the sun's lower limb was 53° 17′, and at 1^h 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. 2^h 23′
Ship's course	S*b*W½W	Dist. run = 2^h 23 × 8 = 19m.
Contained angle	3½ points.	

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.	10^h 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	Difference	715	Log.	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. zen. distance	34 33 N cosine	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	1^h 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. cosine	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.

Example II. Sept. 13th 1793, in latitude 38° 12′ N by account, and longitude 14° E. at 9^h 28′ A. M. *per* watch, the altitude of the sun's lower limb was 40° 42′, and azimuth *per* compass SE¼E, at 11^h 16′ A. M. the altitude was 53° 11′; the ship's course during the elapsed time was W½N at the rate of 9 knots an hour, and height of the eye 12 feet. Required the ship's true latitude at the time of the second observation?

Sun's bear. at first obs.	SE. ¼ E.	Elaps. time 1h. 48′
Ship's course,	W½N.	D. run = 1h48′ × 9 = 16m
Contained angle	11¼ points;	supplement 4¾ pts.

To course 4¾ points, and distance run 16 miles, the difference of latitude is 10′.7, or 11 miles.

First observed alt.	40°	42′	Second obs. alt.	53°	11
Sun's semidiameter	+0	16′	Semidiameter	+0	16
Dip and refraction	—0	4	Dip and refr.	—0	4
Reduction of alt.	—0	11	Corrected alt.	53	23
Reduced altitude,	40	43			

Time of ob. great. alt.	11h 16′	Sun's dec. at noon 3 32⅓
Longitude in time,	0 56	Eq. to time from n. + 1⅔
Reduced time,	10 20	Reduced declin. 3 34

Time *per* Watch.	Alt.	N. Sine	Lat. by acc 38° 12′	Secant 0.10466
9h 28′	40° 43′	65232	Declination 3 34	Secant 0.00084
11 16	53 23	80264	Logarithm ratio -	0.10550
1 48	Differ.	15032	Log. - -	4.17702
0 54			Half elapsed time -	0.63181
1 37			Middle time -	4.91333
0 43			Rising - -	3.24427
Natural number		1376		3.13877
Mer. Zen. dist. 35° 16′ N. cosine		81640		
Declination 3 34				Secant 0.00084
Latitude 38 50				Secant 0.10848

Logarithm ratio -	-	0.10932
Difference of natural sines	15032	Log. 4.17702
Half elapsed time	0h 54′ 0″	Log. 0.63181
Middle time -	1 37 50	Log. 4.91815
Rising - -	0 43 10	Log. 3.26089
Natural number - -	1418	3.15157

Greatest

Method of finding the Latitude and Longitude at Sea.

Greatest altitude	53° 23′ N. sine	80264
Mer. Zen. dist.	35 14 N. cosine	81682
Declination	3 34	
Latitude -	38 48 N.	

This latitude differing only 2 miles from that used in the computation, may therefore be relied on as the true latitude.

Remark. If the sun comes 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.

Example. 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.	A t.	N. Sines.			
11h 57′ 0″	89° 10′	99989	Lat. by acc.	22° 40′	Sec. 0.03491
			Declination	23 28	Sec. 0.03749
12 4 40	88 50	99979	Logarithm ratio		0.07240
0 7 10	Difference	10	log.		1.00000
0 3 50			Half elapsed time		1.77663
0 0 50			Middle time		2.84903
0 3 0			Rising		0.93284

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
		declination	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.

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			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. To find the latitude from double altitudes of the sun and the elapsed time; one of these observations being taken near the east or west points, and the other near the meridian.

Rule. With the latitude by account, the sun's declination and least altitude, compute the apparent time of observation by Problem VII. of next chapter. From whence and the interval of time between the observations, the time from noon when the greatest altitude was observed will be known. To the logarithm rising of which, add the logarithmic cosines of the sun's declination and the latitude of the place by account; the sum will be the logarithm of a natural number, which added to the natural sine of the greater altitude, will give the natural cosine of the meridian zenith distance; and hence the latitude is found as formerly.

Or the time from noon being found, the latitude may be computed by the rule given in the preceding remark.

Example. September 1st 1793, in latitude 40°0′ N by account, at 6h 5′ A. M. per watch, the altitude of the sun's lower limb was 16° 21′, and at 11h 41′ the altitude was 57° 42′; the height of the eye 18 feet. Required the latitude?

First alt.	16° 21′	Second alt.	57° 42′
Sun's semidia. +	0 16	Sun's semidia. +	0 16
Dip and refr. —	0 7	Dip and refrac. —	0 5
True altitude	16 30	True altitude	57 53

Lat.

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Lat. by acc.	40 0 N	Secant		0.11575
Declination	8 3 N	Secant		0.00430
Difference	31 57	nat. cosine	84851	
Altitude	16 30	nat. sine	28402	
		Difference	56449	4.75165

Time from noon of first obs.	5h 0′ 40″	rising		4.87170
Interval of time between obs.	4 45 0			
Time from noon of 2d obs.	0 15 40	rising		2.36839
Latitude by acc.	40° 0′	cosine		9.88425
Declination	8 3	cosine		9.99670
Natural number			178	2.24934
Greater altitude	57 53	nat. sine	84697	
Merid. zen. dist.	31 55	nat. cosine	84875	
Declination	8 3			
Latitude	39 58 N.			

Prob. IX. 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.

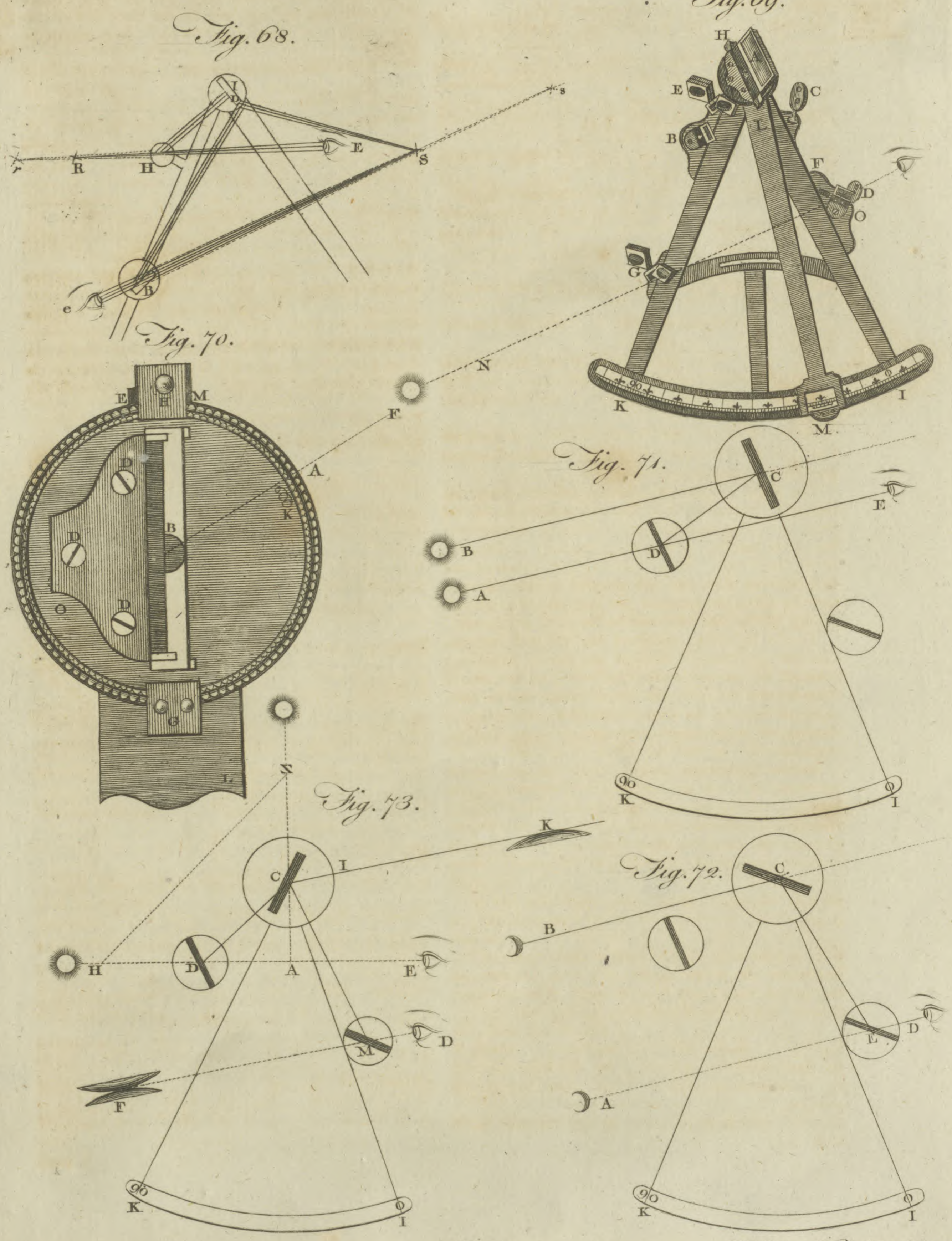
Example I. January 1st 793, the true altitude of Capella was 69° 23′, and at the same instant the true altitude of Sirius was 16° 19′. Required the latitude?

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		9.84 60
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 54 N.	cosine	99051	
Capella's altitude	69 23 N	sine	93 96	
			5455	3.7367[illegible]
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	

Example II. In north latitude, Decem. 30th 1793, the true altitude of Menkar was 43° 38′; and 1h 18′ after the altitude of Rigel was 29° 51′. Required the latitude?

Observed Interval	1h 18′ 6″			
Equation	+ 0 0 13			
Inter. in sid. time	1 18 13			
Right as. of Menkar	2 51 31			
Sum	4 9 44			
Right asc. of Rigel	5 4 34			
Reduced interval	0 54 50	rising		3.45462
Declin. of Menkar	3 16½ N	cosine		9.99929
Declin. of Rigel	8 27 S	cosine		9.99526
Sum	11 43½ N	co.	97913	
			2813	3.44917
Arch first	71 59 N	sine	95100 co.	9.49037
Declin. of Menkar	3 16½	secant		0.00071
Reduced interval	0 54 50	H. E. time		0.62529
Arch second	3 19 36	H. E. time		0.11637

Arch



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Arch first	71°59′	secant		0.50963
Altitude Rigel	29 51	secant		0.06181
Difference	42 8 N	cosine	74159	
Alt. of Menkar	43 38 N	sine	69004	
		Difference	5155	3.71223
Arch third	2^h 24′ 27″	rising		4.28367
Arch second	3 19 36			
Arch fourth	0 55 9	rising		3.45960
Declin. of Rigel	8 27 S	cosine		9.99526
Alt. of Rigel	29 51	cosine		9.93819
Sum	38 18 N	cosine	78478	
			2472	3.39305
Latitude	49 28 N	sine	76006	

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 Almanac 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 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 the longitude 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 distance, 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 silvered 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.

Fig. 74. represents the sextant, so framed as not to be liable to bend (m). 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. Plate CCCXLIII.

In order to observe with accuarcy, 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.

 There

(m) Troughton's patent double-framed sextants are not liable to bend.

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 stem of the finger screw passes.

Plate CCCXLIII.

The sextant is furnished with a plain tube (fig. 75.) without any glasses; and to render the objects still more distinct, it has two telescopes, one (fig. 76.) representing the objects erect, or in their natural position: the longer one (fig. 77.) 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.

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. 78. 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. 79. is a magnifying glass, to assist the observer to read off the angle with more accuracy; and (fig. 80.) a screw-driver.

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 0 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, proceeed 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 on the limb, corrected by the index error, will be the angular distanee 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

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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 move the index till the moon appears by 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.

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.

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Plate CCCXLIII.

Fig. 81. 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. 84; 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 place of the coloured glass fig. 83; and D, its place in certain observations.

Fig. 82. is a section of the instrument, wherein the several parts are referred to by the same letters as in fig. 81: Fig. 83. represents one of the horizon coloured glasses; and fig. 84. one of the central coloured glasses: Fig. 85. is the key for turning the adjusting screws of the mirrors: Fig. 86. is the handle: Fig. 87. a section of one of the radii towards its middle: Fig. 88. is used in some terrestrial observations for diminishing the light of the direct object, whose place at the time of observation is D: Fig. 89. 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, 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.

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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.

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

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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.

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.

Example I. Let 26° 45′ be reduced to time.

26° 45′
4
1h 47′ 0″ = time required.

Example II. 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.

Example I. Let 3h 4′ 28″ be reduced to degrees.

	3h	4	28″
			10
	30	44	40
Half =	15	22	20
Corresponding deg. =	46	7	0

Example II. 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.

Example I 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

Example II 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 of east, but subtract it if west; and the sum or remainder will be the corresponding time under the given meridian.

Example I. 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

Example II. 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 Almanac, 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.

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′	cosᶜ. 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

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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 uncorrect. 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 twelve hours.

Example. January 29th, 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 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.

Example I. September 15th 1792, in latitude 33° 56′ S, and longitude 18° 22′ E, the mean of the times per watch was 8^h 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 Almanac		2° 40′.5 S
Semidiameter	+ 16.0	Equation to 3^h 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	3^h 48′ 51″	rising		4.66132
Apparent time	8 11 9			
Time per watch	8 12 10			
Watch fast	1 1			

Example. II. May 6th 1793, in latitude 56° 4′ N, and longitude 38° 30′ W, at 4^h 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 Almanac	16° 44′.3
Semidiameter	+ 15.9	Equation to 4^h 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		

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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
		rising		4.81333

Apparent time	4^h 38′ 12″
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 Almanac 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.

Example I. December 12th 1792, in latitude 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.	4^h 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		

Example II. January 29th 1792, in latitude 53° 24′ N, and longitude 25° 18′ W, by account, at 14^h 58′ 38″, the altitude of Procyon west of 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.	4^h 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 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 3d 1792, in latitude 51° 38′ N, at 11^h 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 13^h 43′. Required the error of the watch?

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Altitude of the moon's lower limb	= 37° 31′	Moon's right ascension at Green. time	7h 22′ 54″
Semidiameter	+ 15	declination	17° 0 N
Dip	− 3	Sun's right ascension	23h 2′ 0″
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	6 23			

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.

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″	Apparent altitude moon's centre	48° 22′ 0″
Correction	− 1 40	Correction	+ 38 26
Sun's true altitude	27 41 20	Moon's true altitude	49 0 26
Sun's apparent altitude	27 43	Sun's true altitude	27 41 20
Moon's apparent altitude	48 22	Difference	21 19 6
Difference	20 39	Half	10 39 33
Apparent distance	81 23 40	Logarithmic difference	9.994638
Sum	102 2 40	Half 51° 1′ 20″ Sine	9.890639
Difference	60 44 40	Half 30 22 20 Sine	9.703820
			19.589097
Half difference true altitudes	10 39 33		
Arch	51 27 29	cosine	9.794548
Sum	62 7 2	sine	9.946417
Difference	40 47 56	sine	9.815183
			19.761600
	40 32 16	cosine	9.880800
	2		
True distance	81 4 32		

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 Almanac.

RULE. If the given distance is found in the Nautical Almanac 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 corre-

Of finding the Longitude at Sea by Lunar Obſervations.

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 Almanac; 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 Almanac, page vii. of the month, the moon's horizontal parallax and ſemidiameter. Increaſe the ſemidiameter by the augmentation anſwering to the moon's altitude.

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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.

Example I. 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 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 19
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	Logarithmic difference		9.996336
Apparent diſtance	68 35 40			
Sum	71 23 5	Half 35° 41′ 32″½	Sine	9.765991
Difference	65 48 15	Half 32 54 7½	Sine	9.734964
				19.497291
Half difference true altitudes	0 58 20		Coſine	9.748645
Arch	55 54 12			
Sum	56 52 32		Sine	9.922977
Difference	54 55 52		Sine	9.912998
				19.835975
Half true diſtance	34 6 53		Coſine	9.917987
	2			
True diſtance	68 13 46			

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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° 3¼′ W.			

Example II. 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
					18.978448
Half diff. true alt.	22 38 50				
Arch	72 1 57			Cosine	9.489224
Sum	94 40 47			Sine	9.998548
Difference	49 23 7			Sine	9.880301
					19.878849
alf 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		

Variation of the Compass.

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	3 46 6 = 56° 31′½ East.				

For various other methods of determining the longitude of a place, the reader is referred to the article Longitude.

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.

Example I. 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
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.

Example II. 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 sun-setting.

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.

Variation of the Compaſs.

Example I. 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	=8° 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
	2		
True azimuth	S. 45 26 E.		
Obſerved azimuth	S. 23 18 E.		
Variation	22 8 W.		

Example II. January 3. 1794, in latitude 33° 52′ N, longitude 53° 15′ E, 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 ☉ repreſents 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 courſe and diſtances between each ſucceſſively.

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cessively. 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 plane 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 that 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 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 topsails.

4. Allow two points and an half when one topsail is handed.

5. Allow three points and an half when both topsails are handed.

6. Allow four points when the fore-course is handed.

7. Allow five points when under the mainsail 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 works 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

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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 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 judgement. 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.

Fig. 74.

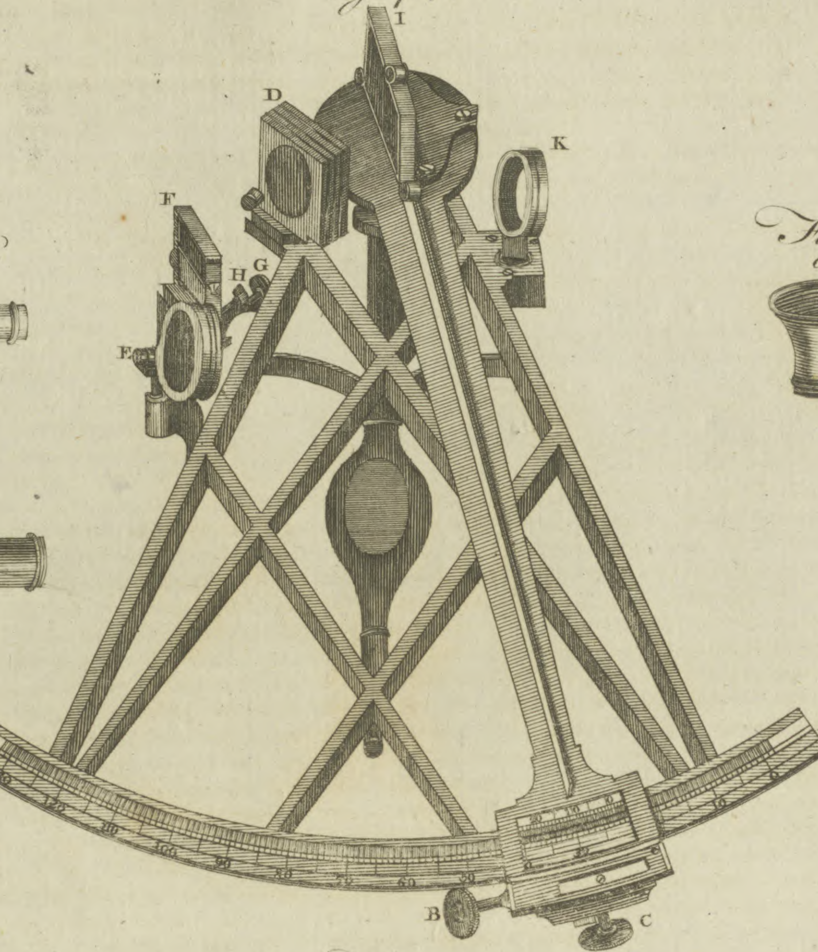

Fig. 75.

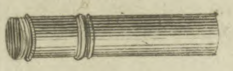

Fig. 78.

Fig. 76.

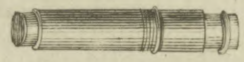

Fig. 79.

Fig. 77.

Fig. 80.

Fig. 83.

Fig. 81.

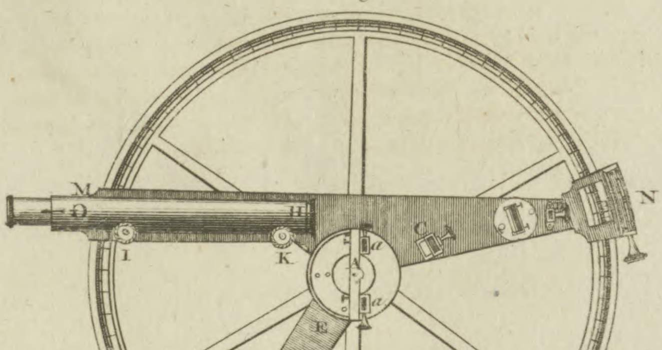

Fig. 86.

Fig. 84.

Fig. 87.

Fig. 88.

Fig. 85.

Fig. 82.

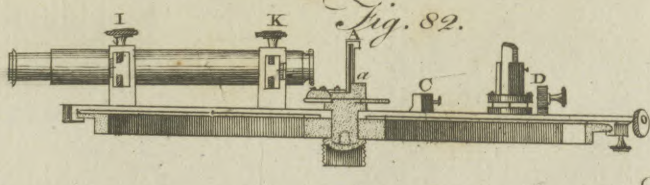

Fig. 89.

A. Bell Prin. Wal. Sculptor fecit.

Ship's Journal.

A JOURNAL of a VOYAGE from London to Funchal in Madeira, in his Majesty's Ship the Resoluton, A—— M—— Commander, *anno* 1793.

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 top-gallant 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 top-gallant 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 top-gallant 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 to 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*E$\frac{1}{2}$E off shore $1\frac{1}{4}$ 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 top-gallant yards.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ♄ Oct. 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 top-gallant 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 N$\frac{1}{4}$E.

A 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			Do. weather.
4	7				
5	7		W*b*S		Set lower studding sails.
6	7				
7	7	4			Fresh breeze and clear weather.
8	7	6			
9	7	3			
10	7	5			
11	7	2			
12	7				Do. weather.

Course.	Dist.	D L.	Dep.	N. Latitude by Acc.	N. Latitude by Obs.	D. Long	W. Lon. by Acc.	W. Lon. by Obs.	W. Var.		
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 from 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 AM. 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. N.	Diff. of lat. S.	Departure E.	Departure W.
S*b*W¾W	18		17.0		6.1
W*b*S¾S	22		5.3		21.3
SW¼W	58		34.6		46 6
S 52½° W.	93		56.9=57m.		74.0

Latitude of Eddistone	-	50 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.

A Journal

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				Light breeze.
4	4			NW.	
5	3		SW*b*W.		A sail S*b*E.
6	3				
7	3				Hazy weather.
8	3				
9	3		SW.	Var.	
10	3				
11	3				
12	2				Do. weather.

Course.	Dist.	DL.	Dep.	N. Latitude by Acc.	N. Latitude by Obs.	D. Long.	W. Long. by Acc.	W. Long. by Obs.	W. Var. by ac.	Porto Sancto's Bearing.	Porto Sancto's Distance.
S 38° W.	99	78	62	47° 51′		93′ W.	7° 51′		$2\frac{1}{4}$ 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 latitude. N.	Diff. of latitude. S.	Departure. E.	Departure. W.
SW¼S.	77		57.0		51.7
SSW ¾ W.	12		10.3		6.2
S*b*W ¼ W.	11		10.4		3.7
S 38°W.	99		77.7		61.6
			1° 18′		

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 - 6 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. 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 SW ¼ W nearly, the bearing *per* compass; and which is the course that ought to be steered.

A 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.	Tried the current and found none.
3					
4			Ship's head to the SW.		Calm.
5					
6					
7					Calm; a long ſwell from the SW.
8			Ship's head from SWtoSSE.		
9					
10	1		WSW	S	
11	1				
12	2				Light airs and hazy.
1	2				
2	2				
3	2				Moderate wind and cloudy.
4	3				
5	3		W	S*b*W	
6	4				Set top-gallant ſails.
7	5				
8	5				
9	5				
10	5		W ½N	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. Latit. by Acc.	N. Latit. by Obſ.	D. Long.	W. Long. by Acc.	W. Long. by Obſ.	W. Var.	Porto Sancto's Bearing.	Porto Sancto's Diſtance.
S 61° W.	51	25	45	47° 26	47° 28′	67′ W.	8° 58′		2 points	S 21° W	932

The ſeveral courſes corrected will be as under.

Courſes.	Diſt.	Diff. of latitude N	Diff. of latitude S	Departure.	Departure. W
SSW	3		2.8		1.1
SW	13		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 47⅔°, 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 S21°W, and diſtance 932 miles. The courſe per compaſs is therefore SW nearly.

A Journal from England to Madeira.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ☿ October 9 1793.
1	5		WbN	SWbS	Squally with rain.
2	5				Handed top-gallant sails.
3	5	5			In 1st reef topsails.
4	5	4			Dark gloomy weather. Tacked ship.
5	5	6	SEbS		
6	5				In 2d reef topsails, and down top-gallant yards.
7	4				Stormy weather; in fore and mizen topsails and 3d reef maintop sail. Handed the maintop 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 SEbS off ESE		
11	}		up WSW off WNW		
12			WbN		
1	3				
2	3	6	WNW	SW	The sea stove in several half ports.
3	3	5			
4	3	5			The swell abates a little.
5	4		WbN	SWbS	
6	4				The swell abates fast.
7	3	2			Up top-gallant masts.
8	3	4			
9	3	4	W	SSW	Set the topsails.
10	4				
11	5				Clear weather; good observation.
12	5				

Course.	Dist.	D.L	Dep.	N. latit. by Acc.	N. latit. by Obs.	D.Long.	W. Long. by Acc.	W. Long. by Obs.	W.Var.	Porto Sancto's Bearing	Porto Sancto's Distance
WbN½N	43	12	41	47° 40′	47° 39′	61′	9° 59′		2 points.		

There is no leeway allowed until 2 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 an half points; from 10 to 12, five points; from 12 to 10 A. M. three and an 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 latit. N	Diff. of latit. S	Departure. E	Departure. W
WbS	10		2.0		9.8
W	15.5				15.5
W½N	5.4	0.5			5.4
EbS½S	10.6		3.1	10.1	
EbS¼S	8		1.9	8.7	
E	3			3.0	
NEbE	1	0.6		0.8	
NWbW	2	1.1			1.7
NWbW½W	17.2	8.1			15.2
NW½W	11	7.0			8.5
WbN½N	7.4	2.1			7.1
		19.4	7.0	21.7	63.2
		7.0			21.7
WbN½N	43	1 4			41.5

Yest. latitude 47 28 N

Lat. by account 47 40 N

To middle latitude 47° 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

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 top-gallant 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 set ship 7 miles in the opposite direction.
12	5				

Course.	Dist.	D.L.	Dep.	N. Latit. by		D. Long.	W. Long. by		W. Var.	Porto Sancto's	
				Acc.	Obs.		Acc.	Obs.		Bearing.	Distance.
S 74° W.	108	30	104	47° 9′		153′ W.	12° 32′		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 Latitude.		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		2.7	6.5	
S 74 W	108		30.0	6.5	110.1
					6.5
					103.6

Yesterday's latitude 47 39
Latitude by account 47 9
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. Porto Sancto -	32 58 Mer. parts -	2097	Longitude -	16 25 W
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				Do. weather.
4	3				Variation *per* amplitude 21° W.
5	4				
6	4	6			
7	4	4			A fine steady breeze.
8	4	5		E	By an observation of the moon's distance from
9	5				α Pegasi, the ship's longitude at half past 8 was
10	5				12° 28′ W.
11	5				Clear weather.
12	5	2			
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. Latit. 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 Jour-

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courses.	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. Latit. by Acc.	N. Latit. by Obs	D. Long.	W. Long. by Acc.	W. Long. by Obs.	W. Var. Obs.	Porto Santo's Bearing.	Porto Santo's 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 13° 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 13°½, and meridional difference of latitude 245 in a latitude column, the difference of longitude in a departure column is 59′ W: hence the yesterday's longitudes 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 Santo.

Latitude ship	42° 1′ N.	Mer. parts	2783	Longitude	13° 58′ W.
Lat. Porto Santo	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 Santo; and the variation being allowed to the right hand of S 12° W, gives S 32°¼ W, the bearing *per* compass; and the distance answering to the difference of latitude 543, under 12 degrees, is 555 miles.

A 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			
3	8	6			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.
4	8				
5	8				
6	8	4			
7	8				Hauled in the lower studding-sails.
8	7	5			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				
1	7			ESE.	
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				
9	8	4			Carried away a fore-top-mast studding-sail boom, got
10	8	2			up another.
11	8				Fresh gales. Took in studding-sails.
12	7	4			

Course.	Dist.	D.L.	Dep.	N. latit. by Acc.	N. latit. by Obs.	D.Long.	W. Long. by Acc.	W. Long. by Obs.	W. Var. by Obs.	Porto Sancto's Bearing.	Porto Sancto's Distance.
S*b*W¼W.	184	178	45	39° 3′		59′ W.	15° 11′	14° 52′	1¼ pts.		

The mean of the variations is about 1¾ points W: hence the course corrected is S*b*W¼W; 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 1¾ points, and meridional difference of latitude 234, the difference of longitude is about 59 m.; 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 1¼ 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 1¼ 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 14° 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.

A Journal

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courſes.	Winds.	Remarks, ☽ October 14. 1793.
1	8		SWbS	EbS	Freſh gales and hazy, ſingle reefed topſails.
2	7	5			
3	7	5			Got down top-gallant 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			Variable.	
10	5				
11	5				
12	4				Do. with lightning all round the compaſs.
1	3				
2	3				
3	3	5	SWbS	SEbS	
4	4				Squally, with rain.
5	5				
6	4				
7	2	5			
8	2		SW	SSE	Moderate weather; out reefs, and up top-gallant-yards.
9	3				
10	3	5			
11	4	5	WSW	S	At 11h 10′ A.M. the latitude from double altitudes of the ſun was 37° 10′. Clear weather.
12	5				

Courſe.	Dif.	DL.	Dep.	N. Latitude by Acc.	N. Latitude by Obſ.	D. Long.	W. Long. by Acc.	W. Long. by Obſ.	W. Var.	Porto Sancto's Bearing.	Porto Sancto's Diſtance.
S 16°W.	116	111	32	37° 12′	37° 8′	41′W.	15° 52′	15° 33′	$1\frac{1}{4}$ pts.	S10°W.	254 m.

As the ſhip is cloſe hauled from 2 o'clock AM. $1\frac{1}{4}$ points leeway are allowed upon that courſe, and 1 point on the two following courſes.

Courſes.	Diſt.	Diff. of latitude. N.	Diff. of latitude. S.	Departure. E.	Departure. W.
SbW¼W	30		29.1		7.3
S¼W	54		53.9		2.7
SSW½W	19		16.8		9.0
SW¾S	8.5		6.8		5.1
SWbW¼W.	9.5		4.9		8.1
S16°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′.

	by account	by ob.
Yeſterday's lon.	15° 11′W.	14° 52′W.
Difference of longitude	41 W.	41 W.
Longitude in	15 52	15 33 W.

The latitude by obſervation at 11h 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. long. 52

Hence the bearing of Porto Sancto is S. 10°W, or SSW ¾ W nearly, *per* compaſs, and the diſtance is 254 miles.

 A Jour-

Ship's Journal.

A Journal from England towards Madeira.

Hours	Kn.	Fa.	Courses.	Winds.	Remarks, ♂ October 15. 1793.
1	4		W*b*S	S*b*W	Moderate and clear weather.
2	4				
3	3	6			Employed working points and rope-bands.
4	3				Ditto weather.
5	3	4			
6	3		W*b*N	SW*b*S	
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	NW*b*W	SW*b*W	
6	3				
7	3				Variation per mean of several azimuths 18° 0′ W.
8	3	6			Ditto weather. Tacked ship.
9	4		S*b*E		
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 Acc.	N. Lat by Obs.	D. Long.	W. Long. by Account.	W. Long. by Observ.	W. Var. by Obs.	Porto Sancto's Bearing.	Porto Sancto's 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. N	Diff. of Latitude. S	Departure. E	Departure. W
W½S	18		1.8		17.9
W*b*N½N	27	7.8			25.8
W½N	7	0.7			7.0
NW*b*W½W	2	0.9			1.8
NW½W	12	7.6			9.3
S*b*E½E	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. S68 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 a 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.
Diff. 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 S*b*W½W nearly

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			People employed occasionally.
9	9				
10	9			NE*b*E.	
11	7				
12	8				Do. weather. Observed sun's meridian altitude.

Course.	Dist.	D.L.	Dep.	N. Latit. by Acc.	N. Latit. by Obs.	D.Long.	W. Long. by Acc.	W. Long. by Obs.	W. Var. Obs.	Porto Sancto's Bearing.	Porto Sancto's Distance.
S 8° E	186	1 5	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 N.	Diff. of latit S.	Departure E.	Departure 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.	186		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 middle latitude and the departure, the difference of longitude in a distance column is 31 E.

Yesterday's lon. by acc. 16 57′W. by obs. 16° 38′W.
Difference of long. 0 31 E. - 31 E.

Longitude in - 16 26 W. - 16 7W.

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

A Journal from London towards Madeira.

Hours	Kn.	Fa.	Courses.	Winds.	Remarks, ♃ October 17. 1793.
1	5		SSW.	NE*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*S.		Porto Sancto W*b*S.
10	7				
11	7		SW*b*W		
12	6				Ditto with rain. Porto Sancto NE.
1	6		SW.		The Deserters SW*b*S.
2	5				
3	6				
4	7				The Deserters WSW. 3 or 4 leagues.
5	6				
6			Various.		Hauled up round the east end of the Deserters.
7					
8			NNW.		Violent squalls; clewed upall at times.
9			NW*b*N.		Running into Funchal Roads.
10					Anchored in Funchal Road, with the best bower in 30 fathom black sand and mud. Brazen head E*b*S$\frac{1}{4}$S, Loo Rock NW, the Great Church NNE, and the southermost Deserter SE$\frac{1}{4}$S; 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.
11					
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 days 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

ing altitudes of the ſun's limb, and diſtances between the ſun's limb and the moon.

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 the 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.

Example I. Required the ſun's declination May 1. 1799?

May 1. 1799 is four years after the ſame day in 1795.

Sun's declination May 1. 1795	-	15° 9'.1 N
Equation from Table X.	- -	+0 0.6
Sun's declination May 1. 1799	-	15 9.7 N

Example 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

As the Author of this Article lives at a diſtance, ſeveral Errata *have eſcaped the Preſs. They are as follow.*

Page	col.	lines
683.	1.	20. and 22. from bottom. For *Markelyne's*, read *Maſkelyne's*.
685.	2.	10. from bottom. For 55' N. read 55' S.
686.	1.	25. For N. read S.; and in line 28. for 13° 44' N. read 18° 6' S.
687.	1.	7. from bottom. After *meaſures*, inſert 177.
ib.	2.	23. from bottom. After *about*, inſert 280.
689.	2.	16. from bottom. After *one*, inſert *fourth*; and in line 21. for *where*, read *whoſe*.
690.	1.	29. For *a*, read *the*.
691.	1.	5. from bottom. After *to*, inſert 43° 53'; and in line 29. for *abſtracted*, read *ſubtracted*, and for 8. read 4.
692.	2	2. from bottom. For 73 N, read N 73°.
693.	1.	15. After *be*, inſert 281; and in line 17. after *is*, inſert 9° 11' W.
695.	1.	21. from bottom. For *mark*, read *make*.
698.	2.	19. For *on*, read *in*; and in line 20. after 61 dele (°)

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*S¼S	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. *The 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
0 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

TABLE VIII. *Sun's Declination for* 1793, *being the first after leap year.*

Days.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	22°57′1 S.	16°52′3 S.	7°17′0 S.	4°49′9 N	15°17′8 N	22°9′6 N	23°5′3 N	17°52′6 N	8°3′0 N	3°27′7 S.	14 41′1 S.	21°56′9 S.
2	22 51.5	16 34.8	6 54.1	5 12.9	15 35.6	22 17.3	23 0.8	17 37.2	7 41.0	3 51.0	15 0.1	22 5.7
3	22 45.5	16 17.1	6 31.1	5 35.8	15 53.2	22 24.7	22 56.0	17 21.4	7 18.9	4 14.3	15 18.9	22 14.1
4	22 39.0	15 59.0	6 8.0	5 58.7	16 10.5	22 31.6	22 50.7	17 5.4	6 56.7	4 37.5	15 37.4	22 22.0
5	22 32.1	15 40.7	5 44.8	6 21.4	16 27.5	22 38.1	22 45.0	16 49.1	6 34.4	5 0.7	15 55.6	22 29.5
6	22 24.7	15 22.1	5 21.6	6 44.0	16 44.3	22 44.3	22 38.9	16 32.5	6 11.9	5 23.8	16 13.6	22 36.6
7	22 16.9	15 3.3	4 58.2	7 6.6	17 0.9	22 50.0	22 32.4	16 15.7	5 49.4	5 46.8	16 31.2	22 43.2
8	22 8.6	14 44.2	4 34.8	7 28.9	17 17.1	22 55.4	22 25.6	15 58.5	5 26.8	6 9.7	16 48.7	22 49.4
9	21 59.9	14 24.8	4 11.4	7 51.2	17 33.0	23 0.3	22 18.3	15 41.2	5 4.0	6 32.6	17 5.8	22 55.1
10	21 50.8	14 5.2	3 47.9	8 13.3	17 48.7	23 4.9	22 10.7	15 23.5	4 41.2	6 22.4	17 22.6	23 0.4
11	21 41.3	13 45.4	3 24.3	8 35.3	18 4.0	23 9.0	22 2.7	15 5.7	4 18.3	7 18.0	17 39.1	23 5.2
12	21 31.3	13 25.4	3 0.7	8 57.2	18 19.1	23 12.7	21 54.3	15 47.6	3 55.4	7 40.6	17 55.3	23 9.6
13	21 20.9	13 5.1	2 37.0	9 18.9	18 33.8	23 16.0	21 45.5	14 29.2	3 32.3	8 3.1	18 11.2	23 13.5
14	21 10.8	12 44.6	2 13.4	9 40.4	18 48.2	23 18.9	21 36.3	14 10.7	3 9.2	8 25.4	18 26.8	23 16.9
15	20 58.9	12 23.9	1 49.7	10 1.8	19 2.3	23 21.4	21 26.8	13 51.9	2 46.1	8 47.7	18 42.1	23 19.9
16	20 47.3	12 3.1	1 26.0	10 23.1	19 16.1	23 23.5	21 17.0	13 32.9	2 22.9	9 9.8	18 57.0	23 22.4
17	20 35.4	11 42.0	1 2.3	10 44.1	19 29.6	23 25.2	21 6.7	13 13.6	1 59.6	9 31.7	19 11.6	23 24.4
18	20 23.0	11 20.8	0 38.6	11 5.0	19 42.7	23 26.5	20 56.1	12 54.2	1 36.4	9 53.6	19 25.8	23 26.0
19	20 10.2	10 59.4	0 14.9 S.	11 25.7	19 55.5	23 27.3	20 45.2	12 34.6	1 13.0	10 15.3	19 39.7	23 27.0
20	19 57.1	10 37.8	0 8.7 N.	11 46.2	20 8.0	23 27.7	20 33.9	12 14.7	0 49.7	10 36.8	19 53.2	23 27.7
21	19 43.6	10 16.3	0 32.4	12 6.5	20 20.1	23 27.8	20 22.3	11 54.7	0 26.3	10 58.2	20 6.4	23 27.8
22	19 29.7	9 54.1	0 56.0	12 26.6	20 31.9	23 27.3	20 10.3	11 34.5	0 2.9 N	11 19.4	20 19.2	23 27.5
23	19 15.5	9 32.1	1 19.7	12 46.5	20 43.3	23 26.6	19 58.0	11 14.1	0 20.5 S	11 40.4	20 31.6	23 26.7
24	19 0.9	9 9.9	1 43.2	13 6.2	20 54.3	23 25.3	19 45.3	10 53.5	0 43.9	12 1.3	20 43.7	23 25.4
25	18 46.0	8 47.6	2 6.8	13 25.7	21 5.0	23 23.7	19 32.3	10 32.7	1 7.4	12 22.0	20 55.3	23 23.7
26	18 30.7	8 25.1	2 30.2	13 44.9	21 15.4	23 21.7	19 19.0	10 11.8	1 30.8	12 42.5	21 6.6	23 21.5
27	18 15.1	8 2.6	2 53.7	14 4.0	21 25.3	23 19.2	19 5.4	9 50.7	1 54.2	13 2.8	21 17.5	23 18.8
28	17 59.2	7 39.9	3 17.1	14 22.8	21 34.9	23 16.4	18 51.5	9 29.5	2 17.6	13 22.9	21 27.9	23 15.6
29	17 42.9		3 40.4	14 41.3	21 44.2	23 13.1	18 37.2	9 8.1	2 41.0	13 42.8	21 38.0	23 12.0
30	17 26.4		4 3.6	14 59.7	21 53.0	23 9.4	18 22.6	8 46.5	3 4.4	14 2.5	21 47.6	23 7.9
31	17 9.5		4 26.8		22 1.5		18 7.8	8 24.8		14 21.9		23 3.4

TABLE VIII. *Sun's Declination for* 1794, *being the second after leap year.*

Days.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	22°58′4 S.	16°56′5 S.	7°22′6 S.	4°44′3 N	15°13′0 N	22°7′7 N	23°6.4 N	17°56′3 N	8°8′2 N	3°22′2 S.	14°36′5 S.	21°54′7 S
2	22 52.9	16 39.1	6 59.7	5 7.4	15 31.3	22 15.5	23 2.0	17 40.9	7 46.3	3 45.5	14 55.6	22 3.6
3	22 47.0	16 21.4	6 36.7	5 30.4	15 49.0	22 23.0	22 57.2	17 25.2	7 24.2	4 8.7	15 14.3	22 12.1
4	22 40.6	16 3.4	6 13.6	5 53.2	16 6.4	22 30.0	22 52.0	17 9.2	7 2.1	4 31.9	15 32.9	22 20.1
5	22 33.8	15 45.1	5 50.4	6 16.0	16 23.5	22 36.6	22 46.4	16 53.0	6 39.8	4 55.1	15 51.2	22 27.7
6	22 26.5	15 26.6	5 27.2	6 38.6	16 40.3	22 42.8	22 40.4	16 36.5	6 17.4	5 18.1	16 9.2	22 34.9
7	22 18.8	15 7.8	5 3.8	7 1.2	16 56.9	22 48.7	22 34.0	16 19.7	5 54.9	5 41.2	16 26.9	22 46.6
8	22 10.7	14 48.8	4 40.5	7 23.6	17 13.2	22 54.1	22 27.3	16 2.7	5 32.3	6 4.1	16 44.4	22 47.9
9	22 2.1	14 29.5	4 17.0	7 45.8	17 29.2	22 59.2	22 20.1	15 45.4	5 9.6	6 27.0	17 1.6	22 53.7
10	21 53.1	14 10.0	3 53.5	8 8.0	17 44.9	23 3.8	22 12.6	15 27.9	4 46.8	6 49.7	17 18.4	22 59.1
11	21 43.6	13 50.2	3 30.0	8 30.0	18 0.3	23 8.0	22 4.7	15 10.1	4 24.0	7 12.4	17 35.0	23 4.1
12	21 33.8	13 30.3	3 6.4	8 51.9	18 15.4	23 11.9	21 56.4	14 52.1	4 1.0	7 35.0	17 51.3	23 8.5
13	21 23.5	13 10.1	2 42.8	9 13.6	18 30.2	23 15.3	21 47.7	14 33.8	3 38.0	7 57.5	18 7.3	23 12.5
14	21 12.8	12 49.7	2 19.2	9 35.2	18 44.7	23 18.3	21 38.6	14 15.3	3 15.0	8 19.9	18 23.0	23 16.1
15	21 1.7	12 29.1	1 55.5	9 56.6	18 58.9	23 20.9	21 29.2	13 56.5	2 51.8	8 42.2	18 38.3	23 19.2
16	20 50.2	12 8.2	1 31.8	10 17.8	19 12.8	23 23.1	21 19.4	13 37.6	2 28.6	9 4.3	18 53.3	23 21.8
17	20 38.4	11 47.2	1 8.2	10 38.9	19 26.3	23 24.8	21 9.3	13 18.4	2 5.4	9 26.3	19 8.0	23 23.9
18	20 26.1	11 26.1	0 44.5	10 59.8	19 39.5	23 26.2	20 58.8	12 59.0	1 42.1	9 48.2	19 22.3	23 25.6
19	20 13.4	11 4.7	0 20.8 S.	10 20.6	19 52.4	23 27.2	20 47.9	12 39.4	1 18.8	10 9.9	19 36.3	23 26.8
20	20 0.4	10 43.1	0 2.9 N	11 41.1	20 4.9	23 27.7	20 36.7	12 19.6	0 55.4	10 31.5	19 50.0	23 27.6
21	19 47.0	10 21.4	0 26.5	12 1.5	20 17.1	23 27.8	20 25.2	11 59.6	0 32.0	10 53.0	20 3.2	23 27.8
22	19 33.2	9 59.6	0 50.2	12 21.6	20 29.0	23 27.5	20 13.2	11 39.4	0 8.6 N	11 14.2	20 16.1	23 27.6
23	19 19.0	9 37.5	1 13.8	12 41.6	20 40.5	23 26.8	20 1.0	11 19.0	0 14.8 S	11 35.3	20 28.6	23 26.9
24	19 4.5	9 15.4	1 37.4	13 1.4	20 51.6	23 25.7	19 48.4	10 58.5	0 38.3	11 56.3	20 40.8	23 25.1
25	18 49.7	8 53.1	2 1.0	13 20.9	21 2.4	23 24.2	19 35.5	10 37.8	1 1.7	12 17.0	20 52.6	23 24.2
26	18 34.5	8 30.6	2 24.5	13 40.2	21 12.9	23 22.2	19 22.3	10 16.8	1 25.2	12 37.6	21 3.9	23 22.1
27	18 18.9	8 8.1	2 47.9	13 59.3	21 23.0	23 19.9	19 8.7	9 55.8	1 48.6	12 57.9	21 14.9	23 19.5
28	8 3.1	7 45.4	3 11.4	14 18.2	21 32.7	23 17.1	18 54.8	9 34.6	2 12.0	13 18.1	21 25.5	23 16.5
29	17 46.9		3 34.7	14 36.9	21 42.0	23 13.9	18 40.7	9 13.2	2 35.4	13 38.0	21 35.6	23 13.0
30	17 30.4		3 58.0	14 55.2	21 50.9	23 10.4	18 26.2	8 51.7	2 58.8	13 57.8	21 45.4	23 9.0
31	17 13.6		4 21.2		21 59.5		18 11.4	8 30.0		14 17.3		23 4.6

TABLE VIII. *Sun's Declination for* 1795, *being the third after leap year.*

Days.	January.	February.	March.	Ap il.	May.	June.	July.	August.	September.	October.	November.	December.
1	22° 59'7 S	17° 0'7 S	7° 28'1 S	4° 38'8 N	15° 9'1 N	22° 5'8 N	23° 7'4 N	18° 0'0 N	8° 13'5 N	3° 16'4 S	14° 31'8 S	21° 52'4 S
2	22 54.3	16 43.4	7 5.3	5 1.8	15 27.1	22 13.7	23 3.1	17 44.7	7 51.7	3 39.7	14 50.9	21 1.4
3	22 48.5	16 25.8	6 42.3	5 24.8	15 44.8	22 21.2	22 58.4	17 29.1	7 29.6	4 3.0	15 9.7	22 10.0
4	22 42.3	16 7.9	6 19.3	5 47.7	16 2.2	22 28.3	22 53.3	17 13.2	7 7.5	4 26.2	15 28.3	22 18.2
5	22 35.5	15 49.7	5 56.1	6 10.4	16 19.4	22 35.0	22 47.8	16 57.0	6 45.2	4 49.4	15 46.7	22 25.9
6	22 28.4	15 31.3	5 32.9	6 33.1	16 36.3	22 41.4	22 42.0	16 40.6	6 22.9	5 12.5	16 4.8	22 33.2
7	22 20.8	15 12.5	5 9.6	6 55.6	16 52.9	22 47.3	22 35.7	16 23.9	6 0.4	5 35.5	16 22.6	22 40.0
8	22 12.8	14 53.6	4 46.3	7 18.1	17 9.3	22 52.9	22 29.0	16 6.9	5 37.8	5 58.5	16 40.1	22 46.4
9	22 4.3	14 34.4	4 22.8	7 40.4	17 25.3	22 58.0	22 21.9	15 49.7	5 15.1	6 21.4	16 57.4	22 52.4
10	21 55.4	14 14.9	3 59.4	8 2.6	17 41.1	23 2.7	22 14.5	15 32.2	4 52.4	6 44.2	17 14.4	22 57.9
11	21 46.0	13 55.2	3 35.8	8 24.6	17 56.6	23 7.1	22 6.7	15 14.4	4 29.5	7 6.9	17 31.0	23 2.9
12	21 36.3	13 35.3	3 12.3	8 46.5	18 11.8	23 11.0	21 58.4	14 56.4	4 6.6	7 29.6	17 47.4	23 7.5
13	21 26.1	13 15.1	2 48.6	9 8.3	18 26.7	23 14.5	21 49.8	14 38.2	3 43.6	7 52.1	18 3.5	23 11.7
14	21 15.5	12 54.8	2 25.0	9 29.9	18 41.3	23 17.6	21 40.9	14 19.7	3 20.5	8 14.5	18 19.2	23 15.3
15	21 4.5	12 34.2	2 1.3	9 51.4	18 55.6	23 20.3	21 31.5	14 1.0	2 57.4	8 36.8	18 34.7	23 18.5
16	20 53.1	12 13.4	1 37.7	10 12.7	19 9.5	23 22.6	21 21.9	13 42.1	2 34.2	8 59.0	18 49.8	23 21.2
17	20 41.3	11 52.4	1 13.9	10 33.9	19 24.1	23 24.5	21 11.8	13 23.0	2 10.9	9 21.1	19 4.5	23 23.5
18	20 29.2	11 31.3	0 50.2	10 54.8	19 36.4	23 25.9	21 1.3	13 3.6	1 47.6	9 43.0	19 18.9	23 25.3
19	20 16.6	11 9.9	0 26.5	11 15.6	19 49.4	23 27.0	20 50.6	12 44.1	1 24.3	10 4.8	19 33.0	23 26.6
20	20 3.6	10 48.4	0 2.8 S	11 36.2	20 2.0	23 27.6	20 39.4	12 24.3	1 0.9	10 26.4	19 46.7	23 27.5
21	19 50.3	10 26.7	0 20.8 N	11 56.7	20 14.3	23 27.9	20 27.9	12 4.4	0 37.6	10 47.8	20 0.1	23 27.9
22	19 36.6	10 4.9	0 44.5	12 16.9	20 26.2	23 27.7	20 16.1	11 44.2	0 14.2 N	11 9.1	20 13.1	23 27.8
23	19 22.5	9 42.9	1 8.1	12 36.9	20 37.8	23 27.0	20 4.0	11 23.9	0 9.2 S	11 30.3	20 25.7	23 27.2
24	19 8.1	9 20.7	1 31.8	12 56.7	20 49.1	23 26.0	19 51.5	11 3.4	0 32.7	11 51.2	20 37.9	23 26.2
25	18 53.3	8 58.5	1 55.3	13 16.3	21 0.0	23 24.6	19 38.6	10 42.7	0 56.1	12 12.0	20 49.7	23 24.6
26	18 38.2	8 36.1	2 18.9	13 35.7	21 10.5	23 22.7	19 25.5	10 21.9	1 19.5	12 32.6	21 1.2	23 22.7
27	18 22.8	8 13.5	2 42.3	13 54.8	21 20.6	23 20.5	19 12.0	10 0.9	1 42.9	12 53.0	21 12.2	23 20.2
28	18 7.0	7 50.9	3 5.8	14 13.8	21 30.4	23 17.8	18 58.2	9 39.7	2 6.3	13 13.2	21 22.9	23 17.3
29	17 50.9		3 29.1	14 32.5	21 39.8	23 14.8	18 44.1	9 18.4	2 29.7	13 33.2	21 33.1	23 13.9
30	17 34.5		3 52.4	14 50.9	21 48.9	23 11.3	18 29.7	8 56.9	2 53.1	13 52.9	21 43.0	23 10.1
31	17 17.7		4 15.6		21 57.5		18 15.0	8 35.3		14 12.		

TABLE VIII. *Sun's Declination for* 1796, *being leap year.*

Days.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	23° 1'0 S	17° 5'0 S	7° 11'0 S	4° 56'1 N	15° 22'7 N	22° 11'8 N	23° 4'2 N	17° 48'5 N	7° 57'0 N	3° 34'1 S	14° 46'4 S	21° 59'4 S
2	22 55.7	16 47.8	6 48.0	5 19.1	15 40.5	22 19.5	22 59.6	17 32.9	7 35.0	3 57.4	15 5.3	22 8.1
3	22 50.0	16 30.2	6 25.0	5 42.1	15 58.0	22 26.7	22 54.6	17 17.1	7 12.9	4 20.6	15 24.0	22 16.3
4	22 43.9	16 12.4	6 1.9	6 4.9	16 15.2	22 33.5	22 49.2	17 1.0	6 50.6	4 43.8	15 42.4	22 24.2
5	22 37.3	15 54.2	5 38.6	6 27.6	16 32.2	22 39.9	22 43.4	16 44.6	6 28.3	5 7.0	16 0.5	22 31.6
6	22 30.2	15 35.8	5 15.4	6 50.2	16 49.0	22 46.0	22 37.3	16 27.9	6 5.8	5 30.0	16 18.4	22 38.5
7	22 22.7	15 17.2	4 52.0	7 12.7	17 5.4	22 51.6	22 30.7	16 11.0	5 43.2	5 53.0	16 36.0	22 45.0
8	22 14.8	14 58.3	4 28.6	7 35.0	17 21.6	22 56.9	22 23.7	15 53.8	5 20.6	6 16.0	16 53.3	22 51.1
9	22 6.4	14 39.1	4 5.1	7 57.3	17 37.4	23 1.7	22 16.3	15 36.4	4 57.8	6 38.8	17 10.4	22 56.7
10	21 57.6	14 19.7	3 41.5	8 19.4	17 53.0	23 6.1	22 8.6	15 18.7	4 35.0	7 1.5	17 27.1	23 1.8
11	21 48.4	14 0.0	3 18.0	8 41.3	18 8.2	23 10.1	22 0.5	15 0.8	4 12.1	7 24.2	17 43.6	23 6.5
12	21 38.7	13 40.1	2 54.3	9 3.1	18 23.2	23 13.8	22 52.0	14 42.6	3 49.1	7 46.7	17 59.7	23 10.7
13	21 28.7	13 20.0	2 30.7	9 24.8	18 37.9	23 17.0	21 43.1	14 24.2	3 26.1	8 9.1	18 15.5	23 14.5
14	21 18.2	12 59.7	2 7.0	9 46.3	18 52.2	23 19.8	21 33.9	14 5.6	3 3.0	8 31.5	18 31.0	23 17.8
15	21 7.3	12 39.2	1 43.4	10 7.7	19 6.2	23 22.1	21 24.2	13 46.8	2 39.8	8 53.6	18 46.2	23 20.7
16	20 56.0	12 18.5	1 19.7	10 28.8	19 19.9	23 24.1	21 14.3	13 27.7	2 16.6	9 15.7	19 1.0	23 23.0
17	20 44.3	11 57.5	0 56.0	10 49.8	19 33.3	23 25.7	21 3.9	13 8.4	1 53.3	9 37.6	19 15.5	23 24.9
18	20 32.2	11 36.4	0 32.3	11 10.7	19 46.3	23 26.8	20 53.3	12 48.9	1 30.1	9 59.4	19 29.6	23 26.4
19	20 19.7	11 15.2	0 8.6 S	11 31.3	19 59.0	23 27.5	20 42.2	12 29.2	1 6.7	10 21.1	19 43.4	23 27.3
20	20 6.9	10 53.7	0 15.1 N	11 51.7	20 11.4	23 27.9	20 30.8	12 9.3	0 43.3	10 42.6	19 56.9	23 27.8
21	19 53.6	10 32.1	0 38.7	12 12.0	20 23.4	23 27.8	20 19.1	11 49.3	0 20.0 N	11 3.9	20 9.9	23 27.9
22	19 40.0	10 10.3	1 2.4	12 32.0	20 35.1	23 27.3	20 7.0	11 29.0	0 3.4 S	11 25.1	20 22.6	23 27.4
23	19 26.1	9 48.4	1 26.0	12 51.9	20 46.4	23 26.3	19 54.6	11 8.5	0 26.9	11 46.1	20 35.0	23 26.5
24	19 11.7	9 26.3	1 49.5	13 11.5	20 57.4	23 25.0	19 41.9	10 47.9	0 50.3	12 7.0	20 46.9	23 25.1
25	18 57.1	9 4.0	2 13.1	13 30.9	21 8.0	23 23.3	19 28.8	10 27.1	1 13.7	12 27.6	20 58.5	23 23.2
26	18 42.0	8 41.7	2 36.6	13 50.2	21 18.2	23 21.1	19 15.4	10 6.1	1 37.2	12 48.0	21 9.6	23 20.9
27	18 26.7	8 19.2	3 0.0	14 9.1	21 28.5	23 18.6	19 1.7	9 45.0	2 0.6	13 8.3	21 20.4	23 18.1
28	18 11.0	7 56.6	3 23.3	14 27.9	21 37.6	23 15.6	18 47.6	9 23.7	2 24.0	13 28.4	21 30.8	23 14.8
29	17 55.0	7 33.8	3 46.6	14 46.4	21 46.7	23 12.2	18 33.3	9 2.2	2 47.4	13 48.2	21 40.7	23 11.1
30	17 38.6		4 9.9	15 4.7	21 55.5	23 8.4	18 18.6	8 40.6	3 10.8	14 7.8	21 50.3	23 6.8
31	17 22.0		4 33.0		22 3.8		18 3.7	8 18.9		14 27.2		23 2.2

TABLE

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.	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°	130°	140°	150°	160°	170°	180°	Add in W. Sub. in E.	Sub. in W. Add in E.
		LONGITUDE.																			
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	0.5	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	4.0	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	February. 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	March. 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	September. 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	5
3	10	0.6	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	3	8
Septem. 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	March. 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.	0h 2/3	1h 1/3	2h 0	2h 2/3	3h 1/3	4h 0	4h 2/3	5h 1/3	6h 0	6h 2/3	7h 1/3	8h 0	8h 2/3	9h 1/3	10h 0	10h 2/3	11h 1/3	12h 0	Add aft. N. Sub. bef. N.	Sub. aft. N. Add bef. N.
		Time from Noon.																			

TABLE X. *Change of Sun's Declin.*

Mont.	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 .2	0 .3	0 .4
	19	0 .0	0 .0	0 .1	0 .1
	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 1793.*

Name of Stars.	Mag.	Right Ascen. in Time. h	m	s	Ann. Var.	Declination. °	′	″		Ann. Var.
γ Pegasi -	2	0h	2′	35″	3″.06	14°	1′	55″	N	+20″.0
β Ceti -	2	0	33	11	3 .01	19	7	32	S	—19 .8
Alrucabah, pole star	2.3	0	50	44	12 .42	88	12	8	N	+19 .6
Mirach -	2	0	58	10	3 .31	34	31	13	N	+19 .4
Achernar -	1	1	30	0	2 .25	58	17	33	S	—18 .5
Almaach -	2	1	51	15	3 .62	41	19	47	N	+17 .7
Menkar -	2	2	51	28	3 .11	3	16	17	N	+14 .7
Algol -	Var.	2	54	45	3 .85	40	8	47	N	+14 .5
Algenib -	2	3	9	38	4 .21	49	6	40	N	+13 .6
Aldebaran -	1	4	24	3	3 .42	16	4	48	N	+ 8 .2
Capella -	1	5	1	25	4 .41	45	46	15	N	+ 5 .1
Rigel -	1	5	4	31	2 .87	8	27	9	S	— 4 .8
β Tauri -	2	5	13	13	3 .78	28	25	1	N	+ 4 .1
Bellatrix -	2	5	14	3	3 .21	6	8	53	N	+ 4 .0
δ Orionis -	2	5	21	27	3 .07	0	27	50	S	— 3 .4
ε Orionis -	2	5	25	44	3 .04	1	20	48	S	— 3 .0
ζ Orionis -	2	5	30	20	3 .03	2	3	52	S	— 2 .6
α Columbæ -	2	5	32	10	2 .17	34	11	34	S	— 2 .4
Betelguese -	1	5	43	58	3 .24	7	21	17	N	+ 1 .4
β Canis Majoris	2.3	6	13	37	2 .65	17	51	56	S	+ 1 .2
Canopus -	1	6	19	22	1 .33	52	35	16	S	+ 1 .7
Sirius -	1	6	36	1	2 .65	16	26	35	S	+ 4 .3
δ Canis Majoris	2	6	59	59	2 .44	26	4	32	S	+ 5 .2
Castor -	1.2	7	21	22	3 .85	32	19	30	N	— 6 .9
Procyon -	1.2	7	28	27	3 .14	5	45	3	N	— 7 .5
Pollux -	2.3	7	32	37	3 .69	28	30	42	N	— 7 .9
ζ Navis -	2	7	56	19	2 .11	39	25	36	S	+ 9 .7
γ Navis -	2	8	3	10	1 .85	46	43	54	S	+10 .3
Acubens -	3	8	47	8	3 .30	12	39	6	N	—13 .4
β Navis -	1	9	10	54	0 .75	68	52	2	S	+14 .8
Alphard -	2	9	17	24	2 .93	7	46	7	S	+15 .2
Regulus -	1	9	57	20	3 .20	12	58	21	N	—17 .2
η Navis -	2	10	37	4	2 .30	58	36	3	S	+18 .7
β Ursæ Majoris	2	10	49	14	3 .71	57	29	17	N	—19 .1
Dubhe -	2	10	50	49	3 .85	62	52	9	N	—19 .1
β Leonis -	2	11	38	29	3 .06	15	43	47	N	—19 .9
γ Ursæ Majoris	2	11	46	51	3 .22	54	50	47	N	—20 .0
α Crucis -	1	12	15	14	3 .24	61	57	6	S	+20 .0
γ Crucis -	2	12	19	47	3 .24	55	57	2	S	+20 .0
β Crucis -	2	12	35	46	3 .41	58	33	19	S	+19 .8
Aliath -	2	12	44	51	2 .67	57	5	14	N	—19 .7
Spica Virginis -	1	13	14	18	3 .13	10	4	31	S	+19 .0
ζ Ursæ Majoris -	2	13	15	32	2 .43	56	0	41	N	—19 .0
Benetnach -	2	13	39	23	2 .40	50	21	7	N	—18 .2
β Centauri -	1.2	13	49	23	4 .11	59	21	49	S	+17 .8
Arcturus -	1	14	6	13	2 .72	20	15	58	N	—19 .1
α Centauri -	1	14	26	1	4 .45	59	58	44	S	+16 .1
Alphacca -	2	15	25	55	2 .53	27	25	16	N	—12 .5
β Scorpii -	2	15	53	26	3 .47	10	13	29	S	+10 .5
Antares -	1	16	16	44	3 .64	25	57	22	S	+ 8 .7
Ras. Algethi -	2	17	5	13	2 .73	14	38	18	N	— 4 .8
Ras. Alhague	2	17	25	20	2 .77	12	43	28	N	— 3 .0
Vega -	1	18	29	56	2 .02	38	35	51	N	+ 2 .6
Altair -	1.2	19	40	41	2 .92	8	19	48	N	+ 8 .5
Deneb -	2	20	34	22	2 .03	44	32	51	N	+12 .5
α Gruis -	2	21	55	6	3 .85	47	57	8	S	—17 .1
Fomalhaut -	1	22	46	10	3 .33	30	42	51	S	—19 .0
Scheat -	2	22	53	45	2 .87	26	57	41	N	+19 .2
Markab -	2	22	54	27	2 .96	14	5	42	N	+19 .2
α Andromedæ -	2	23	57	43	3 .07	27	56	51	N	+20 .0

Navigation of the ancients. See Phœnicia 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, penetrating far into the internal parts. See the article Canal.

The advantages of this mode of conveyance, in an extenſive and populous country, are ſufficiently obvious; whether we take into account the ſuperior cheapneſs, facility, or quickneſs with which great quantities of goods can thus be carried from one place to another, or the advantages which may accrue to agriculture and other arts, by thus conveying manures, the produce of the ground, or heavy manufactured goods, to and from diſtant quarters; which would be altogether impracticable by a land-carriage, without incurring a much greater expence than the commodities could bear. The good effects of inland navigation are particularly evident in the vaſt empire of China, and in the ſtates of Holland. In both theſe countries, the multitude of canals undoubtedly contributes to the opulence of the inhabitants, both by the more free ſcope they give to trade, and the advantages derived from them to agriculture; not to mention, that by means of the canals themſelves the ground is often meliorated and made capable of producing both corn and paſture, where otherwiſe it would perhaps yield neither, or at leaſt very imperfectly. Theſe countries, however, particularly Holland, are very flat, and thus very much fitted for this kind of navigation: Great Britain and Ireland are leſs ſo, on account of the greater inequality of their ſurface; though in them alſo the making of canals is now become very common, notwithſtanding the immenſe expence with which ſuch undertakings are attended.

In a late treatiſe upon this ſubject by Mr Edmund Leach ſurveyor, the author conſiders the advantages which might accrue to the kingdoms of Britain and Ireland, were their inland navigation improved as much as it might be; and he conſiders both countries as exceedingly proper for improvements of this kind on account of the number of fine ſtreams of water they contain. "Every county (ſays he) in each kingdom is furniſhed with rivers and ſtreams of water; very few, if any, of which but may be made navigable to within a mile or two of their ſources" by the method he propoſes.

The method of making canals hitherto practiſed, is ſo fully deſcribed under the article Canal, that nothing needs be ſaid upon it in this place. Mr Leach obſerves, that all the artificial inland navigations made in this, as well as in other kingdoms, have been done by beginning them at the foot or mouth of a river, or at the utmoſt extent of the ebb or flow of the tide; proceeding thence upwards, either in the ordinary courſe of the river by ſinking, widening, and cleanſing it; then with the aſſiſtance of a lock and dam to raiſe the boats or other veſſels to a higher level. This is next to be cut, widened, and cleanſed as before, till we come to a third level, when the veſſels are to be raiſed as in the former; proceeding thus, as it were ſtep by ſtep, till we arrive at the extent of the intended navigation. Otherwiſe the navigation is carried on by an artificial ſide-cut or canal near the courſe of the river, raiſed up by locks and dams as before. Theſe methods, however, tho' probably of very great ſervice to the country are attended with many and conſiderable inconveniences.

1. Every river or other ſtream is the natural receptacle of all the ſprings, rains, and floods, which diſcharge themſelves into it; by which means it ſometimes diſcharges ſuch torrents of water as ſweep every thing away before them. This not only interrupts the navigation for a time, but is often attended with the moſt intolerable expence.

2. The original making of the canal with a number of locks and dams, ſuch as is deſcribed under the article Canal, muſt alſo be very expenſive.

3. Some rivers run very rapidly in particular places; and if the deſcent of the bed be very great, it will require a number of the locks and dams already mentioned to make ſuch a river navigable, though the navigation ſhould extend but a few miles from the mouth.

4. The paſſing of the locks is always attended with a conſiderable difficulty, beſides the loſs of time and expence.

To obviate all theſe inconveniences, Mr Leach propoſes to begin and carry on his canal in a manner preciſely the reverſe of that juſt now deſcribed. In his method, the canal is to be begun as near the ſource of the river as poſſible; that is, as near as there is a probability of having water in the drieſt ſeaſons ſufficient to fill the canal; of which there can be but little required, as a ſtream ſufficient to turn an ordinary mill muſt be ſufficient to anſwer all the purpoſes of ſuch a canal. Thus the navigation may be carried up much higher than in the ordinary canals with dams and locks. If a canal be made properly, and the ſides and bottom plaſtered with a cement that may be made of the ſame earth and clay ſaved in making the trunk, very little water will be requiſite to keep it full. Our author ſuppoſes that a ſtream ſufficient to turn an ordinary mill will be ſufficient to keep it full, even if the canal ſhould be 20 miles long.

To conſtruct a canal of this kind, we muſt make choice of a level as near the head of the river as poſſible; this level muſt be continued for a conſiderable way, ſo that the water may not have the leaſt current, but may abſolutely ſtagnate. Thus the original bed of the river will ſoon be left at a diſtance, and the ſtagnant canal will become higher and higher with reſpect to it, in proportion to the deſcent of the ground or rapidity of the river. Having proceeded this way as far as convenient, the veſſels muſt be let down by a machine (to be afterwards deſcribed) into the bed of the original river, or from one elevated canal to another much lower; perhaps 10, 15, or 20 fathoms.

By this perfect ſtagnation of the water in the canals, there will be no danger of waſhing off the plaſtering from the ſides and bottom, ſo that the only waſte of water will be by evaporation, and what is required for working the machine above mentioned; which, as it is only required at particular times when veſſels are to be raiſed or lowered, muſt be very trifling, and cannot bear any proportion to the conſtant ſupply at the head of the canal.

In order to keep the firſt level eaſily, and for a conſiderable way, it will be neceſſary to avoid the many valleys which are naturally to be met with near the original river, by the deſcent of other ſtreams into it.

 Hence

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Hence canals conſtructed on the plan recommended by our author muſt run out in ſerpentine windings a conſiderable way into the country, which will augment its length greatly beyond that of the original river; and thus a much greater number of people, and larger extent of country, will reap the benefit of it than if it was continued in a ſtraight line. "One inconvenience (ſays our author) attending the old inland navigations that are carried on in or nigh the original rivers, is their being confined within too ſmall a ſpace of land, and where, for the moſt part, there is the leaſt occaſion either for water to water the land, or for manure to enrich the ſoil: whereas, by beginning a canal near the head of a river, and by continuing it on one common level, if the river have any thing of a deſcent, and runs pretty rapid, the original river and its valley is ſoon left, and the canal is removed up into the ſide of the hill, where there is generally moſt occaſion for manure and water both; and the further on it is continued, and the more rapid the river runs, the further the navigation is removed from the valley and the original courſe of the river, till it is brought to the place deſigned for the purpoſe of transferring the veſſels down at once by a machine into the original river, the ſea, or into another canal."

Notwithſtanding the advantages which attend this new mode of conſtruction, our author acknowledges that there are ſome caſes in which the old method only can be put in practice.

With regard to the ſize, form, and expence of canals of this kind, Mr Leach gives a computation from one which was intended to be made in the county of Cornwall, and which was called the *Tamar* canal. An act of parliament was obtained for this in 1774. A navigable canal was to be made from Bude Haven, in the county of Cornwall, on the Briſtol Channel, to the navigable part of the river Tamar; the deſign being to open a communication between the Engliſh and Briſtol Channels through the counties of Devon and Cornwall. By the act, it was determined that the canal ſhould not exceed 63 feet in breadth, nor ſhould the ground be cut more than 39 inches deep below the ſurface, excepting in places where docks or baſons were to be made, or where cranes or other engines were to be erected for particular purpoſes. The breadth allowed (63 feet) was to comprehend the water itſelf, the two towing paths, one on each ſide, and the fences beyond them. The breadth of the canal itſelf was to be 21 feet at the ſurface and 12 at bottom; the depth on the under ſide, 39 inches, as already ſaid; the towing paths 12 feet broad each; and beyond theſe an hedge or rail at the diſtance of ſix feet on each ſide from the paths. There were to be drains as uſual in canals; one on the under ſide for carrying off the ſuperfluous water from the canal; the other on the upper ſide for carrying off the water which might accidentally fall into it in rains, or by ſprings in the higher grounds. Thus the whole would not exceed the breadth propoſed by act of parliament; while the canal itſelf would be ſufficiently large for every neceſſary purpoſe. Mr Leach computes, that on this canal two boats, carrying 10 tons each, might very eaſily paſs: and he recommends this as the proper ſize of canals in other parts of the kingdom.

Canals of this kind, our author obſerves, will, for the moſt part, be made in the ſide of an hill or riſing ground; whence the greateſt part of the earth dug out of it will be thrown upon the under ſide. Here it will elevate the ground ſufficiently to form a towing path, together with an elevated ſpace whereon to plant the hedge or fence. On the higher ſide, 12 feet of the ground muſt be cut down to within 18 inches of the ſurface of the water; and the earth and ſtones dug out in making this path will make the fence on the outſide for keeping off the cattle. As by the act of parliament, however, there is a greater breadth allowed in ſome places for making docks or baſons, our author calculates the whole breadth of the canal at 66 feet; and according to this breadth he makes his computations.

1. The firſt and principal expence is the digging of the trunk of the canal; but this muſt vary ſo much according to the nature of the ground, that no certain eſtimate of the expence can be made. Sometimes the ground may be ſoft, and eaſily cut, ſometimes hard and rocky, ſometimes marſhy and boggy, &c. There muſt alſo be a very conſiderable difference in the expence of cutting the canal, according as the ground on one ſide of it is more or leſs elevated. Mr Leach, after making the proper calculations, ſuppoſes that in every perch of a canal of the kind under conſideration there muſt be removed $40\frac{1}{7}$ cubical yards, or 1085 cubical feet, of earth. Agreements with the workmen are commonly made by the cubic yard. It is rare that a cubic yard can be removed for leſs than 2d. "nor (ſays our author) will any ſort of ground require more than 9d. except in paſſing through a rock, which will not often happen, unleſs where, by the ſituation of the land through which the canal may paſs, it ſhould require to be cut more than four feet under the ſurface, as it may ſometimes happen in cutting through a hill or neck of land, whereby the courſe of the canal may be ſhortened. According to this eſtimate, Mr Leach has formed a table of the expence of making canals from 2d. the cubic yard to 9d. The ſmalleſt expence of theſe per mile is L. 107 : 11 : $1\frac{1}{2}$; the greateſt L. 483 : 19 : 9. Sometimes, however, the expence may be even greater; ſo that the mile may coſt L. 600, or near it; but this muſt be accounted an extraordinary expence, and not often to be expected.

In digging the trunk of the canal, care muſt be taken to preſerve all the ſand, ſtones, and gravel, for the purpoſe of making drains or gutters and the towing paths; alſo for the making of a wall, the outſide face of which is to be 21 feet diſtant from the edge of the canal. The deſign of this is to prevent the earth and rubbiſh from being thrown to too great a diſtance from the ſide of the canal; and likewiſe for the purpoſe of raiſing a bank on the lower ſide about 16 or 18 inches above the ſurface of the water in the canal, when it is full up to the drains. On the top of this bank the towing path is to be made 12 feet wide on that ſide of the canal; and if this wall ſhould be raiſed four feet above the ſurface of the towing path, it would be a fence to keep the cattle off from that ſide. In making the towing path on the higher ſide, the ſurface of the land muſt be ſunk to within 16 or 18 inches of the ſurface of the water in the canal when full; and the turf, earth, ſtones,

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stones, &c. taken from thence in making the towing path on that side, will make the other fence of the canal.

2. Drains or gutters must be made under the towing paths, on both sides of the canal. On the upper side they must be made through the hedge or fence at all convenient places, for admitting springs and rivulets, as well as rain-water into the canal On the higher side, these should be about 132 feet distant from one another, exclusive of those for the admission of springs. On the lower side, it is necessary to have drains at the distance of 66 feet from each other; which will be 80 drains per mile. These may be constructed for 2s. 6d. each, which amounts to L. 10 per mile. On the higher side they will cost about four shillings per drain; and, at the distance of 132 feet betwixt each drain, the expence will be L. 8 per mile.

In making the drains on the lower side, great care must be taken to have them truly level, and parallel to the horizon; the bottom part of the drain being exactly 39 inches perpendicular above the bottom of the canal; as on the true placing of these drains, and the true level of the bottom of the canal, entirely depends the regularity of the deepness of the water.

3. The value of the ground through which the canal is to pass must also be considered. From the observations and memorandums which our author took in the year 1774, concerning the ground through which the Tamar canal was to pass, he concluded that one eighth part of the land through which the tract passed was worth 40s. per acre; another eighth, 20s.; a third eighth part, 10s; and all the rest not worth more than five; and a great deal of it not more than two; the average of the whole being 15s. an acre "Then (says he), if the good, indifferent, and bad land be worth on an average, 15s. an acre, and as 30 years value is a capital price for lands, it will, at that rate, amount to 22l. 10s. per acre. The stipulated breadth of the canal with the towing paths and hedges being, as already said, 66 feet, which is exactly a gunter's chain; then, 10 such chains in length and one in breadth form exactly a statute acre of land; and ten chains in length is a furlong; so that every mile of canal will thus take up eight acres of land, which, at 22l. 10s. per acre, amounts to 180l. per mile.

4. Bridges are likewise a considerable article of expence in the making of canals. Mr Leach supposes that there may be one common road bridge and two swivel bridges required per mile; the former may be erected for 60l. and the latter for 30l. each; so that the expence of all together will amount to 120l. per mile.

5. As in some particular places, on account of short turns, and where docks and basons and landing places are to be made, a greater wideness will be required, our author allows half an acre more land for every furlong on this account; which brings an additional expence of 90l. per mile.

6 It will always be necessary to have sluices for emptying the canal; each of which will cost 20l. Mr Leach allows a sluice and stop-gate for every mile; and as these cost 20l. each, we have thus a farther expence of 40l. per mile.

7. The wall on the lower side against the bank of earth and towing path may be built for three shillings per perch; and as every mile contains 320 perches, the expence of the wall will be 48l. per mile.

8. Our author calculates the towing path on the lower side at the same price; so that it also makes an addition of 48l. per mile; but as he estimates the higher towing path and hedge at 8s. per mile, this will amount to 128l. per mile.

Thus, according to our author's calculation, the whole expence of making a canal with its necessary appendages will amount to L. 944 : 13 : 4½ per mile; and by the calculation of another engineer, the particulars of which he also enumerates, it would not exceed L. 1032 : 13 : 4½. This our author thinks a moderate expence; but an objection naturally occurs from the great length to which such canals must necessarily run; a remarkable instance of which he gives in the proposed Tamar canal; where, though the distance betwixt Bude Haven and the navigable part of the river Tamar is no more than 28 miles in a straight line, the length of the canal would not have been less than 80 miles. This length, however, according to our author, "ought not to be an object of discouragement, but on the contrary an inducement and an encouragement to promote the extending of it as much as possible into the country, as it will bring a market to every man's door that it draws nigh in its passage, and be a means to improve a greater quantity of uncultivated lands; and the navigation will be thereby much more extensive, and a much larger number of inhabitants will reap the advantages thereof, than if it had been carried on upon the original river."

We have already taken notice, that in the method of constructing canals just now mentioned, there will at certain intervals be places where the vessels must be raised and lowered by means of mechanical powers, instead of the dams and locks made use of in other canals. These machines are 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 fix rollers

Plate CCCXLIV.

Inland Navigation.

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 CCCXLIV

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 on 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 as 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 will then 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; by an over-ſhot water-wheel; or by two walking-wheels, for men to walk in as in cranes, &c.

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 in 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 an half in diameter, with 15 rounds or 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 on the right is opened.—The water 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 two 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 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. 3.

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

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

Plate CCCXLIV

The movement of the walking-wheel is shown (fig. 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 ton might be raised by the walking-machine in 12 or 14 minutes, by the undershot-wheel in 15 minutes, and by the overshot-wheel in 30 minutes; and that through a space of no less than 30 fathoms measured on the inclined plane, or 114 feet perpendicular.

NAULUM, a piece of money put into the mouth of a person deceased among the Romans, to enable him to pay Charon the ferryman for his passage. It was to be of the current coin of the reigning emperor: from this money then 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 the old tar 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; but the money put into the mouth of the deceased was 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.

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 inform 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 circus's or amphitheatres, with seats and porticos, &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, (anc. geog.) 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

Nauplia || Nauscopy.

had been driven from Peloponnesus by the Lacedemonians. It became the property of the Lacedemonians after the battle of Ægospotamos, and it was restored to the Locri. Philip of Macedonia 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. 10. p. 898.

NAUPLIA, (anc. geog.), a maritime city of Peloponnesus. It was the naval station of the Argives. The fountain Canathos was in its neighbourhood.

NAUPLIUS, (fab. hist.), 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 surrounded 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, 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, (anc. geog.), 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 mens 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 Taurisci, 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 invented by a M. Bottineau, employed in the King and Company's service in the island of France, from the year 1782 to 1784; and the account of it is given by the inventor as follows:

"This knowledge is not derived either from the undulation of the waves, or from the subtilty of sight, nor 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 towards 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 connection 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 administrators of the island, who gave to M. Bottineau what he calls a *report*, containing the most authentic and most explicit testimony of the reality of the discovery, seem to be of our opinion; and yet they speak of this discovery with doubt, and with a degree of respect to which we think it can lay no claim. Their report is in the form of a letter directed to the *Marechal de Castries*: and that our infidelity may not deprive the public of what, in the immense catalogue of possibilities, *may* lead to a useful discovery, we shall here subjoin a copy of it.

Port Louis, Island of France, the 18th February 1784.

"My Lord, A letter which you have written on the 6th of April to M. Bottineau, employed in the King and Company's service in this colony, obliges us not to refuse him one for you, of which he proposes being himself the bearer. The desire only of being useful to his country, is (as he says) the motive which determines him to take this step. He would be angry with himself were he to conceal a discovery which hath hitherto escaped the most enlightened persons, and of which he only is in possession. This discovery is the art of announcing the presence of one or several ships, at 100, 150, and as far as 200 leagues distance. This is by no means the result of his studies, nor the fortunate application of the principles of any particular science; his science is in his eyes only, and he can have no other: what we call *penetration* and *genius* cannot make up to him what he is deficient in from education. He perceives (as he says) in nature, some signs which indicate to him the presence of the vessels, as we know that there is a fire in a place when we perceive the smoke which comes from it. This is the comparison which he makes use of himself to those who have conversed with him about his art: this (though he has kept his secret to himself)

Fig. 1.

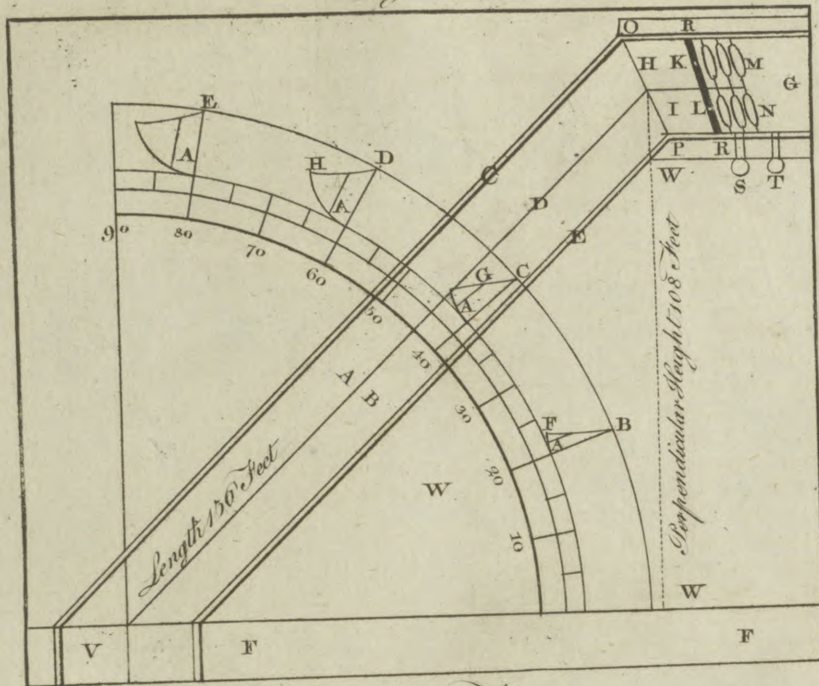


Fig. 2.

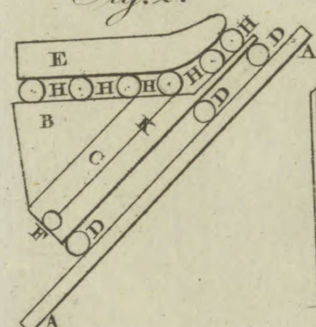


Fig. 3.

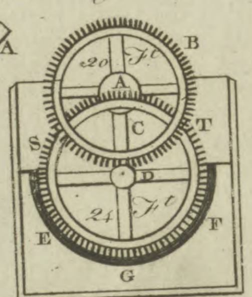


Fig. 4.

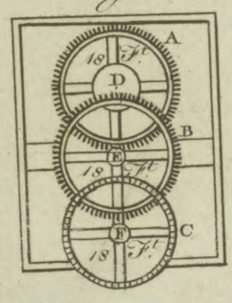
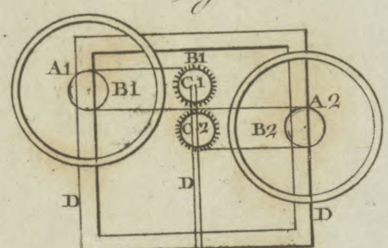


Fig. 5.



Napiers. Rods.

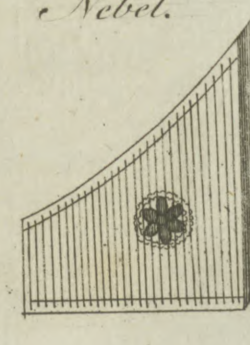
N.° 1.

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

N.° 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

Nebel.



A. Bell Prin. Wal. Sculptor fecit.

Naufc

felf) is the plaineft thing he has faid, in order to make it be underftood that he hath not made this difcovery by the knowledge of any art or fcience, which had been the object of his application, or of his former ftudies.

"It is according to him the effect of chance; he hath taken nature in the act, and hath difcovered his fecret; fo that his fcience, or rather the firft elements of it, hath not coft him the leaft trouble: but the thing which hath coft him a great deal of labour, and which may be really called his own, is the art of judging of the exact diftance.

"According to him, the figns very clearly indicate the prefence of fhips; but none but thofe who can well read thefe figns can draw any conclufions from them with regard to diftances; and this art of reading them well, is, according to him, a true and a very laborious ftudy: for this reafon he hath himfelf, for a very long time, been the dupe of his fcience. It is at leaft 15 years fince he firft foretold here the arrival of fhips. At firft this was regarded only as a frolic. Wagers were laid on both fides He often loft, becaufe the fhips did not arrive at the time prefcribed by him. From thence came his application to find out the caufe of thefe miftakes; and the perfection of his art is the refult of this application

"Since the war, his informations have greatly increafed, and probably were fufficiently exact to excite the attention of the public. The noife of them reached us with the degree of enthufiafm which is always excited by the marvellous. He himfelf fpoke of the reality of his fcience with the tone of a man convinced. It would have been too cruel to have difmiffed him as a vifionary.

"Befides, every thing depended upon proofs, and we required that he fhould produce fome: in confequence, he hath regularly fent us, for eight months, the informations which he thought he might venture to fend us; and the refult is, that feveral of the fhips he announced are arrived at the time he foretold, after feveral days of information.

"Others have come later than was expected, and fome have not appeared at all.

"With regard to fome of thefe, it hath been afcertained, that their delay had been occafioned by calms or by currents. M. Bottineau is perfuaded, that thofe which never appeared were foreign veffels which went on; and accordingly we have learned, that fome Englifh fhips were arrived in India, which might perhaps have been in fight of the ifland at the time indicated But this is no more than a conjecture, which our occupations have not allowed us to inveftigate. What we can afcertain is, that in general it appears that M Bottineau hath made juft obfervations: whether it is owing to chance or to his abilities, it might be, perhaps, imprudent to determine. It is however certain, that the fact is fo extraordinary, under whatever light it is confidered, that we have not thought ourfelves able either to affirm or deny it; and we have wifhed the Sieur Bottineau to compel us to take one or the other fide of the queftion, by trufting his fecret to fome trufty and able perfon.—But this he hath refufed, being probably afraid that he fhould not acquire by the difcovery all the benefit which he imagines he may reap from it.

"Suppofing the reality of the difcovery, we do not believe that its utility can be as important as M. Bottineau perfuades himfelf it is; but it might perhaps throw a great light upon natural hiftory. In order to be ufeful, it would be neceffary that the difcovery fhould be confined to one nation, and remain unknown to all others. This will be impoffible, if every fleet, every veffel, and every privateer, is obliged to carry a man on board who is in poffeffion of this fecret — We remain, with refpect, my Lord, your's, &c. Le V^{te}. de Souillac, Chevreau."

NAUSEA, or SICKNESS; a retching or propenfity and endeavour to vomit, arifing from fomething which irritates the ftomach.

NAUTILUS, in zoology; a genus belonging to the order of vermes teftacea. The fhell confifts of one fpiral valve, divided into feveral apartments by partitions. There are 17 fpecies, chiefly diftinguifhed by particularities in their fhells.

Bonani obferves, that this genus of fhell-fifh is very well named from the Greek ναυτιλος, which fignifies both "a fhip" and "a failor;" for that the fhells of all the nautili carry the appearance of a fhip with a very high poop. Different authors, both ancient and modern, have called the nautilus by the names of *pompilus*, *nauplius*, *nauticus*, *ovum polypi*, *polypus teftaceus*: and the French call it *le voilier*. It is by fome imagined, that men firft learned the art of navigation from this animal.

The moft remarkable divifion of the nautili is into the thin and thick-fhelled kinds. The firft is called *nautilus papyraceus*; and its fhell is indeed no thicker than a piece of paper when out of the water. This fpecies is not at all faftened to its fhell; but there is an opinion, as old as the days of Pliny, that this creature creeps out of its fhell, and goes on fhore to feed. When this fpecies is to fail, it expands two of its arms on high, and between thefe fupports a membrane, which it throws out on this occafion: this ferves for its fail, and the two other arms it hangs out of its fhell, to ferve occafionally either as oars or as a fteerage; but this laft office is generally ferved by the tail. When the fea is calm, it is frequent to fee numbers of thefe creatures diverting themfelves in this manner: but as foon as a ftorm rifes, or any thing gives them difturbance, they draw in their legs, and take in as much water as makes them fpecifically heavier than that in which they float; and then they fink to the bottom. When they rife again, they void this water by a number of holes, of which their legs are full. The other nautilus, whofe fhell is thick, never quits that habitation. This fhell is divided into 40 or more partitions, which grow fmaller and fmaller as they approach the extremity or centre of the fhell: between every one of thefe cells and the adjoining ones there is a communication by means of a hole in the centre of every one of the partitions. Through this hole there runs a pipe of the whole length of the fhell. It is fuppofed by many, that by means of this pipe the fifh occafionally paffes from one cell to another; but this feems by no means probable, as the fifh muft undoubtedly be crufhed to death by paffing through it. It is much more likely that the fifh always occupies the largeft chamber in its fhell; that is, that it lives in the cavity between the mouth and the firft partition, and that it never removes out of this; but that all the apparatus of cells, and a pipe of communication which we so much admire, serves only to admit occasionally air or water into the shell, in such proportion as may serve the creature in its intentions of swimming.

Some authors call this shell the *concha margaritifera:* but this can be only on account of the fine colour on its inside, which is more beautiful than any other mother-of-pearl; for it has not been observed that this species of fish ever produced pearls. It must be observed, that the polypus is by no means to be confounded with the paper-shelled nautilus, notwithstanding the great resemblance in the arms and body of the inclosed fish; nor is the cornu ammonis, so frequently found fossile, to be confounded with the thick-shelled nautilus, though the concamerations and general structure of the shell are alike in both; for there are great and essential differences between all these genera. There is a pretty copious and minute account of this curious animal in the Gentleman's Magazine, vol xxii. p. 6. 7. 8. and 301. and vol. xxv. p. 128.

NAVY, the fleet or shipping of a prince or state. See MARINE.

The management of the British navy-royal under the lord high admiral of Great Britain, is entrusted to principal officers and commissioners of the navy, who hold their places 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; a pouch pendant behind, and the mutilated remains of Priapus to each; one has wooden shoes. These seem the *ludibrium aulæ* in those gross days. The top and upper end of the room is painted in squares, to the number of 107, representing the Saxon kings and heroes. The chimney here is five yards and a half broad. Within this is another apartment, hung with old tapestry, a head of Ann of Cleeves; on one side of her a small picture of a lady in full length, &c. and many others. Many of these paintings were brought from Kirk-Oswald castle when that was demolished. The chapel has a cieling, and part of its wainscot of the same kind, being paintings of Patriarchs, Jewish kings, &c. It has a floor of plaster of Paris, as have some other of the rooms. Some of the apartments are very large and spacious. The small Popish chapel is above stairs, and joining to this chapel is the library, which has a wooden roof; the books are old, there are not above one or two of the manuscripts here now. This castle was built by one of the Dacre's, 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 mastic, though olive-oil is exceeding 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, Naxos, Naxus.

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 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 Agathemerus 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 Bocchart 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 *nacsa*, 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 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.

Naxus, Naylor.

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; the last of all the Ionians, who, in time, possessed the whole island; whence the Naxians are, by Herodotus, called *Ionians*, and ranked among the Athenian colonies. E. Long. 26. 5. N. Lat. 36. 30. It is about 105 miles in circumference and about 30 broad.

Naxus, (anc. geog.), a town of Crete, famous for its hones, called *lapis Naxius*. Another of Sicily, built by the Chalcidian; situated on the south side of Mount Taurus, destroyed by Dionysius the tyrant; from whose ruins Tauromenium, built by Timoleon, either arose or was increased, (Plutarch).

NAYLOR (James), a noted English enthusiast, was born, about 1616, in the parish of Ardesley, not far from Wakefield in Yorkshire. His father, though a farmer, and the proprietor of an estate, gave his son but a mean education; which is perhaps to be regretted, for his parts were very considerable. He married when very young and settled in Wakefield parish. In 1641 he was a private soldier under Lord Fairfax, being then a presbyterian: but he afterwards became an independent, and was made quarter-master under General Lambert. In 1651-2, he was converted by George Fox the apostle of the quakers, and soon commenced a preacher and prophet among that people. One of his prophecies was, that the last and general judgment should be on the 15th day of the ensuing November. The falsehood of this prediction was soon perceived, and of course his imposture ought to have been detected; but such is the power of enthusiasm over the human mind, that his fame rose daily; and upon his going to London in 1655, he excited to no common pitch the envy of his brethren. He had strange fancies of celestial illuminations, and considered himself as a great favourite of heaven. In 1656 he went into the west of England, but his extravagancies were so great and his opinions so blasphemous, that even in those days of fanatical delusion, they were heard with such horror, that the author of them was imprisoned in Exeter gaol; from which however he was relieved in the space of a month. Upon this he determined to return to London; but taking Bristol in his way, he made his entrance into that city in imitation of our Saviour's entrance into Jerusalem, the people strewing the way, &c. and calling out "Holy, holy, holy, lord god of Sabaoth; hosanna in the highest, &c." So impious a conduct could

Nayres, Nazareth.

could not escape animadversion: he was apprehended with six of his associates On examination he defended all that had passed; and was soon after with his followers sent to London, imprisoned, and condemned to be whipt, and then put to hard labour. The sentence, though much petitioned against, was executed, and he recovered his senses, expressed his repentance, and was again received by the Quakers, who, during his impious frenzy, had disowned him. In 1659 he was freed from prison; and the following year set off to see his wife and children; but being robbed and left bound by the way, he was found in that state and carried to a friend's house at Rippon, where he died in November 1660. He was accounted the author of several works. His eccentricities, however, rather than his writings, have preserved his character; and he stands forward to the world, not so much as a man of genius or parts, though he was in some measure possessed of both, but rather as a striking example of the power of enthusiasm over the human mind, and of the danger of giving way to the religious reveries of an overheated imagination.

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 fifteen 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.

Nazareth.

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 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

pretended that he came hither more than once with his diſciples to eat. The inhabitants of Nazareth pay it a kind of worſhip, by 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 Sampſon 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 נזיר *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 Jerom 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 Jerom, who does not reproach them with any error. They were very zealous obſervers of the law of Moſes, but had 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 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

been informed that he everywhere preached up the entire abolition of the law of Mofes, he ought to join himfelf 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 ot 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 ſeparate from his brethren," as it is in our tranſlation; or as the Vulgate and others underſtand the Hebrew, "that he was "as a Nazarite among his brethren," is variouſly underſtood. Some think that the Hebrew word נזיר *Nazir*, in theſe places, ſignifies one who is crowned, choſen, ſeparated, or diſtinguiſhed: the word נזיר *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 Jerom*, &c.

NAZIANZEN. See GREGORY *Nazianzen*.

NAZIM, the lord lieutenant, viceroy, or governor of a province in Hindoſtan; the ſame as *Lubahdar*, 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 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 courſe 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 or 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 (anc. geog.), 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 *Cæne*.—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 Marathesium, 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.

NEBIO, or NEBBIO, a ruined city of Italy, on the north

north side of the island of Corsica, with a bishop's see, whose bishop resides at San Florenzo, from which it is a mile distant.

NEBO, (anc. geog.), a very high mountain, a part of the mountains 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. 5. 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 βασιλεις 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* †."

* Horace, Lib. i. Ode 35.

† Pausanias in Corinth. Cap. 4.

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 were 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 ‡.

‡ 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 Elisabeth 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

Neceſſity. for neither a ſon nor a ſervant are excuſed for 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 for capital offences. And therefore, if a woman commit theft, burglarly, or other civil offences againſt the laws 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. Which 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 miſdemeanors 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 œconomy 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 feme-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 conſequence 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 Puffendorf, 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 mens 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 eſpe-

especially, there would be a peculiar impropriety in admitting so dubious an excuse: 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 Puffendorf, 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 the head and trunk of the body. See ANATOMY, n° 31.

NECOPHORON, in botany, a name used by Pliny and other authors for the *smilax aspera*, or *rough bindweed.*

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 *calendar* 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 Phenicia, we might yet conclude its birth-place to have been Egypt, because, at their *exody*, the Israelites were corrupted

* Deut. xviii. 10, 11, 12.

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 birth-place 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 ferry-man of hell, of *Styx*, *Coccytus*, the *Elysian Fields*, *Tartarus*, the judgement of *Minos*, and *Radamanthus*, &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 chizzel or pick-axe of the artist.

† Lib. I. § 2.

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 avocations 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.

‡ Bryant's *Analysis of Mythology.*

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 *dæmon* or *familiar spirit*, which they had at their command to employ upon every emergency. This dæmon was called OB; and therefore Saul desires his servants to find him a woman who was mistress of an OB (A). It is probable that those wretched impostors had in their pay some persons who occasionally acted the part of the dæmon, 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 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

(A) The orginal, 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. 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.

Necromancy.

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 Euridice, 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 Gallic 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 present 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 *Sky*. The diviner covered himself with a cow's hide, and repaired at night to some deep-sounding cave, whither the person who consulted 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 dæmons of antiquity, gave from beneath the ground their oracular answers. That in the latter days of *taghairm*, the Gallic 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 Sky, 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 frenzy, 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 Sybil in the sixth book of the Æneid; though we cannot

cannot suppose the one to have been borrowed from the other.

At, Phœbi nondum patiens, immanis in antro
Bacchatur vates, magnum si pectore possit
Excusisse 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 dæmons, 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. Sometime 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, than 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, higgelaria, and butcher's broom, all abound with the honey or nectar alluded to.

Dr 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 (*urticularia*), butter-wort, and calves-snout; or in such as have more than one, as lark-spur, violet, fumatory, 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,

pion, 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, buck-wheat, collinsonia, lathræa, navel-wort, 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, screw-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: monk's hood, 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 this 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, in zoology, a genus of insects belonging to the order of coleoptera. The feelers are setaceous; the elytra are shorter and narrower than the wings; the tail is simple. There are 11 species, chiefly distinguished by the size and figure of their elytra. Barbut says, "Its head is black, eyes are large and prominent, jaws are of a dark brown. The antennæ placed on the top of the head between the eyes have their first articulation long and raised upright, the rest bent and turned aside. The antennæ vary as to length and colour. In individuals whose thorax is yellow, they are brown, and equal only to two-thirds of the body in length. On the contrary, in those whose thorax is black, they are likewise black, and somewhat longer than the body. The thorax is margined; in some it is yellow and longer; in others it is black, shorter, and edged only with a little yellow. The elytra are blackish, somewhat clearer in the middle, and terminating in a lemon coloured spot. The wings are rather black, something longer than the body, exceed the elytra by one-third, and are crossed one over the other. In those that have their thorax yellow, the legs and under part of the belly are so likewise. In individuals with a black thorax, the legs are black as well as the belly, which has only a little yellow on the sides. I suspect the latter to be the males. The larva is as yet unknown."

NEDHAM (Marchmont), an English satyrical writer, was born at Burford Oxon. about the month of August 1620. His father died in 1621; but the following year his mother was again married to one Christopher Glynn, vicar and schoolmaster of Burford; who perceiving his son-in-law's pregnancy of parts and genius, took him under his own tuition, and at the age of 14 sent him to All Souls College, Oxon. Here he was made one of the choristers, and continued till 1637, when, having taken the degree of A. B. which made it inconsistent to continue in that office, he went to St Mary's Hall till he became an usher in Merchant Taylor's school, London. About the beginning of the civil wars, he became clerk to an attorney at Gray's Inn, where, writing a good court hand, he obtained a decent subsistence. Not long after this, he began a weekly paper, under the title of *Mercurius Britannicus*, on the side of the parliament: it commenced about the middle of August 1643, coming out on Mondays, in one sheet, and continued till the end of 1646. It procured him popularity, and being an active man he was distinguished by the title of Capt. Nedham of Gray's Inn. Of these mercuries (for there were a number of them published on both sides of the great question which then divided the nation), it is well observed by Johnson, that they taught many to talk whom they could not teach to judge. Nedham's was, indeed, addressed as much to the passions as the reason; and, by telling every man that he was equal to his king, he so flattered vulgar pride, that his licentious opinions were received as the dictates of an oracle. About this time he studied physic, and in 1645 began to practise; by which, and his political writings, he supported a genteel figure. But, for some scorn and affront put upon him, he suddenly left his party, and, obtaining the favour of a royalist, was introduced into the king's presence at Hampton-court in 1647, and asking pardon upon his knees readily obtained it; so that being admitted to the king's favour, he wrote soon after another paper, entitled *Mercurius Pragmaticus*; which being equally witty with the former, as satirical against the Presbyterians, and full of loyalty, made him known and admired by the wits of that side. However, being narrowly sought after, he left London, and for a time lay concealed at the house of Dr Peter Heylin, at Minster-Lovel, near Burford, till at length being discovered, he was imprisoned in Newgate, and in danger of his life. Lenthal, the speaker of the House of Commons, who knew him and his relations

Nedham, Needham. relations well, and Bradshaw, president of the high-court of justice, treated him favourably, and not only got his pardon, but with promise of rewards and places persuaded him to change his side once more for the independents, who then were the uppermost party.— In this temper he published a third weekly paper, called *Mercurius Politicus*, which came out every Wednesday, in two sheets 4to, commencing with the 9th of June 1649, and ending with the 6th of June 1650, which being Thursday, he began again with number 1. from Thursday June 6, to Thursday June 13, 1650, beginning, "Why shou'd not the commonwealth have "a fool, as well as the king had, &c." This paper, which contained many discourses against monarchy, and in behalf of a free state, especially those that were published before Cromwell was made protector, was carried on without any interruption till about the middle of April 1660, when, as several times before, it was prohibited by an order of the council of state.— Upon the return of Charles II. our author lay hid, till, by virtue of some money well placed, he obtained his pardon under the great seal; after which he exercised the faculty of physic among the Dissenters, which brought him in a considerable benefit till his death, which happened suddenly in 1678. Wood, who knew him, tells us that he was a person endowed with quick natural parts, was a good humanist, poet, and boon droll; and, had he been constant to his cavaliering principles, would have been beloved and admired by all; but being mercenary, and preferring his interest to his conscience, friendship, and love to his prince, was much hated by the royal party to the last. In short, there was no depending on this scurrilous ill natured author. He followed whenever interest or passion led, and remains a notorious instance of the danger of brilliant parts, of which he certainly was possessed, without judgment or integrity to controul them. Wood, who in his Athen. Oxon. quoted above, gives a very copious account of him, says: "At length this most seditious, mutable, and railing "author, M. Nedham, died suddenly, in the house "of one Kidder, in D'Eureux-court near Temple-"bar, London, in 1678, and was buried near the "entrance of the chancel of the church of St Clements Danes."

Athen. Oxon. vol ii.

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 Douai, 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 knowlegde of experimental philosophy. In 1740, he was engaged by his superiors in the service of the English mission, and was entrusted 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 connection between this illustrious French naturalist and Mr Needham: they made their experiments and observations together; 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.

Needham.

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 the IId. 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 atchieving 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

Needham, Needle. 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, in Suffolk, 73 miles from London, stands on the Orwell, 9 miles from Ipswich, in the road to Huntingdonshire. Its market is on Wednesday, and fair in October 28.

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 are 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 flatted 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.

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. Plate CCCXLV. fig. 1.

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 Forman 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

Needle.

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 difcovery of the dip to the finding of the latitude; and Mr Bond attempted to apply it to the finding of the longitude alfo; but for want of obfervations and experiments he could not make any progrefs. The affair was farther profecuted by Mr Whifton, who publifhed a treatife on the longitude, and for fome time imagined it was poffible to find it exactly by means of the dip of the needle; yet he at laft defpaired of it, for the following reafons. 1. The weaknefs of the magnetic power. 2. The concuffion of the fhip, which he found it exceeding difficult to avoid fo much as was neceffary 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 compafs of about a degree, vary uncertainly backward and forward; even fometimes, in a few hours time, without any evident caufe. For a particular account of thefe variations both of the horizontal and dipping needle, fee the article VARIATION.

Mr Nairne made a dipping-needle in 1772 for the board of longitude, which was ufed in the voyage towards the north-pole. This is reprefented Plate CCCXLV. fig. 2. The needle AA is 12 inches long, and its axis, the ends BB of which are made of gold alloyed with copper, refts 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 axes of the friction-wheels are likewfe of gold alloyed with copper, and moved in fmall holes made in bell-metal; and oppofite to the ends of the axes of the needle and the friction-wheels, are flat agates, fet in at DDD, finely polifhed. The magnetic needle vibrates within a circle of bell-metal, EEE, divided into degrees and half degrees; and a line, paffing through the middle of the needle to the ends, points to the divifions. The needle of this inftrument was balanced before it was made magnetical; but by means of a crofs, 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 fcrews to receive fmall buttons, that may be fcrewed nearer or farther from the axis, the needle may be adjufted both ways to a great nicety, after being made magnetical, by reverfing the poles, and changing the fides of the needle. GG are two levels, by which the line of 0 degrees of the inftrument is fet horizontal, by means of the four adjufting fcrews LLLL; H is the perpendicular axis, by which the inftrument may be turned, that the divided face of the circle may front the eaft or weft; to this axis is fixed an index I, which points to an oppofite line on the horizontal plate K when the inftrument is turned half round; MMMM are fcrews which hold the glafs-cover to keep the needle from being difturbed by the wind. When this needle is conftructed for fea, it is fufpended by an univerfal joint on a triangular ftand, and adjufted vertically by a plumb-line and button above the divided circle and the dovetail work at the upper 90; and the divifions on the circle are adjufted fo as to be perpendicular to the horizon by the fame plumb-line, and an adjoining fcrew; and when it is adjufted, a pointer annexed to a fcrew, which ferves to move the divided circle, is fixed at the loweft 90. Whenever the inftrument is ufed to find the dip, it muft be fo placed that the needle may vibrate exactly in the magnetic meridian.

Magnetical NEEDLE, in navigation, a needle touched with a loadftone, and fuftained on a pivot or centre; on which playing at liberty, it directs itfelf 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 thofe equally balanced on each fide of the pivot that fuftains them; and which, playing horizontally with their two extremes, point out the north and fouth points of the horizon. For their application and ufe, fee the article COMPASS.

In the conftruction of the horizontal needle, a piece of pure fteel is provided; of a length not exceeding fix inches, left its weight fhould impede its volubility; very thin, to take its verticity the better; and not pierced with any holes, or the like, for ornament fake, which prevent the equable diffufion of the magnetic virtue. A perforation is then made in the middle of its length, and a brafs cap or head foldered on, whofe inner cavity is conical, fo as to play freely on a ftyle or pivot headed with a fine fteel point. The north point of the needle in our hemifphere is made a little lighter than the fouthern; the touch always deftroying the balance, if well adjufted before, and rendering the north end heavier than the fouth, and thus occafioning the needle to dip.

The method of giving the needle its verticity or directive faculty has been fhown already under the article MAGNET; but if, after touching, the needle be out of its equilibrium, fomething muft be filed off from the heavier fide, till it balance evenly.

Needles in fea-compaffes are ufually made of a rhomboidal or oblong form: we have given their ftructure already under the article COMPASS.

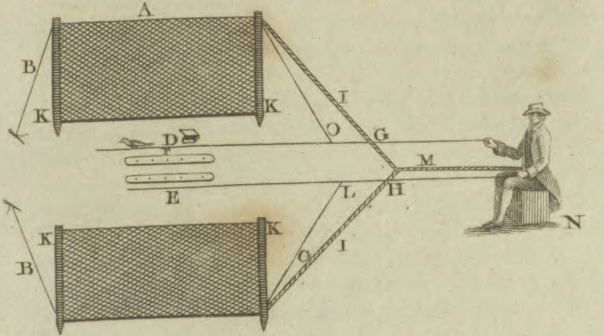
The needle is not found to point precifely to the north, except in very few places; but deviates from it more or lefs in different places, and that too at different times; which deviation is called its *declination* or *variation from the meridian*. See the article VARIATION.

Surgeons NEEDLES are generally made crooked, and their points triangular: however they are of different forms and fizes, and bear different names, according to the purpofes they are ufed for.

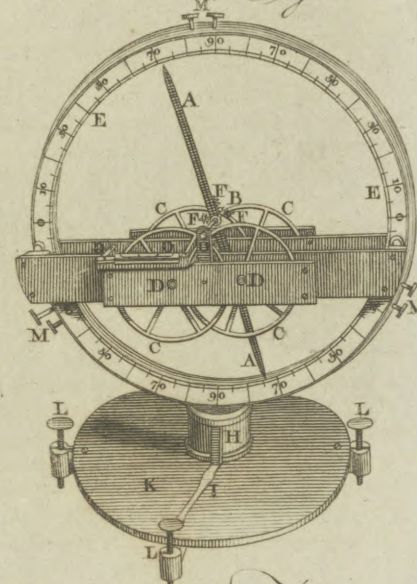
The largeft are needles for amputation; the next, needles for wounds; the fineft needles for futures. They have others, very fhort and flat, for tendons; others, ftill fhorter, and the eye placed in the middle, for tying together of veffels, &c. Needles for couching cataracts are of various kinds; all of which have a fmall, broad, and fharp point or tongue; and fome with a fulcus at the point. Surgeons have fometimes ufed two needles in this operation; one with a fharp point for perforating the coats of the eye, and another with a more obtufe point for depreffing or couching the opaque cryftalline lens: but care fhould be taken in the ufe of any of thefe, that they be firft well polifhed with cloth or leather, before they are applied to the eye.

Mr Warner obferves, that the blade of the couching needle

Day Nett.



Dipping Needle.
Fig. 2.



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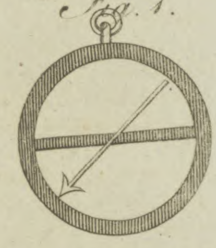

Newtonian philosophy.

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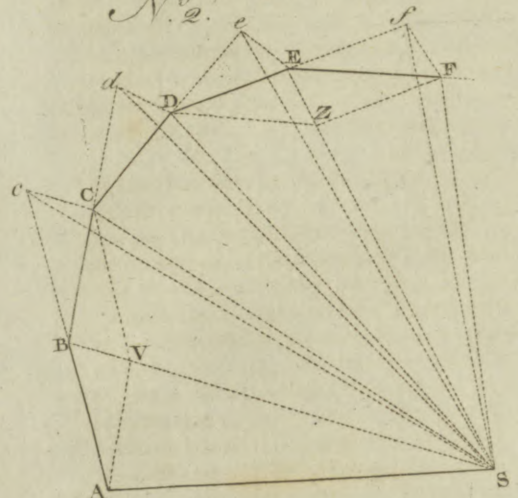

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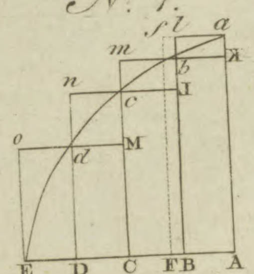

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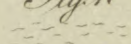

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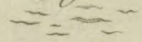

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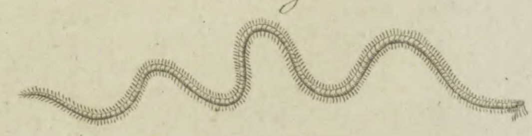
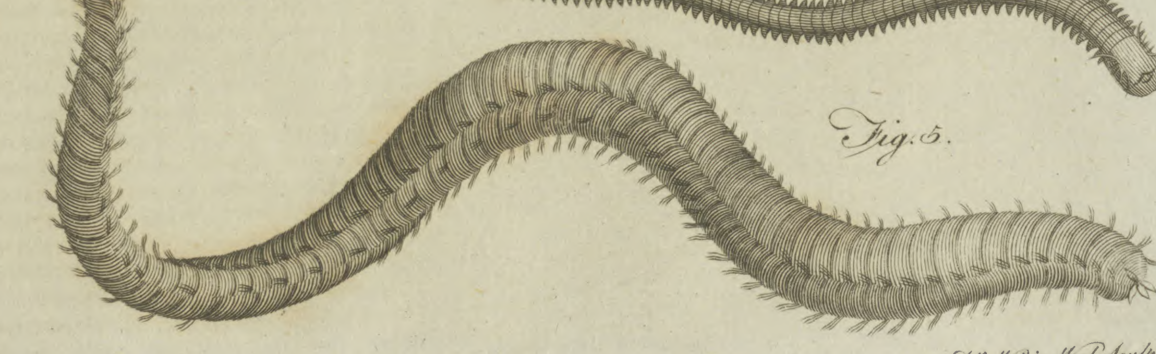


Fig. 4.

Fig. 5.



A. Bell Prin. Wal. Sculptor fecit.

Need
||
Nefa

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 Sygnathus.

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 Wiſe*, which aroſe 120 feet above low-water mark, and in its ſhape reſembling a needle, being undermined by the conſtant efforts of the waves, overſet, 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 prodigious fine ſteeple, and a good ſtone-bridge over the Ouſe, by which coals are brought to it, and ſold through the country. It has a charity-ſchool for 25 poor children. Its market is on Thurſday; fairs on Holy Thurſday, Aug. 1. Corpus-Chriſti Thurſday, June 13. and December 17.; and it is famous for a medicinal ſpring.

NEEDWOOD-forest, in Staffordſhire, between the Trent, Dove, and Blythe, and near Uttoxeter, is ſaid to exceed all the foreſts in England in the excellency 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 licence. 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 1000 l. 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.

NEFERN, in Pembrokeſhire, a village in whoſe church-yard is a remarkable old croſs. The church has no pavement in it, and the frequent burials have raiſed the ground within it to ſeven or eight feet higher than without. In proceſs of time, inſtead of a church, it will be only a ſepulchre. It is pleaſantly ſituated on the banks of a river of the ſame name near Newport.

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. The factory purchaſe very little beſides tobacco and long linen cloths; however, the Dutch have thought proper to erect a fort here. 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 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 a 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

Negative ‖ Negro.

nitude 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 imaginery 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 Maclaurin's Fluxions, book ii. chap. 1. and Ludlam's Algebra, *passim*.

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 singers, or women musicians; and the titles of those 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.

Negro.

The origin of the negroes, and the cause of thier 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 tawny. 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 tawny. 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 Mitchel 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 Kaimes, 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 no where but in the Torrid zone, and only in three regions situated in that zone, to wit, 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 at 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

Negro. frizzled hair resembles fine wool. May we not also suppose, that the varieties in the colour of negroes, who are always naked, are owing to the different temperature of their climates? During eight months of the year they have a continued drought, a sky constantly clear, no rain or storm of any kind, excessive heat, and a plentiful fall of dew after sun-set. Their food and the exhalations from the surface of the earth may likewise contribute to the production of this phenomenon. In a European or white, the lymph is white, except when it is mixed with bile, which gives a yellow tint to the skin. But in a negro, whose lymph and bile are black, according to some accounts, the skin ought in like manner to be of the same colour. It is maintained, however, by skilful anatomists, that the blood, lymph, chyle, and other fluids, even the eyes, teeth, bones, internal part of the lips, &c. of negroes, are not of a different colour from ours. It is evident, then, that the races of black and white men are not two different species, because the fruit of their connection has the faculty of reproducing beings like themselves, excepting the colour.

The young negroes at birth, and even negro fœtuses, have a considerable resemblance to whites, excepting only that the scrotum and glans penis are black, and that they have a black or brown thread or circle on the extremity of the nails. These marks are a certain sign that the infant will be black; and negro fathers, who suspect the fidelity of their wives, consider the want of them as a sufficient reason for abandoning the offspring. Among the Indians, the scrotum is grey, and in mulattoes of a pale red. The bodies of young negroes are whitish for the first eight days, but their natural colour, though weak, is easily discernible: the skin begins to grow brown, then assumes a colour inclining to that of bistre, and last of all becomes black.

Some modern anatomists of great celebrity, who have inquired into the cause of this blackness, have found, that the reticulum in negroes is really as black as ink, and that this mucous colour shines through the whitish epidermis, which is thin and transparent. See *Mem. de l'Acad. des Sciences*, part 30. art. 13. *anno* 1702. See also *Traité de la couleur de la peau humaine*, by M. le Cat; who says, that we must seek, in the nervous system, and the parts connected with it, for the fabrication of those colours which give a taint to the skin of animals, and particularly of the animal Ethiops, which produces the colour of the negro.—It has been added, that the medullary substance of the brain in negroes is generally bluish; and that from this principle it follows, that the colour of the skin in the inhabitants of different zones depends upon the mucous substance of the reticulum. We have, however, been assured by physicians who had the best of opportunities of making observations, that the pretended facts upon which this hypothesis is built are mere imaginations, and that there is no apparent difference between the medullary substance of the brain in negroes and the medullary substance of other men.

A number of other facts equally remarkable are mentioned by authors concerning different men who have been born white in Europe, and who have become black in the same climate. In our days a metamorphosis of this kind, from white to black, or from black to white, is said to be renewed every year in the person of a very respectable and amiable lady of distinction in France, who has a fair complexion and a very white skin. Upon her becoming pregnant, she begins to grow brown, and towards the end of her pregnancy, her colour is that of a true negro. After delivery the black colour gradually disappears, her former whiteness returns; and her offspring has not the smallest taint of black. This has been given to us as a certain fact; but we will not vouch for its truth. We have indeed seen women grow darker in their complexion during their pregnancy, and recover their fairness after delivery; and we suspect that a greater change of this kind than we have seen, has been exaggerated to the metamorphosis just mentioned. We have heard likewise of negroes born in Guinea, who, even in the climate of Africa, have in the same manner become white, without ever returning to their former colour. Not long ago we had an account from Surinam of a negro of Angola whose skin and hair were perfectly white, though both his father and mother had very dark complexions. The eyes of this *albino*, or white negro, had a constant vibratory motion, and were incapable of distinguishing objects with exactness except in the dark. In the *Journal de Physique* of M. Rosier for May 1777, M. Dicquemare has published an account of a white negro girl who was born at Dominica in 1759 of black parents. She has all the features of the negroes, especially those of Lower Guinea; and her hair, eyebrows, and eye-lashes, are the same in every respect, except the colour. Her hair, though a kind of very short wool, is fair; and her eye-brows as well as eyelashes are of a yellowish pale colour. The colour of her skin is a dead white; her cheeks, lips, nose, and other sanguine parts, have a slight teint of red, which becomes stronger when she is affected with liveliness or fear. Her eyes are long; the pupils approach, or sometimes recede from, each other, with a continual and involuntary motion; she is weak but not shortsighted. Light is disagreeable to her, and towards night she sees neither better nor farther than others. She has a timid air, a soft voice, and the smell of green leeks; but her skin is not soft like that of the negroes. Her parents have had several black children; but it is said, that an older one, who was born white, gradually became blacker as he grew up, and at last assumed the colour of the *cabres*. We have ourselves seen a white negro girl in London; and during the years of 1778 and 1779 there was one in Paris, whose mistress tried, but without success, to get her a place among the rare animals in the Menagery at Chantilly. See Albino.

The following is a table of the mixtures which produce a degradation of the black and white colours in the human species.

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 *quarteron*, 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

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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 quarteron woman, or a negro with a quarteron 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. In following generations, if a constant intermixture has taken place, and the white has been married in Europe, the black in Senegal, the complexion will gradually become fairer or darker, till the offspring is either entirely black or entirely white.

Such is the progress of physical effects and causes in the degradation of the colour of the human species. Crossing the breed for four generations is sufficient to render a negro white, and the same will make a white black. It is evident that the mixtures, a mulatto man with a quarteron or mestizo woman, will produce other colours approaching to white or black, in proportion to the progression above stated.

We have already observed, under former articles, that the preservation and continuation of the particular species appears to proceed from that parent, who, in the act of procreation, has discovered most strength and vigour; and this is commonly the father. A young negro woman in Virginia, after having brought forth for the first time a black child, was delivered a second time of twins; one of them, a boy, was black, and the other, who was a girl, was a mulatto. As the boy grew up, he retained his short hair, which was naturally frizzled, and had a resemblance to wool; other marks plainly showed that he was a true negro, and in every respect like the black father who had begotten him. The girl, on the other hand, was tolerably white; she had blue eyes, long black hair, without any natural curl; in short, she had a great resemblance to the overseer of the plantation, whom the negro husband suspected of cohabiting with his wife. Becoming pregnant a third time, she was delivered of three children, two of them mulattoes, and the other a perfect negro. Shall we ascribe this to the effect of imagination? Such an explanation is rejected by the philosopher as absurd, and contrary to every law of nature. We can account for the third delivery, therefore, only by admitting the cohabitation of two fathers of different races, and then a superfœtation.

Thus we see that the white or black colour is only an accidental variety in warm climates, which is confirmed or effaced in foreign climates. In the same manner, the black colour, which in most climates is natural to several kinds of brute animals, is altered or entirely effaced in a different zone. Thus the blackbird, the raven, and the bear, which with us are black, are grey or white in the north. The union of the same species in the same climates makes these varieties hereditary. We repeat it; the black colour in the torrid zone proceeds from a cause altogether extrinsic, depends solely on local temperature, and in the human species is as accidental as the brown, the red, the yellow, the olive, and the tawny colour. We must consider the whites as the stock whence all others have sprung. Adam and Eve and their posterity, till the time of the deluge, were white; in the first age of the world no black nation was to be found on the face of the earth; the regions of the torrid zone were then unknown. Let us consult the sacred and profane historians, and we shall find that Noah, his three sons, and their wives, who were saved in the ark, divided among themselves the whole old continent, in which Africa was then included. The dispersion of Noah's descendants did not take place till after the confusion of tongues at Babel. Those who passed into Africa, multiplied there, and their posterity penetrated by degrees to the extremity of the peninsula. The original inhabitants of Africa were at first white; but by living there they afterwards became somewhat tawny: their children were of a darker hue and almost mulattoes; in the progress of time other succeeding generations became complete Moors; those who spread towards the tropics soon became half blacks; and those who lived under the equator, or in the Torrid zone, from the influence of the sun and climate, appeared in the course of a few generations perfectly black. A very considerable space of time must necessarily have elapsed before this gradual and imperceptible change could be produced. The Ishmaelites, Saracens, Moors, and Arabs, who invaded the western part of Africa, likewise became black in a few generations; while those of the same nations who invaded Spain, underwent little or no change of colour; which was whitish in some, and tawny or yellow in others. M. de Manet, who has lately published an excellent history of Africa, conjectures that the complete change from white to perfect black might have been at the end of three centuries; this makes 15 generations, allowing 20 years for each generation. Benjamin de Tudelle, the celebrated Jewish traveller, said, in 1175, that the white colour became perfectly black in no more than six centuries, and in the course of 30 generations without crossing the breed. A greater number of generations is undoubtedly necessary before negroes, when transplanted into our temperate countries, can entirely lose their black colour.

If we examine philosophically, and with attention, two negroes, the one of the ancient and the other of the modern race, we shall observe that those parts of the skin which are not exposed to the sun's rays, or but in a small degree, lose their colour, or at least retain but a slight taint of it, such as the arm-pits, the spaces between the fingers, the inside of the hands, the space under the chin, the soles of the feet, the space between the thighs, and the lower part of the belly; whereas the head, the outside of the arms, the back, the belly, and the shoulders, being continually exposed to the air (for their skin is their only covering), are of a blacker colour. The women who are employed in washing, and whose hands are consequently often in the water, have these parts almost white. In those who have received wounds, who have suffered by burnings, or who retain marks of the small-pox, the parts which were affected are of a tawny colour.

Negroes are brought from Guinea and other coasts of Africa, and sent to America and the colonies in the West

West Indies, to cultivate tobacco, sugar, indigo, &c. and in Mexico and Peru to dig in the mines; and this commerce is now carried on by all the nations of Europe that have settlements in the West Indies. Mahometan nations, too, import negroes from the pagan parts of Africa, for the purpose of making them eunuchs, and guards of their harems. The best slaves for West India purposes are the negroes who are brought from Angola, Senegal, Cape Verd, the river Gambia, the kingdoms of the Jaloffes, &c. (See GUINEA.) This traffic is perhaps shocking, but it need not appear strange.

Through the whole of the peninsula of Africa with which we are acquainted, slavery has been prevalent from time immemorial. In the interior parts, one class of the people are born slaves to another; and on the gold coast, a freeman is reduced to that state for crimes real or imaginary. Prisoners of war are all considered as slaves, and, together with criminals, are sold, either by one negro chief to another, or by slave-brokers, to European merchants. Slaves which are born such are not permitted to be sold out of the country, unless they have been guilty of some offence which would have subjected them either to that state or to death, though they had been born freemen.

The crimes for which freemen are made slaves, are theft, debt, adultery, and witchcraft; and it is not uncommon for persons to game themselves away. All savages have an itch for games of hazard; and a negro will stake his freedom on a throw of the dice. If he lose, no trial is necessary; he immediately surrenders himself to his successful antagonist. Persons accused of crimes are tried by certain judges called *Pynim's*, who wear a peculiar straw-hat as a badge of their office; and the trial is fairly conducted, according to the laws of the country, either in the market-place or in an open court of justice. Witchcraft proved against a man involves in his punishment the whole family, which is always extirpated, if there be not a European merchant to buy them; and adultery committed with the wife of a great man is considered as a crime of too deep a dye to be punished with slavery either to a black or a white master. Such offenders are instantly doomed to death.

Human sacrifices have at all times been practised in Africa; and such is the depravity of the negro princes, that there is reason to believe that prisoners of war are either all sacrificed or sold to foreign merchants. That insolvent debtors should be reduced to slavery, among a people so very barbarous, can excite no wonder, when we consider that the same thing took place among the Romans, in the earlier periods of the commonwealth. (See NEXI.) It likewise took place among the Jews, and all other ancient nations; and it is apparent from the poems of Homer, that the early Greeks treated their captives, whether male or female, as part of their property. Of the slaves imported into the British colonies, great part are brought from a great distance to the coast; and as these exhibit little or no symptoms of uneasiness at their being sold into a foreign country, and doomed to serve masters whom they never saw before, the probability is, that they have been born slaves to tyrants so cruel, that no change of masters can, in their apprehension, increase their wretchedness. Negroes born on the coast are often extremely miserable on the thoughts of being sold to a foreign master; because these men were originally free, and expect such treatment as they have seen their own chiefs inflict upon prisoners of war, or persons who, among them, have been reduced from freedom to a state of slavery.

These facts are mentioned, not with a view to defend or condemn the British slave-trade, which will be considered in another place, (See SLAVERY and SLAVE-TRADE); but merely because they account for that ferocity and brutality by which negroes in many respects resemble the most savage beasts of prey. Some of them have been known to feed on their brothers, and to devour their own children. But what indeed can be expected of men in their unhappy situation? Almost all blacks, but especially those of Loanga, treat their women as vile slaves, created solely to amuse and obey them. The wife often dares not look at her lord; she speaks to him on her knees; and yet this painful and humiliating situation is not distressing to them. Some negroes, however, are sufficiently attached to their wives, and exceedingly fond of their mistresses: these yield in no respect to the men, but obey without reserve the natural impulse of their constitution. We likewise find negroes of Congo, who, in order to please, become great jesters and buffoons. A single Congo slave is sufficient to diffuse chearfulness and good humour through a whole plantation. But how comes it about that female negroes, who are so prolific in Africa, are not equally so in America?

To discover the cause of such sterility, is an object worthy of the attention of government. According to some, these slaves are often instigated by the bitterness of their lot to rid themselves of a burden which other mothers support with pleasure. This, however, cannot be the fact. Without in any degree pleading the cause of the West India planters, we may venture to suppose, that, in this case, interest will supply the place of that principle of humanity which their opponents affirm them to want. To rear a negro is less expensive than to purchase one from Africa; and by the confession of all parties, a creole slave is double the value of one just imported. That selfishness, therefore, of which the sugar-planters have been so often and so vehemently accused, would make them, one should think, encourage, by every mean in their power, the propagation of negroes, since by the laws of the colonies the child of a female slave is the property of her master. We doubt not that in the West Indies, as every where else, there are men who in sudden bursts of passion forget their interest as well as their duty; and we are not inclined to deny, that there may be many instances of cruelty practised on the slaves both male and female; but in Africa, cruelty is reduced to a system, and yet the mothers nurse and rear their children.

One cause certainly of the barrenness of colonial negroes, is the small number of females in proportion to the males, and the dissolute and licentious lives which they lead. It is a fact, for which physiologists must account, that when a woman, whether white or black, has a promiscuous intercourse with a number of men, she very seldom conceives children; and as our negroes in the West Indies are instructed in no principles of religion, and have appetites as keen as their

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their masters and their mistresses, it is not surprising that many of the females abandon themselves to licentious amours, and become in consequence incapable of conception. The popish clergy in the French and Spanish islands, and the Moravian and Methodist pastors in our own, are at the utmost pains to instruct the negroes in what they conceive to be the truths of Christianity; whilst the missionaries of the English church too generally neglect every duty of their sacred function. The bishop of London has been expected, as diocesan of the West Indies, to take upon himself the forming of some plan for the religious instruction of the negroes in the colonies suited to their temporal condition; but in justice to that prelate, as well as to the memory of his immediate predecessors, it is proper to acquaint the public, that since the death of Dr Gibson in 1748, the bishop of London has had no ecclesiastical authority whatever in the colonies, nor any other episcopal connection with them, than that of conferring orders upon their candidates for livings. That the colonies would gladly adopt any proper plan for improving the morals and meliorating the condition of the negroes, has been lately proved by the most respectable evidence given at the bar of the house of lords; and were such a plan put in execution, there cannot be a doubt, but that the slaves would be more diligent and faithful, the masters have less occasion to exercise cruelty, and the females, if imported in a sufficient number, be as prolific as other women in the same latitudes.

Both in France and in England laws have been lately enacted, to preserve the lives of negroes on what is called the *middle passage*, and to regulate the administration of justice to the negro-slaves in the West Indies. An edict to this purpose was, so far back as March 1724, published at Versailles, called the *black code;* and laws have been lately made by the parliament of Great Britain, to insure better accommodation to the negroes on board of ship from Africa to the sugar islands. The colonial assemblies have likewise themselves enacted laws to protect the persons of the negroes while in their state of servitude; and in some estates, these laws have been so well observed, that we have been informed by gentlemen of undoubted veracity, that they have known negro-slaves possessed of one, two, and 300 l. So horrible, however, to a British ear is the very sound of the word slavery, that a society was some years ago instituted at London, for the purpose of procuring an abolition of the slave-trade; and petitions to parliament for the same purpose were obtained from almost every county and town in the kingdom. The success of these petitions, as well as their consequences, will soon be known, when we shall take an opportunity of laying them before our readers.

NEGROLAND, or Nigritia, a country of Africa, lying next to Guinea towards the north, and extending from 18° of west to 15° of east longitude, and from 10° to 20° of north latitude. On the north it is bounded by Zara or the Desart; 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.

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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 Mundingo 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, 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 grasshoppers and insects, as quite darken the air, and frequently devour all the product of the earth: in which case the people kill those insects and eat them; which they do either by pounding in leathern 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 frying-pan 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 over-run 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,

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 drawbridge no longer than just to let a galley pass through.

END OF THE TWELFTH VOLUME.

DIRECTIONS FOR PLACING THE PLATES OF VOL. XII.