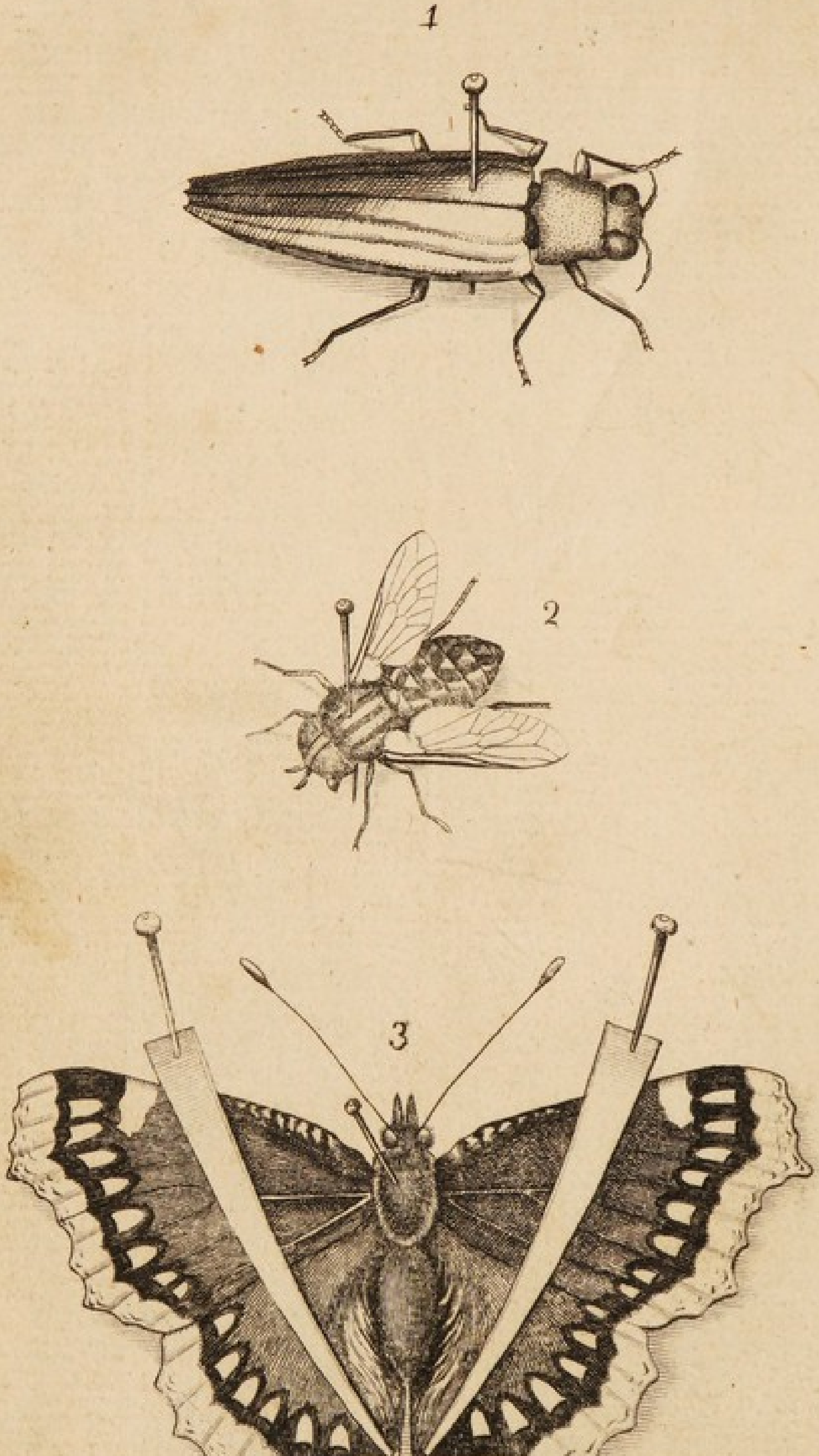
C. LETTSOM



Mos Harris del et Sc

THE NATURALIST'S AND Traveller's Companion.

CONTAINING

Instructions for discovering and preserving Objects of NATURAL HISTORY,

Under the following Heads:

I. The Method of catching and preserving Insects for Collections, illustrated with a Copper-plate.

II. The Method of preserving Birds and other Animals.

III. Directions for bringing over Seeds and Plants from distant Countries.

IV. Method of analysing Medicinal or Mineral Waters.

V. Experiments for discovering the Contents of the Air.

VI. Directions for collecting Fossils, including Earths, Stones, Salts, Inflammables, Minerals, and Metals.

VII. Directions for taking off Impressions or Casts from Medals and Coins.

BY John Coakley Lettsom, M.D.F.S.A.

Multa etenim sunt quæ esse audivimus, qualia autem sint ignoremus! Quamque multa venientis aevi populus, ignota nobis, sciet!

SENECA.

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PREFACE.

THE experienced Naturaliſt muſt not expect to find much Information in this little Treatiſe. The Author had kept it by him for ſome Time in Manuſcript, and occaſionally given Copies to Sea-faring Perſons, and ſuch of his Acquaintance going Abroad, as were deſirous of procuring the Natural Productions of different Countries. But this having neceſſarily confined it to a few Individuals, he has been induced to Publiſh it, that every Perſon might avail themſelves of any Inſtruction it affords, his ultimate Deſign having been to promote a more general Knowledge of Natural Hiſtory.

THE NATURALIST'S AND Traveller's Companion.

SECT. I.

The Method of catching and preserving INSECTS *for Collections.*

INSECTS in general are known to most people, the systematic distinctions but to few; nor have we any English names for the greatest part of them. The general denomination of beetles, butterflies, moths, flies, bees, wasps, and a few other common names, are all that our language supplies. It would, therefore, be in vain to enumerate the immense variety of genera and species to any person unskilled in the science of entomology: we may, however, give directions under general names, where to find and how to catch each kind; and ſuch as require more particular information upon this ſubject, may conſult an ingenious treatiſe, which has appeared ſince the firſt publication of this, (*a*) under the title of *Inſtructions for collecting and preſerving Inſects, by W. Curtis* (*b*).

I. The firſt great claſs called beetles (*c*), are found in and under the dung (*d*) of animals, eſpecially of cows, horſes, and ſheep: many of them make holes under the dung three or four inches deep; it will therefore be neceſſary to have an iron ſpade to dig them out, when in ſearch of this tribe of inſects.

Some (*e*) are found in rotten and half decayed wood, and under the decayed bark of trees; on the carcaſes (*f*) of animals that have been dead four or five days; on moiſt bones that have been gnawed by dogs or other animals; on flowers having a fœtid ſmell; and on ſeveral kinds

(*a*) Gentleman's Magazine, vol. XLI. 1771, page 6. It may be neceſſary to obſerve, that the following claſſes and genera of inſects are made after the Linnæan ſyſtem.

(*b*) See alſo Chaeffer Elementa Entomologica; Forſter's catalogue of the animals of North America.

(*c*) COLEOPTERA. (*d*) Scarabæus, *chafer*. Dermeſtes, *leather-eater*. Hiſter, *mimick-beetle*. Staphylinus, *rove-beetle*. (*e*) Lucanus, *ſtag-beetle*. Cerambyx, *capricorn-beetle*. Dermeſtes. (*f*) Hiſter, Silpha, *carrion-beetle*. Staphylinus.

(*g*) Byrrhus,

kinds of fungous ſubſtances, particularly the rotten and moſt ſtinking: others (*g*) may be found in a morning about the bottoms of perpendicular rocks and ſand banks, and alſo upon the flowers of trees and herbaceous plants.

Many kinds (*h*) may be caught in rivers, lakes, and ſtanding pools, by means of a thread net, with ſmall meſhes, on a round wire hoop, fixed at the end of a long pole.

In the middle of the day, when the ſun ſhines hot, ſome (*i*) are to be ſeen on plants and flowers, blighted trees and ſhrubs; others (*k*) in moiſt meadows are beſt diſcovered at night, by the ſhining light which they emit.

A great variety (*l*) ſit cloſe on the leaves of plants, particularly of the burdock, elecampane, coltsfoot, dock, thiſtle, and the like; or feed on different kinds of tender herbs (*m*).

Numbers (*n*) may be found in houſes, dark cellars, damp pits, caves, and ſubterraneous paſſages, or on umbelliferous flowers (*o*), on the trunks

(*g*) Byrrhus, curculio, *weevil*. Bruchus, *ſeed-beetle*. (*h*) Gyrinus, *whirl-beetle*. Dytiſcus, *water-beetle*. (*i*) Coccinella, *lady-fly*. Bupreſtis, *burn-cow*. Chryſomela, *golden-honey-beetle*. Cantharis, *ſoft-winged-beetle*. Elater, *ſpring-beetle*. Necydalis, *clipt-winged-beetle*. (*k*) Lampyris, *glow-worm*. (*l*) Caſſida, *tortoiſe-beetle*. (*m*) Meloë, *bliſter-beetle*. (*n*) Tenebrio, *ſtinking-beetle*. (*o*) Cerambyx, Ptinus.

trunks as well as the leaves of trees; in timber-yards, and in the holes of decayed wood.

Some (*p*) inhabit wild commons, the margins of pools, marſhes, and rivulets; and are likewiſe ſeen creeping on flags, reeds, and all kinds of water-plants.

Multitudes (*q*) live under ſtones, moſs, rubbiſh, and wrecks near the ſhores of lakes and rivers. Theſe are found alſo in bogs, marſhes, moiſt places, pits, and holes of the earth, on ſtems of trees; and in an evening they crawl plentifully along path-ways after a ſhower of rain.

Some (*r*) may be diſcovered in the hollow ſtems of decayed umbelliferous plants, and on many ſorts of flowers and fruits.

II. Another claſs (*s*) of inſects are found about (*t*) bake-houſes, corn-mills, in ſhips, and in all places where meal is kept; on graſs (*u*), and all kinds of field herbage. Some (*v*) of theſe frequent rivers, lakes, and ſtanding-pools.

III. Butterflies and moths make another great

(*p*) Leptura, *wood-beetle.* Cicindela, *gloſſy-beetle.* (*q*) Carabus, *ground-beetle.* (*r*) Forficula, *earwig.*

(*s*) HEMIPTERA. (*t*) Blatta, *cock-roach.* (*u*) Mantis, *camel-cricket.* Gryllus, *locuſt.* Fulgora, cicada, *flea-locuſt.* Cimex, *bug.* (*v*) Notonecta, *boat-fly.* Nepa, *water-ſcorpion.*

division

division (*w*). In the day when the sun is warm, butterflies (*x*) are seen on many sorts of trees, shrubs, plants, and flowers. Moths (*y*) may be seen in the day time, sitting on walls, pales, trunks of trees, in shades, out-houses, dry holes, and crevices; on fine evenings they fly plentifully about the places they inhabit in the day time: some (*z*) are seen flying in the day time over the flowers of honey-suckles and other plants with tubular flowers. Insects of this species seldom sit to feed, but continue vibrating on the wing, while they thrust the tongue or proboscis into the flower.

IV. Insects of this class (*a*) are found in woods (*b*), hedges, meadows, sand-banks, walls, pales, fruits, and umbelliferous flowers; some (*c*) fly about lakes and rivers in the day.

V. The fifth division (*d*) including wasps (*e*), bees (*f*), *&c.* may be seen about hedges (*g*), shrubs, flowers, and fruits. Wasps and bees are the only winged insects that have any great

degree

(*w*) LEPIDOPTERA. (*x*) Papilio, *butterfly.* (*y*) Phalæna, *moth.* (*z*) Sphinx, *hawk-moth.*

(*a*) NEUROPTERA. (*b*) Myrmeleon, hemerobius, *pearl-fly.* Raphidia, *camel-fly.* (*c*) Libellula, *dragon-fly.* Ephemera, *may-fly.* Phryganea, *spring-fly.*

(*d*) HYMENOPTERA. (*e*) Vespa, *wasp.* (*f*) Apis, *bee.* (*g*) Tenthredo, *saw-fly.* Sirex, *tailed-wasp.* Ichneumon, *ichneumon-fly.* Sphex, *ichneumon-wasp.* Vespa. Apis.

(*h*) Mutilla,

degree of poiſon in them, they ſhould therefore be taken with a pair of forceps, and handled cautiouſly on account of their ſtings, which are dangerous. Some (*h*) of this diviſion have ſtings, but no poiſon, and are to be found on the flowers of umbelliferous plants, when the ſun ſhines hot in the middle of the day, at which time others (*i*) are ſeen on ſand-banks, walls, and pales.

VI. Flies of various kinds conſtitute the next claſs (*k*); they fly about the tops of trees (*l*), little hills, horſes, cows, ſheep, ditches, dung-hills, and every offenſive object. Some (*m*) are found on all ſorts of flowers, particularly thoſe of a fœtid ſmell. Many (*n*) of theſe are moſt eaſily taken when they begin to feed; for in the middle of the day they are ſo quick and active, that it is almoſt impoſſible to catch them.

VII. The laſt great diviſion (*o*) contains ſcorpions, ſpiders, crabs, lobſters, &c. It is neceſſary only to obſerve here, that all kinds of inſects having no wings may be preſerved in ſpirits, brandy or rum, except crabs, lobſters,

(*h*) Mutilla, *naked-bee*. (*i*) Chryſis.

(*k*) DIPTERA. (*l*) Oeſtrus, *gad-fly*. Muſca, *fly*. Tabanus, *whame*. Hippoboſca, *horſe-fly*. (*m*) Tipula. Conops. Aſilus, *waſp-fly*. (*n*) Bombylius, *flower-breeze*.

(*o*) APTERA.

and the like, which may conveniently be preserved dry.

I. The firſt claſs of inſects, conſiſting of beetles (coleoptera) are hard winged. Many kinds fly about in the day, others in the evening, ſome at night only. They may be caught with a gauze net, or a pair of forceps covered with gauze. When they are taken, ſtick a pin thro' the middle of one of the hard wings, and paſs it through the body, as in plate, fig. 1. They may be killed inſtantly, by immerſion in hot water, as well as in ſpirit of wine; then ſtick them on a piece of cork, and afterwards carefully place their legs in a creeping poſition, and let them continue expoſed to the air until all the moiſture is evaporated from their bodies. Beetles may alſo be preſerved in ſpirit of wine, brandy, or rum, cloſely corked up.

II. Inſects of the ſecond claſs (hemiptera) may be killed in the ſame manner as beetles, and likewiſe by means of a drop of the etherial oil of turpentine applied to the head.

III. The diviſion of butterflies and moths (lepidoptera) as well as all flies with thin membranaceous wings, ſhould be catched with a gauze net, or a pair of gauze forceps: when taken in the forceps, run a pin through the thorax or ſhoulders, between the forewings, as in plate, fig. 3. After this is done, take the pin by the head, and remove the forceps, and with the

other

other hand pinch the breaſt of the inſect, and it will immediately die: the wings of butterflies ſhould be expanded, and kept ſo, by the preſſure of ſmall ſlips of paper, for a day or two. Moths expand their wings when at reſt, and they will naturally take that poſition.

The beſt method of having the moſt perfect butterflies is to find out, if poſſible, the larva or caterpillar of each, by examining the plants, ſhrubs, or trees they uſually feed upon, or by beating the ſhrubs and trees with long poles, and thereby ſhaking the caterpillars into a ſheet ſpread underneath to receive them; to put them into boxes covered with thin canvas, gauze, or cat-gut, and to feed them with the freſh leaves of the tree or herb, on which they are found; when they are full grown, they will go into the pupa, or chryſalis ſtate, and require then no other care, till they come out a perfect butterfly, at which time they may be killed, as before directed. Sometimes theſe inſects may be found hanging to walls, pales, and branches of trees, in the chryſalis ſtate.

Moths might likewiſe be procured more perfect, by collecting the caterpillars, and breeding them in the ſame manner as butterflies. As the larvæ or caterpillars cannot be preſerved dry, nor very well kept in ſpirit, it would be ſatisfactory if exact drawings could be made of them while they are alive and perfect. It may be

neceſſary

neceſſary to obſerve, that in breeding theſe kinds of inſects, ſome earth ſhould be put into the boxes, as likewiſe ſome rotten wood in the corners; becauſe, when the caterpillars change into the pupa, or chryſalis ſtate, ſome go into the earth, and continue under ground for many months before they come out into the moth ſtate; and ſome cover themſelves with a hard ſhell, made up of ſmall pieces of rotten wood. Hence alſo, as many go into the earth, valuable inſects may ſometimes be found by digging after them a foot deep, about the roots of trees, ſhrubs, and plants.

IV. The fourth claſs of inſects (neuroptera) may be killed with ſpirit, or with a drop of ætherial oil of turpentine.

V. Inſects of the next claſs (hymenoptera) are beſt killed by oil of turpentine alſo. A pin may be run through one of their wing-ſhells and body, as repreſented in plate, fig. 2.

VI. Thoſe of the ſixth claſs (diptera) may be killed with ſpirit of wine.

VII. The laſt diviſion (aptera) in general are ſubjects which ſhould be kept in ſpirit.

When in ſearch of inſects, we ſhould have a box ſuitable to carry in the pocket, lined with cork at the bottom and top to ſtick them upon, until they are brought home. If this box be ſtrongly impregnated with camphor, the inſects ſoon become ſtupefied, and are thereby prevented from fluttering and injuring their plumage. Befides a gauze forceps, the collector fhould have a large mufcheto gauze net, made in the fhape of a bat fowling-net, and alfo a pincufhion with three or four different fizes of pins, to fuit the different fizes of infects.

In hot climates, infects of every kind, but particularly the larger, are liable to be eaten by ants and other fmall infects, efpecially before they are perfectly dry: to avoid this, the piece of cork on which our infects are ftuck in order to be dried, fhould be fufpended from the cieling of a room, by means of a flender ftring or thread; befmear this thread with bird-lime, or fome adhefive fubftance, to intercept the rapacious vermin of thefe climes in their paffage along the thread.

After our infects are properly dried, they may be placed in the cabinet or boxes where they are to remain: thefe boxes fhould be kept dry, and alfo made to fhut very clofe to prevent fmall infects from deftroying them; the bottoms of the boxes fhould be covered with pitch, or green wax, over which paper may be laid; or, which is better, lined with cork, well impregnated with a folution of a quarter of an ounce of corrofive fublimate mercury, in half that quantity of æthereal oil of turpentine, and a pint of the camphorated fpirit of wine.

The

The fineſt collections have been ruined by ſmall inſects, and it is impoſſible to have our cabinets too ſecure. Such inſects as are thus attacked may be immerſed in ſpirit of wine, without injuring their fine plumage or colours; and afterwards let them be ſprinkled about their bodies and inſertions of the wings with the ſolution above-mentioned. We may diſſolve a much larger proportion of ſublimate mercury, by means of a ſaturated ſolution of crude ſal ammoniac in water: I find that an ounce of the ſal ammoniac ſolution will diſſolve twenty ſcruples of the ſublimate.

Theſe obſervations and directions reſpecting inſects, may, perhaps, be the means of exciting the curioſity of ſome, whoſe enquiries after this part of natural hiſtory will be amply compenſated by the frequent opportunities of enlarging their knowledge, as there is ſcarce any part of the ſurface of this globe, ſcarce a tree, a ſhrub, or a plant, an animal either living or dead, or even the excrements of animals, on which ſome kind of inſect does not depend for its ſubſiſtance and propagation. An inquiſitive traveller, as well as every other perſon, has it more or leſs in his power to add to the common ſtock of knowledge, with very little expence either of time or labour.

SECT. II.

Method of preserving BIRDS *and other Animals.*

THE general increase of knowledge of late in natural history, from the attention of individuals to various branches of it, must afford no small degree of pleasure to the sensible part of mankind. Whilst such different researches have given entertainment to different dispositions, enlarged the mind, and engaged and diverted it from unprofitable or dangerous pursuits, they have occasionally given rise to the most useful improvements in every department of life, and afforded means of joining utility with elegance.

To promote these purposes more effectually, a more general knowledge of a good antiseptic for animal substances has been much enquired after. Owing to a want of this, many curious animals, and birds particularly, come to our hands in a very imperfect state: some from foreign parts entirely miscarry, and others of the finest plumage are devoured by insects.

Many ſubjects I have prepared myſelf with ſucceſs; but ſince the firſt inſertion of this account in the Gentleman's Magazine *, the methods uſed by the ingenious captain Davis, and T. S. Kuckahn, have been publiſhed in the Philoſophical Tranſactions †, of which I ſhall alſo avail myſelf.

The former directs birds in perfect plumage, "to be opened from the upper part of the "breaſt, to the vent, with a ſharp knife or "pair of ſciſſars, the feathers of the breaſt and "belly being firſt carefully laid aſide by the fin-"gers, ſo as not to hinder the ſkin being eaſily "come at. The ſkin muſt then be carefully "looſened from all the fleſhy parts of the breaſt, "body, thighs, and wings; after this, cut off "all the fleſh from thoſe parts, and take out "alſo the entrails and all the inſide: then, hav-"ing got a compoſition of burnt alum, cam-"phor, and cinnamon, of each an equal quan-"tity, well powdered and mixt together, ſtrew "ſome of this powder lightly over the whole "carcaſe; but ſalt is by no means to be uſed "with this compoſition, as it always will drop "and naſty the plumage in moiſt weather; pour "alſo into the body a ſmall quantity of camphor

* Vol. XL. 1770, page 293.

† Vol. IX. anno 1770, page 184, and 302. From the ſpecimens both theſe methods appear to ſucceed.

"diſſolved

"dissolved in rectified spirits of wine; after "that, fill up the cavity with fine cotton, or "any soft woolly substance, pouring some of "the aforesaid spirits into the cotton or stuffing. "Open next the mouth, and with a pair of scis-"sars take away the tongue, the roof of the "mouth, eyes, brains, and inside of the head *; "fill that also with the same composition; and "having procured eyes as near the natural ones "as possible, put them into the sockets by means "of a small pair of nippers introduced at the "mouth. The eyes will be best made by letting "fall some drops of black sealing wax on a card "of the size of the natural ones †; the card "must be cut something larger than the wax, "to prevent their falling out of the head. Fill "the head quite full with cotton, pouring some "of the spirits down the throat, with some of "the powder; a small piece of brass wire, that "has been heated in the fire to make it pliable, "may be put down the throat, being passed

* Kuckahn directs the neck to be pulled within the skin, till the back of the skull is drawn in sight, out of which a small piece is to be cut, and the brains extracted; the cavity of the skull is then to be moistened with the varnish, sprinkled with the powder, and filled up with cotton, &c. and then the skin may be drawn back to its proper place.

† To answer this purpose, beads may be conveniently introduced, by means of a needle and thread, passing the needle through the mouth, and out at the eye.

"through

"through one of the noſtrils, and faſtened to
"the breaſt-bone, to place the head in any atti-
"tude you chooſe; next fill up the body, where
"the fleſh has been taken away, with cotton
"and your compoſition; and, having a fine
"needle and ſilk, ſew up the ſkin, beginning
"at the breaſt, obſerving, as you approach to-
"wards the vent, to ſtuff the ſkin as tight as it
"will bear. This will be eaſieſt accompliſhed
"by means of a ſmall piece of ſtick or ivory,
"like a ſkewer, till the whole is done: then lay
"your feathers of the breaſt and belly in their
"proper order, and your bird will be com-
"pleated. If you would chuſe to put it into an
"attitude, by introducing a ſmall piece of the
"wire above-mentioned through the ſole of
"each foot up the leg, and into the pinion of
"each wing, it may be diſpoſed of as you
"pleaſe."

Inſtead of uſing the ſolution of camphor in ſpirit of wine, Kuckahn recommends a liquid varniſh, made of two pounds of common or raw turpentine, one pound of camphor, and one pound of ſpirit of turpentine. The camphor is to be broke into very ſmall pieces, and the whole is to be put into a glaſs veſſel, open at top, which is to be placed in a ſand heat, till the ingredients are perfectly diſſolved *.

For

* The ſolution of corroſive ſublimate, Sect. I. page 3, would

For the dry compound of cinnamon, burnt alum, and camphor, directed in the foregoing method, he ſubſtitutes the two following compoſitions.

Corroſive ſublimate,	— —	$\frac{1}{4}$ lb.
Saltpetre prepared or burnt,		$\frac{1}{2}$ lb.
Alum burnt,	— —	$\frac{1}{4}$ lb.
Flowers of ſulphur,	— —	$\frac{1}{2}$ lb.
Muſk *,	— — —	$\frac{1}{4}$ lb.
Black pepper,	— — —	1 lb.
Tobacco ground coarſe.	—	1 lb.

Mix the whole together, and keep it in a glaſs veſſel ſtopped cloſe. Some of this is to be ſtrewed upon the inſide of the ſkin and cavity of the head, after they have been waſhed with the varniſh.

The other dry compoſition is made of equal quantities of tanſy, wormwood, hops, and tobacco, which are to be cut ſmall and mixed together; with this the cavities of the craw and body are to be ſtuffed. He likewiſe directs an artificial breaſt to be made of ſoft wood, and

would probably prove more effectual againſt inſects than this varniſh, or the camphorated ſpirit.

* The muſk renders this compoſition very expenſive, for which the ſame quantity of camphor might be ſubſtituted with real advantage.

fitted

fitted to the proper place, after being moiſtened with the varniſh *.

When theſe antiſeptic powders before mentioned cannot be had, tobacco ſand mixed with a ſmall proportion of alum, black pepper, and camphor may be ſubſtituted. If the ſublimate ſolution (Sect. II. page 16.) can be procured, the abdomen and throat of the animal may be firſt waſhed with it, and the tobacco, oakum, or tow, ſteeped alſo in the ſame liquor.

Small birds are well preſerved in brandy, rum, arrack, or firſt runnings, the fineſt plumage not being injured by ſpirits.

Large ſea-fowl have thick, ſtrong ſkins, and ſuch may be ſkinned; the tail, claws, head, and feet are carefully to be preſerved, and the plumage ſtained as little as poſſible with blood. The inſide of the ſkin may be moiſtened with the ſublimate ſolution, and then ſtuffed with oakum, tow, or tobacco ſteeped in the ſame, and afterwards dried in an oven, not heated ſufficiently to criſp the feathers. The eyes may be filled with white putty, which, when dry, may be painted

* I am informed that both Leman's and Grace's curious collections were preſerved with cork breaſts. I have found that this gives the ſubjects a plumpneſs, which cannot be equalled by tow, or any ſtuffing; though it muſt be admitted, that the ſpecimen exhibited before the Royal Society by captain Davis, can be exceeded by nothing but life itſelf.

to resemble the natural eyes. "Baking is not "only useful in fresh preservations, but will also "be of very great service to old ones, destroy-"ing the eggs of insects; and it should be a "constant practice once in two or three years, "to bake them over again, and to have the "cases fresh washed with camphorated spirit, "or the sublimate solution, which would not "only preserve collections from decay much "longer, but also keep them sweet *."

When the subject is to be kept some time in a hot climate, it should be secured in a box filled with tow, oakum, or tobacco, well sprinkled with the sublimate solution. The same preparations and precautions already described, are equally applicable to quadrupeds in general.

Small quadrupeds, all kinds of reptiles, as snakes, lizards, and frogs; fish of all sorts, and small tortoises, with sea eggs †, and sea stars, may be put into brandy, rum, arrack, or first runnings, with a little alum in it.

Shells constitute an extensive part of natural history, and may be collected in great plenty and variety on the shores of most islands and continents. Those which are found with the fish in

* See Philosophical Transactions, vol. LX. page 319.

† The echini, or sea eggs, may also be dried; but they are then so liable to be broken, that the safest method is to preserve them in spirit.

them,

them, are the moſt valuable for the brightneſs of colour, and ſmoothneſs of ſurface, as they loſe that beauty and poliſh, when they have been long expoſed to the ſun. In bivalves, or thoſe having double ſhells, as cockles, oyſters, *&c.* both the ſhells ſhould always be collected. It is ſufficient in packing up ſhells, to prevent their rubbing againſt each other by means of paper, moſs, ſand, *&c.* ſome of the ſhell fiſh may be preſerved in ſpirits, as this might prove an uſeful addition to the knowledge of this department of natural hiſtory.

The neſts and eggs of birds, would likewiſe contribute to increaſe the knowledge of natural hiſtory, and prove alſo highly ornamental amongſt collections in that branch of zoology.

SECT. III.

Directions for bringing over SEEDS *and* PLANTS *from diſtant Countries.*

EVERY part of the world has its peculiar productions, and in no objects of natural hiſtory is the variety more entertaining, than in the vegetable kingdom. The gardens of the curious have already been enriched with many valuable acquiſitions from diſtant countries; but many attempts alſo to introduce ſeveral other plants equally rare, have been unſucceſsfully made, owing to the bad ſtate of the ſeeds or plants when firſt procured, or the method of diſpoſing of them during long voyages, and the accidents which the utmoſt precaution cannot prevent. The ingenious J. Ellis, Eſq; has favoured the world with the moſt judicious obſervations on the preſent ſubject, which may ſoon prove the means of many uſeful additions in horticulture to this kingdom. He directs ſound ripe ſeeds to be choſen, which have been collected in dry weather, and kept dry without

expoſing

expoſing them to ſunſhine; and internally they ſhould be plump, white, and moiſt.

a. They may be preſerved by rolling each in a coat of yellow bees wax, about half an inch thick; and afterwards a number of theſe thus prepared, may be put into a chip box, which is to be filled with melted bees wax, not made too hot *: the outſide of the box may then be waſhed with the ſublimate ſolution, (Sect. II. page 16.) and kept during the paſſage in a cool airy place. In this manner tea ſeeds, the ſtones of mangoes, and all hard nuts and leguminous ſeeds in general, may be prepared.

b. Inſtead of putting ſmall ſeeds in bees wax, they may be incloſed in paper or cotton which has been firſt ſteeped in melted bees wax, and then placed in layers in a chip box, which is to be filled as before with melted bees wax. Pulpy

* Inſtead of melted bees wax, plaſter of Paris, mixed with water, (Sect. VII.) and poured upon the nuts, ſeeds, &c. may be ſubſtituted. I ſhall not lay much ſtreſs at preſent upon this method, becauſe I never knew it tried; but from analogy it appears to me preferable to any other for preſerving ſuch ſubſtances in a ſtate fit for vegetation. The coat formed by plaſter of Paris excludes air and moiſture; and at the ſame time is ſufficiently porous to abſorb the exhalation from the vegetable included. Another advantage is, that it may be applied cold. It alſo remains of the ſame conſiſtence in all climates, and under all degrees of heat of the air. I would therefore recommend a trial of this cheap body.

ſeeds,

ſeeds, as thoſe of ſtrawberries, mulberries, arbu-tuſes, *&c.* may be ſqueezed together and dried, and then put into the cerate paper or cotton above-mentioned.

c. The ſmall ſeeds well dried may be mixed with dry ſand, put into the cerate paper or cotton, and packed in glaſs bottles, which may be covered with a bladder or leather. Theſe bottles may be put into a keg, box, or any other veſſel, filled with four parts of common ſalt, two of ſaltpetre, and one part of ſal armoniac, in order to keep the ſeeds cool, and preſerve their vegetative power.

d. Seeds and nuts in their pods, may be put, with alternate layers of ſilk paper, into half-pound caniſters with double rim covers, made of tin and tutenague, and lined with the ſame paper: theſe ſhould be well covered with paper at the top, and kept in an airy cool place.

e. The ſeeds well dried may be put into a box, not made too cloſe, upon alternate layers of moſs, in ſuch a manner as to admit the ſeeds to vegetate, or ſhoot their ſmall tendrils into the moſs. In the voyage, the box may be hung up at the roof of the cabin; and when arrived here, the ſeeds ſhould be put into pots of mold, with a little of the moſs alſo about them, on which they had lain.

Seeds preſerved after this manner, and alſo in the preceding (d), which are procured in the

East

Eaſt Indies, may be examined when the ſhip arrives at St. Helena; and ſome of them which appear in a ſtate of vegetation, ſhould be ſown in caſes or tubs of earth kept as ſecure as poſſible from ſea water; ſome holes ſhould be cut in theſe caſes or tubs, and covered with baſt-mats or ſail-cloth, which will admit ſufficient air.

More of the ſame ſeeds may be alſo ſown after the ſhip has paſſed the tropic of Cancer, near the latitude of thirty degrees north. Plants or ſhrubs that are to be tranſported, muſt be taken out of the ground with a quantity of the ſoil covering the roots, which ſhould be wrapped in wet moſs, and ſurrounded with a baſt-mat, or dry plantain leaves, and put into the caſes or tubs, with the precautions above-mentioned.

When the naturaliſt is in ſearch of vegetable productions, different ſoils and ſituations ſhould be examined; as the ſea, and its ſhore, deep running waters, dikes, marſhes, moors, mountains, cultivated and barren fields, woods, rocks, *&c.* afford each their peculiar plants; and wherever any are collected, the particular ſoil and ſituation ſhould be remarked. Sometimes it may prove inconvenient to convey the plants which may be diſcovered, when it would not be ſo to ſend them dried in the form of a hortus-ſiccus. To do this in the beſt manner, and to make their ſtalks, leaves, *&c.* lie flat and ſmooth,

they

they muſt be expoſed betwixt papers to a free dry air, with conſiderable preſſure upon them. The leaves and flowers ſhould be carefully expanded, for on this the beauty and value of the ſpecimen greatly depends. Thoſe plants ſhould alſo be gathered on a dry day, while they are in full bloom, and all their parts perfect and entire. When perfectly dry, they may be kept either looſe in quires of paper, or faſtened into a book, with glew made of fine iſinglaſs diſſolved in boiling water. Particular care is to be taken to avoid any injuries from moiſture, or inſects; to prevent any accident from the latter, let the paper and ſtalks of the plants be ſprinkled with the ſublimate ſolution. (Sect. II. page 16.)

The impreſſions of plants well taken off upon paper, look very little inferior to the beſt drawings, and may be done with very little trouble. For this purpoſe, ſome printer's ink *, and a pair of printer's boſſes, ſuch as are uſed for laying the ink on types, are neceſſary. After rubbing theſe boſſes with a little of the ink, lay the plant betwixt them, and preſs it ſo as to give it ſufficient colour; then take the plant and lay it carefully on a ſheet of paper, and preſs it with the hand, to give the impreſſion of the plant to the paper, which may be afterwards coloured accord-

* Where this cannot be procured, ivory, or lamp black, ground with boiled linſeed oil, may be ſubſtituted.

ing

ing to nature; a piece of blotting paper may be placed betwixt the plant and the hand, to prevent the latter from being dirtied by the ink.

But the moſt effectual method of ſending a branch of any plant with the flowers, and parts of fructification entire and perfect, is to put them in bottles of brandy, rum, or arrack.

Corals, corallines, ſponges, *&c.* inhabitants of the ſea, are found in conſiderable variety near the coaſts of iſlands and continents, particularly in hot climates. Some of theſe are very tender and brittle when dry, and ſhould therefore be carefully packed up in ſand, in order to keep them ſteady, or placed betwixt papers in the manner of an hortus ſiccus.

In hot climates, the inſects are very rapacious; and I have ſeen the fineſt fan-corals, and others of a ſoft texture when firſt taken out of the ſea, almoſt devoured by ants, before they became dry and hard. To prevent injuries of this kind, a little powdered corroſive ſublimate, or the ſublimate ſolution (Sect. II. page 16.) may be ſprinkled upon theſe productions. Some of the ſmall, and branches of the large ones, might alſo be put into ſpirits, and the parts of them thereby preſerved much more diſtinct, which would ſerve greatly to illuſtrate their natural hiſtory *.

* Though the author agrees with the ingenious J. Ellis, Eſq; in the propriety of ranking corals, corallines, &c. among the animal kingdom, he has placed them under this ſection, as they are uſually thought to be vegetable productions.

SECT.

SECT. IV.

Method of analyzing MEDICINAL WATERS.

AS many ſprings contain a volatile principle, ſoon liable to be diſſipated, it is neceſſary to make our experiments on the ſpot, in order to diſcover the contens of ſuch waters. Various as theſe contents may at firſt appear, the apparatus proper to detect all of them may be reduced into a very ſmall compaſs.

When we purpoſe to examine any medicinal ſpring, the ſoil and face of the country ſhould be conſidered, the ſtony or mineral appearance, and particularly whether there are any mineral veins; the degree of heat of the water ſhould be aſcertained by a thermometer, and its comparative weight to other ſprings in the neighbourhood alſo carefully obſerved; after which we may enter on our experiments.

I. AERIAL MATTERS.

1. Mephitic, fixable, or fixed *air*, is heavier than common, or vital air, and frequently mixed with water; by which union, common water is capable of diſſolving iron, and thereby forming a chalybeate ſpring, as in Pyrmont, Spa, and many other celebrated mineral waters.

This mephitic air is detected by lime-water, the former precipitating the calcareous earth of the latter in a white powder. To diſcover the quantity of this aërial matter, a bottle filled with the mineral water, ſhould be tied over the mouth with a looſe bladder: the bottle is then to be placed in boiling water, the heat whereof will extricate the mephitic air, which riſing into the bladder, may be collected by tying the bladder cloſe to the neck of the bottle, and afterwards meaſured by a proportionable bulk of water. (See Sect. V.)

II. SALINE BODIES.

1. AN acid is ſometimes found in the compoſition of mineral waters, which is always the vitriolic.

a. In

a. In its fixed ſtate, which is ſuppoſed to be ſeparated from pyrites: this is however very rare, and probably never occurs, as it cannot remain long in this ſtate, without being neutralized by earths, ſalts, or metals.

Many of thoſe ſprings called acidulæ, received this name from the mephitic air we have already mentioned. If this acid be preſent, it may be diſcovered by an infuſion or ſyrup of violets, or by an infuſion of lacmus, or archil *, which are turned of a brighter or reddiſh colour by it. This acid may be detected alſo by a ſolution of lead in the nitrous acid; the ſolution ſhould be fully ſaturated. The nitrous acid uniting with calcareous earth, or foſſil alkali, falls in a white ſediment, while the vitriolic acid combines with the lead.

b. In its volatile ſulphureous ſtate. (See page 32.)

2. An ALKALI is alſo very ſeldom found in water in its proper ſtate.

a. When a *foſſil alkali* is preſent, it is more nicely detected by the ſyrup of violets, or infuſion of lacmus, than the former, theſe being turned green by the leaſt portion of alkali. If a conſiderable quantity of alkali were combined with

* This is ſo nice a teſt, that even mephitic air is apt to give it rather a brighter colour.

the

the water, it might be precipitated by a folution of calcareous earth, or by acids.

b. A *volatile alkali* may be diftinguifhed by a folution of corrofive fublimate mercury in water, or in the nitrous acid; the alkali rendering the folution white, a precipitation of a white powder enfues, but no change is produced, when the alkali is the fixed or foffil; or if any, the mercury will be precipitated in an orange, brown, or reddifh powder; where there is a confiderable quantity of the volatile alkali, the water turns blue by the addition of copper. When this alkali is in a very fmall proportion, fome of the water fhould be diftilled over.

3. Neutral salts are frequently found in medicinal waters.

a. Glauber's salt, compounded of vitriolic acid, and fixed foffil alkali, fpirit of wine added to a folution of this falt, precipitates it in a white powder; but no change is produced by the addition of any alkaline falt.

b. Epsom salt, formed of the fame acid, and the earth of magnefia, is often a compofition in purging waters. Any alkaline falt, either fixed or volatile, turns this water milky or curdly; the alkaline falt uniting with the vitriolic acid, precipitates the earth of magnefia.

c. Nitre, is compofed of the nitrous acid, and fixed alkali. Water containing this falt fhould

be

be evaporated, and the nitre remaining may be known by deflagration, or by its making a crackling noife over the fire. When the nitrous acid is combined with calcareous earth inftead of the fixed alkali, the earth may be precipitated by the addition of this alkali.

d. COMMON SALT, confifting of the muriatic acid, and foffil alkaline falt. The acid of this falt is nicely detected by a folution of filver in the nitrous acid; the muriatic acid, having a nearer affinity with filver than the nitrous, unites with the filver, which falls down in a white fediment, while the nitrous acid joins with the alkali of the common falt. It is proper to have a redundancy of the nitrous acid in the folution of filver, left the filver be precipitated by a calcareous earth, which may be in the water.

III. EARTHY SUBSTANCES.

a. CALCAREOUS EARTH, or calcined LIME-STONE, is found in moft wells and medicinal fprings; the prefence of which is beft difcovered by a folution of lead in the nitrous acid. This acid fhould be faturated with as much lead as it will diffolve, left the fuperfluous acid fhould faturate the earth, and prevent the precipitation of the lead. If there be any calcareous earth in the water, this folution turns it milky, and after

fome

ſome time a white powder is depoſited, the calcareous earth precipitating the lead, by uniting with the nitrous acid.

b. If calcareous earth be ſuſpended in water by combination with the vitriolic acid, gypſum, or ſelenites is formed, which may be diſcovered by the addition of alkaline ſalt to this compound; the mixture ſhould be warmed a little, to promote the precipitation of the ſelenitic earth.

c. The ſame acid united with argillaceous earth, or earth of alum, produces an aluminous auſtere compoſition; and the earth may be precipitated alſo by alkaline ſalt, which uniting with the vitriolic acid, allows the earth to fall down in a ſediment.

IV. SULPHUREOUS.

Sulphur may be ſuſpended in its proper form, though it is not ſoluble in this ſtate; but when the principle of inflammability in ſulphur is combined with calcareous earth, or any alkali, in the form of an hepar ſulphuris, it readily diſſolves; in which caſe the water ſmells diſagreeably, like the ſcourings of a gun, or putrid eggs. It is diſtinguiſhed alſo by a ſolution of ſaccharum ſaturni (ſugar of lead) in the nitrous or vegetable acids; a little of this ſolution being

marked

marked in lines on paper, and the paper suspended over the water, the volatile sulphureous fumes rising from the water turn these lines of a brown or dark colour; the inflammable matter of the sulphur uniting with the lead in the solution of the saccharum saturni, partly revives the metal, and hence produces that dark colour. (See Sect. V. page 39, 40.)

V. BITUMINOUS BODIES.

Bitumen frequently runs from amongst rocks, whence it is called petroleum; it is also common in the bowels of the earth, as hath been often fatally experienced from those bituminous vapours called fire-damps, which prove inflammable, and therefore different from mephitic air, the latter extinguishing fire. Whether this inflammable vapour is formed of the principle of inflammability of sulphur and the vitriolic acid in a volatile state, is not so well ascertained as the remarkable effects produced by these bituminous bodies in the mountains of Ætna, Vesuvius, and many others mentioned in history.

Liquid bitumen, naptha, or petroleum, is never found combined with water, but floats on its surface in a manner evident to the eye, and particularly may be distinguished by taste and smell.

VI. METALLIC SUBSTANCES.

a. IRON is a common ingredient in mineral waters, whence they are called chalybeate. The general method of diſtinguiſhing this metal, is by an infuſion or powder of galls, which turns water containing iron of a purple or black colour, deeper in proportion to the quantity of iron preſent.

But the moſt accurate method, is by means of the Pruſſian alkali *; fully ſaturated with the inflammable matter of the dried blood. This alkali mixed with a chalybeate water turns the latter immediately blue, and depoſits the iron in a powder of the ſame colour.

b. COPPER in water is precipitated in a red powder by the ſame alkali.

c. ZINC is precipitated in a white powder by the Pruſſian alkali. Although this alkali precipitates all the metallic ſubſtances from acids, ſo that they may be diſtinguiſhed from one another, it does not any of the earths.

d. ARSENIC has been ſuſpected in ſome mineral ſprings, but I am acquainted with no proof of it.

* The Pruſſian alkali is made of equal quantities of dried ox-blood, and fixed alkali. Theſe are to be burnt together in a crucible, and the aſhes diſſolved in a ſufficient quantity of water, when we enter on our experiments.

it. However, it may poffibly happen that water running through arfenical veins, may carry off a quantity of arfenic. To difcover this, the water fhould be evaporated, and the refiduum may be placed on a hot bar of iron, and if there be any arfenic, it is known by emitting a ftrong garlick fmell; or this refiduum may be moiftened with oil, and put between two bright plates of copper, which, when heated, are turned of a white colour, if any arfenic be prefent; but the fmell generally affords a fufficient teft.

SECT. V.

Experiments on the CONTENTS *of the* AIR.

NOTHING is more evident than that our atmoſphere abounds with a great variety of ſubſtances, if we conſider the various exhalations conſtantly taking place from all vegetables; in prodigious quantities from all animal bodies; and the great variety of foſſil matters that are inceſſantly riſing in the atmoſphere.

To inveſtigate the nature of all theſe is impoſſible; in very few caſes can we find the exhalation of one kind only; and many of them are of little conſequence; for if we conſider the quantity that is conſtantly exhaling, and the powers many of them might have in acting upon the human body, we ſhould expect the effects to appear every moment to a conſiderable degree, which we find very far from being the caſe: there are certainly ſome means by which they are obviated: theſe exhalations are no doubt more or leſs diffuſed into the higher regions of the air; and probably alſo, from their mixture with one another,

ther, the moſt active come to be neutral and innocent. It is in few inſtances that the exhalations are not expoſed to the means of mixture; and it is but ſeldom, comparatively, that effects are produced upon human bodies, although in a particular manner immerſed in this vitiated atmoſphere.

There are, however, ſome impregnations in the atmoſphere, which daily experience ſhews have conſiderable influence on our bodies; for though they may not ſenſibly affect the more robuſt and ſtrong, they certainly do the weak and delicate. With a view to inveſtigate them more particularly, the following experiments were made in the beginning of Auguſt, in the year 1769.

For ſome preceding weeks the air had been generally warm and dry, and moſtly free from wind; the evening on which I began to condenſe the atmoſpherical moiſture was calm, and clos'd a fine warm day; the place where this moiſture was collected, was in a court about the centre of Gracechurch-ſtreet.

I procured a large glaſs globe perfectly clean on the outſide, into which I put a quantity of ice and ſal ammoniac powdered; the globe thus prepared, was ſuſpended in the air about five yards from the ſurface of the ground; the cold produced by the ice and neutral ſalt congealed the moiſture of the air on the external ſurface of the globe in the form of ice. This condenſed body was careſfully ſcraped off with a ſilver ſpatula, and received into a wide-mouthed bottle well rinced: when I had collected in this manner ſome ounces of condenſed matter, I proceeded on the following experiments.

EXPERIMENT I.

TO know if it contained any fixable or mephitic air, I put one ounce of the condenſed moiſture into a vial, the cork of which was perforated through the whole length, to admit the extricated air to paſs through: over the cork was tied a looſe bladder free from any air; I then placed the vial thus prepared, in boiling water; the heat of the water extricating the fixable air from the condenſed moiſture, it eſcaped through the perforation of the cork into the bladder, where it was collected; the quantity of this air occupied a ſpace, which of ſimple diſtilled water was equal in bulk to $1\frac{1}{2}$ drachm. The vial, upon weighing it after the ſeparation of the air, was reduced a few grains lighter.

To be more certain that a great part of this extricated air was fixable, or mephitic, I applied it to lime-water; a precipitation of calcareous earth enſued, which convinced me of the preſence of mephitic air. (See Sect. IV. page 28.)

EXPE-

EXPERIMENT II.

I TOOK a quantity of the condenſed atmoſpherical moiſture, which had not been expoſed to heat; with this I mixed ſome ſyrup of violets diluted; the ſyrup evidently became of a greener colour; which perſuaded me that no acid, but an alkali, predominated. (See Sect. IV. page 28.)

EXPERIMENT III.

BY mixing the condenſed moiſture with a ſolution of corroſive ſublimate mercury, the mixture became of a pale white, which proved the alkali to be volatile; for with a fixed alkali, no change could have been produced; or, if any, the mercury would have been precipitated in a brown or reddiſh powder, called *mercurius precipitatus fuſcus Wortzii.* (See Sect. IV. page 22, 23.)

EXPERIMENT IV.

A PIECE of paper marked with a ſolution of lead in diſtilled vinegar, was ſuſpended over a quantity of the condenſed moiſture, while in a ſtate of evaporation; but no change taking place in the lines marked on the paper, I concluded no ſulphur or inflammable matter was detached. (See Sect. IV. page 30.)

EXPERIMENT V.

THE condenſed moiſture evaporated to dryneſs, yielded a browniſh ſaline body, which from ſome experiments (ſee Sect. IV. and VI.) appeared to be chiefly a compound ſalt of the vitriolic acid and volatile alkali, forming ſal vitriolatum ammoniacum; this I procured in the proportion of about 1½ grain, in two ounces of the moiſture.

From what appears to be the contents of the city air, as above related, many particulars obviouſly reſult, which afford ſome inlight into the nature and cauſe of the different diſeaſes in the city from thoſe without. There is reaſon to preſume, that putrid effluvia are noxious to animal bodies; they may very often introduce a ferment into a ſubject diſpoſed to the putrifactive fermentation, and hence have a tendency to promote diſeaſes which ariſe from a putrid diatheſis.

Probably the effluvia of perſpiration, when accumulated in more confined places, as in goals, hoſpitals,

hoſpitals, and large cities, are liable to a further degree of putrifaction, and to be converted into peculiar miaſmata, which we very well know produce diſeaſes of this kind, as in caſes of goal fevers.

There appears from Experiment I. another material circumſtance, which, until very lately, we were unacquainted with; we find that in all fermentations, a mephitic air is detached, which has frequently proved a certain, and ſometimes ſudden poiſon to animals; it is therefore reaſonable to ſuppoſe, if taken in very largely, without proving a poiſon, that it may produce diſeaſes of very dangerous tendency, and particularly of a putrid kind. The ſame mephitic, or fixed air, ariſes from numberleſs and various ſources; it is exhaled from the earth; it riſes certainly from all breathing animals, probably from all burning bodies, and ſeemingly in a peculiar manner from the putrifactive fermentation.

SECT. VI.

Directions for collecting and distinguishing Fossil Substances, including Earths, Stones, Salts, Inflammables, Minerals, and Metals.

TO write particularly upon these objects of natural history, is not the present design: a few general instructions may be sufficient to direct a traveller in the choice of such fossil bodies as he may meet with. Wallerius, Woodward, Cronstadt, Linnæus, and Da Costa, may supply a more inquisitive enquirer with the most extensive information.

Many are discouraged from pursuing this part of natural history, owing to the great variety of objects it comprehends, and the numerous properties by which they are distinguished. But these when attended to, appear much less complicated, and capable of being reduced to a few simple heads; simple in their nature, and uniform in their composition; all new combinations producing chiefly a change only in form, colour, and consistence.

I. EARTHS and CALCAREOUS STONES.

A. CLAYS are ſoft earths; mixed with a quantity of water they form a ductile paſte; when burnt, they become hard and ſolid.

Theſe are various in their conſiſtence and colour, owing to their mixture with other bodies. Some, containing calcareous ſubſtances, effervefce with acids, which they do not when pure; and their variety in colour is owing to the addition of iron, or ſome inflammable matter, which may be ſeparated by waſhing and by heat.

a. Pipe-clay is of a ſoft unctuous nature, not gritty to the teeth. Here may be included the porcelane clay of which China ware is compoſed.

b. Boles, Tripoli, Terra Sigillata, Lemnos, and brick clay, are all different kinds of clay, more or leſs pure, in proportion to the mixture of other bodies they contain.

B. CALCAREOUS BODIES efferveſce with, and are diſſolved by acids; by burning they are converted into lime.

a. They appear under many different forms, and are found in ſtrata in the bowels of the earth, and frequently in large beds, as lime-ſtone,

 marble,

marble, &c. When lime-ſtone is of a brighter colour, it is called marble, diſtinguiſhed by authors into many varieties, ſome of the fineſt of which are met with in Greece, Egypt, and Italy.

b. Free-ſtone is generally calcareous, and cuts in all directions, of a concreted granulated ſtructure; found in large beds in the bowels of the earth, as Portland ſtone, &c.

C. SPARS are calcareous bodies, found in mines, attendant on ores, &c. when pure, of a glaſſy appearance, and often cryſtalized into polygonal figures.

a. Found alſo in the rents or veins of rocky matter, under a variety of forms, called calcareous ſpar, having a rhomboidal figure, without any acute or right angles. In ſome veins this ſpar is found very tranſparent, and is then called Iceland-cryſtal. When theſe veins are not entirely filled up with ſpar, there are cryſtals found in them of a cubical, pyramidal, and columnar form.

b. In caverns under ground in a diverſified form, ſometimes reſembling icicles, occaſioned by water containing earthy and ſtony matters diſtilling down theſe caves, and depoſiting the earth, &c. in theſe forms. Incruſtations likewiſe are included here; the ſtony ſubſtances ſuſpended

ſuſpended by the water being depoſited upon moſſes, roots, and branches of plants.

D. GYPSA * are firm concretions, eaſily ſcraped with a knife, do not effervesſce with acids, fall into a white powder in the fire, and concrete again with water into a maſs, which ſoon hardens, called plaſter, or ſtucco.

a. Sometimes diſpoſed in little grains, reſembling Epſom ſalt, or ſugar cryſtals. When gypſa are of a fine texture, and indurated ſo as to bear a poliſh, they are called alabaſters.

b. Of a fibrous texture, the fibres running parallel to one another, called fibraria.

c. Compoſed of thin clear tranſparent plates, eaſily to be ſplit, and flexible, by ſome called glacies mariæ, and improperly Muſcovy talc.

d. In the form of cryſtals; columnar, reſembling nitre; rhomboidal, *&c.* called ſelenites.

e. Gypſeous powder is alſo found ſuſpended in ſome ſprings, whence the water is uſually ſaid to be hard: this is procured by evaporating the water. (See Sect. IV. page 32.)

* Gypſeous bodies are not calcareous, though they are here placed under that head, after moſt writers. They are more properly neutrals, being neither vitrifiable nor refractory.

2. VITRIFIABLE BODIES.

THESE ſtrike fire with ſteel, and ſcratch glaſs. They do not efferveſce with acids: the file alſo makes no impreſſion on them. By heat they vitrify, or become glaſſy.

A. FLINTY BODIES are found plentifully in ſtrata of ſand and chalk. The dark colour of black flints is owing to the inflammable matter they contain, for on burning they become white.

a. Stony ſtrata of a quartzoſe baſis, and the various kinds of granites belong to this head.

b. Whin-ſtone contains the quartzoſe baſis mixed with iron. This kind of ſtone is now uſed for paving the ſtreets of London. Sometimes it is found in a cryſtallized form, as in the Giant's Cauſeway in Ireland, and at Arthur's Seat near Edinburgh.

c. In gravel or pebbles, containing a proportion of ſand, diſtinguiſhed from the places where they are found, as the Egyptian, Scotch, *&c.* The finer ſort of them are known by different names, as agate, chalcedony, onyx, cats-eye, *&c.*

d. Cornelians,

d. Cornelians, and Mocha ſtones which are diverſified in their ſurfaces like trees and moſſes, are a purer kind of flinty ſubſtances. The jaſper likewiſe is included amongſt the flints.

e. Porphyry, wherein the flinty matter is ſo diffuſed as to render this ſubſtance opaque, is variegated like marble, but does not efferveſce with acids.

B. CHRYSTALS are bodies of angular or polygonal figures, pellucid, bright, reſembling glaſs.

a. Found in fiſſures of rocky ſtrata, and in the centre of pebbles. Theſe have a ſhort column conſiſting of ſix ſides, terminated with a pyramid.

b. Corniſh diamonds, Briſtol ſtones, *&c.* are alſo cryſtals, which are more or leſs valuable, according to their hardneſs, clearneſs, briliancy, *&c.*

C. GEMS are chryſtals of various colours, uſually found in ſmall bodies, hard, bright, and radiant, as the diamond, ruby, ſapphire, topaz, beryl, emerald, garnet, hyacinth, chryſolite, amethyſt, *&c.* Many of theſe are probably to be found in rocky ſtrata, and in the broken ſides of mountains both in England and Scotland, as well as in other parts of Europe.

3. APYRI,

3. APYRI, or REFRACTORY SUBSTANCES.

THESE do not ſtrike with flint, or effer-veſce with acids; they are not changed by fire, nor are they ſoluble in water.

A. TALCS are bodies which cohere ſlightly toge-ther, ſlippery to the touch, and ſo ſoft as to be eaſily ſcraped with a knife.

a. They are ſeldom found in large ſtrata, but are generally mixed with other bodies, as metallic ores, black lead, ſlate, whin-ſtone, *&c.*

b. Steatites, or ſoap-rock, feels like ſoap or tal-low, is generally of a light, yellowiſh, or pale brown colour.

c. Serpentine ſtone differs from the preceding, in containing a quantity of iron in it, and is uſually found in ſtrata like marble.

B. MICÆ, or GLIMMERS, have a ſcaly texture, the plates moſtly running horizontally parallel, eaſily ſeparable. They are found of various colours.

a. Reſembling the Moſcovy glaſs, or glacies mariæ

b. Sometimes found in thick maſſes, of a dark, red, or grey colour, reſembling metallic ſubſtances.

C. ASBESTOS and AMIANTHUS, are bodies likewise unaffected by the fire. The former is the most flexible, and may be wove with the addition of hemp or lint into cloth, capable of enduring the greatest heat; the lint is indeed consumed, but the asbestos remains unchanged. Formerly dead bodies were wrapped in this kind of cloth, when they were thrown upon funeral piles, to prevent their ashes mixing with the common ashes.

Amianthus is of a similar nature, and has the same property of resisting the force of the fire. These bodies are of various colours, white, green, yellow, brown, *&c.*

II. SALTS.

SALTS are fusible or volatile in fire; soluble in water, and sapid.

1. The simple salts are either alkaline or acid *.

A. ALKALINE SALTS turn the syrup of violets, or an infusion of purple flowers of a green colour, and effervesce with acid salts.

* Some of these salts are not native productions; but as an acquaintance with these substances may prove an introduction to the knowledge of many useful chemical facts, a more general account is here given of them.

a. Foſſil alkali, ſo called from its being found in the earth, in large ſtrata, but in a compound ſtate. It is alſo in ſea ſalt, and may be procured from the aſhes of ſea weeds by burning. This ſalt is the *natrum* of the ancients.

b. Vegetable alkali, procured chiefly from the aſhes of land vegetables, whence are produced pearl aſhes, pot aſhes, *&c.*

c. Volatile alkali is diſtinguiſhed from the other two by its volatility, as it evaporates by heat before it becomes fluid. It is procured from putrid ſubſtances, particularly animal, and alſo from ſome ſubterraneous fires, the urine of animals, all horny and bony ſubſtances, and plentifully from ſoot.

B. Mineral acid salts turn the ſyrup of violets, or an infuſion of purple flowers of a red colour; they efferveſce with alkaline ſalts, and are only obtained in a fluid ſtate.

a. Vitriolic acid, or oil of vitriol, ſo called from vitriol or copperas, which contains this acid united with iron; is heavier than water, and colourleſs when pure. With the principle of inflammability it forms ſulphur, from whence this acid is chiefly procured.

b. Nitrous acid, or aqua fortis, is of an orange tawney colour. Expoſed to the air, it emits fumes of a fiery colour.

c. Muriatic acid, or ſpirit of ſea ſalt, is a colourleſs tranſparent fluid. Expoſed to the air, its fumes are white.

C. Beſides theſe, we may enumerate,

a. Vinegar, or the acetous acid, which has the general properties of acid ſalts.

b. Tartar is a dry ſaline ſubſtance, neither fuſible nor volatile; ſuffers no change from heat under the boiling point, or 212°. It does not readily diſſolve in water, nor does it affect the ſyrup of violets ſo much as the preceding acids.

c. Sedative ſalt has the properties of ſalts in general. We are in great meaſure ignorant of its origin. It is chiefly procured from borax, a ſubſtance that is brought from the Eaſt-Indies. Sedative ſalt is generally got in a cryſtallized form, reſembling ſnow, or bruiſed ſperma ceti.

2. Compound salts, or ſuch as conſiſt of an acid united with an alkaline ſalt, having the properties of ſalts in general. There are eighteen of theſe ſalts, which are enumerated in the following table.

	Vitriolic acid.	Nitrous acid.	Muriatic acid.	Vinegar.	Tartar.	Sedative falt.
Foffil alkali.	Glauber's falt.	Cubic nitre.	Common falt.		Rochelle falt.	Borax.
Vegetable alkali.	Vitriol-ated tartar.	Nitre.	Digeftive falt.	Regene-rated tartar.	Tartarifed tartar.	
Volatile alkali.	Vitriolat. ammoni-ac.	Nitrous ammoni-ac.	Sal am-moniac.	Vegetable ammoni-ac.		

In this table the acids and alkalies point refpectively to the falts which they compofe. Thus the nitrous compound falts are placed in the fecond column, under the nitrous acid; and on the left fide the particular alkali, with which each compound falt is combined, and fo on of all the others.

Thefe neutral or compound falts may be decompofed by the addition of an acid or alkaline falt; and their attractions are in proportion to the order fet down in the table: thus if we want to feparate a volatile alkali from an acid, either of the fixed alkalies will anfwer. There is no line drawn between the foffil and vegetable alkalies, becaufe their powers of attraction are nearly the fame. The acid falts are likewife placed in the fame order of attraction; the firft column or vitriolic acid, feparates the fecond or nitrous acid;

acid; and this the third or muriatic acid, and ſo on of all the reſt.

III. INFLAMMABLES.

THESE are not malleable or ductile; ſoluble in oils; and flame.

A. SULPHUR is found in all ores, except thoſe of tin, biſmuth, and cobalt. It is plentiful in ſtrata of coal, and is always diſcoverable from the ſmell it emits.

a. Mineraliſed with iron, it is called iron pyrites, marcaſite, or copperas ſtone, of pale, grey, and yellow colours, and ſtrikes fire with flint.

b. Mineraliſed with copper, the pyrites is of a ſparkling green colour, or of various hues like a rainbow, and does not ſtrike fire.

c. United with earths, clays, and ſtones, ſometimes in regular cryſtalliſed figures; or in round or ſquare maſſes.

B. BITUMENS are either fluid or ſolid. Liquid bitumen iſſues out from crevices in mines, and takes fire by a candle; from this property it is known to miners by the name of fire-damp.

c. NAPHTHA is a bituminous fluid, found floating on the ſurface of ſome waters, particularly in Perſia, from whence it is chiefly procured.

b. PETROLEUM

b. PETROLEUM is thicker than the former, ouzes out of the crevices of rocks, whence it receives its name. It is frequent in Bavaria, Sicily, and France.

c. Pix judaica, or aſphaltum, is of the ſame nature, but hard.

d. Amber, and ambergris, are inflammable bodies, ſimilar to the foregoing. The former is found principally in Pruſſia. Ambergris is met with in the greateſt quantities in the Eaſt Indies, at Madagaſcar, Mauritius, Borneo, the Molucca iſlands, and on the Egyptian coaſt.

e. Jet and foſſil coal are nearly alike. The latter is ſufficiently known.

IV. MINERALS.

THERE are fourteen metallic bodies at preſent known, gold, ſilver, copper, iron, tin, lead, quickſilver, platina, antimony, zinc, biſmuth, arſenic, cobalt, and nickel. The ſix latter are brittle, diſtinguiſhed by the name of ſemi-metals.

A. GOLD when pure is not ſonorous, nineteen times heavier than water, ſoluble in aqua regia, but not in the nitrous acid.

a. It

a. It is moſt frequently found pure, in its metallic ſtate, in thin plates, ſolid, cryſtalliſed, or in a powder, called waſh-gold, or gold duſt.

b. It is found in quartz, and ſometimes in marcaſite, and alſo mineraliſed with iron, quickſilver, and a mixture of zinc and iron.

The largeſt quantities of gold are brought from the Brazils and the Spaniſh Weſt Indies. This metal is found alſo in Hungary, Tranſylvania, and in many other parts of Europe, in red, yellow, black, or iron-coloured ſands. It is met with likewiſe in ſome rivers, as the Tagus, Ganges, Rhine, Saale, Niger, Danube, *&c.* called river, or waſh-gold.

B. Silver, when pure, is eleven times heavier than water, ſoluble in the nitrous acid, but not in aqua regia.

a. It is often found native or pure, generally of about ſixteen carats ſtandard.

b. Minera argenti vitrea, or glaſs ſilver ore, of a dark colour like lead ore, is ductile, and contains ſulphur.

c. Minera argenti cornea, reſembling reſin in colour, and containing arſenic.

d. Minera argenti rubra, a brittle red-coloured ore, containing arſenic and ſulphur.

e. Minera argenti alba, combined with arſenic, and containing more copper than ſilver, of a

light

light grey colour, and of a dull ſteel-grained texture.

f. United with arſenic and regulus of cobalt, of different colours, brown and dark blue.

g. Mixed with lead ore, ſometimes in a white cryſtalliſed form.

Silver is found in all countries, but moſt plentifully in America, particularly in Peru and Potoſi.

C. COPPER, when pure, is near nine times heavier than water, the moſt ſonorous of all metals, diſſolves in all the acids. The leaſt quantity of this metal in ſolution, turns blue by the addition of volatile alkali. The vitriol of copper is of a deep blue colour, called blue, or Roman vitriol.

a. Copper is found native in a ſolid or granulated ſtate, but more frequently in the ſtate of ore, of which there are various kinds, which may be included under the following heads:

b. Conſiſting of the pure calx of the metal, ſometimes with a little iron, which comprehends the minera cupri vitrea, and the minera cupri viridis, of a green or blue colour.

c. Combined with arſenic or ſulphur. This is ſofter, and more common than the former. It appears of a red, brown, duſky, or grey colour. Sometimes blended with quartz, flinty ſtone, *&c.* Theſe (b and c) are rich ores of this metal.

d. Containing

d. Containing more iron than copper, yet sufficient of the latter to be wrought for it. This kind, called copper pyrites, is generally of a yellow colour resembling marcasite, or sulphur pyrites, but is of a richer yellow than the iron or sulphur pyrites. It is also softer, and does not strike fire with flint like the iron pyrites. When broke, it shews the rainbow colours.

Copper ores are found in most countries, particularly in Sweden, Hungary, and Transylvania. Japan also affords a fine sort of copper.

D. Iron is about eight times heavier than water, is attracted by one of its ores called the loadstone. Its solution is turned of a black or dark purple colour, by galls and vegetable astringents. The vitriol of this metal is green, called green vitriol, or copperas. (See Sect. IV. page 34.)

a. Iron is sometimes, though very rarely, found in its pure state. The ore of the metal is found all over the world, most generally of a dusky brown colour. The purer ores are generally pale and yellowish, with white sparkling appearances.

b. In most clays and ochres, and may be extracted from the ashes of most animal and vegetable substances, and collected by the magnet.

c. Indurated amongst some fossils, in the state of ruddle, blood-stone, &c. of blue, red, and brown colours. Emery is also an ore of this metal;

but one of the moſt remarkable of its ores is the load-ſtone.

d. Iron is found in countries abounding with coal, called iron ſtone, in which ſtate it is of a light brown colour, and on calcination becomes of a deep purple colour.

e. The ores of ſome other metals contain iron; the copper ores uſually contain more iron than copper.

E. TIN is a ſilver-coloured metal, ſeven times heavier than water, does not vitrify like lead, is malleable and unſonorous.

a. Cryſtalliſed tin ore, or grain tin, found in cryſtalline maſſes, commonly of a poliſhed ſurface, of a blackiſh brown colour.

b. Cryſtalline concretions, reſembling the foregoing, but of a lighter colour, and more unctuous on the ſurface; ſometimes in a cubic form.

c. Tin-ſtone, intermixed with a large proportion of ſtony and other mineral matters.

d. Mineraliſed with iron; and alſo with ſulphur and iron, called black-lead.

Tin is found in England, Bohemia, Saxony, and in Malacca in the Eaſt Indies.

F. LEAD is above eleven times heavier than water, unſonorous, malleable, and very fuſible. It gives a ſweet taſte in ſolution.

a. Galena

a. Galena plumbi, or potter's lead ore, is a rich ore of lead, composed of flat planes, with cubic angles.

b. Steel-grained ore, is also a rich lead ore, containing silver.

c. Antimoniated lead ore, containing antimony, and having irregular striæ, or radiated lines, like that semi-metal.

d. Lead is often found mixed amongst calcareous earth; and likewise in some veins in the earth where cavities are formed, in white or yellow crystals.

G. QUICKSILVER, or MERCURY, is a fluid metallic substance, fourteen times heavier than water, easily divisible, and evaporates in a heat below ignition, or before it becomes red hot.

a. Sometimes it is found in a pure state, called virgin mercury, but this happens very rarely.

b. It is chiefly procured in an ore united with sulphur, called cinnabar, of a red colour, and brittle.

c. Combined with sulphur and copper, of a dark grey colour, and brittle glassy texture.

Cinnabar is found in Hungary, Transylvania, Carinthia, Bohemia, the Palatinate, France, Spain, Sweden, and probably in the East Indies and Japan.

H. PLATINA, PLATA SILVER, or PLATINA DE PINTO, introduced into England in the year 1749. Is eighteen times heavier than water, difficult of fusion, and hardens most metals on mixture, resembles silver in colour. This metal is said to be found in the gold mines of the Spanish West Indies. [Vide Lewis's Philosophical Commerce of Arts.]

I. ANTIMONY is the metallic mineral, and the metal separated is called regulus of antimony, which is a semi-metal of a silver colour, consisting of brittle shining planes.

a. Native, pure, or regulus of antimony.

b. Mineralised with sulphur, arsenic, and most metals, generally of a radiated, crystallised, or steel-grained texture; silver-coloured, red, brown, or dusky.

It is found in Bohemia, Saxony, Transylvania, Hungary, France, and other parts of Europe.

K. ZINC, OR SPELTRE, is a white semi-metal, inclining a little to blueish, seven times heavier than water, bears the stroke of the hammer longer than any other semi-metal; soon evaporates by heat. United with copper, it forms prince's metal, pinchbeck, and brass. The vitriol of this metal is white, called white copperas, or white vitriol.

a. Indurated in a cryſtalliſed ſolid form of a greyiſh colour. It is alſo frequently found half indurated with a martial ochre, called lapis calaminaris, of brown, yellow, and red colours.

b. Mineraliſed of various colours, as mock-lead, black-jack, or mock-ore, *&c.* Sometimes it is met with in a ſcaly texture.

Zinc is found at Goſlar in Germany, and at Holywell, and other places in England. It is alſo brought from the Eaſt Indies, in a pure ſtate, called tutenague.

L. BISMUTH, OR TIN-GLASS, is a ſemi-metal, of a white yellowiſh colour, and laminated texture; above ſeven times heavier than water, and very fuſible.

a. It is found plentifully in Saxony, and in leſs quantities in England, but it is ſcattered in arſenical ores very generally.

M. ARSENIC, wherever it is found, may be known by evaporation over the fire, as it gives forth a ſtrong garlick ſmell, very noxious in a large quantity. (See Sect. IV. page 35.)

a. Sometimes found pure, looſe, or indurated, of a pale or grey colour.

b. Mineraliſed with ſulphur, called yellow, or red orpiment. Sometimes it is united with ſilver, copper, or antimony. The richeſt ſilver ores abound with this ſemi-metal.

Arſenic

Arſenic is found principally in the Bohemian and Saxon mines; but the richeſt native orpiment is brought from Turkey and Natolia.

N. COBALT is a ſemi-metal of a whitiſh grey colour, fine grained texture, hard and brittle, about ſix times heavier than water; ſoluble in aqua regia, the vitriolic and nitrous acids, and the ſolution becomes red. After the diſſipation of the arſenic from cobalt, and by calcination, the blue glaſs called ſmalt is procured.

a. Cobalt is found united with earths, arſenic, iron, and other metals of various colours, black, grey, violet, blue, or aſh-coloured. Sometimes it looks like melted ſcoria, or glaſs of a blueiſh grey colour, called ſlag cobalt. Sometimes cryſtalliſed in cubical figures; frequently it is found in a looſe friable ochre.

It is found moſt plentifully in Saxony, particularly in the diſtrict of Miſnia; but it is alſo met with in many other parts of Europe.

O. NICKEL is a ſemi-metal, which was firſt diſcovered about the middle of the preſent century *; is about $8\frac{1}{2}$ times heavier than water,

* This metal was diſcovered by Cronſtedt. See the Royal Academy of Sciences at Stockholm, for the years 1751 and 1754.

of

of a coppery colour. It is found united with iron, arſenic, ſulphur, and particularly with cobalt and biſmuth. Its ſolution in the nitrous and muriatic acids is green. The vitriolic acid has little or no effect upon it.

In the preceding obſervations on foſſils, effervefcence with acids, and ſtriking fire with flint, have been often mentioned: it would be neceſſary, therefore, for a traveller in ſearch of foſſil ſubſtances, to have with him a bottle of aqua fortis, or the nitrous acid, and a ſteel, to diſcover thereby on the ſpot certain properties of ſuch bodies as may be collected. A hammer alſo may be neceſſary to break ſtones, &c. that are too bulky to bring away.

A blow-pipe is likewiſe an uſeful article; by blowing long and forcibly through ſuch an inſtrument, upon the flame of a candle, by which the point of the flame may be directed againſt the body to be examined, it will frequently diſcover, whether it is a calcareous, vitrifiable, or refractory ſubſtance; and for greater preciſion, experiments for the ſame end may be afterwards made at the fire-ſide, on a charcoal fire, &c.

The collector ſhould alſo attend to as many of the following particulars as poſſible.

1. When any article is collected, mark it by a number, or ſome ſign of diſtinction, referring to

a cataa catalogue, with all the particulars that may be known relative to it; as,

2. Where it was found.

3. In what quantity, whether ſcarce or abundant.

4. If on the ſurface of the earth, or at what depth.

5. In what poſition, whether horizontal, perpendicular, &c. And with what other foſſil bodies it was found, as clay, ſtone, ſlate, mineral, &c.

6. Whether in ſtrata, or in looſe nodules.

7. The depth and thickneſs of the ſtrata, how they incline, or to what points of the compaſs they tend; or if level or horizontal; whether they have perpendicular or horizontal fiſſures, and what foſſil bodies are contained in theſe fiſſures.

8. All high mountains and hills, eſpecially their ſides, are to be ſearched; the ſhores alſo of the ſea, with their banks, and the cliffs adjacent, and the falls of caſcades, rivers, and great gullies.

9. The ſituation of mines, pits, and quarries, whether in a valley or hill; and the diſpoſition of the ſtrata, whether horizontal, inclining, &c. their thickneſs, and the depth they lie, and what other foſſils are imbedded either in the ſtrata, or in the neighbouring caverns, fiſſures, partings, &c.

10. The

10. The waters of mines ſhould be examined, whether pure, taſteleſs, purgative, vitriolic, or chalybeate, *&c.*

11. The damps and ſteams of mines, and what are the conſequences or effects of them; in what ſeaſons and ſtate of the air they are chiefly obſerved; and what temperature the air bears in different depths of ſuch mines.

12. The account given by the natives, inhabitants, miners, workmen, *&c.* who may be acquainted with the ſubject.

SECT. VII.

Directions for taking off IMPRESSIONS *or* CASTS *from* MEDALS *and* COINS.

CHIEFLY owing to the coſt required for purchaſing a cabinet of medals, it has happened that the ſtudy of them has hitherto been confined, comparatively, to a few individuals. Another principal impediment to the cultivation of an acquaintance with them, has ariſen from the difficulty of underſtanding the inſcriptions, for want of a ſufficient knowledge of languages; on which account in particular, this ſtudy has been condemned by the illiterate as barren and uſeleſs; but ſuch as are acquainted with the advantages which have already reſulted from thoſe *nummi memoriales*, cannot heſitate a moment to aſſiſt a promotion of a more general purſuit of the ſubject *.

* Though the ſtudy of medals does not properly belong to natural hiſtory, this ſhort account of taking impreſſions from them, may prove acceptable to ſome travellers.

While

While Coloſſian ſtatues, and the hardeſt marbles, with their deepeſt inſcriptions, are deſtroyed by accidents, or by time, and paintings finiſhed with the higheſt colours quickly fade, a medal ſhall ſurvive innumerable accidents, and diſcloſe hiſtorical facts a thouſand years after ſtatues are crumbled away; and when nothing but the names of an Apelles, or a Praxiteles remain. Does not a ſingle medal, of which we are in poſſeſſion, give us greater light into hiſtory, than the once famous libraries of Alexandria and Pergamus, which are now no more? From theſe, and many other conſiderations, I would willingly contribute my endeavours to render this ſtudy more general, and conſequently more uſeful. I have tried a variety of methods to enable a young medaliſt to collect a cabinet, which may initiate him into the knowledge of medals and coins at a trifling expence.

The method of taking off plaſter of Paris and ſulphur impreſſions, is known to every body: the firſt is too ſoft to preſerve them from injury, and the brittleneſs of ſulphur is a greater objection.

I found by forming a coat or layer of thin metal over the plaſter of Paris, it would be a conſiderable defence. Tin is the cheapeſt and moſt convenient metal for the purpoſe, as it is ſufficiently flexible, and at the ſame time very much resembles ſilver. The tin-foil I have tried, is of the ſame kind with that uſed for ſilvering looking-glaſſes. It ſhould be laid over the medal or coin intended to be taken off, and then rubbed either with a bruſh, the point of a ſkewer, or a pin, till it has received perfectly the impreſſion of the medal; the tin-foil ſhould now be pared off round the edge of the medal, till it is brought to the ſame circumference: the medal muſt then be reverſed, and the tin-foil will drop off into a chip box or mould ready to receive it, the concave ſide of the foil, or that which is laid on the face of the medal, being uppermoſt; upon this pour plaſter of Paris made in the uſual manner, and when dry, the figure may be taken out of the box or mould, with the tin-foil ſticking on the plaſter, the convex-ſide being now uppermoſt again, in which poſition it is to be kept in the cabinet, after it becomes dry. To have an impreſſion very perfect, the thinneſt tin-foil ſhould be made uſe of*.

The impreſſions taken in the foregoing manner almoſt equal ſilver medals in beauty, and are very durable: if the box or mould † be rather

* This method does not in the leaſt injure any medal or coin.

† Chip boxes, uſed by apothecaries, anſwer this purpoſe, and may be eaſily procured. A ſlip of paper wrapped round any circular body with a flat ſurface, is equally convenient.

larger

larger than the impreſſion of tin-foil, the plaſter when poured on, runs round its edges, and forms a kind of white frame, or circular border round the foil, whence the new-made medal appears more neat and beautiful. If this tin-foil be gilt with gold-leaf, by means of thin iſinglaſs glue, or boiled linſeed oil, the medal will reſemble gold.

F I N I S.