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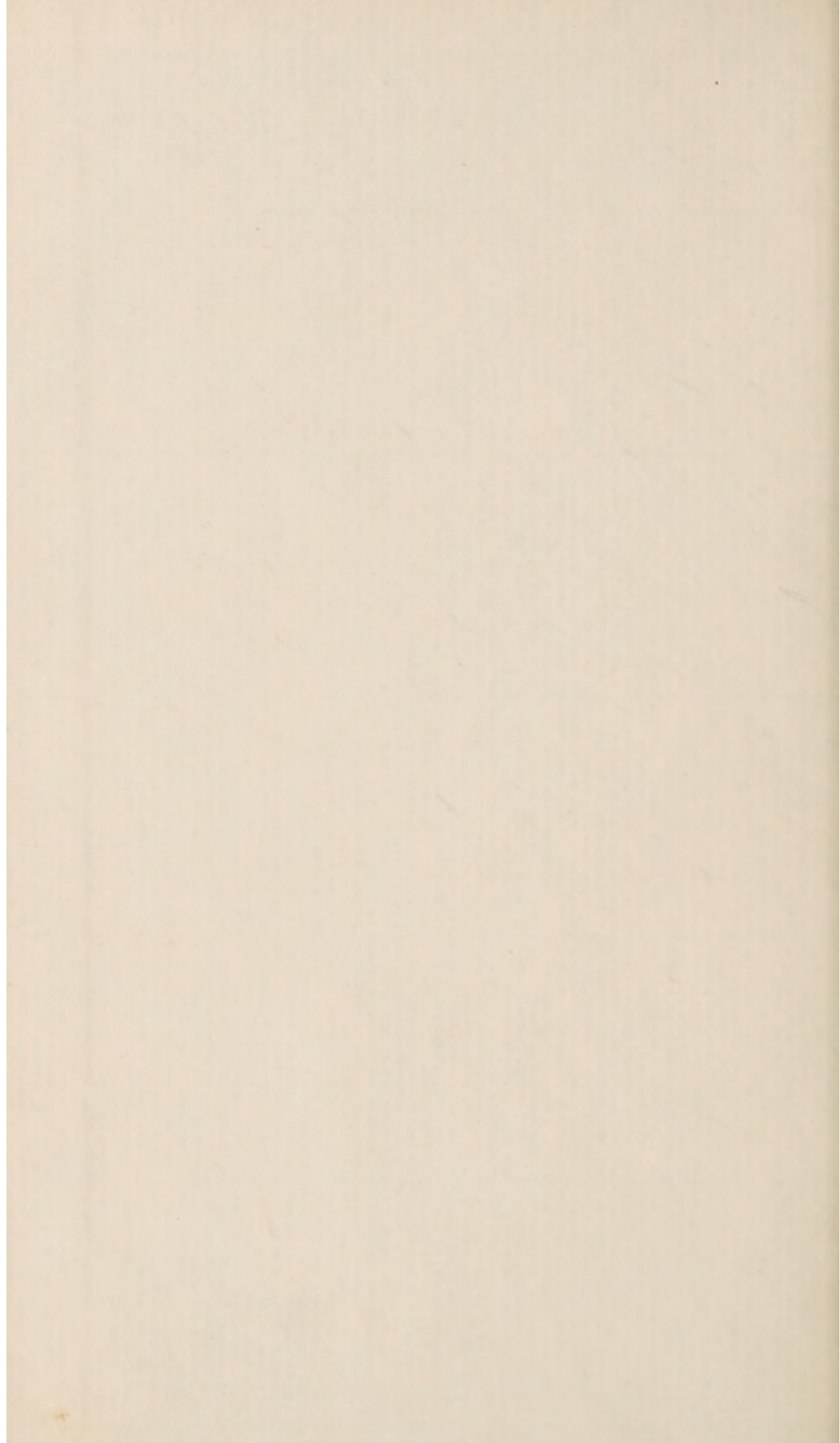
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Bernard In Several *Principles*
ESSAYS.

See BY *Doct.*
RICHARD MEAD, M. D. F. R. S.
And Physician to St. *Thomas's* Hospi-
tal.

1767.

The Third Edition.

DUBLIN:

Printed by S. POWELL, for JOHN WATSON,
Bookseller on the *Merchant's-key*, near the *Old-Bridge*.

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Mechanical Account

POISSON

in several

ESSAYS



RICHARD M. D. F. R. S.
And Physician to the Tower's Hospital

The Third Edition

DUBLIN

Printed by S. Powell, for John W. & Co.
Booksellers on the Strand, near the Old Bailey.
MDCCLXXIX



Principal THE *Books*
PREFACE.

TO give an exact and particular Account of the Nature and Manner of acting of Poisons, is no easie Matter; but to Discourse more intelligibly of them than Authors have hitherto done, not very difficult. One may without much Pains shew their Effects to be owing to something more than the bare Qualities of Heat or Cold; and discover the Foot-steps of Mechanism in those surprizing Phænomena which are commonly ascribed to some occult or unknown Principle. But to unravel the Springs of the several Motions upon which such Appearances do depend, and trace up all the Symptoms to their first Causes, requires some Art as well as Labour; and that both upon the account of the exquisite Fineness, and marvellous Composition, of the Animal Machine in which they are transacted, and of the Minuteness of those Bodies which have the force to induce in it such sudden and violent Alterations.

I have attempted somewhat this way in the following Essays; in which I do not promise Methodical, and finish'd Treatises, but only some short Hints of natural History, and rude Strokes of Reasoning; which, if put together, and rightly

The Preface.

ly improved, may perhaps serve to furnish out a more tolerable SPECIMEN of the DOCTRINE of POISONS, than has yet been Published.

The first Draught of this small Piece, I made some Years since, entertaining my self at leisure Hours, with Experiments on Vipers, and other venomous Creatures; examining now and then the texture of Arsenic, Mercury Sublimate, and the like Malignant Substances; turning over what Authors had said on the several Subjects, and making such Remarks as from time to time occur'd.

These continued Enquiries made up at last, three or four short Discourses; which, when I began to digest into order, the increase of Business contracted the Intervals of my spare time; and the Diversion of such Studies quickly giving way to the Severity of more necessary Labours, they were quite thrown by. Till talking not long since with Dr. Areskine, concerning the Viper, I took Occasion to review my scattered Papers, and confirm my Reasonings by new Experiments. He very readily offered me his Anatomical Observations; these I have put at the End of the first Essay; which do not promise a complete Dissection of the Animal, but chiefly shew the Make of those Parts which are concern'd in the Poison.

My Design, in thinking of these Matters, was, to try how far I could carry Mechanical Considerations in accounting for those Surprizing Changes, which Poisons make in an Animal Body; concluding (as I think, fairly) that if so abstruse Phænomena as these did come under the known Laws of Motion, it might very well be taken for granted, that the more obvious Appearances in the same Fabrick are owing to such Causes as are within the Reach of Geometrical Reasoning; and that therefore as the first Step towards the removal of a Disease is to know its Origin, so he is likely to be the best

The Preface.

best Physician, who having the same assistance of Observations and Histories with others, does best understand the Human Oeconomy, the Texture of the Parts, Motions of the Fluids, and the Power which other Bodies have to make Alterations in any of these.

Nor indeed ought any One to doubt of this, who considers that the Animal Compages is not an irregular Mass, and disorderly Jumble of Atoms, but the Contrivance of infinite Wisdom, and Master-piece of that Creating Power, who has been pleased to do all things by establish'd Laws and Rules, and that Harmony and Proportion should be the Beauty of all his Works.

It were therefore heartily to be wish'd, that those Gentlemen who are so much afraid of introducing Mathematical Studies, that is, Demonstration and Truth, into the Practice of Physick, were so far at least instructed in the necessary Disciplines, as to be able to pass a true Judgment, what Progress and Advances may be made this way; they would not then perhaps decry an Attempt of so much Moment to the welfare of Mankind, as vain and impossible, because it is difficult, and requires Application and Pains.

It is very evident, that all other Methods of improving Medicine have been found Ineffectual, by the Stand it has been at these two or three thousand Years; and that since of late Mathematicians have set themselves to the Study of it, Men do already begin to talk so Intelligibly and Comprehensibly, even about abstruse Matters, that it may be hop'd in a short time, if those who are design'd for this Profession, are early, while their Minds and Bodies are patient of Labour and Toil, initiated in the Knowledge of Numbers and Geometry, that Mathematical Learning will be the distinguishing Mark of a Physician from a Quack; and that he who wants this necessary Qualification, will be as ridiculous as one without Greek or Latin.

I have,

The Preface.

I have, as to what regards the Animal Oeconomy, referr'd as much as I could to the Works of Bellini, which have brought great Light into the dark Regions of Physick, and taught us to argue clearly and consistently, instead of amusing our selves with unintelligible Words, or precarious Hypotheses. The Dissertations of Dr. Pitcarne, who is the Honour of his Profession in Scotland, are a convincing Proof of the advantage of such a mechanical way of Reasoning; nor could Malice it self deny this, were not Ignorance in Confederacy with it, which will secure any One from being benefitted by the most useful Demonstrations.

Notwithstanding this, I have been forced now and then to make Digressions from my Subject, to clear some Doctrines necessary to be known which have not been explained by others. For indeed the Data from which we argue in these Matters are by many too few. Dr. Cheyne, the Author of the New Theory of Fevers, has enumerated several Particulars in which the Theoretic Part of Medicine still wants Improvement. If these Deficiencies were made good, we might with more Ease proceed in our Enquiries into human Nature, and should soon convince the World, that the most useful of Arts, if duly cultivated, is more than meer Conjecture, or base Empiricism.

As to the Authors I have made use of, who have treated of Poisons, I have quoted only those who furnished me with Matter of Fact; for there are but few Originals; and very large Volumes on this Subject do many times contain little more than a Collection of Vulgar Errors.

I had once thought to have carried these Searches farther; in Particular, besides what is occasionally mention'd in the last Essay concerning Infection in acute Diseases, to have enquired into the Nature of Contagious and Hereditary Distempers. But the Humour of Scribbling would not hold out; and some perhaps will say, 'tis well enough it didn't; for I am not ignorant how few I am like to Please; if it be hard to think

The Preface.

think and write justly, 'tis harder yet to bring others to one's own Taste; nor shall I be at all angry, if to many I have afforded matter of Satyr and Invective; Less Wit suffices for these than for the Discovery of useful Truths. They who have no smattering of Mathematical Knowledge, are incompetent Judges of what Service I have done towards the Improvement of the Theory, or Practice of Medicine; and those who are acquainted with these Matters, will, it may be, think it something to talk Intelligibly on such difficult and abstruse Points. I neither want Applause, nor fear Censure; and therefore be the Fate of these Papers what it will, as they were first penn'd for my own Satisfaction, and innocent Entertainment; so I am resolved they shall never engage me in the trouble of Quarrels or Disputes.



THE CONTENTS.

ESSAY I.

O*f the Viper.*

Page 1.

*An Appendix containing Anatomical Observations,
and an Account of some other Venomous Animals.* } 21

ESSAY II.

Of the Tarantula and Mad Dog.

34

ESSAY III.

Of Poisonous Minerals and Plants.

59

ESSAY IV.

Of Opium.

79

ESSAY V.

*Of Venomous Exhalations from the Earth, Poisonous
Airs and Waters,* } 90

ESSAY

ESSAY I.

OF THE VIPER.



THE Viper has always been so Notorious for its Venom, that the most remote Antiquity made it an Emblem of what is hurtful and destructive. Nay, so terrible was the Nature of these Creatures, that they were very commonly thought to be sent as Executioners of divine Vengeance upon Mankind for enormous Crimes, which had escaped the Course of common Justice. Thus *Herodotus* (a) and *Ælian* (b) do both take notice that Adders were sacred among the *Ægyptians*; that they affirmed of one sort of 'em particularly, that they were made to be Ministers of the Will of the Gods, by averting Evil from good Men, and punishing the Bad. And *Pausanias* (c) observes of the *Arabians*, that they forbore to offer any Violence to the Vipers which were found near to the Balsam-Tree, as reputing 'em holy. The Foot-steps of which Superstition do still remain among these People to this very Day, for *Veslingius* (d) saw many of 'em take

(a) *Lib. 2. Cap. 74.*

(b) *De Animalib. lib. 17. c. 5.*

(c) *Bæotic. p. m. 303.*

(d) *Not. in Alpin. de Plant. Ægypt. Cap. 14.*

these Creatures into their Houses, feed 'em, and worship them as the *Genii* of the Place. The same odd Fancy obtains in the *East-Indies*, for the King of *Calicut* causes Cottages to be set up for Serpents to keep them from the Rain, and makes it Death to any that shall hurt one of 'em; thinking them to be Heavenly Spirits, because they can so suddenly kill Men (e). A remarkable Instance of such an Opinion as this we have in the History of *St. Paul* (f), whom the People of *Malta*, when they saw the Viper leap upon his Hand, presently concluded to be a Murderer, and as readily made a God of him, when instead of having his Hand inflamed, or falling down Dead, (one or other of which is usually the Effect of those Bites) he without any harm shook the Beast into the Fire. It being obvious enough to imagine, that he must stand in a near relation at least to the Gods themselves, who could thus command the Messengers of their Vengeance, and counterwork the Effects of such powerful Agents.

And this, after the many Conjectures upon the Matter, seems to be the true Reason why Antiquity not only represented the first Masters of Physick, *Hermes*, *Æsculapius*, *Hippocrates*, &c. in their Statues and Medals, with a Viper added to their Figure, but also worshipped them under this Form; for Diseases in those Days, especially the most violent, Plagues, Fevers, &c. were in like manner, as these Creatures, reputed the commission'd Messengers of divine Anger and Displeasure (g). They therefore who by their Art could cure and stop the Course of these, as they were supposed to do this by the particular Leave and Assistance of Heaven, so had Honours paid to them accordingly, and this representation was in the Nature of an Hieroglyphic Character; for as the learned *Spanhem* observes, (h) the Viper was a Symbol or Emblem of divine Power.

(e) *Purchase's Pilgrimage*, l. 5. c. 12.

(f) *Act. Apost. Chap. 28.*

(g) *Leg. Cornel. Cels. præfat. in Medicin. Morbos aut vetustissimis temporib. ad Iram Deorum immortalium relatos esse, & ab iisdem opeiri solitam.*

(h) *Divina Potentia Symbolum. Vid. Ezech. Spanhem. De Usu Numismat. p. m. 125, 126, & 181, 227.*

Macrobius indeed gives us another account of this Custom, and that is from the Property which all Serpents have of casting their *Exuvie*, or Upper-Skin, every Year, which makes 'em fit emblems or representations of Health; the recovery of which from Sickneſs and Diſeaſes may juſtly be looked upon as the beginning of a freſh Period of Life, and (as the throwing off the *Senectus* of theſe Creatures ſeems to be) the Renewing of Age. (i)

Whether one or the other of theſe Reaſons be allow'd of, or both thought good, certain it is that ſuch fond and ſuperſtitious Fancies concerning the Viper, together with the miſtaken Opinion that few of its Parts were exempt from Poiſon, did not ſuffer the Ancients to make any curious Enquiries into its Nature by Anatomy and Experiments, and this is the Cauſe of the many Errors they have delivered down to us in theſe Points, which by gradual advances have ſince been rectified, and the inward Make, Properties, and Generation of this Animal, largely treated of; more eſpecially *M. Redi* (k), *Charas* (l), and *Dr. Tyſon* in his Diſſection of the *Rattle-Snake* (m), which is a larger Species of a Viper, have taken Pains on this Subject, to whoſe Discoveries, what is yet wanting, we ſhall add at the End of this Eſſay.

The Symptoms which follow upon the Bite of a Viper, when it faſtens either one or both its greater Teeth in any Part of the Body, are an acute Pain in the Place wounded, with a Swelling at firſt Red, but afterwards Livid, which by degrees ſpreads farther to the neighbouring Parts with great Faintneſs, and a quick, tho' low, and ſometimes interrupted Pulse, great Sickneſs at the Stomach, with bilious, convulſive Vomitings, cold Sweats, and ſometimes Pains about the Navel; and if the Cure be not ſpeedy, Death it ſelf, unleſs the Strength of Nature prove ſuffici-

(i) *Saturnal. Lib. 1. c. 20. Ideo Simulachris Eorum (Æſculapii & Salutis) junguntur figura Draconum quia præſtant ut humana Corpora, velut infirmitatis pelle depoſitâ, ad priſtinum revireſcant vigorem, ut viſceſcant Dracones per annos ſingulos pelle ſenectutis exutâ.*

(k) *Oſſervazioni intorno alla Vipere.*

(l) *Nouvelles Experiences ſur la Vipere.*

(m) *Philosophical Transactions, Vol. XII. No. 144.*

ent to overcome these Disorders; and tho' it does, the Swelling still continues inflamed for some time; nay, in some Cases more considerably upon the abating of the other Symptoms, than at the beginning; and often from the small Wound runs a sanious Liquor, and little Pustules are raised about it; the colour of the whole Skin is changed Yellow, as if the Patient had the *Faundice*.

These Mischiefs, altho' different Climates, Season of the Year more or less Hot, the greater or lesser Rage of the Viper, the Beast it self of a larger or smaller Size, and consequently able to communicate more or less Venom, and the like Circumstances, may variously heighten or abate 'em, yet do usually discover themselves much after the same manner in all; unless the Bite happen not to be accompanied with the Effusion of that *Liquor*, which is the main Instrument and Cause of this violent and shocking Disturbance.

But before I proceed to enquire into the Nature and Manner of Acting of this *Juice*, it may be worth the while to take notice, that this is not made on purpose to be deadly and destructive to *Mankind*; but that the true Design of it is (tho' Authors have not regarded it) to perform an Office and Service of so great Moment, to the Preservation of the Individual, that without it this Creature could not subsist.

For Vipers live chiefly upon Lizards, Frogs, Toads, Mice, Moles, and the like Animals, which they do not chew, but swallow down whole, and they lie in the Stomach; or if that be not big enough to receive them, partly in that, and partly in the Oesophagus, which is Membranous, and capable of great Distension, till by the salival Juices of those Parts, together with the Help of the Fibres of the Stomach, and the Contraction of the Muscles of the Abdomen, they are gradually dissolved into a Fluid Substance, fit for the Nourishment of their Bodies, which is the Work of many Days; this is *one* Reason why these Creatures can live so long without taking any fresh Food, which I have known them to do three or four Months; as *another* is, that their Blood is a grosser and more viscid Fluid than

than that of most other Animals ; so that there is but a very little expence of it by Transpiration, and consequently less need of Recruit ; this not only *Microscopes* discover, but Reason teaches ; because there is but very little muscular Force in the Stomach to comminute the Food, and make a Chyle of fine Parts, and therefore the Blood must accordingly be of a tough and clammy Consistence. Besides, the Heart of a Viper has properly but one Ventricle, and the circulation of the Blood is performed after the same Manner as it is in a Frog and Tortoise, in which not above one Third of it passes thro' the Lungs ; upon which Account its Communion in them by the Air is proportionably lesser than in other Animals. Now such a manner of feeding as *this* does necessarily require, that the Prey should upon the first catching be immediately kill'd, otherwise it were by no means fit to be let into the Stomach ; for we are not to think that the force of this Part would be alone sufficient to destroy it, the Subtilty of a living Creature (besides the consideration of the Weakness of the Fibres) being in a great Measure able to elude *that*, as indeed we do every Day find live Animals in the Ventricles of others ; and therefore to do *this* is the proper Use both of the Teeth and their Poison ; for which being designed and adapted, it is no wonder if the Viper, this same way by which it destroys its Prey, proves sometimes mischievous to any other Creatures besides, when it happens to be enraged, or by any Provocation stirred up to bite.

The description of the poisonous *Fangs*, their Make, Articulation and Motion, as also of the Glands that separate the yellowish Liquor, and the Bags that contain it ; I shall give, together with some anatomical Observations, at the End of this Discourse.

This venomous Juice it self is of so inconsiderable a Quantity, that it is no more than one good *Drop* that does the Execution ; and for this reason Authors have contented themselves with Trials of the Bite upon several Animals, never essaying to examine the Texture and Make of the Liquor it self ; for which purpose I have oftentimes by holding a Viper advantageously, and inraging it till it struck
out

out its Teeth, made it to bite upon somewhat solid, so as to void its Poison; which carefully putting upon a Glass Plate, I have with a Microscope, as nicely as I could, viewed its Parts and Composition.

Upon the first Sight I could discover nothing but a Parcel of small Salts nimbly floating in the Liquor, but in a very short time the Appearance was changed, and these saline Particles were now shot out as it were into *Chrystals* of an incredible Tenuity and Sharpness, with something like Knots here and there, from which they seemed to proceed, so that the whole Texture did in a manner represent a *Spider's-Web*, tho' infinitely finer, and more minute; and yet withal so rigid were these pellucid *Spicula*, or *Darts*, that they remained unaltered upon my Glass for several Months (n).

I have made several Trials with this *Juice* in order to find out under what tribe of Salts these *Chrystals* are to be ranged; and not without some difficulty, by reason of the minute Quantity of the Liquor, and the hazard of Experiments of this Nature, have plainly seen that it does, as an *Acid*, turn the blue Tincture of *Heliotropium* to a Red Colour.

I did not succeed so well in mixing it with Syrup of Violets, and yet it did really seem to induce in this a *Reddish Hue*; but I am very certain it did not at all change it to a *Greenish* Colour, as it would have done if any ways *Alcalious*.

This may suffice in their own way of arguing, to convince those Gentlemen, who without the Assistance of any Experiments, meerly to serve an *Hypothesis* which they have too fondly taken up, have with great Assurance told the World, that the Viperine Venom is an *Alkali*, and consequently to be cured by *Acid* Remedies. But it is by far more easie to spin out a false Notion into precarious Reasonings, than to make faithful Experiments, and fairly improve 'em by just and necessary Consequences.

(n) *Vid. Fig. 19.*

To proceed, this Discovery agrees very well with a Relation communicated by an ingenious Person to Dr. *Tyson*, which does so much illustrate this Matter, that I shall transcribe it in his own Words, out of the before cited *Philosophical Transactions*; he says then, That being in the *Indies*, there came to him an *Indian* with several Sorts of *Serpents*, offering to shew him some Experiments about the force of their Poison; having therefore first pulled out a large One, the *Indian* told him this would do no harm; and making a Ligature on his Arm as in letting Blood, he exposed it naked to the Serpent, being first irritated to make him bite it; the Blood that came out of the Wound, made by his Teeth, he gathered with his Finger, and laid it on his Thigh, till he had got near a Spoonful, after this he takes out another called *Cobra de Capelo*, which was lesser, and enlarges much upon the greatness of his Poison; to shew an Instance of it, grasping it about the Neck, he expresses some of the Liquor in the Bags of the Gums, about the Quantity of half a Grain, and this he puts to the coagulated Blood on his Thigh, which immediately put it into a great *Fermentation*, and working like *Barme*, changed it into a *Yellowish* Liquor.

This I say does well enough accord with what we have been advancing concerning the Nature of this *Juice*; for Mr. *Boyle* has long since proved by Experiments, that there is nothing of Acid in human Blood; and Dr. *Pitcairne* (o) has demonstrated, that the *Acid Substances* of Vegetables taken into the Stomach, are by the Action of this Part, the Lungs and Heart, when they come into the Blood-Vessels, turn'd to *Alcalions*; so that the Arterial Fluid must necessarily be considered as an *Alkali*; and therefore according to the known Principles of Chymistry, its mixture with such a Liquor as we have discovered the Viperine *Sanies* to be, will always exhibit some such appearance as this now related.

(o) *Dissertatio de Opera quam præstant Corpora Acida vel Alcalica in Curatione Morborum.*

But not to engage any farther in these sort of Controversies, we may perhaps from the foregoing Observations receive some Light in order to understand the Nature and Reason of all those Symptoms which attend the Bite of this Creature. For the pungent Salts of this Venom, when with Force thrown into the Wound, will not only as so many *Stimuli*, irritate and fret the sensible Membranes, whereupon there necessarily follows a greater Afflux than ordinary of the Animal Juices that way, (as is manifest from the *Bellinian* Doctrine, *De Stimulis*) so that the wounded Part must be Swelled, Inflamed, Livid, &c. but also these *Spicula* being mix'd with the Blood, will so disjoin and disunite the Parts of it, that its Mixture must be quite alter'd; and from the various *Cohesion* of its *Globules* will arise such different Degrees of *Fluidity* and *Impulse* towards the Parts, &c. from what this Liquor had before, that its very Nature will be changed, or in the common way of speaking, it will be truly and really *Fermented*.

To understand aright how all this is done, it is necessary to hint somewhat concerning the Nature of *Fluids* in General, and those Alterations in them which we call *Fermentations*; for I shall retain this known Word, tho' in the proper Sense in which 'tis commonly used, there can be no *Fermenting* of the Liquors in the Animal Body.

And here I must refer to the Treatise of *Bellini de Fermentis*, who has with great Clearness shewn, that there is in all *Fluids* not only a simple *Contact* of their Parts, but also a *visus in Contactum*, or *Cohesion*, and this of a certain Degree or Force, and besides of a particular *Direction*; which is indeed, tho' express'd in other Words, the very same thing with the *Attraction* of the Particles, one to another; This Mr. *Newton* has demonstrated to be the great Principle of Action in the Universe, has taught us the Laws of it in the greater Quantities and Collections of *Matter*; and he who rightly studies his Philosophy will understand that the same obtains in the most Minute and Finest Corpuscles, which do unite into Bodies of different *Solidity* and *Make*, according to the Degree with which they do mutually *attract* each other, and to the *Superficies*, by which, when drawn, they do

touch

touch and *adhere*. To this if we add a *Pression* of the several Parts of the Fluid every way, and consider withal, that this *Uniform* Attraction of the Parts to one another must be variously changed by the different Attraction of Heterogeneous Bodies mixt with them, we have the great Principles of all Fluids, upon which their several *Phænomena* do depend.

And hence it follows, that whatsoever *Power* is sufficient to make a Change in this Attraction, or Cohæsion of the Parts, makes an alteration of the Nature of the Fluid; that is, as the Chymists express it, puts it into a *Fermentation*. And if any one should think it necessary to enquire into the particular Manner of producing such an Effect, we may perhaps in so abstruse a Matter not improbably conjecture *thus*, that our Blood consisting chiefly of two Parts, a simple *Lymph*, and an infinite Number of small *Globules*, containing a very subtle and elastick Fluid, these acute Salts, when mingled with it, do prick those Globules, or *Vesiculae*, and so let out their imprisoned active Substance, which expanding it self every way, must necessarily be the Instrument of this speedy Alteration and Change (p). From such an *Hypothesis* as this (and, it may be, not very easily from any other) we may account for many of the surprizing Phænomena in the Fermentations of Liquors; and as precarious as it seems, its Simplicity, and Plainness, and Agreement with the forementioned Doctrine, will, I believe, recommend it before any other to those who are not unacquainted with *Geometrical* Reasonings. But I wave these Considerations at present, and shall only add one Remark or Two with Relation to the Purpose in Hand, and so proceed.

In the first place then, we may from this *Theory*, learn, how it comes to pass that so small a Portion of Juice should infect so great a quantity of Liquor; for in order to do this, it is not necessary that the Venom should be at the very first mixt with all its Parts; but it is sufficient that it prick some of the *Bladders*, and the elastic Matter of these being

(p) *Vid. Bernoulli de Effervescencia & Fermentatione.*

let out, will be a nimble *Vehicle* to the acute Salts, and not only by its activity disperse them thro' the Fluid, but restore to them their decreasing *Force*, and thus continue their Effects, till a great part of the Liquor undergoes at least, in some Degree, the like Alteration.

And this will the more easily happen in the present Case, because the *Force* with which this Poison is thrown into the Blood, as appears from the Mechanism of the discharging Organs, is very great, and consequently its Effects will be proportionably violent, or the Mischief more large and diffused.

The want of this may be one Reason why the Experiment of first making a Wound in the Flesh with any sharp instrument, and then dropping in the *Sanies*, may not always succeed so well in killing Animals, as one would from the preceeding Doctrine be ready to expect. Tho' if some amends be made for this Defect, by taking a greater quantity of the Juice, and carefully instilling it, it proves equally fatal this way, as when immediately discharg'd from the Viper itself. Thus it might happen that those Trials of this kind, which were happily made by Sr. *Redi*, might not however convince Mr. *Charas*, in as much as there is oftentimes a great deal of difference in the Event of Experiments, when made with Purpose, and a Design that they should succeed, and when timorously and cautiously managed, lest they should unluckily overthrow a darling *Hypothesis*.

The other Observation I shall draw from the foregoing Theory, is this, that it appears from hence what a vast *variety* there may be in the Fermentations even of one and the same Fluid; for these being no other than *Changes* made in the *Cohesion* of the compounding Particles, are capable of as many Alterations as *Motion* in its *Degrees* and *Directions* can admit of, which are really Infinite.

This I mention with regard to some of the following *Essays*, in which, if we ascribe many Symptoms seemingly very different, to a Ferment rais'd in the Blood, it may be consider'd, that the Nature of this Cause is such, as according to the several Properties of the *Primum Agens*, or
Fermenting

Fermenting Power, to bear by far more Varieties than any one can be aware of.

To return to the Viper; the Effects of such an Agitation of the Blood, as we have been describing, must not only be whatever are the Consequences of a disturbed *Circulation*, and irregular and interrupted *Secretion* of the Spirits, as low Pulse, Faintings, Sicknes, Palpitation of the Heart, Convulsive Vomitings, Tremblings of the Body, &c. but also the *Texture* of this Fluid being thus broken, those Parts of it which are of the slowest Motion, and greatest Viscidity, will be easily separated from the others; such they are, which when united together do compound the *Bile*, and therefore these will tinge the capillary Vessels, and fine *Ducts* in the Skin, with a yellowish Colour; that is, will induce an *Icterus*, or Jaundice.

For it is not only (if at all *Primarily*) from an Obstruction of the *Biliary Canals* that this Symptom does proceed, but also from any Cause whatsoever, which either destroys the saline Part of the Bile, by the means of which its Oil is kept mixt with the Water of the Blood, or else increases the Oily and Sulphurous Part to that degree, that tho' it be duly impregnated with Salt, yet the watery Part of the Blood, which can only take up a certain Proportion of it, being already *Saturated*, can receive no more; or lastly, does, by *disuniting* the compounding Particles of the Blood, alter that *Intestine* Motion and Agitation which is necessary to carry along thro' the Vessels, together with the more volatile Parts, those which are more Clammy and Glutinous. For in all these Cases 'tis plain that the Bilious Corpuscles must be *precipitated* upon those Parts of the Body where there is least Motion, that is, upon the extreme Superficies.

And tho' this Theory may perhaps appear extravagant, because new and uncommon, yet it will not, I believe, seem ill grounded or irrational to those who understand the Doctrine of the *Mixture* of Heterogene Fluids, and their *Separation*; and who withal know, that the Vessels are rarely obstructed, unless it be from the fault of the Liquid they carry, and consequently that a Defect in the Bile it self must

be (excepting some extraordinary Cases) antecedent to the Obstruction of the Biliary Ducts.

In short, the different Cure of this Disease confirms these Notions; for an *Icterus* from the first Cause assign'd, which is generally owing to a sedentary Life, want of Exercise, &c. and attended with an extreme Costiveness and white *Feces*, is cured by volatile, acrimonious, and bitter Salts. From the Second produced oftentimes by drinking strong Liquors, Spirits, &c. and accompanied with a *Diarrhœa*, partly by diluting and temperating, partly by stomachic and strengthening Medicines. As the last Species of it (for the sake of which we have mention'd the other) is removed by such *Antidotes* as overcome and destroy the venomous Ferment, corrupting the Blood, and breaking its *Compages*. But to have hinted these things may abundantly suffice for the present.

We must however take notice, that *tho'* the *main* Alterations made by this Poison be in the Fluid of the Arteries, yet that *That* of the Nerves may hereby be considerably *changed* too; for *This* consisting, as well as the Blood of differing Parts, and being dispersed in small *Tubes* all over the Body, is not only very capable of *various* Degrees of *Force*, *Impulse*, &c. but *Undulating* continually towards the Brain, and being the chief Instrument of Motion and Action, may perhaps sometimes more immediately convey the Mischief to the sensible Membranes, and thus be the Cause of those violent Pains, Convulsions, Sicknels, &c. with which those who are bitten are presently seiz'd.

Many are the Experiments I could relate to evince the Truth of this Reasoning concerning the Viperine Venom, which do entirely agree with those made by Sr. *Redi*, whose Judgment and Sincerity in Observations of this Nature no Body ever called in Question, till Monsieur *Charas* having espous'd a Notion, that this Poison does not lie in the yellow Liquor of the Gums, but in the enraged Spirits of the Viper, rais'd new Difficulties about the Success of some Trials made in *France*, endeavouring thereby to invalidate the Force and Authority of those made in *Italy*.

I shall

I shall therefore, in order to put this Matter out of all doubt, mention two or three Experiments made by Dr. *Areskine*, when at *Paris*, that it may appear how defective those of Mr. *Charas* are, and that the difference of the Climate does not (as some began to imagine (a)) make any considerable Alteration in the Effects of this Venom, or its manner of Killing.

First then, having got a large Female Viper, he made it to bite Six Pigeons, one after another; the First and Second that were bit, died within about half an Hour, one a little Time before the other; the third liv'd about two Hours; the Fourth seem'd to be very sick, but recovered; the Fifth and Sixth were no more hurt than if they had been prick'd with a Pin or Needle.

Then he cut off the Head of a brisk Viper, and let it lie twenty four Hours, with the Fangs of which he wounded one Pigeon in the Breast, and another in the Thigh, which both expired as soon after, as if they had been bitten by a living Viper. After this, having got a great many Vipers together, he made them bite upon a piece of Glass of a Cylindrical Figure, by this means preserving the Yellow Juice which they emitted, and slightly wounding two Pigeons, he first let the Bleeding be stopt, then put some of this Liquor into the Wounds, upon which both the Pigeons died about two Hours after.

The same ingenious Person tells me, that Monsieur *du Verney* made not only these, but also several other Experiments of the same Nature, in the *Royal Academy*, with the like Success.

These Proofs are so convincing and full, that no one, I think, can desire more; but they will receive yet a farther Confirmation from the *Apparatus* or Mechanism of the Organs, with admirable Nicety contrived for the Discharge of this Venom, of which more by and by.

Nor is it any Objection against all This, that the *Liquor* is innocent and harmless in the Mouth or Stomach of any one, so as that it may be safely tasted or sucked out of the Wound,

(a) *Vid. Redi Lettera sopra alcune opposizioni, &c.*

and swallowed; for, *as* we observ'd before, that many *Acid* Substances taken into the Stomach are by the Action of that Part turned to *Alcalious*, so there is no Question but these saline *Spicula* are partly by the muscular Force of the Fibres, partly by the salival Juice, all broken and dissolved; or if any can pass into the Intestines, the Balsam of the *Bile* will be an *Antidote* for them; the Reason of which will appear when we come to the Cure.

In the mean time it may not be amiss to Remark; That even the Ancients seem to have known thus much concerning the Nature of this Poison; of this *Galen* gives us Testimony in several Places; particularly in his Book *de Temperamentis* (b), where he takes notice, that *nothing has the same Power upon the human Body outwardly as inwardly*; Thus (says he) *neither the Venom of the Viper, nor of the Asp, nor frothy Spittle of the Mad Dog, are alike mischievous when they fall upon the Skin, or enter into the Stomach, as when outwardly communicated by a Wound.*

The chief of the *Latin* Physicians (c), *Celsus* has elegantly express'd the Matter in few Words, when advising to Suck the Wound made by the Bite, he adds, *Neque Hercules Scientiam præcipuam habent hi qui Psilli nominantur, sed audaciam usu ipso confirmatam, nam Venenum Serpentis, ut quedam etiam Venatoria Venena, quibus Galli præcipue utuntur, non gustu, sed in vulnere nocent.*

And therefore brave *Cato*, when marching the Remains of *Pompey's* Army thro' *Africa*, very wisely told the Soldiers, almost choak'd with Thirst, yet afraid to drink of a Spring they came to, because full of Serpents (d),

*Noxia Serpentum est admisto sanguine Pestis,
Morsu Virus habent, & Fatum Dente minantur,
Pocula Morte carent-----*

(b) *Lib. 3. Cap. 2.*

(c) *Medicin. Lib. 5. c. 27.*

(d) *Lucan. Pharsal. l. 9.*

In the like manner it was in those times also known, that the virtulent Juice had the same bad Effects, when mixt with the Blood, by means of a common Wound, as when communicated by the venomous Bite. This made *Celsus* (e) advise in sucking out the Poison, to take care there be no Ulcer in the Mouth; tho' this Caution be rather slighted and ridiculed by *Severinus* (f), and others; who do hereby discover how little they understood of the Seat and Nature of this Poison. And *Galen* (g) mentioning the Story of *Cleopatra*, relates from other Authors, that she killed her self by pouring the Virus of an *Asp* into a Wound made in her Arm by her own Teeth.

In short, it is upon this Foundation, that *Pliny* (h) assures us, the *Scythians* poison'd their Arrows with the *Sanies* of Vipers mixt with human Blood; the way of doing it *Aristotle* (i) has at large related; and the *Tartars* are said to use the like Trick to this Day. After the same manner the *Indians* make use of the Venom of the Lizard, called *Gecco*; this Creature they hang up by the Tail, and by Whipping exasperate till it discharge its *Virus*, in which they tinge their Darts; and a very slight Wound with these Weapons is speedy Death (k).

It is worth the while in the next Place to consider the Cure of this Mischief, which without all doubt ought to be by such external Management of the Wound as may immediately destroy the infused Venom.

Mr. Boyle (l) experienced a hot Iron held as near the Place as the Patient could possibly endure it very effectual to this Purpose. But the same Method did not answer Expectation in the famous Case related by *Monfieur Charas* (m).

(e) *Loc. ante citat.*

(f) *Vipera Pythia*, p. 361.

(g) *De Theriac. ad Pison.* lib. 1. c. 8. *Vid. etiam c. 10.*

(h) *Nat. Hist.* lib. 11. c. 53. *Scythæ Sagittas tingunt Viperinâ Sanie & humano Sanguine; irremediabile id Scelus.*

(i) *De Mirabilibus.*

(k) *Bontii Hist.* Ind. lib. 5. c. 5.

(l) *Usefulness of Experimental Philosophy*, Part 2. p. 50.

(m) p. m. 66.

An extraordinary Virtue against this and other venomous Bites is ascribed to the *Snake-stones* brought from the *East Indies*, one of which is to be presently applied to the Part, and let stick till it drop off; these are said to be taken out of the Head of the Serpent called by the *Portuguese*, *Cobra de Capelo*; and to suck the Poison out of the Wound. Sr. *Redi* (n) made Trials with several of them, but found no Service from any. Yet *Baglivi* (o) tells us of a terrible Bite of a Scorpion cured this Way. Monsieur *Charas* (p) his Pigeons all died, tho' *these* were immediately clapped on, and stuck close to the Wound: But Dr. *Havers* saw a good Effect of *one* upon a Dog, who tho' severely bitten suffered no harm, nor any farther Mark of the Poison than a livid Circle round the Place.

In plain Truth, *as* these celebrated *Stones* do not seem to be what it is pretended they are, but rather factitious Bodies compounded, it may be, of calcined Bones, and some testaceous Matters mixt together; so by Reason of their spongy and porous Texture, they do very readily adhere to any moistened Part of the Flesh, and imbibe whatsoever humidity they meet with. This their Quality any one may experience by holding one of them to the Roof of his Mouth; and it is upon this Score, that when put into Water, Bubbles are raised by the Air in their Interstices, which some have too fondly thought to be the Effects of their throwing out the Venom they had sucked in.

Their *make* being thus, some Part at least of the poisonous Juice may easily be drawn out of the Wound by such an Application, and yet so much of it may sometimes happen to remain in the Flesh, as may make the Bite however to prove Mortal. And thus it fared with a Pigeon, to the Thigh of which, first bitten by a Viper, I applied one of the Stones; for tho' it stuck fast to the Wound, and thus saved the Life for about four hours; (whereas others usually died in about half an Hour) yet after this the Mortifica-

(n) *Esperienze intorno a diverse Cose Naturali.*

(o) *Dissert. de Tarantula Histor. 5.*

(p) *Pag. 88.*

tion of the Part prevailed to that Degree as to become fatal to the tender Creature.

But our *Viper-Catchers* have a Remedy far beyond all these, in which they do place so great Confidence, as to be no more afraid of a Bite than of a common Puncture, immediately curing themselves by the Application of their *Specifick*.

This, tho' they keep as a great Secret, I have however upon strict Enquiry found out to be no other than the *Axungia Viperina* presently rubbed into the Wound. And to convince my self of its good Effects, I enraged a Viper to bite a young Dog in the Nose; both the Teeth were struck deep in; he howled bitterly, and the Part began to swell; I diligently applied some of the *Axungia* I had ready at hand, and he was very well the next Day.

But because some Gentlemen who saw this Experiment were apt to impute the Cure rather to the Dog's spittle, (he licking the Wound) than to the Virtue of the *Fat*, we made him to be bit again in the Tongue, forbearing the Use of our Remedy, and he died within four or five Hours.

At another time I made the like Trial with the same Success.

As this *Axungia* consists of clammy and viscid Parts, which are withal more penetrating and active than most other oily Substances, so these, without all doubt, do involve, and as it were sheath the volatile Salts of the venomous Liquor, and thus prevent their shooting out into those Crystalline *Spicula*, which we have observ'd to be the main Instruments of that deadly Mischief which attends the Bite.

By this means it comes to pass, that this Cure, if rightly manag'd, is so easie and certain, as not to need the help of any *Internal Medicines* to forward it; but these however must take place, where, thro' want of the other, the Poison is spread farther, and has tainted the whole Mass of Blood.

Nor yet is it necessary even in this Case to fatigue the Patient with a *Farrago* of *Theriacas*, *Antidotes*, &c. for the *Volatile Salt* of Vipers is alone sufficient to do the Work,

if given in just Quantities, and duly repeated; provided moderate Sweats be encouraged in Bed; thus it succeeded with Monsieur Charas in the before cited Case, and in some others I could relate; in one of which the Mischiefe had gone so far as to induce an universal *Icterus*.

This leads me last of all to hint something concerning the Use of the Viper in *Physick*; because Authors are very large in enumerating its Virtues against many, and those too some of 'em very obstinate, Distempers.

One of the first whom we find in Antiquity to have made use of the Flesh of this Creature to medicinal Purposes, was, I think, *Antonius Musa*, the Famous Physician to *Octavius Caesar*; of whom *Pliny* (q) tells us, That when he met with incurable Ulcers, he ordered the eating of Vipers, and by this means they were quickly healed.

It is not improbable that he might have learned this from the great Greek Physician *Craterus*, mention'd often by *Cicero* in his Epistles to *Atticus*, who, as *Porphyrius* (r) relates, very happily cured a miserable Slave, whose Skin in a strange manner fell off from his Bones, by advising him to feed upon Vipers dressed after the manner of fish.

Be this as it will, in *Galen's* time the profitable Qualities of the Viper were very commonly known; himself relating (s) very remarkable Stories of the Cures of the *Elephantiasis*, or *Lepra*, done by the Viper Wine.

Aretæus, who most probably liv'd about the same time with *Galen*, and of all the Ancients has most accurately described the *Elephantiasis*, commends, as *Craterus* did, the eating of Vipers instead of Fish in the same Diseases (t). And to this purpose I remember, that as *Lopes* (u) in his Relations of the Kingdom of *Congo* in *Africa*, takes notice how greedily the Negroes eat Adders, roasting them, and esteeming them as the most delicious Food; so *Dampier*

(q) *Lib.* 30. c. 13.

(r) *De Abstem. ab animal.* lib. 1. p. m. 16.

(s) *De simpl. Medic. Facult.* lib. 11. c. 1.

(t) *Curat. Diuturn.* lib. 2. c. 13.

(u) *Vid. Purchas. Pilgrims*, Part 2. l. 7. c. 9.

(x) also informs us, that the Natives of *Tonquin* in the *East Indies* do treat their Friends with *Arack*, in which *Snakes* and *Scorpions* have been infus'd, accounting this not only a great Cordial, but also an Antidote against the *Leprosie*, and all other Sorts of Poison.

The Physicians in *Italy* and *France* do very commonly prescribe the Broth and Gelly of Vipers Flesh for much the same Uses, that is, to invigorate and purifie the Mass of Blood exhausted with Diseases, or tainted with some vicious and obstinate *Ferment*.

From all this it appears, that the main Efficacy of the *Viperine* Flesh is to quicken the Circle of the Blood, promote its due Mixture, and by this means cleanse and scour the *Glands* of those stagnating Juices, which, turning to Acidity, are the Origine of many, at least, of those troublesome Distempers in the Surface of the Body, which go under the Names of *Scrophulous*, *Leprous*, &c.

These good Effects are owing to that penetrating, strong *Salt*, with which the Substance of these Creatures does, in a very great Proportion, abound; and the Reason of *this* is from the Food they live on, which we have observ'd before to be Lizzards, Moles, &c. whose Nature every one knows to be such as must necessarily, when they are dissolv'd in the Stomach, supply the Blood with a great Quantity of Active and Volatile Parts. And herein lies the Difference between the Flesh of Vipers, and *that* of other innocent Serpents, which feeding upon Grass, Herbs, &c. do not recommend themselves to us by any of those Properties which are in so eminent a Degree found in the former.

Whosoever reflects on what has been said on this Head, will very readily acknowledge, that our Physicians deal too cautiously or sparingly with a Remedy which may be apply'd to very good Purposes, when they prescribe a few Grains of the *Powder* of dried Vipers, or make up a small Quantity of their Flesh into *Troches*; whereas, if Service be really to be done this Way, the Patient ought to eat

(x) Voyages, Vol. 2. Part 1. p. 53.

frequently of Viper-Gelly, or Broth; or rather, as the ancient manner was, to boil Vipers, and eat them like Fish; if this Food will not go down, (tho' really very good and delicious Fare) to make use at least of Wine, in which Vipers have for a long time been infused, by which I know a very obstinate *Lepra* has been removed; or lastly, in some Cases, especially where Wine is not convenient, to take good Quantities of their *Volatile Salt*, in which alone the Virtue of the before-named Medicines does principally reside.



A N
A P P E N D I X
T O T H E

Foregoing Essay;

C O N T A I N I N G

*Some Anatomical Observations on the
VIPER, and an Account of some
other Venomous Animals.*

IN repeated Dissections of the *Viper*, comparing the *Descriptions* given Us by Authors with the *Parts* themselves, I have found them in many Particulars to be very Defective. I shall however at present confine my self to some Observations made chiefly on those Organs which serve to prepare and emit the *Poison*.

To begin therefore with the Head. The *Skull* (*Fig. 2.*) is composed of several Bones, joined together by *Sutures*, as in *Man*, but with this Difference, that the *Os Frontis* in the *Viper* consists of Two Bones united by a Rectilinear *Suture*, and the *Parietal* Bones are entire; whereas in *Man* the *Parietal* Bones have *Sutures*, and the *Os Frontis* is entire.

(a) Shews Two small Semicircular Bones, which form the inferior part of the *Nostrils*.

(b) The Two Bones which make the upper part of the *Nose*; from the latter pass down two thin *Laminae*, which touching one another, and falling perpendicular upon the *Ossa Palati*, compose the *Septum* of the *Nose*.

(cc) Point out the *Ossa Frontis*, which form the upper Part of the *Orbits* of the *Eyes*. And (cc) the *Orbits* themselves.

The *Parietal Bones* (d) make a large Cavity, in which the greatest Part of the *Brain* is contained, and this we may call the *Sinciput*.

Behind this Bone are placed the *Ossa Temporum* (ff), in which lye the Organs of *Hearing*; and behind Them a Bone (g), which we may call the *Os Occipitis*, covers the posterior part of the *Brain*. This is joined to the first *Vertebra* of the *Neck* (h), by a Spherical Articulation, as all the *Vertebrae* are to one another; and this is the Reason why this Creature can turn its Head and Body so much, and so nimbly, every way.

To some of *These* there are Two other Bones Articulated for particular Uses.

The first of *Them*, which serves as a *Basis* to the Articulation of the Rest (a, Fig. 4.), is fastned by one Extremity to a small Protuberance (i, Fig. 2.) in the middle and lateral Part of the *Os Sincipitis*, and running back towards the *Vertebra*, lies in the same Plain with the *Sinciput*. This Bone has a Motion, tho' very inconsiderable, both upwards and downwards. By means of this, the opening of the Mouth is somewhat enlarged in the Time of *Deglutition*.

That End of this Bone, which is next to the *Vertebra*, is articulated at oblique Angles with Another (b), placed Horizontally, and whose Motion is forwards and backwards, being made chiefly for moving the Bones of the upper and lower Jaw, into which the Teeth are inserted. By reason of this kind of Articulation, It cannot contribute any thing towards widening the Mouth for Swallowing.

This

This Bone, and That with which it is joined, I call the *Common Bones*.

The *Upper Jaw* (*Fig. 3.*) is, besides the Teeth, composed on each side of *three* Bones. The *First* (*a*), into which the Poisonous *Fangs* are fixt, is articulated with the Anterior Protuberance of the *Orbit* of the Eye; and has a Motion of Flexion and Extension, that is, forwards and backwards, by which the *Fangs* are Erected or Depress'd. It is small at the Joint, but grows broader by degrees, to a pretty large *Basis*, the better to contain a considerable Number of *Teeth*. It is *Spongy* like the Substance of the *Vertebrae*, and no ways fit to be the immediate Organ of *Hearing*, as Mr. *Charas* and some others have imagined.

The *Second* (*c*), is a broad thin Bone, Articulated by one Extreme to the *Former* (*f*), and by the other firmly fix'd to the middle of the *third* Bone. When *this* is thrust forwards, it likewise pushes the *First*, and by this means the *Erection* of the *Fangs* is helped; and when it is pull'd backwards, they are depressed.

The *third* Bone (*e d*), is join'd by one Extremity (*e*), to the End of one of the Bones of the lower Jaw (*c*, *Fig. 4.*), And being somewhat crooked, turns in a little towards the *Basis* of the *Cranium*, and running along the Inferior Part of it towards the *Nose*, terminates near the Internal and Anterior Part of the *first* Bone.

The *Lower Jaw* (*c d e f g*, *Fig. 4.*) on each side is made up of two Bones, but firmly united, the Extremity of the one entring within the other (*f*). The *First* (*c d e*) articulates with the *Second* of the *Common Bones* (*b*), where it is broad, and sends off an *Apophysis*, into which there is a *Muscle* inferted, which helps to open the *Jaw*. There is in *this* a *Hole* (*d*), for the Entrance of the Branch of the *Nerve*, which passing thro' a *Canal* in the middle of it, goes to the Extremity of the *Second* Bone, and in its way sends off several Branches which go to the *Teeth*; and also a very considerable one, which goes out at (*e*), and is wholly spent upon the Neighbouring *Muscles*.

The *Second* Bone (*f g*) serves chiefly to receive the small *Teeth*, which answer to those in the upper Jaw.

As for the *Teeth*, they are of two Sorts, the *Great*, or poisonous *Fangs*, and the *Small*.

The *Great* (*b*, *Fig. 3.*) being fix'd in the First Bone of the *Upper Jaw*, are Crooked and Bent, like the *Dentes Canini* in most *Carnivorous* Animals. They are manifestly hollow from their Root a considerable way, not to the very *Apex* or Point, (which is solid and sharp, the better to pierce the Skin) but to a small distance from it, as is plainly seen by splitting the Tooth thro' the middle (*Vid. Fig. 6.*). This Cavity ends at the Convex Part in a visible *Slit*, very well resembling the *Nip* or *Cut* of a *Pen* (*Fig. 9. d*), which is the *Emissary* or Outlet to the Poison.

Galen (*a*) has given us a considerable Hint of this Make of the Tooth: For, *The Mountebanks* (He says) *used to suffer themselves to be bit by Vipers, having first with some Pastes stoppt the Holes of their Teeth, that the Venom being thus kept in, the Spectators might think they did by their Antidote secure themselves from its dangerous Effects.*

The Reason why these Teeth are *Crooked*, is, That the *Point* of the Tooth, when the Viper bites, may be *Perpendicular* to the Part to be Wounded; for the Head being raised back in the Time of Biting, and the Tooth erected, if this were strait, It would not, by reason of its oblique Situation to the Part, enter with so much Force, nor so deep into the Flesh.

As for the *Number* of the Poisonous Fangs, I have observed, that there are, for the most part, besides One, Two or Three on each side, fix'd Perpendicularly to the first Bone of the Upper Jaw, some others which are Young, and of a smaller Size, adhering to the same Bone: Their *Points* are hardened, and they have their *Fissures* formed as in the other, but their *Roots* are soft and Mucilaginous, like the Roots of the Teeth in Infants, and so they lie always depress'd at the *Bottoms* of the *Former*, as may be seen *Fig. 10. c.*

They drop off from the Bone at the least Touch; and therefore some Anatomists have imagined them to be fasten-

ed to Muscles or Tendons, which would have rendered them altogether useless. For they are made to supply the Place of the *Greater*, when they fall away, or are pulled out by Accident, and in order to do this, they do by degrees harden, and rise more and more, till at last they stand upright, and come to a Perpendicular Situation in the Bone.

They are not all of the same *Growth*; for in some we can only discern the Shape of a Tooth without any Hardness, in *others* the Point, and in the *next* somewhat more is hardened, and so on to the greatest Fang.

Their Number is very uncertain, there being sometimes six or seven in each side of the Jaw, sometimes fewer.

These seem to have occasioned the Disputes among the Ancients concerning the Number of the Viperine Teeth.

The poisonous Fangs have small Holes at the internal Part of their Root, thro' which the Vessels pass, which carry their Nourishment (*Fig. 5. a*).

It is remarkable, that Nature has provided young Vipers with poisonous Teeth grown to their Perfection, that so they may kill their Prey as soon as they come into the World.

The *Second* Kind of Teeth, or the *Small*, are hooked, and bent, as well as the former, but without any *Slit* or opening. Of these there are four Rows, two on each side of the Mouth. They are fixt in the *third* Bone of the upper Jaw, and in the *Second* in the lower, as exhibited to view in the *Figures*.

Their Use is to hold the Prey fast while Execution is done by the Bite, lest in struggling to get away, it should pull out the Fangs.

The Instruments that *Emit* the Venom being thus describ'd, we come next to *those* which serve to *Prepare* and *Contain* it.

This *Liquor* is separated from the Blood by a *Gland* on each side of the Head, placed in the anterior and lateral Part of the *Os Sincipitis*, just behind the Orbit of the Eye (*Fig. 9. a*); It lies immediately under that Muscle which

helps to depress the Fangs, so that by the Action of *this* it is press'd; which is an admirable Contrivance to forward the *Secretion* of the Juice out of it.

'Tis a *Conglomerated* Gland, composed of many smaller ones contained in a common Membrane; each of these sends off an Excretory Vessel, all which do afterwards unite and form one *Duct* (*b*), which running towards the Roots of the Fangs, discharges the yellow Liquor into a *Bag*.

This *Bag* is fixt to the *Basis* of the *first* Bone of the Upper Jaw, and also to the Extremity of the *Second*, covering the Fangs near the Root (*d*, *Fig. 10.*). To the upper Part of this *Vesicula* there is joined another (*a*), in the anterior Part of which there is a Passage for the poisonous Teeth.

This consists of muscular Fibres, both *Longitudinal* and *Circular*, by means of which it can *Contract* it self when the Fangs are erected; and by this Contraction the *Venom* is press'd into the Hole at the Root of the Tooth, and forced out at the Fissure near the Point.

That this is so done, I have frequently observed with the naked Eye, having cut off the Head of a Viper, and immediately pinching the Neck to make it open the Mouth wide; for by this means the *Venom* was *Squirted* out as from a *Syringe*.

When the Viper lies quiet with its Mouth shut, the Fangs are depress'd and covered with the *External Bag*; when it intends to bite, it opens the Mouth very wide, at the same time the lower Extremity of the *Second* of the *Common* Bones (*Fig. 4. b*) is moved forwards by proper Muscles, and turns as it were upon the fixt Centre (*b*), thus pushing forward the upper and lower Jaws, whose Extremes are united at (*c*). By this means the lower Part of the first Bone of the upper Jaw (*Fig. 3. a*) is thrust forwards, the other Extremity turning in the Cavity of its Articulation, where it is fastned by *Ligaments*; the Fangs being by this Mechanism erected, the Bags which covered them, by the Contraction of their *Longitudinal* Fibres, are pulled back, and the Action of the *Circular* Ones

Ones does at the same time straiten the *Internal Bag*, and force the *Juice* into the Teeth.

Besides this, when the Viper bites, it strikes in the Fangs to the very Root; and thus the *Vesiculae* are still more squeezed for the Discharge of the Liquor.

It is worthy our Observation, that the Viper can move the Jaw Bones on *one* side without moving those on the *other*, for they are not joined together at the Extremes as in other Animals; which Contrivance is very beneficial to it in the *swallowing* its Prey; in that, while the Teeth on one side stand unmoved, and fixt in the Flesh to hold it, *Those* on the other side are brought forward, to draw it in farther, then they keep it fast till the former Jaws advance again in their *Turn*. Thus they act successively, and force the Animal intire (there being no *Dentes Incisivi* or *Molares* to divide it) into the *Oesophagus*, whose muscular Fibres are very weak, and can help but little in the Business.

It may not be amiss to conclude these *Remarks* with a short *Hint* concerning the *Organs of Hearing*; Mr. Charas (who is however followed by others in it) having, as we mention'd before, entertain'd a very absurd Opinion about *Them*.

These then are placed in the *Temporal Bones*, as in other Animals, and consist of *One* long, small Bone (*Vid. Fig. 11.*), like that of *Birds*, whose Extremity is broad, like the *Basis* of the *Stapes* in *Man*, and situated upon a little Hole which opens into the *Labyrinth*; and besides of *three* *Demicircular Canals* (*Fig. 12. a b*) which also open into the *Labyrinth*.

This *Labyrinth* (*Fig. 13*) has a great many *Eminencies* in it of no determin'd Regular Figure (*Fig. 14.*), and is covered with a *Membrane* full of *Nerves* and *Blood Vessels*. The *Nerve* enters from the Brain at a Hole in the middle of this *Cavity* (*a, Fig. 15.*).

There is no *Cochlea* in the Ear of the Viper; but the Anterior *Demicircular Canal* opens into a *Semicanal*, which makes some *Spiral Turns* in the Fore-part of the *Labyrinth*; in like manner as it is in *Fish*.

The *Passage* for the Air to these Organs is not *Outward*, but, as in some Fish, thro' the Mouth, between the Upper and Under Jaws, running below the *Second* of the *Common Bones*. But of *This*, and also of the true mechanic Use of the aforesaid *Parts*, more hereafter.



Poisonous Animals.

AS the *Viper* is hurtful by instilling a liquid *Poison* into the Wound made by its Teeth; so likewise are all *venomous* Creatures whatsoever, whether they *Bite* or *Sting*, tho' there be some difference in the Contrivance of their *Organs*, mischievous after much the same *Manner*; and mostly for the same good *Use* and Purpose, that is, in order to kill their *Prey*.

This will fully appear, by examining the *Instruments* of Death in several of *Them*.

First then, The *Spider* which lives upon Flies, Wasps, and the like *Insects*, is provided with a hooked *Forceps*, placed just by the Mouth, very sharp and fine; with *this* he pierces the Flesh of little Creatures caught in his *Webb*, and at the same time infuses a *Juice* into the Puncture, by which means the Animal being killed, he sucks out the Moisture from the Body, and leaves it a dry husky Carcass.

Mr. *Van Leewenhoek*, in his Account of *Spiders*, lately publish'd (a), has, together with the other Parts, by the help of his Glasses, describ'd these *Weapons*, which he finds to lie couched on each side the Mouth, in a Row of Teeth, till they are raised to do Execution. These Rows of small *Teeth* are design'd to hold the Prey, that it may not escape the Force of the Bite. And in the convex Part, towards the Point of each *Claw*, he has delineated a little Aperture or *Slit*, thro' which he supposes the Poison issues out at the same time the Wound is made.

This *Situation* and *Motion* of these Parts, I have several times view'd; but was never able to discern the *Exit* or Opening; which, having a just Deference to the Industry

(a) *Philos. Transact.* No. 271.

and Application of so nice an Observer in things of this Nature, I, at first, imputed to my own Unskilfulness in such Enquiries, knowing my *Microscope* to be very good; till at last, after repeated Trials, I very plainly saw, that nothing dropt out of the *Claws*, which were always dry while the Spider Bit, but that a short, white *Proboscis* was at the same time thrust out of the Mouth, which instilled a *Liquor* into the Wound.

Then I concluded, that Mr. *Leeuwenhoek* had delineated the *Apertures* in these *Weapons*, only from the *Analogy* which he thought they must bear to the Viperine *Fangs*, the *Sting* of the *Scorpion*, *Bee*, &c. And I was confirmed in this Opinion by examining a *Claw* of the great *American Spider*, described (tho' but lamely) by *Piso* (b), and called *Nhamdu*; this was given me by Mr. *Pettiver*, and being above fifty Times bigger than *that* of the largest *European Spider* (c), if there had been any Slit in it, my Glass would no doubt have discovered it, but yet I found it to be quite Solid. And indeed the Quantity of *Liquor* emitted by our common Spiders when they kill their Prey, is visibly so great, and the wounding *Weapons* so minute, that they could contain but a very inconsiderable Portion thereof, if it were to be discharged that way.

To this purpose, I remember Mr. *Boyle* somewhere tells a Story of a Person blinded by a Spider dropping its *Venom* into his Eye, which tho' it can hardly find Credit with some, is however confirmed by what *Piso* relates of his *Nhamdu*, viz. That in catching it great heed is to be taken, lest its Poison fall into the *Eye*, this causing a total Loss of the *Sight*.

What Mr. *Leeuwenhoek* observes of the Enmity these Creatures bear to one another I have often seen; for if Four, Five, or more be put together into a Glass, they immediately fall to *Fighting* with all the Fury imaginable; *Limbs* struck off are usually the *Preludes* to the terrible Slaughter,

(b) *Nat. Hist.* lib. 5. cap. 10.

(c) *Vid. El.* 18.

which continues till all are killed, the *Surviving Conqueror* himself most commonly Dying of his Wounds.

The *Weapons* of Mischief in the *Scolopendra* are much the same with those of the Spider, only larger. One of these Creatures I had brought to me alive out of a Ship which came from the *East-Indies*, where *Bontius* (d) says, their Bite is so painful, that it makes People almost mad; but it died before I had an opportunity of making Trial of its Poison; however, I very diligently looked upon the Claws (e), and found them to have no more *Cavity* than is necessary for the Insertion of their Muscles, nor any *Exit* or *Outlet* towards their *Apex*; these therefore serve only to pierce the Flesh and the Venom is infused from a *Proboscis* out of the Mouth; tho' this I could not very well discern, because the Parts had been kept too long dry before I examined them.

The Case is much the same with *Stinging Animals*; of these the *Scorpion* is the Chief, whose *Virus* in different Countries is more or less dangerous, according as 'tis exalted by various Degrees of *Heat*; thus in *Africa* particularly its Effects are so dreadful, that as *Joann. Leo* (f) tells us, the Town of *Pescara* there is in a manner left desolate by the Inhabitants in the Summer Time, by Reason of the great Abundance of these Creatures, certain Death following their *Sting*.

Some of this deadly kind (the same, tho' not so large with that in the *East-Indies*, of which *Swammerdam* (g) has given a very accurate Description and Figure) *Sr. Redi* had sent him from *Tunis* (h); and it being *November*, irritated them to *Sting* Pigeons, Pullets, &c. without any bad Effect at all of their *Poison*; but upon the approaching Spring, one of them which had been kept all the Winter, nay, eight Months, without any Food, and the Wound of whose Sting before was harmless, stung to Death two

(d) *Hist. Ind.* p. m. 56.

(e) *Vid. Fig.* 17.

(f) *Histor. Afric.* lib. 6.

(g) *Hist. Insect.* p. 147.

(h) *Generazione degli Insetti.* p. 15.

Pigeons successively ; but a Third and Fourth wounded in like manner, suffered no hurt. Yet having let the *Scorpion* rest all Night, he killed another Pigeon the next Morning.

At the *Point* of the *Sting* he very often could discern a small drop of white *Liquor*, which when the Wound was made, entred into the *Flesh*.

As this *Liquid Venom* is either not separated from the Blood into the Cavity of the *Sting*, during the cold of Winter, or at least the *Scorpion* wants Strength at that time to throw it out with Force and Energy ; So even in the hot Months, after it is exhausted by two or three *Attacks*, the *Sting* is no longer hurtful, till the expence of this *Juice* is recruited by Time.

'Tis very remarkable concerning this *Insect*, what an ingenious Gentleman who lived several Years in *Barbary* told me, he had many times tried ; that if it be surrounded with a Circle of *Burning Coals*, it does, upon the Sense of the *Heat*, turn it self violently every way to make an Escape ; but finding it impossible, and the *Pain* from the Fire increasing, it strikes it self twice or thrice with the *Sting* on the *Back*, and immediately dies of the Wounds.

Others may make what Reflections they please on this *Self-Murder*, it is to me beyond all dispute sufficient to decide the *Controversie* between Writers, whether poisonous Animals of the same *Species* can kill each other. Which is not only confirmed by what we before observed of the *Spider*, but is likewise true of *Vipers* ; for Dr. *Herman* bringing from the *Indies* three of the *Cobras de Capelo* all in one Glass, two of them were killed in the Voyage by *Fighting*.

As the *Viperine Venom* is the *Quintessence* and most active Part of those *Animal Juices* with which the *Viper* is nourished, so is also that of the *Scorpion* ; for this *Insect* lives chiefly upon *Locusts*, &c. and the same Person from *Barbary* inform'd me, that seeing oftentimes *Locusts* sticking up in the Ground as if they were *Set* there, by looking he found that some part of them was always eat away, and that these Places were the *Holes* of *Scorpions*, who had dragg'd their Prey thither, and fed on it as they had Occasion.

In like manner, as the *Axungia Viperina* cures the Bite of the Viper, so also the *Oleum Scorpionum*, or Oil in which Scorpions have been infused, is a present Remedy for the Sting of this Creature.

The Mechanism of the Sting of a Bee, Dr. Hooke has very accurately described (i). One may with the naked Eye sometimes see it discharge the *Venom*; and in this, by the help of a *Glass*, I can easily discover a great Number of minute *Salts* floating.

And indeed this *Apparatus* or Contrivance is so universal, that we find even in *Vegetables* something analogous hereunto; for the last mention'd Author (k), has shewn us, that the pricking Points of *Nettles* do at the same time they pierce the Skin, instil a venomous *Juice* into the Wound.

(i) *Micrograph. Observ.* 34.

(k) *Ibid. Obs.* 25.



ESSAY II.

OF THE BITE OF THE *TARANTULA* AND MAD DOG.



Join these two *Poisons* together, because tho' they differ very much in their Effects, yet both do agree in this, that they induce a particular *Delirium sui generis*, attended partly with *Maniacal*, partly with *Melancholy* Symptoms.

The *Tarantula* (of which the Figure may be seen in *Baglivi's Dissertation* (a),) is a *Spider* of *Apulia* of the *Octonocular* kind; that is, of that *Species* that has eight Eyes, and

(a) *De Tarantul.*

spins Webbs ; it has eight Legs, four on each side, and in each Leg three Joints ; from the Mouth proceed two Darts, in Shape just like to a hooked *Forceps*, or Crab's Claws ; these are solid, and very sharp, so that they can easily pierce the Skin ; and between these and the Fore-Legs there are two little Horns, which I suppose do answer to those Bodies call'd from their Use in *Flies* the *Feelers* ; because as they do, so this Creature is observed to move 'em very briskly when it approaches to its Prey.

This, as other Spiders do, propagates its *Species* by laying Eggs, which are very numerous ; so that there are found sometimes in the Female, when dissected, a hundred or more ; and these are hatched partly by the Heat of the Mother, partly by that of the Sun, in about twenty or thirty Days Time.

There is also a Spider of the like Nature with the *Tarantula* in the *West-Indies*, which *Fr. Hernandez* (b) describes by the Name of *Hoitztocatl*, or the *Pricking Spider* ; and says, that its Bite induces Madness.

In the Summer Months, especially when the Heats are greatest, as in the Dog-Days, the *Tarantula* creeping among the Corn in the Fields, bites the Mowers and Passengers ; in the Winter it lurks in Holes, and is scarcely seen ; and if it does bite then, it is not venomous, neither does it induce any ill Symptoms.

But in the hot Weather, altho' the Pain of its Bite is at first no greater than what is caused by the Sting of a Bee, yet the Part quickly after is discoloured with a Livid, Black, or Yellowish Circle, and raised to an inflam'd Swelling ; the Patient within a few Hours is seized with a violent Sickness, Difficulty of Breathing, universal Faintness, and sometimes Trembling, with a Weakness of the Head ; being ask'd what the Ail is, makes no Reply, or with a querulous Voice, and melancholy Look, points to his Breast, as if the Heart was most affected.

During this mournful Scene, all the usual *Alexipharmick* and *Cordial* Medicines are of no Service ; for notwithstanding

(b) *Histor. Animal. Nov. Hispan. Tract. 4. c. 5.*

ing their repeated Use, the Patient growing by degrees more melancholy, stupid, and strangely timorous, in a short Time expires, unless Musick be called to his Assistance, which alone, without the Help of Medicine, performs the *Cure*.

For at the first Sound of the *Musical Instrument*, altho' the Sick lie, as it were, in an Apoplectick Fit, they begin by Degrees to move their Hands and Feet, till at last they get up, and fall to Dancing with wonderful Vigour, at first for three or four Hours, then they are put to Bed, refreshed from their sweating, for a short time, and repeat the Exercise with the same Vehemence, perceiving no Weariness or Weakness from it, but professing they grow stronger and nimbler the more they dance.

At this Sport they usually spend twelve Hours a Day, and it continues three or four Days; by which time they are generally freed from all their Symptoms, which do nevertheless attack 'em again about the same time the next Year; and if they do not take care to prevent this Relapse by Musick, they fall into a *Jaundice*, want of Appetite, universal Weakness, and such like Diseases; which are every Year increased, if Dancing be neglected, till at last they prove incurable.

As Musick is the common *Cure*, so they who are bitten, are pleas'd some with one Sort of it, some with another; one is rais'd with a Pipe, another with a Timbrel; one with a Harp, another with a Fiddle; so that the Musicians make sometimes several Essays before they can accommodate their Art to the Venom; but this is constant and certain, notwithstanding this Variety, that they all require the quickest and briskest Tunes, and are never moved by a slow, dull *Harmony*.

While the *Tarantati*, or Affected, are Dancing, they lose in a manner the use of all their Senses, like so many Drunkards, do many ridiculous and foolish Tricks, talk and act obscenely and rudely, take great Pleasure in Playing with Vine-Leaves, with naked Swords, red Cloaths, and the like; and on the other hand can't bear the Sight of any thing

thing black ; so that if any By-stander happen to appear in that *Colour*, he must immediately withdraw, otherwise they relapse into their Symptoms with as much Violence as ever.

It may afford some Light towards Understanding the Nature of this Poison, to observe that *Apulia* is the hottest Part of all *Italy*, lying *Eastward*, and having all the Summer long but very little Rain to temper the Heats, so that the Inhabitants, as one of that Country observes (c), do breathe an Air, as it were, out of a fiery Furnace ; hence their Temperament is dry, and adust, as appears by their being generally lean, passionate, impatient, ready to Action, quick-witted, very subject to inflammatory Distempers, Phrensies, Melancholy, and the like, upon which Account there are more mad People in this, than in all the other Parts of *Italy* ; nay, what in other Countries is but a light Melancholy, arises here to a great Heigth ; for Women in a *Chlorosis* do suffer almost the same Symptoms as Persons poisoned by the *Tarantula* do, and are cured the same Way ; and in like manner the Venom of the *Scorpion*, does here in Effects and Cure agree very much with that of this Spider.

From all this History it sufficiently appears, that those that are bitten by a *Tarantula*, do thereupon become *Delirious* ; and that in order to account for their surprizing Symptoms, the Nature of a *Delirium*, from which many of them proceed, ought to be understood.

Such is the Constitution of the *Human OEconomy*, that as upon the Impression of outward *Objects* made upon the *Organs*, and by the Fluid of the Nerves conveyed to the *Common Sensory* ; different *Species* are excited there, and represented to the Mind ; so likewise upon this Representation, at the Command and Pleasure of the Soul, part of the same Fluid is determin'd into the Muscles, and mixing with the arterial Blood there, performs all the Variety of voluntary Motions and Actions.

(c) *Baglivi*, p. 11.

This Order has been always so constant in us, that at length by a kind of natural Habitude, without the Intervention of the Reasoning Faculty, Representations made to the Mind do immediately and necessarily produce suitable Motions in the bodily Organs. When therefore these Representations are irregular, the Actions consequent to them must necessarily be so too.

This being premis'd, it may perhaps be probably said, that a *Delirium* is the Representation and various Composition of several *Species* to the Mind, without any Order or Coherence; together, at least most commonly, with irregular, or, as it were, undesigned Motions of the Body; that is, such a wandering and irregular Motion of the nervous Fluid, whereby several Objects are represented to the Mind, and upon this Representation divers Operations perform'd by the Body, tho' those Objects are not impress'd upon the Organs, nor those Operations or Motions deliberately commanded by the Soul.

The Mind indeed is the first Principle of all muscular Motion; but in such Cases as these, its Promptitude to Action or Habit being so great, it is in a manner surpriz'd, and cannot recover it self after the Spirits are with violent Force determin'd pursuant to the Representation of the *Species*. For, as in the former State of Things a Man is said to act Rationally, so this latter Case is call'd a *Perturbation of Mind*, that is, a *Delirium*; tho' it is very manifest, that in reality the Defect is not in the *Rational*, but *Corporeal* Part; such *Species* being really presented to the Mind, upon which by the Order of our Constitution such Motions ought to follow in the Body.

Thus, for Instance, if the Liquor of the Nerves is, without the Presence of any thing hurtful, put into a Motion like unto that which a painful Impression makes in it, the same bodily Actions must insue as proceed from Fear, Anger, or the like Passion, determining the Spirits towards the muscular Parts; and a By-stander, who sees no reason for such a Representation made to the Mind, will presently conclude that the Person thus acting, acts without or besides his Reason, that is, is *Delirous*; especially if the Hurry
and

and Confusion of the Spirits be such, that not only *one*, but *several* different *Species* be at the same time presented to the Mind; for a Man in this Case may act the Part of one Joyful, Angry, Timorous, or the like, without any appearing Reason, and all this almost in the same Moment of Time.

In one Word, *Deliria* are the *Dreams* of those who are *Awake*; and *as these* in us *Sleeping* are infinitely various and wonderfully Compounded, and all from the same common *Cause*, diversely pressing the Orifices of the Nerves, and thus making different *Repercussions* of their Fluid; and *as* we all know that this Confusion making the Representation of several *Species* to the Mind, there do hereupon follow, tho' the Body seem now at Rest and in perfect Repose, such Motions in the Organs as are usually the Effect of the Arbitrary Determination of the Spirits thither; we are now to enquire what Alteration of the Body made by this Venom, can be the occasion of this Disorder and Tumult in the nervous Fluid, which excites in the Party infected such surprizing, and almost contradictory, Representations.

Most of the Symptoms of those who are bitten by the *Tarantula* are at the first, that is, before they rise to a *Delirium*, plainly the same with those which the Bite of a Viper induces; without doubt therefore, as we have before observed of the common Spider, that it pierces the Flesh with its hooked *Forceps*, and at the same time instils from the *Proboscis* in the Mouth a liquid Venom into the Wound; so the like *Claws* in *This* (of which I have taken the Figure (a) out of *P. Bonanni*, very much magnified (b),) do serve to make way for an active and penetrating Juice emitted from the same Part.

Of the Nature of which we may probably conjecture, that it is, when mixed with the Blood, being exalted by the Heat of the Climate, of so great Force and Energy, that it immediately raises an extraordinary Fermentation in the

(a) *Vid. Fig. 16.*

(b) *Micrograph. Curios. p. 69.*

whole arterial Fluid, by which its Texture and *Crafsis* is very considerably altered; the Consequent of which Alteration, when the Ebullition is over, must necessarily be a Change in the *Cohesion* of its Parts, by which the *Globules*, which did before with equal Force press each other, have now a very differing and irregular *Nifus* or Action, so that some of 'em do so firmly cohere together, as to compose *Molecule*, or small Clusters; upon which account there being now a greater number of *Globules* contained in the same Space than before, and besides, the *Impulse* of many of these when united together, differing according to the Conditions of their *Cohesion*, as to Magnitude, Figure, &c. not only will the *Impetus*, with which this Fluid is drove towards the Parts, be at some Strokes at least greater than ordinary; but the Pressure upon the Blood Vessels must be very unequal and irregular; and this more especially will be felt in them which are most easily distended; such are those of the Brain, &c. And hereupon the Fluid of the Nerves must necessarily be put into various *Undulatory* Motions, some of which will be like unto those which different *Objects* acting upon the Organs or Passions of the Mind, do naturally excite in it, whereupon such Actions must follow in the Body, as are usually the Consequents of the several *Species* of Sadness, Joy, Despair, or the like Determinations of the Thoughts; and we shall readily pronounce one in this Condition, *Sad, Joyful, Timorous, &c.* and all without any apparent Reason or Cause; that is, in one Word, we shall say he is *Delirous*.

This is in some Degree a *Coagulation* of the Blood, which will the more certainly, when attended with an extraordinary Heat, as in the present Case, produce such like Effects as these, because the *Spirits* separated from the Blood thus inflamed, and compounded of hard, fixt and dry Particles, must unavoidably share in this Alteration; that is, whereas their Fluid consists of two Parts, *One* more active and volatile, the *Other* more viscid and glutinous, which is a kind of Vehicle to the former; their *Active* Part will bear too great a proportion to the *Viscid*; and thus they must necessarily be of more than ordinary Volatility and

and Force, and will therefore, upon the least Occasion imaginable, be irregularly determin'd to every Part; and hereupon will follow Tremblings of the Body, Anger or Fear upon a light or no Cause, extream Pleasure at what is but a trivial Entertainment, as red, green Colours, or the like; and on the other hand, wonderful Sadness at any thing not agreeable to the Eyes, as dark and black Things; nay, ridiculous Laughter, obscene Talk and Actions, and such like Symptoms; because in this Constitution of the nervous Fluid, the most light Occasion will make as real a *Reflux* and *Undulation* of it to the Brain; that is, will present as lively and vivid *Species* there, as the strongest Cause and Impression can produce in its natural State and Condition; nay, in such a Confusion, the Spirits cannot but sometimes, without any manifest Cause at all, be hurried towards those Organs, to which at other times they have been most frequently determined; and every one knows which they are in hot Countries and Constitutions.

We must however here remember what in the former Essay we mention'd of the Fluid of the Nerves, being *immediately* altered by the venomous Juice.

It will perhaps make this Theory more than probable, to consider that *Baglivi* (a), in the Dissection of a *Rabbit* kill'd by a *Tarantula*, found the Blood Vessels of the Brain very turgid, and the Substance of the Brain it self, that is, the beginning of the Nerves, lightly inflamed, and with livid Spots here and there, the *Lungs* and other *Viscera* distended, with concrete glotted Blood, and large Grumes of Blood with *Polypons* Branches in the Heart, a large Quantity of extravasated *Serum* upon the Brain, which is (as he takes Notice) mostly observed in those Subjects which died by a Coagulation of the Blood.

Neither is it amiss to remark, that in a *Chlorosis* there is nothing preternatural but an *infarctus* of the Arteries, and hence a retarded *Circulation*, from an Evacuation suppress'd; and in this Country too much Heat; that is, a beginning *Coagulation*, together with an inflammatory Disposition.

In short, *Bellini* has at large demonstrated, how *Deliria*,

as well *Melancholic* as *Maniacal*, do proceed from a State of the Blood and Spirits, not unlike to that I have here described.

But no less a Confirmation of these Notions may we have from the *Cure*; as to which it is observable, that the *Tarantati* have no Inclination to *dance* before they hear the Musick; for being ask'd to do it, they answer 'tis impossible, they have no Strength.

As for the Reason therefore of their starting up at the first Noise of the Instrument, we must reflect upon what we have just now been saying concerning the Cause of the Motions of the Body in a *Delirium*; and consider withal, that muscular Motion is no other than a Contraction of the Fibres from the arterial Fluid making an Effervescence with the Nervous Juice, which by the light Vibration and Tremor of the Nerve, is derived into the Muscle.

And thus we have a twofold Effect and Operation of Musick, that is, both upon the Mind and Body. For a brisk Harmony excites lively *Species* of *Joy* and *Gladness*, which are always accompany'd with a more frequent and stronger Pulse, or an increased influx of the Liquor of the Nerves into the Muscles, upon which suitable Actions must immediately follow; and if we remember what we before hinted, that People in this Country are sprightly and ready to exercise, and that in such a state of the Fluids as we have describ'd, a slight Occasion presents a strong *Species*, as a greater can at another time: The Influence of Musick on the *Mind* will appear to be so much the more powerful and certain.

As for the *Body*, since it is sufficient for the purpose of putting the Muscles into Action, to cause those *Tremors* of the Nerves by which their Fluid is alternately dropt into the moving Fibres; it is all one whether this be done by the determination of the Will, or the outward *Impulsions* of an *Elastic* Fluid; such is the *Air*; and that Sounds are the *Vibrations* of it, is beyond dispute.

These therefore rightly modulated may shake the Nerves as really as the *Imperium Voluntatis* can do, and consequently produce the like Effects.

That

That this is so, besides, what we shall add anon, we may be convinced by a Story which Mr. Boyle (a) relates out of Scaliger, of a Knight of Gascony whom the sound of a Bagpipe would unavoidably force to make Water; for this Secretion we know is regularly the Effect of an arbitrary Contraction of the Muscle of the Bladder.

The obstinate continuing of the *Tarantati* in this Exercise, is doubtless in a great Measure owing to the strong Opinion they have of receiving Advantage from it, being encouraged by the By-standers, and having always believed, and been told, that it was the only Cure in these Cases.

The Benefit from Musick is not only their dancing to it, and so evacuating by Sweat a great Part of the inflammatory Fluid; but besides this, the repeated Percussions of the Air hereby made, by immediate Contact shaking the contractile Fibres of the Membranes of the Body, especially those of the Ear, which being continuous to the Brain, do communicate their Tremblings to its Membranes and Vessels; by these continued Succussions and Vibrations, the Cohesion of the Parts of the Blood is perfectly broken, and its Coagulation prevented; so that the Heat being removed by Sweating, and the Coagulation by the Contraction of the muscular *Fibrille*, the wounded Person is restored to his former Condition.

If any one doubts of this force of the Air, let him consider that it is in *Mechanics* (b) demonstrated, that the smallest Percussion of the smallest Body, can overcome the Resistance of any great Weight which is in Rest; and that the languid Tremor of the Air, which is made by the Sound of a Drum or Trumpet, may shake the vastest and strongest Edifices.

But besides all this, we must allow a great deal to the *determinate Force*, and particular *Modulation*, of these trembling Percussions; for contractile Bodies may be acted upon by one certain Degree of Motion in the ambient Fluid, tho' a greater Degree of it differently qualified may produce no-

(a) Of Languid and unheeded Motion.

(b) Borelli de Vi Percussion. Prop. 90, and 111.

thing at all of the like Effect; this is not only very apparent in the common Experiment of two string'd musical Instruments tuned both to the same Heighth, the Strings of the one being struck upon, those of the other will sound, and yet a much greater Motion of the Air may not cause any sensible Vibration at all in the same Chords; but also by the *Trick* which many have of finding the Tone or Note peculiarly belonging to any *Wine Glass*, and by accommodating their *Voice* exactly to that Tone, and yet making it loud and lasting, they will make the Vessel tho' not touch'd, first to tremble, and then burst; which it will not do if their Voice be but a little either too low or too high.

This last Consideration makes it no very difficult matter to conceive the Reason, why different Persons, infected with this Venom, do require oftentimes a different sort of Musick in order to their Cure, in as much as their Nerves and *Distrañtile* Membranes have differing *Tensions*, and consequently are not in like manner to be acted upon by the same *Vibrations*.

Nor are we to wonder at the Oddness of this Method and Practice; for *Musick*, altho' it be Now-a-days applied to quite different Purposes, was anciently made great Use of for the removing of many, and those too some of the most difficult and obstinate Diseases.

For this we have a famous Testimony in *Galen* himself, (a) who tells us, that *Æsculapius* used to recover those in whom violent Motions of the Mind had induced a hot Temperament of Body, by Melody and Songs. *Pindar* (b) mentions the same thing; and indeed from hence not only the Notion, but the very Name of *Charming* (c) seems to have taken its Origine. *Athenaus* (d) relates that *Theophrastus* in his Book of *Enthusiasm* says, *Ischiadic Pains are cured by the Phrygian Harmony*. This Sort of Musick was upon a *Pipe*, and the most vehement and brisk, of all the Anci-

(a) *De Sanitate Tuenda*, lib. 1. c. 8.

(b) *Pythior. Od.* 3. *μαλακαῖς ἐπαοιδᾶς*. *Vid. ibid. Scholia*.

(c) *A Carmine*.

(d) *Deipnosoph.* 1. 14. p. m. 624.

ents knew ; so that indeed it was said to raise those who heard it to downright Fury and Madness (e) : And such we have observed to be required to the Venom of the *Tarantula*.

But what is besides in this last Authority very observable to our Purpose, is the manner of using this Remedy, and that was (f) by *playing upon the Part affected*, which confirms what we have just now advanced concerning the Effect of the *Percussion* of the Air upon the Contractile Fibres of the *Brain*, for *Piping upon any Member of the Body*, cannot be suppos'd to do service any other way, than by such Succussions and modulated Vibrations as we before mention'd. And this indeed *Celius Aurelianus* (a) agrees to, who calls this Practice, *Decantare Loca dolentia* ; and says, that the *Pain is mitigated and discuss'd by the Tremblings and Palpitations of the Part*.

Aulus Gellius (b) not only relates this same Cure of *Ischiadic Ails* as a thing notorious enough, but adds besides out of *Theophrastus*, that the *Musick of a Pipe rightly managed healed the Bites of Vipers*.

And not only does *Apollonius* (c) mention the Cure of Distractions of the Mind, Epilepsies, and several other Distempers this same way ; but *Democritus* (d) in his Treatise of Plagues, taught, that the *Musick of Pipes was the Medicine for most Diseases* ; which *Thales of Crete* confirmed by his Practice, when sent for by the *Lacedemonians* to remove from them the Pestilence, he did it by the help of Musick (ee).

All which Instances do evince this Remedy to have been very ancient in many Cases ; and indeed as *Celius Aurelianus*

(e) *Vid. Bartholin. de Tibiis Veter. l. i. c. 9.*

(f) *εἰ καὶ ταυλήσοι τις τὴν τέρη τῆς φρενὸς ἀρμονίᾳ.*

(a) *Morb. chronic. l. 5. c. 1. Quæ cum saltum sumerent, palpitando discusso dolore mitescerent.*

(b) *Noct. Atticar. l. 4. c. 13.*

(c) *Histor. Mirabil.*

(d) *Apud Aul. Gell. loc. citat. Plurimis hominum Morbis Medicinam fuisse Incentiones Tibiarum.*

(ee) *Plutarc. de Musica.*

(f) takes notice that the first use of it was ascrib'd to *Pythagoras* himself, so he having settled and founded his Sect in those very Parts of *Italy* which are the Country of the *Tarantula*, going then under the Name of *Græciamagna*, now *Calabria*; it is not, I think, at all improbable that he may have been the Author and Inventor of this Practice there, which has continued ever since. Especially since *Jamblichus* affirms (g), not only that he made use of Musick in Physick, but particularly that he found out and contrived some Harmonies to ease the Passions of the Mind, and others for the Cure of Bites: But of Musick enough.

To conclude with this Poison, we may take notice that, as to the Return of the Symptoms the next Year, that is owing to the same excessive Heat in those Months, acting again upon the small remains of the Venomous Ferment; Thus *Bartholin* (h) relates a Story of a Melancholy Physician at *Venice*, who suffer'd the Attacks of his Disease only during the Dog-days, which yearly ended and return'd with them. A convincing proof how great a share Heat has in all these Cases.

(f) *Loc. ante cit.*

(g) *De Vit. Pythagor. cap. 25. πρὸ διγμῶς βοηθητικώτατα μέλη.*

(h) *Hister. Anatom. Cent. 2. H. 26.*



Of the Mad D O G.

MORE difficult and terrifying are the Symptoms from the Bite of a *Mad Dog*, whose Venom has this also surprizing in it, that the bad Effects do not appear oftentimes till the Cause of 'em is forgot; for the Wound is as easily cured as a common Bite is; but nevertheless a considerable time after, a melancholy Tragedy succeeds, sometimes sooner, sometimes later; for there are Instances of its being deferred to Two, (k) Six Months, nay, a Year, and longer, tho' the Attack is generally within Forty Days after the Wound; about that time, the Patient complains of Running Pains all over his Body, especially near the Part wounded, like unto those in a Rheumatism, grows pensive and sad, prone to Anger upon little or no Occasion, with an intermitting Pulse, Tremblings and Contractions of the Nerves, with a great inward Heat and Thirst; and yet in a few Days (when the Disease is come to its height) a dread and fear of Water, and any Liquor whatsoever; so that at the very sight of it he falls into dismal Convulsions and Agonies, and cannot drink the least drop; and this *Hydrophobia*, or *Aque Timor*, has been always accounted the surest Sign and Mark of this Poison, as distinguishing it from all others.

The Ancients have at large described these Symptoms, as *Galen*, *Dioscorides*, *Aetius*, *Aegineta*, but most particularly of all, *Caelius Aurelianus* (a); and later Writers have given us several Instances of the *Hydrophobia*; Two Histo-

(k) *S. Ardoyn de Venen.* pag. 381,

(a) *De Morb. Acut.* lib. 3.

ries of it published, the one by Dr. *Lifter* (b), the other by Dr. *Howman* (c), I shall more especially take Notice of, and refer to, as containing the most exact and large Account of any I have met with; he that desires more, may consult the several Authors cited by that diligent Observer, *Stalpart van der Wiel* (cc).

That this Disease is accompany'd with a *Delirium*, is almost the common Opinion both of Ancients and Moderns (d); *Damocrates* called it the barking Phrensie (e), but Dr. *Lifter* agrees in this Point with *Petrus Salius Diverfus* (f), and will not allow a *Delirium* to be the necessary consequent of this Venom; and yet at the same time he tells us, that his Patient barked like a Dog, and bit at the By-standers; that he threw into his Mouth what was given him more hastily and suddenly than it is natural or customary for Men to do.

From such Actions as these, together with those mentioned before in relating the Symptoms, it is obvious enough to conclude, that Persons thus affected are in a proper Sense *Delirous*. Tho' at the same time I do think that the *Hydrophobia* it self (whatever is commonly believed) does not at all proceed from this *Delirium*, as will by and by appear.

I know indeed that the main and plausible *Objection* against a *Delirium* is this, that the Patient himself does Reason against his Timorousness, tho' he cannot overcome it, forewarns the Standers-by of his outrageous Fits, desires them to take care of themselves, and the like. Which from what I have already said concerning a *Delirium*, appears to be very consistent with it, nay, convinces that there is the greatest Degree of it in this Case; in as much as that it is not a Distemper of the Mind but of the Body. And to this purpose I remember to have seen

(b) *Exercitat. de Hydrophob.*

(c) *Poilosoph. Transact. N°. 169.*

(cc) *Observ. Rarior. Centur. 2. Obs. 100.*

(d) *Vid. Galen. de Theriac. ad Pison, l. 1. cap. 16.*

(e) *Παρακοπιὰν ὑδακτὶμὰν, apud Galen de Antidict. lib. 2. cap. 15.*

(f) *De Hydroph.*

my self an Instance of one in a Fever, who foretold some time before any signs of a *Delirium* were discovered, how raving and unruly he should be, and made good his *Prognostick* to that degree, that it was very hard Work to tame and master him ; tho', as he told me afterwards, he reason'd as much as he could against that groundless Jealousie of his Friends designing to murder him, which put him upon his mad Actions, but was not able to conquer the prevailing *Species* of Fear and Anger.

This *Delirium* therefore, as *Celsius Aurelianus* (g) says, *Proceeds intirely from an Indisposition of the Body*, which is without all doubt owing to the Alteration made in the Blood by the *Saliva* of the *Mad Dog*, instill'd into the Wound inflicted by the Bite.

That we may rightly understand this, we must take notice, that the *Rabies* or Madness in a Dog is the effect of a violent Fever ; and therefore it is most common in excessive hot Weather, tho' sometimes intense Cold may be the Cause of it ; That no Dog in this Case ever sweats ; from whence it follows, that when his Blood is in a Ferment, it cannot, as in other Creatures, discharge it self upon the surface of the Body, and therefore must of necessity throw out a great many *Saline* and active Particles upon those Parts, where there is the most constant and easie Secretion ; and such, next to the *Miliary* in the Skin in us, are the *Salival* Glands ; for this reason much more Spittle is separated in a Dog when mad, than at any other time, and that very frothy, or impregnated with hot, subtil Parts.

Now as we every Day observe, that what is thrown out from Liquors in a Ferment, is capable of inducing the like Motion in another Liquor of the same kind, when duly mixed with it ; so we may very well suppose in the present Case, that the *Saliva*, which is it self one of the most fermentative Juices in Nature, being turgid with fiery, saline Particles thrown into it out of the boiling Blood, when it comes by means of a Wound to be incorporated with the arterial Fluid of any one, does by Degrees raise a preternatu-

(g) *Loc. citat. Tota oritur ex Corporis ipsius mala Affectione.*

ral Effervescence in it; the Effects of which will necessarily be most felt in those Parts which being tender, are the least able to resist the Distension of the Blood Vessels; such are the Stomach, and especially the Brain; and hereupon *Deliria*, with *Maniacal*, and such like Symptoms, will easily ensue.

A Person thus affected may be said in a Degree to have put on the *Canine* Nature, tho' his Reason be all this time untouch'd and intire, may bite, howl, &c. because the like violent Agitation of the Blood in him as was in the Dog will present like *Species*, and consequently (so far as their different Natures will allow) produce like Actions; just as it has been observed, that *Sheep* bitten by a Mad Dog, have run at the Shepherd like so many Dogs to bite him; so much can an Alteration of the Blood and Spirits do. And as a timorous Creature may be imboldened, so we oftentimes see Persons courageous enough by a Change made in the Blood by Evacuations, that is, by want of Force and Motion in that Fluid, made sheepish Cowards, in despite of their Reason, so long as that Defect is continued.

But the main Difficulties in this matter are, the Mischief discovering it self so long after the Bite, and the *Hydrophobia*.

As to the former, we are to consider, that Fermentation being a Change made in the Cohæsion of the compounding Parts of a Fluid, it is sometimes a longer, sometimes a shorter time before this Alteration is wrought; which Variety may proceed either from the different Nature and Constitution of the Ferment, or of the Liquor fermented, and a great Number of Circumstances besides. So that this Venom may be all the while doing its Work, tho' the Change made by it may not be so considerable as to be sensibly taken Notice of till a long time after.

Nay, it may so happen, that the *Ferment* being Weak may not raise in the Blood any remarkable Agitation at all, till some accidental Alteration in the Body unluckily gives it an additional Force. As we before observed, how much external Heat concurs to heighten the Symptoms from the Bite of the *Tarantula*. And this probably may be the Case
of

of Those in whom this Malignity has not appear'd till Six, or Twelve Months after the Wound.

That we may understand the Reason of the *Hydrophobia*, it is to be Remarked, that this dread of Water does not come on till the latter end of the Disease, three or four Days before Death; that is, not till this preternatural *Fermentation* in the Blood is come to its Height; and as in the Dog, so in the Patient, a great quantity of Fermentative Particles is thrown off upon the Glands of the Mouth and Stomach, as appears by his Foaming at the Mouth, &c.

As also, that this *Fear* is not from a sight of, or any imaginary appearance in the Water, for if the Vessel be close shut, and the Patient bid to suck thro' a Quill, as soon as he has tasted, he falls into Anguish and Convulsions, as Dr. Lister observed. It is therefore highly probable, if not certain, that this surprising Symptom proceeds from the intolerable *Pain* which any Liquor at this time taken induces, partly by hurting the inflamed Membranes of the *Fauces* in Deglutition; partly by fermenting with these Active Particles discharged by the Blood upon the *Stomachic* Glands, and thus twitching and irritating the Nervous Membranes; the very memory of which *grievous Sence*, after it is once felt, is so terrible, that the affected Person chuses any thing rather than to undergo it a second time.

The Effects of this *Irritation* are manifest in the Convulsions of the Stomach, and frequent *Singultus*, with which the Patient is continually oppress'd. And we all know by how necessary a kind of *Mechanism* we do fly from and abhor those things which have proved disagreeable to the *Animal OEconomy*, to which nothing is so contrary and repugnant as *Pain*; at the first Approaches of which, Nature starts and recoils, tho' Reason be arm'd with never so much Courage and Resolution to undergo the Shock.

Nor will any Body wonder how this *Ferment* should cause such *Torment*, who considers how often, even in *Colic* Cases, Persons are downright distracted by excessive Pain, from a Cause not unlike to this we are treating of, that is, from a corrosive Ferment in the Bowels, rarefying

the Juices there into *Flatus*, and by this means irritating and stimulating those tender Membranes into Spasmodic and Convulsive Motions.

And indeed Dr. *Lifter's* Patient told him, that the very swallowing of his own Spittle put him to such Torture in his Stomach, that Death it self was not so terrible as the inexpressible Agony.

It may serve both to illustrate and confirm this Theory, to take Notice, that not only may (according to these Principles) other Bites besides that of a *Dog*, happen to induce the like Symptoms; thus *Malpighi* (a) relates a Story of a Mother made *Hydrophoba* by the Bite of her *Epileptic* Daughter; but that there are other Cases, without any Bite at all, which are attended with an *Hydrophobia*.

Thus *Schenkius* (b), *Salmuth* (c) and others have observ'd a *Dread of Water*, without any Suspicion of a Bite, from *Malignant Fevers*. Now in *These* there is doubtless a Hot, Putrid *Ferment* in the Blood; and it is no wonder if Part of it be discharged upon the Throat and Stomach, which we do evidently find in these Distempers to be more particularly affected by it, especially towards the latter End, from the *Aphthæ*, *Singultus*, and the like usual Symptoms of a fatal Malignity.

Nay, *Hippocrates* (d) himself seems more than once to have remarked something like this Symptom in Fevers, and to call those who were thus affected *Βραχυπότες* or little Drinkers; for I cannot assent to Dr. *Lifter*, (tho' *Celius Aurelianus* be on his side) who thinks that the *Βραχυπότες* are *επιφοβέες* from the Bite of a Mad Dog; as well for other Reasons, as becaule *Plutarch* (e) assures us, that the *Hydrophobia* and *Elephantiasis* were both first taken Notice of in the time of *Asclepiades* the Physician; who liv'd in the Days of *Pompey* the Great, many Years later than either *Hippocrates* or *Aristotle*.

(a) *Opus. Posthum.* p. 55.

(b) *Obser. de Venen. Animal.*

(c) *Obser. Cent. 2. Obs. 52.*

(d) *In Proreptic. & coac. & alibi.*

(e) *Symposiac. 5. 9.*

Neither is it amiss to add, that *Joannes Faber* (f) in the Dissection of one who dy'd at *Rome* of the Bite of a Mad Dog, and a *Hydrophobia* succeeding it, found the Blood *Coagulated* in the right Ventricle of the Heart, the Lungs wonderfully *Red* and *Tumefied*; but especially the *Throat*, *Stomach*, and *Bowels*, bearing the Marks of the inflammatory Venom.

The same Observation has been made by others in Bodies Dead of this Disease. Thus the *Acta Medica Hafniensia* (a) on a Case, in which, part of the Liver was *Inflamed*, the Lungs Parched and Dry, and the inner Coat of the *Stomach* so *Mortified*, that it might be abraded with one's Fingers.

Bonetus (b) tells another, where all the *Viscera* were found quite *arid*, without any Juice at all.

And in a very particular History of an *Hydrophobia*, lately published at *Ulm* (c), We are informed, that the *Stomach*, when opened, discover'd the Marks of an *Erosion* or Excoriation, with something like a Gangrene, and Suffusion of Blood here and there. Which does very well agree with the Observations in the *German Ephemerides* (d), where we find several *Footsteps* of a *Sphacelus* or Mortification in the Bodies of those who died *Hydrophobi*.

The Cure of this Poison is either immediately upon the Wound made, or some Days after, before the fear of Water is discover'd; for at that time all Authors do agree the Malady to be Incurable; and the Reason is plain from what has been already deliver'd.

As in other Venomous Bites, so in this, *Galen* (e) very wisely advises to enlarge the Wound, by making a round

(f) *Apud Hernand. & Recch. Plantar. & Anim. Mexicanor. Histor.*
P. 494.

(a) *Vol. 5. Obs. 114.*

(b) *Sepulcret. Lib. 1. Sect. 8. Obs. 8.*

(c) *Rossini Lentilii Dissertatio de Hydrophobia Causa & Cura.*

(d) *Eph. Cur. Dec. 3. Ann. 2. Obs. 104.*

(e) *De Theriac. ad Pison. l. 1. c. 16.*

Incision about it, to Cauterise it with a hot Iron, and apply drawing Medicines, so as to keep it a running Ulcer at least Forty Days. (f) *Scarifying* and *Cupping* may answer where this Severity is not allow'd: And however, the Dressing it with *Unguentum Egyptiacum* (or the like) Scalding Hot, must not be omitted; by which alone, timely applied, I am assured that one Bitten was happily preserved.

but where these Means of destroying the Ferment in the beginning are omitted, the dangerous Consequences of its being mixed with the Blood is by all possible Care to be prevented.

To this purpose, to say nothing of the many inconsiderate Jumbles of *Antidotes*, *Theriacas*, &c. nor of such vulgar Trifles as the *Liver* of the Mad Dog, of which *Galen* (a) observed, that tho' some who made use of it, together with other good Medicines, recover'd, yet that they who trusted to it alone died; one of the greatest Remedies commended to us by Antiquity, is the *Cineres Cancrorum Fluviatilium*; which *Galen* (b) says, no Body ever made use of, and miscarried; and before him *Dioscorides* (c) assured, that 'tis a Medicine may be rely'd on. These were given in large Quantities, viz. a good Spoonful or Two every Day for Forty Days together, either alone, or rather mix'd with the Powder of *Gentian Root* and *Frankincense*. The *Vehicle* was either Water or Wine. In like manner at this Day, the Remedy in the greatest Repute of any against most Poisons in the *West-Indies*, is a kind of a *River-Craw-Fish*, call'd *Aratu* (d).

This is manifestly an *Absorbent*, and very *Diuretick* Medicine, especially when prepared after the right manner, which was by burning the *Craw-Fish* alive upon a *Copper-Plate*, with a Fire made of the Cuttings or Twigs of

(f) *Vid. Aetium* l. 6. c. 24.

(a) *Simpl. Medic. Facult.* l. 11. c. 1.

(b) *Ibid.* l. 11. c. 34.

(c) *Theriac.* Cap. 2.

(d) *Vid. Pison. Histor. Nat. & Med. Ind.* lib. 5. c. 16.

White Briony : For whether the latter part of the Management signifies much or no, the former most certainly does; and the *Salt* of the *Copper*, which powerfully provokes Urine, being mix'd with that of the *Ashes*, may very much exalt their Virtue.

And 'tis upon this same Score, that the *Spongia* of the *Cynorrhodos* or *Rosa Sylvestris* is so Celebrated an Antidote, not only for this Poison, but also for that of the Viper, *Tarantula*, and others too, that 'tis call'd in *Sicily Sanotodos*, or All-heal; this being not a *Vegetable*, as *P. Boccone* (e), who has wrote a whole Letter of its wondrous Virtues, terms it, but an *Animal Alkali*, as well as the former; for as Mr. Ray (f) has observed, this Spongy Excrecence, if it be cut, is found full of White Worms; being the Nest of these Insects which lodging here all the Winter, do in the beginning of the Spring turn to Flies, and quit their Quarters. Indeed this Remedy was anciently too of so great Esteem, that *Pliny* recommends it as the only Cure of an *Hydrophobia*, divinely discovered by an Oracle (g).

As all Insects abound with a Diuretick Salt, so *Cantharides* more than any others; therefore the learned *Bacchius* (h) goes farther, and from the Authority of *Rhazes* and *Joannes Damascenus*, advises to give these in Substance for many Days together. The Preparation of this Antidote, (so he calls it) is by infusing the *Cantharides* in four Butter-milk Twenty Four Hours, then drying them, and with the Flower of Lentils and Wine making them up into *Troches* of a Scruple Weight, of which one is to be taken every Day. By which means he assures us, that tho' the Patient make bloody Urine, yet that Milk largely drank will abate that Symptom, and that an *Hydrophobia* will be happily prevented. *Boccone* (i) tells us, that in Upper

(e) *Museo di Pianta rare*, Osservaz. 2.

(f) *Hist. Plant. Tom. 2. p. 1471.*

(g) *Histor. Natur. l. 8. c. 41. & l. 25. cap. 2.*

(h) *De Venen. p. 80.*

(i) *Museo di Fisica*, Osservaz. 21.

Hungary they give *Cantharides* to Men bitten by a Mad Dog, *Five* to a Dose; and to *Beasts* in greater Quantity. But of the inward Use of these Flies more in its proper Place.

In short, all the *Specifics* in this Case are such as do either absorb a peccant *Acidity* in the Stomach, or carry it off by Urine; as *Terra Lemnia*, highly commended by *Galen* (k), *Garlick*, *Agrimony*, *Oxylapathum*, and many others, of which a Catalogue may be seen in *S. Ardoynus*. So the *Alyssum* or Madwort, celebrated for this use by the ancient Physicians, as well that described by *Diascorides*, which is a Species of *Leucoium*, as the other of *Galen*, which is a *Marrubium*, is very manifestly a Bitter, Stomachic, and Diuretick Plant (l). The *Lichen cinereus terrestris*, recommended in the Philosophical Transactions (m), operates the same way.

But the greatest and surest Cure of all, is frequent *Submerging* or Ducking the Patient in Water. The first mention I find of this is in *Cornelius Celsus* (n); whether he had it from the Ancient *Grecian* Physicians, or it was the Discovery of his own Age, matters but little to our Purpose; certain it is, that he collected his Principal Rules of Bathing from *Cleophrantus*, who, as *Pliny* says (o), did, besides many other delightful things, first introduce the Use of Baths; As appears by comparing the Writings of the One with the Fragments of the Other, preserv'd in the Works of *Galen*. And that from *Asclepiades*, who afterwards so far improved this Part of Physick, that he discarded almost all inward Medicines, he might learn this Management, is not improbable; for the *Hydrophobia* (as we before took Notice) having been first regarded in the time of this great Physician, 'tis very likely that among other Advantages of his new Method, he might commend it for the Cure of so deplorable a Malady.

(k) *Medicam. facult. lib. 9. c. 1.*

(l) *Fab. column. Phytobasan. pag. 27.*

(m) *N°. 237.*

(n) *Lib. 5. c. 27.*

(o) *Nat. Hist. l. 26. c. 3.*

However it be, this Practice was in this last Age with great Authority revived by the Ingenious *Baron Van Helmont* (a), who having in his own Country seen how great Service it did, has at large set down both the manner of the Operation; and, consonant to the Principles of his own Philosophy, shewn the Reason of its good Effects. Since him *Tulpinus* (b), an Observer of very good Credit, takes notice, that tho' he saw many, yet that never one miscarry'd, where it was in time made use of.

As all Baths do chiefly act by the sensible Qualities of Heat and Cold, and the gravity of their Fluid; so we need go no farther to fetch the Reason of the great Advantage of this Method in the present Case, than to the Pressure of the Water upon the Body of the Patient.

Every one knows how plentifully plunging into cold Water provokes Urine, which proceeds no doubt from the Constriction hereby made of the Fibres of the Skin and Vessels. Thus this outward Cure differs not much in effect from the inward Medicines beforementioned, but must necessarily have the better of them in this Respect, that when the Fermenting Blood stretches its Vessels, the exceeding weight of the ambient Fluid resists and represses this Distension, and so prevents the Effects of it. For this Reason the Salt Water of the Sea is especially chosen for this Business, because its greater Gravity than that of Fresh does more powerfully do all this, and break the beginning Cohæsion of the Parts of the Blood.

Thus we may, without having recourse to the *Fright* and *Terror*, with which this Method, when rightly practis'd, (by keeping the Party under Water for a considerable time, till he is almost quite drowned) is usually accompanied, probably enough account for the Advantages of this Immersion. Tho' it is not unlikely that this new Fear may have some good Effect in the Case too, for not only Convulsions, but Agues, and other Diseases, have oftentimes been happily cured, merely by terrifying and surprising the Patient.

(a) *Tr. Demens Idea.*

(b) *Observ. 20.*

The Reason of this will easily be understood by him who knows what Alterations the Passions of the Mind do make in the Fluid of the Nerves and Arteries ; of which in another Place.

It may for our present purpose suffice to take notice, that as in Consideration of the last mentioned Effect upon the Mind, *Van Helmont* commends this same Practice in all Sorts of Madness, and Chronical *Deliria* ; so upon the Account of the before hinted Alterations on the Body, Bathing was, among the Ancients, the common Cure of Melancholy, and such like Distempers (c). And as the younger *Van Helmont* (d), to confirm his Father's Notions, tells us, that one *Dr. Richardson* did with wonderful Success make use of this Management in these Cases, so in like manner *Prosper Alpinus* (e) takes Notice, that the *Egyptians* do at this Day perfectly recover melancholy Persons by the same Method, only with this Difference, that they make their Baths warm.

He that compares what has been already advanc'd concerning *Deliria*, with the *Bellinian* Theory of Melancholy and Maniacal Distempers, and reflects upon the Nature of Baths, and their manner of Acting, will see so much Reason in this Practice, as to be sorry that 'tis now-a-days almost quite laid aside and neglected. For we must observe, that altho' there be some Difference in the Treatment and Cure of *Deliria*, whether Maniacal or Melancholy, when they are originally from the Mind, as the Effects of Care, Trouble, or the like, and when from an Indisposition of the Body ; yet that both do agree in this, that they require an Alteration to be made in the Blood and Spirits ; inasmuch as the Mind, by often, nay, almost continually, renewing to it self any one *Idea*, of Love, Sorrow, &c. does so constantly determine the Spirits and Blood, one and the same way, that the Body does at last as much share in the Alteration, as if it had been primarily affected, and consequently must have, in some manner, the same Amendment. Upon this Score *Baccius* (f) asserts the admirable Use of

(c) Vid. *Aretæum Cappad. Gur. Diut.* lib. 1. cap. 5. Et *Aetium*, l. 6. c. 11.

(d) Tr. Man and his Diseases.

(e) *Medicin. Egyptior.* l. 3. c. 19.

(f) De Therm. l. 7. c. 22.

temperate Baths, in all kind of Distractions; and assures us, that not only common *Deliria*, but even the *Demoniaci*, *Phanatici*, *Lycanthropi* themselves, &c. are cured by frequent Washings in fresh Water, and a moist and nourishing Diet.

But to insist upon this Subject is foreign to our purpose; only in regard that the most usual Methods of Cure in these Cases are so very tedious, and oftentimes unsuccessful at the last, I thought it not amiss to hint thus much, in order to the advancing something more certain and effectual towards the Removal of the greatest Unhappiness to which Mankind is liable.

To conclude with the *Hydrophobia*; where these Remedies fail, or are administred too late, the Patient, from the prevailing inflammatory Disposition of the Blood, grows more and more *Delirous*, and by Degrees downright raving Mad, at last (as it most commonly happens in maniacal People) suffers a total Resolution of Strength, and dies. Thus Dr. *Howna's* Case ended in a perfect universal *Paralysis*.



ESSAY III.

O F

Poisonous Minerals

A N D

PLANTS.



Ltho' there be a great Variety of Internal *Poisons*, as well *Mineral* as *Vegetable*; yet they do all of 'em seem to agree in their primary Effects, and Manner of Operation; and as the Teeth or Stings of *Venomous* Animals do constantly infuse a Juice into the Wound they make, by which the Mass of Blood is infected; so the Force of *These* is chiefly confined to the Stomach and *Primæ Viæ*; and tho' it may in some Cases be communicated farther, yet the principal Mischief is done in these Parts.

Deleterious

Deleterious Medicines, says Dioscorides, are many, but the Alterations made by them in the Body, common, and but few (a).

Of all this kind, those of a *Mineral Nature* are the most violent and deadly, the greater Gravity and Solidity of their Parts giving to these a Force and Action surpassing the mischief of *Vegetable Juices*; and therefore whereas noxious Plants do vary their Effects in different Creatures, so as to prove harmless, nay, perhaps beneficial and nutritive to some, as Hemlock they say is to Goats (b) and Starlings (c), and Henbane to Hogs (d), the Strength of the Stomach in these Animals being sufficient to conquer and divide such corrosive Substances, and their Blood perhaps requiring to be recruited by such warm and active Particles; A mineral Malignity is not, at least so far as we know, conquerable by any, but becomes universally hurtful and destructive.

We shall here give the first Place to *Mercury Sublimate*.

This is no other than a mixture of *Quicksilver* with common Salt. The Way of preparing it, as 'tis made at Venice, from whence great quantities are sent into other Countries, *Tochenius* has given us in his *Hippocrates Chymicus* (e); as to which we must observe, that tho' there be always added a proportion of *Salt-Petre*, and *Calcin'd Vitriol* to the other Ingredients, yet these do not enter into the Composition, but only serve to facilitate the Work; as abundantly appears from this Experiment, that Mercury sublim'd with the same proportion of Nitre and Vitriol without *Marine Salt*, neither receives any increase of its Weight, nor acquires any malignant Quality.

The Effects of this *Poison* when taken are, violent Gripping Pains, with a Distension of the Belly, vomiting of a slimy, frothy Matter, sometimes mixt with Blood, and

(a) Ποικίλα μὲν γὰρ τὰ δηλητήρια Φάρμακα, κοινὰ δὲ ἔχ' ἢ πολλὰ ἐξ αὐτῶν γινόμενα διαθέσεις. *Alexiph.* pag. 399.

(b) *Lucret.* lib. 5.

(c) *Galen. Simp. Medic.* l. 3. cap. 18.

(d) *Sext. Empiric. Hypoth. Empiric.* 1.

(e) *Cap.* 24.

Stools of the same, an intolerable Heat and Thirst, with cold Sweats, Tremblings, Convulsions, &c. as will appear from the following History (f).

To a large Dog was given a Drachm of *Mercury Sublimata*, mixt with a little Bread; within a quarter of an Hour he fell into terrible Vomitings, casting up frequently a viscid, frothy *Mucus*, every time more and more Bloody, and purged the same downwards; till tired and spent with this hard Service, he lay down quietly as it were to sleep, but died the next Morning.

The *Abdomen* being opened, a great quantity of extravasated Blood was found between the Liver and Stomach, and between the duplicature of the *Omentum* about the Stomach; the Guts as well as the Stomach were distended, and full of a frothy bloody *Mucus*; on the outside they were of a livid Colour, within all over red, and inflamed down to the very *Rectum*; the fibrous Coat of the Stomach being taken off, between that and the nervous one, grumous Blood was found in several Places; the like was discovered here and there in the Intestines between the same Coats.

The same *Symptoms* with these, and manifest Signs of a burning Corrosion followed with *Ulcers* in the Bowels, *Baccius* (g) observ'd in a young Man poison'd by *Sublimata*, mixt with his Meat.

What we are here chiefly to examine is, how from Ingredients singly innocent and harmless, so mischievous a Compound can result; for as the Case is very plain with respect to *Salt*, so is it likewise now notorious enough, that *Quick-silver* it self, which the Antients, *Dioscorides*, *Galen*, *Pliny*, &c. have unjustly rank'd among Poisons, is in many Diseases inwardly taken of very safe and beneficial Use; and that not only when disguised with *Sulphur*, *Sugar*, &c. but *Crude*, without any Correction, or vainly pretended Mortification.

This the *Arabian* Physicians first gave the Hint of; *Avicen* (h) having observ'd, that *They who drink it in a*

(f) *Wepfer de Cicut. Aquatic. pag. 300.*

(g) *De Venen. pag. 21.*

(h) *Can. Medic. l. 4. Fen. 6. Argentum Vivum plurimum qui bibunt non laeduntur eo; egreditur enim cum dispositione sua per inferiore m*

large quantity receive no hurt, its weight making a free Passage thro' the Body. This was Incouragement enough for the Practice of giving whole Pounds of it in the *Iliac Passion*; which is oftentimes done with good Success, without any frightful Symptom accompanying the Advantage receiv'd from its Ponderosity.

Afterwards it plainly appear'd that this Mineral, tho' not taken in so great a Dose as could immediately force its way thro' the Intestins, even when it was lodged for some time in this or that Part, was not at all hurtful by any corrosive or malignant Quality. And *Fallopins* (i), *Brasavolus* (k), with others of great Note, confirmed its harmless Efficacy in the Cure of the *Worms*, not only in adult Persons, but even in the more tender Constitutions of Children.

Nor are these the only Cases in which good Service may be had from this weighty Fluid; he that rightly considers the State of the Animal *Oeconomy*, the various Alterations it suffers from the Stagnation of its more viscid Juices in the smallest Canals, and how much the Impulse and Force of the circling Blood, by which Obstructions are to be removed, must be increased by its carrying along with it such Particles as the *Mercurial Globuli*, will perhaps see good Reason to allow, that the prudent and cautious Management of *Quick-silver* may do that in some obstinate and dangerous Diseases, which we cannot promise our selves from any other of our known Medicines whatsoever.

But I am not to insist on this Head; and the learned *Author* of the *New Theory of Fevers* (l), has already most ingeniously explain'd the *Mechanism* by which such Effects as these are produced in the human Body. It suffices to my present purpose, to have proved that pure *Mercury* is not Poisonous or Corrosive; and therefore not only have I seen two Ounces of it given every Day for one and twenty Days together, without any Inconvenience at all; but found once some quantity of it in the *Perineum* of a Sub-

(i) *De Morb. Gallic. cap. 76.*

(k) *De Morb. Gall. inter Autores de Morb. Gall. pag. 599.*

(l) *Pag. 91. & seq.*

ject I took from the Gallows for a Dissection (whose rotten Bones quickly discovered what Disease it was had required the Use of it, and that I suppose chiefly in external Application by Uñction) without any Marks of Corrosion of the Part where it was lodged.

Tho' withal we may upon this Occasion remark, that the extreme Gravity of this Mineral alone, however serviceable it may be in other Respects; yet when it happens in so great a Quantity to obstruct the capillary Ducts, as that the Force of the circling Fluid is not sufficient to wash it away, must necessarily induce Symptoms troublesome and bad enough, as *Spasms, Contractions, Palsies, &c.* which they do commonly experience, who have either been too often dawbed with *Mercurial Ointments*, or for a long time imploy'd in rubbing the *Quick-silver* upon *Looking-Glasses*; for the internal Use of it will never produce any such Mischiefs.

As for *Sublimate* then, most certain it is, that the *Saline* Particles do impart to the *Mercury* this malignant Quality; or to speak more properly, that the *Salt* receives from the *Mercurial Corpuscles* such an Increase of its Gravity and *Momentum*, as renders its cutting Corrosion more effectual and penetrating; for the manner after which this Matter is done, is plainly this.

The *Globules* of the *Mercury*, tho' so minutely divided by the Action of the Fire, as to rise in the form of a *Fume*, yet are still solid and ponderous Bodies; 'tis all one to the present purpose, whether we suppose 'em perfectly *Spherical*, or with the learned *Gulielmini* (a) *Spheroidical*, for in both Cases, by reason of their extream Parvity, being perhaps simple and elementary Bodies, they will easily be lodg'd in the Pores and Interstices of the *Saline Crystals*; which being compos'd of the *Atoms* of *Salt*, variously by *Sublimation* combin'd and united, are a kind of cutting *Lamella* or *Blades*; the force of which could never have been very penetrating, upon the account of their lightness and easie dissolution, if the *Mercury*, without blunting their Edge, or

(a) *Trattato de Fumi.* Cap. 1.

breaking their Figure, did not lend 'em an additional Weight, and thus at the same time strengthen their Action, and prevent their quick Solution by the Juices of the Stomach; which cannot now disjoin their compounding Parts, because the Vacuities into which they should, in order to do this, insinuate themselves, are already possess'd, and taken up by the *Mercurial Globules*.

In short, These *Crystals*, which are to be considered as so many sharp Knives or Daggers, wounding and stabbing the tender Coats of the Stomach, and thus causing excessive Pains, with an Abrasion of their natural *Mucus*, and (upon the constant Sense of Irritation) continual Vomiting, &c. must of necessity, sticking here and there in the capillary Vessels, stop the Passage of the Blood in several Places, whereupon it stagnates, and there follow little Inflammations, which growing higher and higher, terminate quickly in perfect Ulcers and Gangrenes; and these though singly very small, yet many in number, do altogether make up one continued and incurable Mortification.

This being the Nature of *Sublim'd Mercury*, it may not be amiss to enquire, how it comes to pass, that this same Compound resublim'd with *live Mercury* in the Proportion of four Parts to three, (for the *Sublimate* will not take up an equal quantity) especially if the Work be repeated three or four times, loses its corrosivenes to that degree as to become not only a safe, but in many Cases, a noble *Medicine*. For I do not see that any of the Chymical Writers have hit upon the true Solution of this *Phenomenon*.

Here then it is to be considered, that the Action of the *Saline Crystals* depending upon their solidity and largeness, these must necessarily, by every subsequent Sublimation, be broken into smaller and smaller Parts; the *Mercurial Globules* (for the Reasons given by the *Author* (a) of the forementioned *Theory of Fevers*) arising more quickly and easily than the *Salts*, quit the Interstices in which they

(a) Pag. 93.

were lodged, and the *Crystalline* Blades are divided every time more and more by the force of the Fire; whereupon a new Combination of Parts succeeds; and although there be a greater Proportion of the *Mineral* to the *Salts* than before, which makes *Dulcify'd Mercury* Specifically heavier than the *Corrosive*; yet the broken pieces of the *Cry-stals* uniting into little Masses of differing Figures from their former Make, those cutting *Points* which were before so sharp, are now either quite lost, or at least, by reason of their Bluntness, cannot make Wounds deep enough to be equally mischievous and deadly; and therefore do only vellicate and twitch the sensible Membranes of the Stomach to that Degree, as excites them to an Excretion of their Contents and Glandular Juices, upwards or downwards, according as the force of Irritation is greater or less.

Thus a violent *Poison* is mitigated into a *Vomit* or *Purge*; nay, it may easily happen (especially in robust Constitutions, and if the Bowels be at the same time by any means defended against the stimulating Power of the Medicine) that this twitching may be so slight, as to be almost insensible, and hardly troublesome; and then the *Mercurial Globules* being freed indeed from most of the *Saline Parts* in their Passage thro' the *Prima Via*, but still having a mixture of some few of them, are quickly conveyed into the Blood, where by their Motion and Weight they must necessarily dissolve the preternatural Cohæsions of all the Liquors, particularly of those which circulate in the smallest Canals, and are most viscid and tenacious, making 'em more fluxile and thin, or of more easie Secretion; whereupon all the Glands of the Body are, as it were, set to work, and scoured of their Contents; but the *Salival* ones especially, being many in Number, very large and wide, and the Juice they separate of a tough and ropy Substance, so that a considerable quantity of it is accumulated before it is forced out at the Orifices of the Ducts, these Effects will be most remarkable in *them*, and a *Salivation* or Spitting must continue so long, till the active mineral Particles are thro' these and the other Passages discharged out of the Body. As

As the Difference between Mercury *Corrosive* and *Dulcified* lies in a greater and lesser Degree of Operation and Force, so this same Consideration distinguishes the several *Preparations* of this Mineral from each other; which tho' very many, yet do all vary their Effects in the Body, only according as the *Mercurial Globules* are differently combined with *Salts*, and the *Points* of *These* more or less broken by the Action of the Fire, in the burning of Spirits upon them, and such like Managements: And therefore however dignified with the great Names of *Arcana*, *Panacea*, *Princes Powders*, &c. they do not afford us any thing singular and extraordinary, beyond what we may with equal Advantage promise our selves from some or other of the most common and usual *Processes*.

We may also fairly conclude from this Reasoning, that the safest way of raising a *Salivation* is by *Internal Medicines*; since whatever Mischiefs can be apprehended from *these*, may in a greater degree follow from the *External Use* of *Mercury*; not only because, as we have already hinted, the mineral *Globules* being intimately combined with *Salts* in the several Preparations given inwardly, will by the Irritation of *these*, be easily and fully thrown out at the Organs of Secretions, till the Blood is quite discharged of its Load; whereas, in all the Dawbings with mercurial Ointments, we can never be certain that none of the heavy Particles are left lodg'd in the *Interstices* of the *Fibres* or *Cells* of the *Bones*; but also, in as much as by computing the Portion of *Mercury* in all the Doses necessary to promote a Spitting, and the Weight of the same Mineral usually apply'd when this is done by *Uction*, it will appear, that the Quantity in the latter Case vastly exceeds that in the former, and consequently that the Inconveniencies to be feared will be in the same Proportion.

Therefore this external Management of *Mercury* is only to be allow'd of, where either the Case will bear the Violence of such a Method, or outward *Ulcers* and *Tumours* require a particular Cure by *Liniments*, &c.

Nor is it improper to remark that, we do hereby see how the Use of this Mineral comes to produce that Effect so

often complain'd of, (tho' not always with Reason) of making the Bones Foul or Carious. For, if the *Lamina* or *Fibres* of these are already so much broken and spoiled by a Disease, as that the Circulation of the Fluids thro' 'em can't be maintain'd, they must necessarily be corrupted more by the Weight of the *Mercurial Globules*; tho' here also it is plain, that the *outward* Use of this Remedy will be more to be blamed than the *inward*.

And indeed, as the earliest Use of *Mercury* was in *Unguents* and *Emplasters*, so most of the Prejudices and Outcries against it are owing to Effects produced this way. For the first Attempts of the Cure of *Venereal Maladies* by this Remedy, were learned from the *Arabians* (a), who having recommended *Mercurial Ointments* in the *Lepra* or *Scabies*, gave a handle to the *Italian* Physicians to try their Efficacy, in removing the Foulness of the Skin from a new and terrible Contagion; neither were they sparing of their Lini-ments, which they continued to rub in for 12, 15, nay, sometimes for above 30 Days together (b). So that it is no wonder if they often met with very untoward Symptoms from so severe a Treatment, and if, (as some of them (c) do affirm) they now and then found *Mercury* in the rotten Bones of their Patients, who had, it may be, suffered too much both from their Disease and their Physician.

Thus much of *Mercury*. Let us in the next Place examine *Arsenick*, about the Nature and Composition of which Authors are very much puzzled.

This, in short, is either *Native* or *Factitious*, and each of three sorts; *Yellow*, *Red*, and *White*. The *Native Yellow*

(a) Vid. Jaan. Baptist. Montan. Tract. de Morb. Gallic. inter Autor. de Morb. Gall. p. m. 482. Et Fallop. de Morb. Gall. Cap. 76.

(b) Nicol. Mass. de Morb. Gall. Tract. 4. Cap. 2.

(c) *Argentum vivum* accepi ex Osse Cujusdam corrupto, quem perunctum ab Empyricis plus decies ferebant, non semel emanavisse. Anton. Gall. in Lib. de Ligno Sancto non permiscendo.

Non semel in Sepulchris *Argentum Vivum* in Mortuorum Capitibus reperi. Anton. Musa Brasavolus in Tract. de Morb. Gallic.

is what the *Latins* call'd *Auripigmentum*; and this *Olaus Wormius* (b) makes Three-fold. The *Red* is the *Sandaracha* of the *Greeks*. The *White* was not known to the *Ancients*; and indeed *Theophrastus* seems only to have known the *Red*; but *Dioscorides* describes both *Red* and *Yellow*; *Nicander* had no Knowledge of either; The only mineral Poisons he mentions are *Litharge* and *Ceruss*.

Orpiment and *Sandaracha* differ only by their greater or lesser Concoction in the Earth; and therefore from *Orpiment* boiled in a close Pot five Hours in a Furnace Fire, is made the *Factitious Sandaracha*, as perfect as the *Natural* (c).

The *Factitious Yellow* is made from the Crusts of the *Natural Orpiment* (d).

The *Native White* is more rare, but found plentifully in some silver Mines in *Germany* (e).

But the *White Factitious* is of the most common Use of all; and it is, as *Agricola* tells us, no other than *Orpiment* again and again sublimed with an equal part of *Fossile Salt*, till it is brought to a Whiteness.

Orpiment and *Sandaracha* are mostly found in Mines of Gold; and all metallic Writers do agree them to be the best Signs of the Richness of the Vein. This is Ground sufficient for the *Chymists* to take *Arsenick* for the Subject Matter of their great Work, as they call It; and they have very fondly accommodated some *Ænigmatical Lines* in the *Sibylline Oracles* (f) to this Mineral. Tho' the Interpretation be strained, and not fairly made out, (the *Author* of these Verses, whatever he might mean, being indeed dis-

(b) *Museum*, p. 28.

(c) *Agricola de Natura Fossil.* p. m. 592.

(d) *Idem*, *Ibid.*

(e) *Block Scrutinium Arsenici*, §. XIV.

(f) *Lib.* 1.

Εν τέλει γράμματα ἔχω, τετρασυλλαβός εἰμι, νόσι με.

Αἱ τρεῖς αἱ πρῶται δύο γράμματα ἔχουσιν ἐκείνη.

Ἡ λοιπή δὲ τὰ λοιπὰ, καὶ εἰσὶν ἄφωνα τὰ πέντε.

Τὸ πάντος δ' ἀριθμὸς ἑκατοντάδες εἰς δις ὀκτώ,

Καὶ τρεῖς τρις δεκάδες.

coursing of the Name of the *Divine Power* it self) yet very true it is, that this great Expectation from *Arsenick* is as old at least as *Caligula*; that is, of more ancient Date considerably than the far greatest part of those supposititious and ill-contrived Compositions which do now bear the Name of *Oracles*: For that covetous Emperor, as *Pliny* relates (g), ordered a great quantity of *Orpiment* to be wrought upon, that he might extract *Gold* out of it, and made some; but as it usually happens in such like Attempts, the Quantity did not answer the Expence.

It is more to our purpose to take notice, that the later Pretenders to this *Philosophy*, by finding their three Principles, *Salt*, *Sulphur*, and *Mercury* in this Body, will lead us into its true Nature and Composition.

For whether we take *Orpiment* or *Sandaracha*, either of them will afford a *Regulus* or mercurial Substance, more pure than that of *Antimony*. The manner of extracting it *Lemery* (h) has taught; and to this indeed the Mineral owes its great Ponderosity.

The Inflammability and Smell of *Arsenick* are sufficient Proofs of its abounding *Sulphur*, which may without much difficulty be separated from it (i).

That it consists of some *Saline Parts* we are assured by its Solution in common Water (k); and it is upon the account of these that it does more happily promote the Flowing of Metals than any other *Salt-Powders* which the Workmen make use of: Wherefore some have called it a coagulated *Aqua Fortis*.

From all this it appears, that Authors do vainly dispute wherein the noxious quality of *Arsenick* resides, since the Case here is plainly much the same with that of *Sublimate Corrosive*; and as the Salts there, together with the Mercurial Particles, do compose pungent *Crystals*, so without all

(g) Nat. Hist. l. 33. c. 4.

(h) Cours de Chymie, Part 1. Chap. 10.

(i) Lemery, ibid.

(k) Vid. Eman. Konig Regn. Mineral. and Boyle History of Mineral Waters.

doubt the *Regulus* of this Mineral gives a like force to the *Saline Bodies*, which without this weight could be but of small Effect. The main difference is, that in *Arsenick* we have an addition of *Sulphur*, which does not only strengthen the Action of the other Parts, in that as a *Vinculum* it keeps them united together; but consisting besides of many hot and fiery Corpuscles, promotes the Inflammation of those Wounds which the crystalline *Spicula* make in the Membranes of the Stomach.

Upon the Score of such a Texture and Make as this, *Arsenick* makes no Ebullition either with *Alcalies* or *Acids* (a); and as the *Regulus* of it being cleared from most of its Salts, is by much less hurtful than the crude Mineral it self; so on the other Hand, the *Fætitious White*, in which there is a much greater Proportion of the Saline to the metallic Parts, is the most violent of all the kinds, superior in Force to *Mercury Sublimate*.

The several Histories related by *Wepfer* (b), do put this out of Question; It is sufficient to our Purpose to mention One.

A Dog having eat some Fat mixt with *White Arsenick*, died the next Day; the upper Part of the Stomach, when opened, was red and inflamed, the Coats thinner than ordinary, the bottom of it was covered with a fætid Slime, and some Pieces of Fat; the thin Guts were so corroded as to be Pervious in three Places, two of the Ulcers so large that they would easily admit a *Bean*. The Cavity of the *Abdomen* contained a yellowish *Ichor* tinged with Blood.

The Case being thus, one would wonder what should induce Authors to prescribe so corrosive a Mineral to be worn upon the Pit of the Stomach, as an *Amulet* against the Plague. This Trick we may well believe to be dangerous, when *Lionardo di Capo* (c) tells us of a Child kill'd

(a) *Grew* of Mixture, pag m. 246.

(b) *Cicut. aquat.* pag. 274. & seq.

(c) *Incertezza de Medicament*, p. m. 82.

by the violent Vomiting and Purging, occasion'd from a slight Wound made in the Head by a *Comb* wet with Oil in which *Arsenick* had been infused; for the Pores of the Body being opened by Heat and Exercise, some of the noxious *Effluvia* may easily insinuate themselves into the Part; accordingly *Crato* (d) observ'd an Ulcer of the Breast caused by this Application; *Verzascha* (e) violent Pains, and fainting Fits; *Diemerbroeck* (f), and Dr. *Hodges* (g), Death it self.

The Truth of the Matter is, this Practice seems to owe its Origine to a Mistake (h), some of the *Arabian* Physicians had commended *Darsini* worn in a Bag for a Preservative in Plague time; This in their Language signifies *Cinnamon*; but the *Latin* Interpreters retaining the same Word in their Translations (as was frequently done), one or other afterwards not understanding its meaning, and deceived by the likeness of the sound, substituted in its Place *De Arsenico*, as if *Darsini* were all one with *Zarnich*. The Authority of the first Author served to propagate the Error; nor were those wanting who reason'd upon the Matter, and found it agreeable to their Philosophy, that this Mineral should draw to it self and center the *Arsenical Effluvia* out of the Air, and thus secure the Body from their Infection; these being, as they imagined, the common Cause of Pestilential Diseases.

Having thus particularly discoursed of the Nature of these two Poisons, I shall not need to insist upon any more out of the *Mineral Kingdom*.

All of *Them* bear some Analogy to the former, and are more or less dangerous, according as their *Salts* receive a differing Force from the *metallick* Particles. For this Reason

(d) *Epistol.* 168.

(e) *Observation* 66.

(f) *De Peste*, *Histor.* 99.

(g) *De Peste Londinens.* p. 239.

(h) *A. Deusingius de Peste*, Part 4. Sect. 3. c. 3.

as we have observed, that the most Virulent may be mitigated by breaking the *Points* of the *Saline Crystals*; so on the other Hand, the most Innocent Minerals may become Corrosive, by combining them with *Salts*, as we see in the several Preparations of *Silver, Antimony, Iron, &c.*



Poisonous Plants.

TO proceed therefore to *Vegetables*; the most notorious of *These* for venomous Juices among the Ancients were *Cicuta* and *Aconitum*.

Our *OEnantheCicuta facie, succo viroso*, which *Wepfer* has described by the Name of *Cicuta Aquatica*, and of the dismal Effects of which in some Children, who by mistake did Eat of it, he has wrote a large Volume, was very probably the *Cicuta* so much in use of old, especially at *Athens*, for *Killing*. At least the Violence of *This* makes it a much fitter Instrument of Death than the common *Hemlock*, which is not by far of so malignant a Quality.

Tho' we must withal allow differing *Climates* very considerably to heighten or abate the *Virtues* of *Plants*. And it is not altogether improbable, that the Poison with which the *Athenians* took away the Lives of Malefactors was an inspissated Juice compounded of *That* of *Cicuta* and other corrosive Herbs (i).

But be this as it will; the Alterations which *Wepfer* observed the Roots of *OEnanthe* to make in the Body, were a violent Pain and Heat in the Stomach, terrible Convulsions, with the Loss of all the Senses; Distorsion of the Eyes, and flowing of Blood out of the Ears, the Mouth so fast shut that no Art could open it, Efforts to vomit, but nothing thrown up, frequent Hick-Coughs, with a great Distension and Swelling, especially at the Pit of the Sto-

(i) *Vide Wepfer, Pag. 60.*

mach; and when Death had concluded the Tragedy, a continued Running of green Froth at the Mouth.

Stalpart van der Wiel gives us the like account of two Persons kill'd at the *Hague*, by the same *Roots* (k).

In a *Dog*, who for Experiment's sake died by this *Poison*, the Stomach when opened was found quite *Constringed*, and shut up at both *Orifices*, its inward Surface red, with livid Spots here and there; the Intestines were empty; only the *Rectum* contained a little greenish *Mucus*.

Thus it appears, that this Plant consists of Hot, Acridous and Corrosive Parts, which by rarefying the Juices of the Stomach, and wounding its nervous Membrane, are the Cause of all those Disorders which do immediately follow.

For upon the Sense of a violent *Irritation* and *Pain*, the Fluid of the Nerves is presently in large quantities determined to the Part affected; and this, if the *Stimulus* be not over great, will be only to such a Degree as is sufficient, by contracting the Fibres of the Stomach, and Muscles of the *Abdomen*, to throw off the Cause of the disagreeable *Sensation*; but the uneasy *Twitching* being too terrible to be born, the Mind, by a kind of surprize, does with *Haste* and *Fury* as it were Command the Spirits thither; thus the Business is over-done, and the Action of the Fibres becomes so strong, that the Orifices of the Stomach are quite closed; so that instead of discharging the noxious Matter, the *Torment* is made greater, and the whole *OEconomy* put into Confusion.

This forcible Contraction of the Muscles was the Reason that one of the Children which *Wepfer* saw, made *Urine* in the midst of the Agony, to the height of five or six Foot, with a Strength and Violence surprising to the Spectators.

Nor is it any Wonder, if in these *Circumstances* all Sense be lost, Blood gush out at the *Ears*, *Nostrils*, &c. the Parts being all torn and broke by the Violence of the Con-

(k) *Observat. Centur. 1. Obs. 43.*

vulsions; which tho' they began in the Muscles of the Belly, must at last prevail in the Members too, till the whole Fabrick is shock'd and overturn'd; and some of the *Corrosive Salts* perhaps getting into the Blood, and by the Rarefaction of It distending the Vessels, the membranous Coats of which being already overstretched, will the more easily give way, and let out their Fluid.

The Case of *Aconitum* is much the same; this is our *Napellus* or *Monks-hood*; and its Effects do so nearly agree with those now related of *Oenanthe*, that I shall not need to recite them; the Experiments of *Wepfer* (a) are full and convincing. And indeed as all the *Histories* which this same *Author* has so carefully given us of Trials made with several vegetable Poisons, *Solanum*, *Nux Vomica*, *Coculus Indicus*, &c. on different Creatures, do put it out of all doubt, that the common Mischief of *these* is a Twitching and Inflammation of the Stomach; so it appears from hence that *virulent Plants*, although they may be distinguished even from one another by *particular Virtues*, do however kill by a like Operation and Force, which differs chiefly in Degree from *that* of noxious Minerals.

And therefore in order to know what the *Specifick Qualities* of any such *Herbs* are, they must be given only in very small *Doses*; and then perhaps it would appear, that they are not made (as some do imagine) to be Deleterious and Destructive, but for very good and beneficial Uses; as we do particularly Experience in the Case of *Opium*.

Nor is it at all strange, that the *Symptoms* from a *Vegetable*, and from a *Mineral* Virulency, should be so different, although of the same kind, and only of unequal force; for the more solid Parts of *Minerals*, eroding the Coats of the Stomach, induce a perfect Mortification and Gangrene, and thus do their Work at once; whereas the weaker Salts of *Plants* can make but a slighter *Excoriation*, upon the painful Sense of which those Agonies and Convulsions that follow do rather gradually exhaust the Strength; and

(a) Pag. 176. seq.

thus the Animal is not kill'd so speedily, nor with the same *Appearances*.

Upon this Score, tho' Mineral Poisons do not pass the *Prime Viæ*, vegetable ones in some Cases possibly may; just as we find those Medicines which have a great Degree of Irritation presently to induce a *Vomiting*; whereas the same *Twitching* a little weakned suffers them to pass into the Intestines, and *Work* downwards by Stools.

By this we may perhaps give some Guess at the Nature of those *Poisons*, with which they tell us the *Natives* in some Parts of *Africa* and *India* are so expert at killing, that they can do it in a longer or shorter time as they please. These are most probably either the *Fruits*, or the Inspissated *Juices* of Corrosive Plants, which inflaming the Bowels, may cause little Ulcers there, whose fatal Consequences, we know, may very well be slow and lingering.

This I am the rather induced to believe, because an ingenious *Surgeon*, who liv'd in *Guinea*, told me, that the *Antidote* by which the *Negroes* would sometimes cure those who were *poisoned*, was the *Leaf* of an *Herb* which purged both upwards and downwards. For by this means the Stomach might be cleared from the adhering corrosive Parts of the Venom. Yet I can hardly think it possible at the same time that they should be able, by varying the Composition or Quantity of the *Dose*, to ascertain the Time in which it shall kill, to a Week, Month, &c. nor indeed have I ever met with any Person who could attest this, to be matter of Fact.

Tho' repeated Trials and Observations may help one well practised in such Tricks to give notable Conjectures in this Point.

The Ancients indeed pretended much the same thing with their *Aconitum*, of which they seem to have made a kind of Secret and Mystery, as we learn from *Theophrastus* (a), who says, *the ordering of this Poison was different, according as it was designed to kill in two, three Months, or a Year*: But this he relates only as a common Tale or O-

() *Hist. Plant.* l. 9. c. 16.

pinion, and not as a Story to which himself gave any manner of Credit.

It is very plain ; that the common *Cure* of all *Poisons* of this kind, must be by freeing the Stomach, as soon as possible, from the corrosive vellicating Particles, and defending the Membranes from their Acrimony, by such things as are of a smooth, oily and lubricating Substance.



ESSAY IV.

O P I U M.



THE Ancients having experienced that *Opium* would oftentimes kill, though taken in no large quantity, ranked it with *Poisons*, and gave it the first place among those, which from their stupifying Quality they call'd *Narcotic*.

True indeed it is, that we do every Day find this to be in a small Dose, one of the most noble Remedies in the World. But it is not worth the while to engage in the Controversie warmly debated by some *Authors*, how far *Poisons* are medicinal; since it is notorious enough, that Medicines do sometimes prove *Poisonous*. And take the Matter as we please, it may serve to very good Purposes to understand the manner of Operation of so celebrated a *Drug*, and help us in a great measure to ascertain its Use in different Cases; if we are beforehand rightly apprised of its Nature and Way of acting.

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In order hereunto, it is necessary, besides some other *Præcognita*, since one of the chief Virtues of this Medicine is *Hypnotic*, to define distinctly what *Sleep* is, or rather, (to avoid Confusion and Disputes about Words) what Difference there is between an Animal Body when *asleep* and when *awake*. For I suppose the *History, Manner of Preparing, &c.* of *Opium*, to be already sufficiently known.

First then, there is no One but knows that in *Sleep* there is a Cessation from Action. When *Waking*, we walk, discourse, Move this or that Limb, &c. but in natural and undisturbed *Rest* there is nothing of all these; that is, whereas being awake, we do perform several Motions by the *voluntary* Contraction of our Muscles; when asleep, those Muscles only are Contracted, whose Action is in a manner *Involuntary*, or to which the Mind has always so constantly determin'd the Spirits, that it does it by a *Habit*, without the Intervention of the Reasoning Faculty; such are *Those* of the Heart and Breast.

So that there is at this time a kind of *Relaxation* or Looseness of the moving Fibres of the several Members; or at least such a quiet Position and State of them, by which all the *Antagonist* Muscles are in an *Equilibrium* and Equality of Action, not overpowering one another. For this indeed seems to be one great Design of Sleep, to recover to the Parts overstretched by Labour their former *Tone* and Force; and therefore we do naturally, when composing our selves to *Rest*, put our Body into that Posture which does most Favour the *particularly* wearied Limbs, and conduce to this end.

In the next Place, it is very plain that there is in *Sleep* not only a Rest and Suspension from acting of most of our Bodily Organs, but even of our *Thinking Faculty* too. That is, (for I would prevent Cavils) a ceasing from such *Thoughts* as when waking we are exercised about, which we do *Reflect* upon, and *Will* to employ our Mind with. For though *Dreams* are Thoughts, yet they are but imperfect and incoherent Ones, and are indeed either so faint and languid *Representations*, as to be consistent with our *Sleep*, as
some

some may be; or else if they be strong and lively, they are, as every one knows, the *Interruption* and Disturbance of it.

From hence it will follow, that the *Motion* of the Arterial Fluid must be, *Cæteris Paribus*, more sedate, even and regular, in the time of *Sleeping* than *Waking*; For, besides the various Alterations which in the latter State this receives from the several *Passions* of the Mind, the very *Contractions* of the Muscles themselves in Exercises of the Body do differently forward its Course; whereas in *Sleep* the force of the Heart and Pectoral Muscles being more constant and uniform, gives it a more calm and equally continued Impulse.

Hence also it will come to pass, that the *Influx* of the *Liquor* of the Nerves into the Organs of the Body, as also its *Reflux* towards the *Brain*, is in *Sleep* either none or very inconsiderable; that is, that this Fluid has at this time but little or no *Motion*. For 'tis Muscular *Action* and *Sensation* that require it to be thus determin'd, this way or that, which are now hardly any. And yet by the arrival of Blood at the Brain, this *Juice* will still be separated there, fit to be derived into its Canals or Tubes. So that by this means there will be a kind of *Accumulation*, or laying up in Store, of *Spirits* for the Offices and Requirements of *Waking*.

Thus we may in short look upon the time of *Watching*, as the time of Wearing out, or the Destruction of the Animal Fabrick; and the time of *Sleep*, as that in which it is repaired and recruited; not only upon the account of what we have just mentioned concerning the *Nervous Liquor*, but also with respect to all the other Parts, as well Fluid as Solid. For *Action* does necessarily by Degrees impair the Springs and Organs; and in *Motion* something is continually abraded and struck off from the Distractile Fibres, which cannot otherwise be restored than by their being at rest from *Tension*. Besides that, such a regular and steady *Course* of the Blood, as we have observed to be in *Sleep*, is by far more fit and proper for Nutrition, or an Ap-
M position

position of Parts to the Vessels, which an uneven *Hurry* of it is more apt to tear off and wash away.

The Case being thus, it is very plain that whatsoever can induce such a Disposition of the Fluids and Muscular Parts of the Body, as this we have described, will so far cause *Sleepiness*. And in like manner, when any thing interposes and hinders this Composedness and Tranquillity, the removing of the *Impediment* will be the causing of *Sleep*; inasmuch as this is only reducing the Animal *Oeconomy* to its right State, in which by natural Order there must be a Succession of Sleeping and Waking.

Thus it appears how necessarily continued Exercises do make us *Sleepy*, since these do exhaust the Juice of the Nerves; that is, both lessen its Influx into the Organs of Motion, and incline the Mind not to determine it any longer that way, upon the account of the Pain and Uneasiness, with which too violent a Tension of the Parts is always attended; which therefore we must needs desire to relax, or lay to *Rest*.

That *Sleepiness* which follows upon a fulness of the Stomach after Eating or Drinking, is owing to a different Cause; and does indeed so nearly fall in with the Effects of *Opiate* Medicines, that it requires a particular Consideration.

As *Hunger*, or the Emptiness of the Stomach, is a painful Sensation; so the satisfying or removing of *This*, is a pleasing or agreeable One. Now all *Pain* is a *Stimulus* upon the Part affected; and this, we all know, being attended with Contractions of the pained Membranes, causes a greater Afflux than ordinary of the nervous Juice that way. On the other Hand, *Pleasure*, or a delightful Sensation in any part, is accompanied with a smooth Undulation, and easie Reflux of the Liquor of the Nerves towards the Brain. This is, as it were, the *Entertainment* of the Mind, with which being *Taken up*, it does not determine the Spirits to the Organs of Motion; that is, there is such a *Relaxation* of the Muscular Fibres, and such a Disposition of the Nervous Fluid, as we have observed to be necessary to Sleep.

This

This is the Reason of that *Chilliness* in the Limbs, which we commonly Complain of after a good Feast.

If it seem strange that a Pleasure in the Stomach should so powerfully Influence the Mind; let it be considered, on the other Hand, how violent Effects, an uneasie and disagreeable Sense in the same Part does produce; what a terrible Agony Two or Three Grains of *Crocus Metallorum* throws the whole Fabrick into; how readily the Fluid of the Nerves is with a more than Ordinary *Impetus* determin'd and commanded into the Muscles of the Stomach and *Abdomen*, in order to throw off the Enemy, and remove the ungrateful Sensation.

Now the Consequences which we have ascribed to a pleasing Sense in this Part, are only just the contrary of these we find the opposite Affection of Pain induces. And indeed *Pleasure* and *Pain* are two great Springs of Action in the Animal OEconomy; The Changes they make in the Fabrick are the Causes of many Effects which seem surprising, because we do not regard the Mechanism by which they are produced: but these must be more considerable in the Stomach than any where else; This Part being, for very wise Purposes, of so acute a *Feeling*, that some Philosophers have for this Reason thought It to be the Seat of the Soul.

Besides this Consideration, we must take notice that, the Stomach being distended with Food, presses upon the descending *Trunk* of the *Aorta*, and thus causes a greater Fulness of the Vessels in the upper Parts; whereupon the Brain is loaded, or the Derivation of Spirits into the Nerves diminished, and *Unactivity* or *Drowsiness* insues. From hence proceed Those *Flushings* in the Face, Redness, &c. after plentiful Eating or Drinking, most Visible in those whose Vessels are lax and weak, as in exhausted and Hectick Persons they more especially are.

Thus we may, without the Assistance of the *New Chyle* entring into the Vessels, account for that Inclination to Sleep which follows upon a full Stomach; Tho' we must also

allow the Distension from *This* to be a considerable Cause of the same Effect; But this does not happen immediately, nay, sometimes perhaps not within two or three Hours after Eating; and therefore the sudden *Drowsiness* must (as well as the present Refreshment and Reviving which Meat gives) be chiefly owing to some more speedy Alteration.

Welcome then in the next Place to *Opium* it self; The Chymical *Analysis* of which (a) does out of one Pound afford of a Volatile *Spirit* of the like Nature with that drawn from Harts-horn, Five Ounces and Five Drachms; of a *fætid Oil*, one Ounce, two Drachms and a half; of *Caput Mortuum*, smelling like Spirit of Harts-horn, Seven Ounces and Six Drachms.

The Virtues therefore of *Opium* are owing to a volatile *Alcaline Salt*, intimately mixt and combin'd with an Oily, Sulphureous Substance. The Effects of which we must consider, first of all upon the Stomach, and afterwards, when they have passed the *Prima Viæ*, upon the arterial Fluid it self.

An agreeable Sensation produced in the Stomach, together with a Distension of its Membranes, we observed before to be the Cause of that Sleepiness to which we are so prone after Eating. The *One* of these engages the Mind, the *Other* acts upon the Body. For Pleasure amuses the Soul, as it were, so that it does not think, or exercise it self about any outward Objects; that is, is inclined to Rest. And the fulness of the Vessels in the Brain checks and hinders, in some Measure, the Derivation of the nervous Juice into the Organs, &c.

Now they who take a moderate Dose of *Opium*, especially, if not long accustomed to it, are so transported with the pleasing Sense it induces, that they are, as they oftentimes express themselves, in Heaven; and tho'

(a) Vid. *Pitern. de Circulatione Sanguinis in animalibus*, §. 20.

they do not always sleep, (which proceeds from the Presentation of pleasing Images to the Mind being so strong, that like Dreams they do over-engage the Fancy, and so interrupt the State of Rest) yet they do however enjoy so perfect an Indolence and Quiet, that no Happiness in the World can surpass the Charms of this agreeable Extasie.

Thus we have from this Medicine, but in a far more eminent Degree, all those Effects which we observed to follow upon that grateful Sense in the Stomach, which a moderate Fulness produces. For no Bodies are so fit and able pleasingly to affect our sensile Membranes, as those which consist of volatile Parts, whose activity is tempered and allayed by the smoothness of some lubricating and oily ones; which by lightly rarefying the Juices of the Stomach, and causing a pleasant Titulation of its nervous Coat, will induce an agreeable *Plenitude*, and entertain the Mind with Ideas of Satisfaction and Delight.

The Case being thus, we easily see upon what Mechanism the other Virtues of *Opium* do depend, its easing Pains, checking Evacuations, &c. not only in that the Mind being taken up with a pleasing Sense, is diverted from a disagreeable *One*; but all Pain being attended with a Contraction of the Part, that Relaxation of the Fibres which is now caused, eludes and destroys the Force of the *Stimulus*.

In like manner in immoderate Secretions there is most commonly an irritation of the Organs, the Removal of which will abate the Discharge. And herein lies the *Incrassating* Quality of this Medicine, in that the twitching Sense upon the Membranes of the Lungs, Bowels, &c. being now lessened, the sharp Humour is suffered to lodge there in a greater quantity, before it is so troublesome as to be thrown off and expell'd; it being all one as if there were no irritation of the Part, if the uneasie Sense thereof be not regarded by the Mind.

These Effects will all be heightned by the Mixture of the *Opiate* Particles with the *Blood*; Which is hereupon Rarefied, and Distends its Vessels, especially those of the Brain;
and

and thus does still to a greater Degree lessen the Influx of the nervous Fluid to the Parts, by pressing upon the little *Tubuli*, or Canals, thro' which it is derived.

This is the Reason of that *Difficulty of Breathing*, which they do for a time Experience who take these kind of Medicines; This Symptom being inseparable from the Rarefaction of the Blood in the Lungs.

From hence it appears, that the Action of *Opium* is very Analogous to that of other Volatile Spirits, only that a small Portion of It has a force equal to that of a greater quantity of most of Them.

This is very evident in those who accustom themselves to take large Doses of it; as the *Turks* and *Persians* do to that Degree, that it is no uncommon thing there to Eat a Drachm or two at a time; for the Effects of it in them are no other than downright *Drunkenness*; upon which account (b) it is as common a saying with them, and on the same Occasion, *He has eat Opium*; as with us, *He has drank too much Wine*.

Neither indeed do they otherwise bear such large quantities of it, than our *Tipplers* will a great deal of *Brandy*; that is, by habituating themselves to it by degrees, beginning with small Doses, and requiring still more and more to raise themselves to the same *Pitch*. Just as *Galen* (c) tells us of a Woman at *Athens*, who by a gradual Use had brought her self to take, without any hurt, a considerable quantity of *Cicuta* or *Hemlock*. Which Instance is the more to our Purpose, because *Nic. Fontanus* (d) knew one who being recovered of the Plague, and wanting Sleep, did, with very good Effect, eat *Hemlock* for some time, till falling ill again of a Fever, and having left off the Use of this

(b) Vid. *Belon. Voyag.* lib. 3. c. 15.

(c) *Simpl. Medicam. Facult.* l. 3. c. 18.

(d) *Respons. Curat. Medic.* p. 162.

Remedy, he endeavoured to procure Rest by repeated Doses of *Opium*, which (Nature having been accustomed to a stronger Alterative) had no Operation, till the help of *Cicuta* was again call'd in with desired Success.

It is a sufficient Confirmation of all this Reasoning, that *Prosper Alpinus* (e) observed among the *Egyptians*, those who had been accusom'd to *Opium*, and were faint and languid thro' want of it, (as Drinkers are if they have not their *Spirits*) to be recovered, and put into the same State of Indolence and Pleasure, by large Doses of *Cretic Wine* made hotter by the Infusion of *Pepper*, and the like strong *Aromatics*.

Nor is it perhaps amiss to remark, that in *Maniacal* People, as is frequently observ'd, a Quadruple Dose of *Opium* will scarce produce any considerable Effect: Now in Persons so affected, the Mind is deeply engaged and taken up with some *Images* or other, as Love, Anger, &c. so that it is not to be so easily moved or diverted by those pleasing Representations which it would attend to at another time, and upon which the Virtues of this Medicine do in a great measure depend. Besides this, those who are *Maniacal* do to a Wonder bear the Injuries of Cold, Hunger, &c. and have a prodigious degree of Muscular Force, which argues the Texture of their *Blood* to be very strong, and the Cohæsion of its *Globules* great; so that the spirituous Parts of the *Opiate* cannot make that Disjunction and Rarefaction of this Fluid in them, which it does in ordinary Bodies and Constitutions.

Many are the Improvements which might be made of this Theory, with relation to the Practice of Physick; but these will be obvious enough to one instructed in the Animal *OEconomy*.

(e) *Medicin. Ægypt.* l. 4. c. 1.

To conclude then as to the Subject in Hand, it is very plain that there needs no more to make *Opium* prove Destructive or a *Poison*, than to take too great a quantity of it; for then it must Inflamm the Stomach, and Rarifie the Blood to such a Degree, that the Vessels cannot again recover their Tone, whereupon Apoplectic Symptoms, &c. will insue.

To be convinced of this, I forced into the Stomach of a small Dog about half a Drachm of Crude *Opium* dissolved in boiling Water. He quickly Vomited it up with a great quantity of frothy Spittle; but repeating the Trial, by holding up his Head, and beating him, I made him retain three or four Doses, intermitting between each about a quarter of an Hour; when he had thus taken, as I could guess, near two Drachms, I watch'd him about an Hour, then he began to sleep, but presently started up with Convulsions, fell into universal Tremblings, his Head constantly twitch'd and shaking, he breath'd short and with labour, lost intirely the Use first of his hinder Legs, and then of the fore ones, which were stiff and rigid like Sticks. As he lay Snorting, to hasten his End, I was giving him more of the Solution, but on a sudden his Limbs grew limber, and he died.

Opening his *Stomach*, I found it wonderfully distended, tho' empty of every thing but some Water and *Opium*; parcels of frothy *Mucus* swimming in it; the inside was as clean as if scraped and washed from all the Slime of the Glands, with some Redness here and there, as in a beginning Inflammation. The *Pylorus* was Contracted. The Blood-Vessels of the Brain were very full; and I took out a large Grume of concrete Blood from the upper part of it, cutting into the *Sinus Longitudinalis*, as is not uncommon in Apoplectic Carcasses; but found no extravasated *Serum* in the *Ventricles*, nor among any of the Membranes.

As to the Cure of such a Case; besides other Evacuations, acid Medicines and lixivial Salts must certainly do Service; these by their *Diuretic* force causing a Depletion of the Vessels. This is the Foundation

tion upon which *Starky* compounded his *Pacific Pill*. Generous *Wine*, which the Ancients gave for an Antidote, can be no other ways useful, than as it dissolves the *Resinous* Clammy Part of the *Opium* sticking to the Coats of the Stomach, and so forwards its Expulsion by other Helps, which cause a Contraction of the Muscular Fibres.



ESSAY V.

O F

Venomous Exhalations

FROM THE

EARTH,

Poisonous Airs and Waters.



ESIDES these already treated of, there is yet another way of being *Poisoned*, and that is by *Venomous Steams* and *Exhalations*, or a *Poisonous Air* taken into the Body by the Breath.

This is notorious enough, and Authors do upon many Occasions make mention of it; but when they come to explain the particular manner how this kills, they

they most commonly reduce it to some of the *Poisons* which prove destructive by being admitted into the Stomach, alledging that Malignant Fumes and Airs are therefore fatal, because impregnated with *Arsenical*, *Mercurial*, and the like, Deleterious *Μίσημα* or Particles, they do convey these into the Blood; which being of a very corrosive Nature, must necessarily do hurt both to the Fluid and Solid Parts.

And indeed that the *Fumes* of these same Minerals are very pernicious, and Air fill'd with their Atoms very unfit for respiration, is most certain; but to argue from hence, that all deadly *Vapours* and malignant *Airs* owe their Mischief to these only, is too fond and ill-grounded a Conceit; since upon a due Enquiry it will appear, that there may be, and are, *Mortiferous Exhalations* from the Earth, infecting the Air, of a Nature so different from any of those *Poisons*, that the very Substance from which they arise may not be at all hurtful, tho' taken into the Stomach it self.

Venomous Steams and Damps from the Earth the *Latins* in one Word call'd *Mephites* (a).

This, as many other *Tuscan* Words, comes from a *Syriac* Theme, which signifies to blow or breathe (b).

And in ancient times several Places were notorious for 'em; so the *Mephitis* of *Hierapolis* was very Famous, of which *Cicero*, *Galen*, but more particularly, and from his own Sight and Knowledge *Strabo* (c) makes mention.

Such another was the *Specus Corycius* in *Cilicia*, which upon the account of its stinking deadly Air, such as is thought to proceed from the Mouth of *Dragons*, which the Poets give to *Typhon*, was call'd *Cubile Typhonis*. This

(a) *Virgil Æn.* 7. v. 84.

— *Sævamq; exhalat opaca Mephitim.*

Vid. Servium, ibid.

(b) *Scaliger. Conject. in Varron.*

(c) *Lib. 13.*

Pompon. Mela (d) describes; and it is indeed as ancient as *Homer* (e); for *Arima*, in which he places it, was, as *Eustathius* says, a Mountain of *Cilicia*.

Neither are such *Fumes* as these infrequent now-a-days; and though mostly taken notice of in Mines, Pits, and other Subterraneous Places, yet they are sometimes met with in the Surface of the Earth too, especially in Countries fruitful of Minerals, or pregnant with Imbowelled Fires; such are *Hungary* and *Italy*, which latter (as *Seneca* (f) observes) has always been more than any other remarkable for 'em.

I shall therefore, having had the Opportunity of making some Remarks upon one the most famous of all in those Parts, give as good an account as I can of *that*, and its manner of killing; which tho' I dare not affirm to be universally applicable to any *Mephitis* whatsoever, yet seems plainly to be the Case of most of 'em; and where it is not, this simple Mischief will only be found to be complicated with another; and then some extraordinary Symptoms or Appearances in the Animals kill'd, will easily make a discovery of the additional Venom and Malignity.

This celebrated *Mofeta* taken notice of, (or at least some other hereabouts) even in the time of *Pliny* (g), is about two Miles distant from *Naples*, just by the *Lago d' Agnano*, in the Way to *Pozzoli* or *Puteoli*, and is commonly call'd *la Grotta de Cani*, because the experiment of its deadly Nature is frequently made upon *Dogs*; tho' it be as certainly fatal to any other Animal, if it come within the reach of its Vapour; for *Charles the Eighth* of France prov'd it so upon an *Ass*; and two *Slaves* put into it by order of *D. Pietro di Toledo*, Viceroy of *Naples*, with their Heads held down to the Earth, were both kill'd (h).

(d) *De Situ Orb.* l. 1. c. 13.

(e) 'Εν Ἀρμύρε ἐστὶ Φατὶ Τυφώεος ἔμμεναι ἑνός. *Il.* β. v. 783.

(f) *Nat. Quæst.* l. 6. c. 28.

(g) *Nat. Hist.* l. 2. c. 93.

(h) *L. di Capoa delle Mofet.* pag. 37.

'Tis a small *Grotta* at the Foot of a little Hill, about eight Foot high, twelve long, and six broad; from the Ground arises a thin, subtle, warm *Fume*, visible enough to a discerning Eye, which does not spring up in little parcels here and there, but is one continued Steam, covering the whole Surface of the bottom of the Cave; and has this remarkable difference from common Vapours, that it does not, like Smoak, disperse it self into the Air, but quickly after its rise falls back again, and returns to the Earth; the Colour of the sides of the *Grotta* being the measure of its ascent; for so far it is of a darkish Green, but higher, only common Earth, and this is about ten Inches. And therefore as my self found no Inconvenience by standing in it, so no Animal, if its Head be kept above this Mark, is in the least injured: But when (as the manner is) a Dog, or any other Creature, is forcibly held below it, or by reason of its smallness can't hold its Head above it, It presently, like one stunn'd, loses all Motion, falls down as dead, or in a Swoon, the Limbs convuls'd and trembling, till at last no more Sign of Life appears than a very weak and almost insensible beating of the Heart and Arteries, which if the Animal be left there a little longer, quickly ceases too, and then the Case is irrecoverable; but if snatch'd out, and laid in the open Air, soon comes to Life again, and sooner if thrown into the adjacent *Lake*.

In this short, but accurate, History of the *Grotta de Cani*, I have set down those particulars which do not only distinguish *Mephitical* Exhalations from common and innocent Fumes, but also give hints sufficient, I think, mechanically to determine the Reason and Manner of their surprising Effects.

And not to spend time in refuting the Opinions of others, I shall only take notice, that here can be no suspicion of any true *Venom* or real Poison; if there was, it were impossible that Animals taken out of the *Grotta*, should so immediately recover the Effects of it, without any remaining appearance of Faintness and Sickness, or such like Symptoms as those suffer who have been breathing in an
Air

Air impregnated with malignant corrosive *Effluvia*. Besides, that the venomous Corpuscles would certainly, in some Degree at least, infect the Air in the upper Part of the Cave, which continues pure, and fit for respiration. Neither indeed after what manner soever this Poison be imagin'd to act, whether by dissolving or coagulating the Blood, could its Efficacy be so sudden and momentaneous, without some Marks of it in the Creatures kill'd, when opened, which yet do discover nothing of this Nature extraordinary, neither in the Fluid, nor in the Solid Parts.

In order therefore to understand wherein this deadly quality consists; I say in the first Place, that Life, so far as it respects the Body, is, in one Word, the *Circulation* of the Blood; that is, its Motion in *Conical* Distractile Vessels from the Heart to the extreme Parts, and its Return to the Heart again by the same Canals inverted; for 'tis upon this that all Animal Functions, all Sense and Motion voluntary and involuntary, do depend; so that the Regularity of this Course is the Measure of Health, or the most perfect Life, as its various Irregularities are the Occasions of Sickness and Diseases, or a beginning Death.

Now all the Animal Operations and Offices which proceed from this Circulation, are the Effects of several Secretions of Liquors of very different Natures out of the same fluid Mass; it was therefore absolutely necessary that the Blood, before it be distributed to the Organs, should be so comminuted and broken, as that no Cohæsion of its Parts should hinder the separation of these *Juices* from it, when it arrives with a determinate Force at the Orifices of the Secretory Vessels.

This Work is done in its Passage thro' the *Lungs*, by the repeated Compression of the Air in those *Bladders* upon the Arteries, with wonderful Contrivance dispers'd among'em (a). Herein lies the Use and Necessity of *Respiration*; and the sudden Mischief of stopping it, in that the whole Mass of Blood being to pass this way, upon a

(a) Vid. *Malpigh. de Pulmon.*

Check here, there presently insues a Stagnation, that is, a Cessation of all animal Functions, or Death; which will be the more speedy, if not only no Air is inspired, but a Fluid of a quite different Nature from it succeeds in its Place.

Wherefore it must be observed, that this good Effect of the Air is performed by its *Elasticity*; and that no Fluid whatsoever, that we know besides, is *Elastic*, at least to any considerable Degree, that is, has a faculty of expanding and dilating it self when compressed; no, not *Water*, as near as that is thought to approach to Air in its Nature.

And now as to the present Case, I took notice before that this *Vapour* is one continued and uninterrupted *Steam*, and that quickly after its rise it falls down again; that is, that it has little or no mixture of Air with it, or no *Elasticity*; and is, on the other Hand, very heavy, when forsaken by the force of *Heat* that drove it upwards.

So that I make no Question, but that Animals in this Place do instead of Air inspire *Mineral Fumes*, that is, a thin watery Vapour, impregnated with such Particles as do, when united together, compose solid and heavy Masses; which is so far from helping the Course of the Blood thro' the *Lungs*, that it rather expels the Air out of the *Vesiculae*, and straitens the Passage of the Blood Vessels, by its too great Gravity; whereupon the *Bladders* are relaxed and subside, and the Circulation is immediately Interrupted. But if the Animal be in time removed out of this *Steam*, that small Portion of Air which does after every Expiration remain in the *Vesiculae*, may be powerful enough to drive out this noxious Fluid; especially if the Head of the Creature be held downwards, that so its Gravity may forward its Expulsion; or it be thrown into Water, which by assisting, upon the account of its Coldness, the Contraction of the Fibres, promotes the retarded Circle of the Blood; as we every Day experience in a *Deliquium Animi*, or Swooning Fit.

Tho' if this Stagnation be continued too long, no Art can renew Life, no more than in one perfectly strangled;
nor

nor will the *Lake of Agnano* it self be of any Service; which shews that there is no singular Virtue in that Water beyond any other; nor is it, as some have fondly imagin'd, a peculiar Antidote to the Poison of the *Grotta*.

The bad Effects of such *Fumes* as this will be the more certain, because the inspired Mineral Particles twitch and irritate the Membranes, which are hereupon contracted to that Degree, as not to be able to recover their Tone, and so the Force and Action of the *Lungs* is quite lost.

It appears from all this not to be at all necessary to make any farther Enquiry into the particular Nature of these Mineral Particles, since they do in this Case act chiefly by their *Gravity*, which is common to 'em all. Tho' indeed the *Greenish* Colour of the Earth, together with its *Subacid* Taste, very much (as *L. di Capoa* observes) like to that of the *Phlegm* of *Vitriol*, seem to declare them, if not altogether, yet principally at least, to be *Vitriolick*.

To conclude this Part of our Discourse; I think it a sufficient Confirmation of this reasoning, that in *Frogs* kill'd in this *Grotta*, the *Bladders* of the *Lungs* (more visible otherwise and distinct in these Creatures than in most others) were found subsided, and quite empty of Air (c). But if any one desires a farther Proof, he may, according to these Principles, make (as *Lionardo di Capoa* (d) did) an artificial *Mephitis*; for if *Antimony*, *Bismuth*, or any other such Mineral be finely powdered, and moistened with *Aqua Fortis*, or *Spirit of Nitre*, there will arise a great Heat, and a thick dark Smoak, in which, as in the *Grotta de Cani*, Torches are extinguish'd, and Animals, tho' but slowly, stifled and kill'd. And this Effect will be more sensible, and equal to the most violent *Mephites*, if the *Antimony* or *Marcafite* be mix'd with *Bitumen*, and the *Spirit* of *Nitre*, or *Aqua Fortis*, intirely depurated from all its *Phlegm*.

(c) Vid. *L. di Capoa Mofet.* pag. 40.

(d) Pag. 128.

And thus I have shewn how Death may enter at the Nostrils, tho' nothing properly *Venomous* be inspired. It were perhaps no difficult Matter to make it appear, how a lesser Degree of this Mischief may produce Effects, tho' seemingly very different from these now mention'd, yet in reality of the same pernicious Nature; I mean, how such an alteration of the common Air as renders it in a manner *Mephitical*, that is, increases its *Gravity*, and lessens its *Elasticity*, (which is done by too much Heat, and at the same time too great a Proportion of watery and other grosser Particles mixt with it) may be the Cause of *Epidemic Diseases*, and, it may be, more especially of those, which by Reason of their untoward Symptoms, are usually call'd *Malignant*.

For it is very remarkable, that *Hippocrates* (a) observ'd the Constitution of the Air, which preceded *Pestilential Fevers*, to be great *Heats*, attended with much *Rain* and *Southern Winds*; and *Galen* (b) takes Notice, that no other than a *moist* and *hot* Temperament of the Air brings the *Plague* it self; and that the Duration of this Constitution is the Measure of the Violence of the Pestilence. *Lucretius* (c) is of the same Mind, for in his admirable Description of the *Plague* of *Athens*, these *Diseases*, says he, *either come from the Air, or arise from the Earth*.

——— *Ubi Putrorem humida nacta est
Intempestivis Pluviisq; & Solibus icta.*

In short, the general *Histories* of *Epidemic Distempers*, do almost constantly confirm thus much, and would have done it more, if the vain Notion of *Occult Venoms* had not prepossess'd the Minds of Authors, and made them regardless of the manifest Causes.

And this is notorious enough in those Countries where *Malignant Diseases* are most rife; thus it is a very common

(a) *Epidem.* l. 2, & 3.

(b) *De Temperament.* l. 1. c. 4. & *Commentar.* in *Epidem.* l. 3.

(c) *L.* 6. v. 1098.

Observation in the *East-Indies*, that during the dry Heats the Season is Healthful, but when the Rains fall immediately upon the Hot Weather, then *untoward Fevers* begin to threaten.

The same is observ'd in *Africa*; for (as *Joan. Leo* (d) relates) if *Showers* fall there during the Sultry Heats of *July* and *August*, the *Plague* and *Pestilential Fevers* insue thereupon, with which whosoever is infected hardly escapes.

And here I might, by reflecting on the Use and Necessity of *Respiration*, and the particular manner of performing it, (of which I have hinted something already) and considering withal the true Nature of *Fevers*, easily shew how such a Constitution of the Air, as this is, must necessarily produce such Effects; might run over the *Propositions* of *Bellini*; which as they do plainly evince *Malignant* and *Pestilential Fevers* to be owing to a viscid and tenacious *Lentor* or *Slime*, which at first obstructs the *Capillary Arteries*, and afterwards being dissolved by Heat, ferments with the Blood, and changes it into a Mass unequally Fluid and Glutinous, and therefore unfit for all the Operations of the Animal OEconomy; so it would be no uneasy Task to prove, that Air at the same time *Hot* and *Moist*, being less able to comminute and break the arterial Fluid in the *Lungs* than is necessary, in order to prepare it for Secretions, it is no wonder, if when the Blood passing thro' the *Capillary Vessels* arrives at the *Secretory Organs*, the Cohæsion of its Parts not being sufficiently removed, instead of deriving several Juices out of it into the *Glands*, it leaves its most Glutinous and Viscid Parts sticking about the *Orifices* of these Vessels; which tho' they may at first be wash'd away by the repeated Impulses of the succeeding Blood, yet the Cause continuing, and these Strokes growing still weaker and weaker, (from a lesser quantity of Spirits being separated, and hence a more languid Contraction of the Heart) these Obstructions are increas'd to that Degree as not to be remov'd, till by the violent Agi-

(d) *Histor. Afric. l. 1. c. 1. Vid. Purchas's Pilgrims, l. 6. c. 1.*
tation

tation of a greater Heat, this *Slimy Mucus* is thrown into the Blood again, and there in the nature of a *Ferment* so disturbs its *Mixture*, and changes its *Compages*, as to make it a Fluid of quite different Properties, that is, altogether unfit for the same Functions or Offices.

This Effect will be the more certain, because a damp Air upon the surface of the Body checks insensible Perspiration, so that a great quantity of this being detained, the Obstructions are still greater in the small Tubes; whereas indeed upon the Account of a more than ordinary Heat, this Discharge ought now to be in an increased Proportion.

Such a Disposition of the Blood as this the Ancients call'd *Putrid*; and to speak plainly, it is a beginning Stagnation, with a succeeding Heat and Fermentation.

Nor would it be amiss here to take notice, how unjustly some Authors, having quitted the Consideration of *plain Causes*, for *Occult Venoms* and *Deleterium quid*, have brought in the θεῖον τι (*something Divine*) of *Hippocrates* (e) to favour their fond *Hypothesis*; tho' his best Interpreter *Galen*, understood by this Expression no such thing as they mean; but on the other Hand, only the *manifest Constitution* of the *ambient Air*, such as himself has described in his *Aphorisms* (f), and which is exactly the same with that we have been discoursing of.

And therefore not only does *Minadous* (g) rightly Remark, that in his whole *Epidemics*, *Hippocrates* never once mentions any *Venom* or *Poison* as the Cause of *Malignant Diseases*, but the divine old Man himself in another *Treatise* (h) expressly teaches us, that *All Maladies do equally, or one as much as another, proceed from the Gods, there being nothing more Divine in this than in that, each acknowledging its own natural and manifest Cause.*

(e) *Prognostic.* 1. & *Galen. Comment.*

(f) *Sect.* 3. *Aph.* 11.

(g) *De Febre Malign.* 1. 1. c. 11.

(h) *De Aere, Locis, & Aquis.*

But I willingly wave insisting upon these Heads, as well as the Hints which might be taken from this Theory, of some use perhaps in the Cure of these Distempers; and leave it to our Physicians to judge upon how good Grounds they do, in Cases of this Nature, under the Notion of *Alexipharmics*, give such Medicines as raise a great Heat both in the Stomach and Blood; only praying them to take Care, lest while they are engaging the animal Spirits in War with *Malignities*, they do send treacherous *Auxiliaries* to the supposed weak *Party*; that is, that they either raise new Tumults and Disorders of worse Consequence than the original Mischiefs; or at least, by clogging the Wheels, and throwing Dust upon the Springs of the finest Machine in the Creation, do check and interrupt the Action of Nature (i), when 'tis employ'd about the most Nice and Critical Work.

Neither can I, tho' an occasion be fairly offer'd, by any means be induced to intermeddle in the Controversie of those Gentlemen, who by the help of two Words are made Masters both of Philosophy and Physick; I mean, the violent Assertors of *Acid* and *Alkali*. These scanty Principles fall infinitely short of that vast Variety there is in the Works of Nature; However, for their Sakes who are as yet advanc'd no farther, I will advise the contending Parties, (because little good is got by quarrelling) to think of an Union, and if they can find no Remedies but out of these two Tribes, to make use of such as result from a prudent Mixture of some out of each. If this *Project* does not take, to resolve however on both sides, to distinguish the differing Times of the same Disease, and know, that as, on the one Hand, *Acid* Medicines are oftentimes as certainly hurtful in the latter End, as they do service in the Beginning of the Fever; so, on the other, those which are *Alcalious* must necessarily for the same Reason do mischief

(i) *Πόσις* Νέστον *Int.* of *Hippo. r.* Epid. 6.

in the first Periods, for which they are profitable in the last Days of the Distemper.

By what Mechanism this comes to pass, they will easily understand, when they have learn'd what Alteration such things as these are do make in the human Body; nor will it then be a difficult Matter to convince them, that he is equally a fond Slave to an *Hypothesis*, who because *Acids* are sometimes of great service in Fevers, concludes that their Origine is *Alcalious*; as he who knowing that stagnating and fermenting Juices do easily turn to *Acidity*, from thence Argues that *Alcalies* are the only Cure of this Stagnation and Ferment.

But Dr. *Pitcarne* (k) has abundantly demonstrated the weakness of these Men's Reasonings, and the Vanity of such Immechanical Theories.

And here I would put a Period to this part of the Discourse, were it not that these Distempers being sometimes *Contagious*, and *Contagion* being justly reputed a real *Poison*, it may be worth the while to examine a little what this is, and wherein it consists; more especially, because some may perhaps be apt to think this to be an Argument of an *Occult Venom's* being the first and original Cause.

We are therefore to take Notice, that when a *Fever* is communicated by way of *Infection* from one already Diseased, this most commonly happens in the latter End of the Distemper, that is, (as we before discoursed concerning the *Hydrophobia*) when the fermenting Blood is throwing off great quantities of its Active Fermentative Particles upon the Glands of the most constant and easie Secretion; such are those in the Surface of the Body, and the Mouth and Stomach; By this means therefore the Liquid of insensible Perspiration, and the Sweat is impregnated with these *μιάσματα*, and thus the ambient Air becomes fill'd with 'em; so that not only, (as *Bellini* argues (l),) may some of these *Effluvia* insinuate themselves into the Blood of a sound

(k) *Dissertatio de opera quam præstant corpora acida vel alcalica in Curatione Morborum.*

(l) *De Febrili Prop.* 27.

Person thro' the Pores of the outward Skin, but also in Inspiration thro' the Membrane of the Lungs; for he has in another Place (*m*) demonstrated how the Air, or something from it, may this way come to be mix'd with the arterial Fluid; And thus the like *Ferment* will be rais'd here, as was in the originally distemper'd Subject.

This may be *One*, but there is perhaps *another* yet more dangerous manner of *Infection*, and that is, by the Breath of the Diseased taken in by a By-stander, especially in the last Moments, seizing the *Stomach*, and fixing a *Malignity* there. For it is upon this Score, that those who are *Infected* do presently complain of an extreme Pain and *Nausea* in the upper Orifice of the *Stomach*; and that all Authors do agree in the admirable Use of *Vomits* timely given in this Case; These by their stimulating Force removing the very *Minera* of the Disease; and likewise that, oftentimes in *Pestilential* Illnesses, the *Stomach* when open'd has been found Gangren'd and Mortify'd. This made *Van Helmont* (*n*), who had observ'd this Part in one kill'd by a *Plague Infection*, perforated and eroded in several Places, no otherwise than he had seen in one Poison'd by *Arsenick*, conclude, that the *Plague* for the most Part begins in the *Stomach* from a coagulated *Tartar* there.

Herein lies the difference of *Contagion*, from the first Invasion of malignant Distempers; The Effects of the *One* are the Cause and Beginning of the *Other*; and therefore 'tis no wonder, if tho' the Symptoms in the former are by a gradual Increase wrought up to their height, they do however in the latter, even at the very first, discover their ill Nature and Violence, and, like a reinforc'd Enemy, by surer Strokes make quicker Dispatch. And this also is the Reason of the great Increase of *Funerals* in *Plague* Time, in that one Death is thus added to another.

If it be difficult to explain the particular manner how the *Stomach* comes to be thus affected, we must not therefore deny Matter of Fact, and may however probably Con-

(*m*) *De Motu Cordis*, Prop. 9.

(*n*) *Tumulus Pestis*, pag. m. 163, & 172.

jecture, that the last *Breath* of one dying of a malignant Distemper, proves thus pernicious, in that those fermenting active Particles, which, as we just now observ'd, the Blood discharges upon the Glands of the *Mouth, Stomach, Lungs, &c.* impregnating the Air in its Passage thro' these; when the same happens to be immediately inspired by a sound Person, it may easily taint the *Salival* Juices in the Mouth, which are very Glutinous, and of a fermenting Nature, and therefore susceptible enough of *Contagious Effluvia*, but especially of such as proceed from the same Liquor infected in the sick Party. Now the *Spittle* is continually swallowed down into the Stomach, and so will quickly impress its *Labes*, or ill Quality, on so tender and sensible a Part; that is, will lodge these Corrosive *Salts*, (for such we may suppose the Particles of Infection) in the Secretory Ducts; whereupon the Glands being obstructed, little *Tumors* are by the Afflux of their Fluid rais'd here and there, which breaking become small *Ulcers*, and produce that dismal Train of Symptoms which we have already related.

And here it may not be amiss to take notice, that all Authors do agree, one great Cause of *Pestilential* Distempers, especially in Armies and Camps, to be dead Bodies lying expos'd and rotting in the open Air; The reason of which is plain from what we have been advancing; For Battles being generally fought in the Summer Time, it is no wonder, if the Heat acting upon the unbury'd *Carcasses*, and fermenting the Juices, draws forth those active Particles, which in great quantities filling the Atmosphere, when they are inspired and let into the Stomach, do affect it after the manner already described.

To illustrate this Matter, I shall relate a remarkable Story told me by the learned Dr. *Baynard*. The Body of a Malefactor was hung up in Chains in the Country; after a few Months, in very hot Weather it was Sport and Pastime to some Boys, playing thereabouts to swing the Carcass up and down; One more bold than the rest struck it with his Fist upon the naked Belly, which being outwardly parch'd and dry, and, from the falling down of the Humours, swell'd

swell'd and tense, was easily burst by the Blow; out gush'd a Water so Corrosive and Fiery, that running down the poor Lad's Arm, it caus'd a violent *Excoriation*, and a very hard Matter it was to preserve it from being truly mortified. What this *Serum* could do upon the outward Skin, the more volatile Parts of it would, without all doubt, effect upon the more tender and sensible Membranes of the *Stomach*, if a considerable number of them were fixt there. The Fluids of human Bodies being ranker and more abounding in active Salts than those of other Creatures, which are not continually repaired and nourish'd by the Juices of Animals.

The Way by which *Bad Food*, *ill ripened Fruits* of the Earth, &c. do oftentimes produce *Malignant* and *Pestilential* Diseases, is not very different from *That* by which we have observ'd unwholsome Airs to be the Cause of the like Effects. For the Juices with which those do supply the Blood being Corrupted, must necessarily make a Fluid of quite other Properties than what the Animal OEconomy requires, that is, neither fit for Nutrition, nor for the Secretion of those Liquors which in the several Organs are to be derived from it; whereupon the small *Tubes* are obstructed by an unequally Glutinous *Slime*; and it is therefore no wonder, if besides the other Symptoms insuing, *Sore Pustules*, *Inflammations*, *Ulcers*, &c. (more common in Fevers from this Cause than in any other,) are rais'd in the Surface of the Body.

This is the Ground of the common Observation, that a *Famine* is very often succeeded by a *Pestilence*. And this *Calamity* generally begins among the poorer sort of People, whose Diet to be sure is the worst.

The City of *Surat* in the *East-Indies* is seldom or never free from the Plague; and yet it is observ'd, that the *English* who trade there, are in no danger of being Infected thereby. Now the chief of the Natives in this Place are *Banians*, who neither eat Flesh, nor drink Wine, but live very poorly upon *Herbs*, *Rice*, *Water*, &c. and most of the Inhabitants do the like, except Foreigners; This poor Fare, together with the heat of the Climate, makes them so liable to malignant

lignant Distempers; from the Attacks of which those who feed well are more safe and secure.

Thus much concerning *Poisonous Exhalations and Airs*, so far as the Consideration of the *Grotta de' Cani* has led us on to inquire into their Effects; for tho' there may be other Alterations of this same Element, differing in their Nature from this we have insisted upon, and yet equally pernicious and hurtful, yet we take no notice of any of them, in regard that those which are from *Arsenical, Mercurial*, and the like *Fumes*, are reducible to a foregoing *Essay*; and those which are owing to a Change of the known Properties of the Air, may be easily explain'd by what has been already delivered in *this*. I shall therefore rather chuse to make some Remarks on the Mischief of another *Fluid*, which as it is the next in use to this we have been treating of, so the bad Qualities of it, when it comes to be altered, must necessarily be almost equally fatal and dangerous.

I mean *Water*, which is of so constant Service, not only for our Drinks, but also in preparing of our Flesh and Bread, that it may justly be said to be the *Vehicle* of all our Nourishment; so that whenever this happens to put on other Properties than are necessary to fit it for this purpose, it is no wonder if in its Passage thro' the Body these do make suitable Impressions there.

Thus at *Paris* (o), where the Water of the River *Seine* is so full of Stony Corpuscles, that even the Pipes through which it is carried, in time are incrusted and stopt up by 'em, the Inhabitants are more Subject to the *Stone* in the Bladder than in most other Cities. The same I observed in the *Baths* of *Abano*, a few Miles from *Padua*, to that Degree, that it is necessary very frequently to clear the Wheel of a Mill driven by the Current of these Springs,

(o) *Vid. Lister's Voyage to Paris.*

from the great quantity of *petrify'd* Matter with which it is from time to time incumbered.

In like manner, let the gross Particles with which the *Water* is saturated be of any other Nature, *Metallick*, *Salts*, &c. these, according to their various Gravity, the Capacity of Canals, and such like Circumstances, will, when they come to circulate in the Animal Body, be by the Laws of Motion deposited in one Part or other. So those Mineral Bodies, and Nitrous Salts, which abound in the Snowy Waters of the *Alps*, do so certainly stuff and enlarge the Glands of the Throat in those who drink 'em, that scarce any who live there are exempted from this Inconvenience (a).

For this Reason, the Choice of *Water* for Drink among the Ancients was by Weight, the lightest being preferr'd, as most free from all Heterogeneous Bodies.

The Case therefore of *Poisonous Springs* is, their having Corrosive Corpuscles mixt with their Water, which cannot fail when forsaken in the Canals of the Body of their Vehicle, to do the same mischief as they would if taken by themselves undiluted; only with this difference, that they may in this form be carried sometimes farther into the Animal OEconomy, and so having pass'd the *Primæ Viæ*, discover their Malignity in some of the inmost Recesses. Thus the *Fons Ruber* in *Æthiopia*, mention'd by *Pliny* (b), about which abundance of native *Minium* or *Cinnabar* was found, shew'd its ill Effects chiefly on the Brain; and therefore *Ovid* (c) says of it,

——— *Si quis Faucibus hausit*
Aut furit aut patitur mirum Gravitate Soporem.

We shall not need then to enlarge on this Matter since any

(a) *Quis tumidum Guttur miratur in Alpibus.* Juvenal. Satyr. 13.

(b) Lib. 31. cap. 2.

(c) *Metam.* lib. 15.

of the foremention'd *Mineral Poisons* may thus impart their deadly quality to *Waters*; and accordingly there are Instances of *Arsenical*, *Mercurial*, &c. Fountains, of which the Histories may be seen in the Collections of the learned *Baccius* (d). And one very remarkable in the *Philosophical Transactions* (e).

But as we before took Notice concerning *Airs*, so it may be worth the while to observe of *Waters*; that there are some Alterations of them, which tho' not properly *Poisonous*, yet are of so great Consequence in their Effects, that they may very well deserve to be regarded.

This I shall do with respect to a great Abuse, committed in this kind about the City; and that is, in the chusing of stagnating impure *Well-Water* for the *Brewing* of *Beer*, and making other Drinks. Such a Fluid indeed has oftentimes a greater Force and Aptness to extract the Tincture out of *Malt*, than is to be had in the more innocent and soft Liquor of Rivers; but for this very Reason it ought not, unless upon meer Necessity, to be made use of; this quality being owing to the *Mineral* Particles and *Aluminous* Salts with which it is impregnated.

A late *Author* (f) by searching into the first Accounts of the Distemper we call the *Scurvy*, describ'd by *Pliny* (g) and *Strabo* (h), under the promiscuous Names of *Stomacace* and *Scelotyrbe*; and examining the Authentick Histories of it in later Years, made by the most observing Physicians in those Countries where it was unhappily revived, as *Olaus Magnus*, *Balduinus Ronsseus*, *J. Wierus*, *Solomon Albertus*, &c. finds that the Origine of it was in all times and places charged upon the use of unwholesome stagnating *Waters*. Then by comparing together the *Clayie*

(d) *De Therm.* lib. 6.

(e) No. 8.

(f) *Dr. J. H. Scelera Aquarum*: Or, a Supplement to Mr. Graund's on the Bills of Mortality.

(g) *Lib.* 25. c. 3.

(h) *Geogr.* lib. 6.

Strata of the Earth about the Cities of *London*, *Paris*, and *Amsterdam*, he shews that where the Water is worst, there this Malady is most rife. So that he has put it out of all doubt, that most of the perplex'd and complicated Symptoms which are ranged under this one general Name, if they do not entirely owe their Birth to the Malignity of this Element, do however acknowledge it to be their main and principal Cause.

And indeed *Hippocrates* himself, as he has very plainly decipher'd this Disease (i), by the Title of σπλῆνες μέγιστοι, or *great Milts*; so he does very particularly in another *Treatise* (k), take notice, that drinking of *Stagnating Well-Waters* must necessarily induce an ill Disposition both of the *Milt* and *Belly*.

If we enquire into the Reason of such ill Effects, we must consider, that *Clay* is a *Mineral Glebe*, and that the gross Particles and Metallick Salts with which Waters passing thro' such a Bottom do abound, are, as *Dr. Lister* (l) observes, not to be mastered, that is, indigestible in the *Humane Body*. Not only therefore will these Cause, as he very well argues, calculous Concretions in the *Kidneys*, *Bladder*, and *Joints*; and as *Hippocrates* experienced hard Swellings in the *Spleen*; but they must necessarily oftentimes by their Corrosive Quality twitch and irritate the sensible Membranes of the *Stomach* and *Bowels*, and thus hinder and interrupt the Digestion of our Food. Nay, besides all this, when they come into the Blood, it is no wonder if the small Canals of insensible Perspiration are frequently stopt and obstructed by 'em; for it is upon this Score that *Sandborius* (m) teaches us, that heavy Water converts the Matter of Transpiration into an *Ichor*, which being retained, induces a *Cachexy*.

(i) *Proorrh.* l. 2. c. 16.

(k) *De Aere, Aquis & Locis*, sub finem.

(l) *De Fontib. Med. Angl.* P. 2. pag. 74. *At fossilia sive Metallica salia alia atq; alia sunt, & nobis & pene igni dixeram indomabilia.*

(m) *Medicin. Static.* Sect. 2. Aphor. 6.

What Mischiefs will insue hereupon every one sees; not only Pains in the Limbs, livid Spots in the Surface of the Body, Ulcers, &c. from the Acrimony of the undischarged Moisture; but many besides of those perplexing Symptoms which go by the Name of *Hysterical* and *Hypochondriacal*, may take their Rise from the same Source; for the before cited *Sanctorius* (n) has remark'd that the *F'atus* or *Wind* so inseparable from those Cases, is no other than the *Fluid of Perspiration rude and unfinished*.

If these Inconveniences are oftentimes not felt, at least not till towards the declining Age, in strong and active Habits of Body; yet I am, from very good Experience, assured, that they deserve Consideration in weaker Constitutions, and a Sedentary Life, especially of the more tender Sex.

I have the honour to be nearly related to a worthy Person, who led formerly an afflicted Life from the frequent Returns of violent *Colick Pains*, till she was with happy Success advised by the noble *Van Helmont* not to drink (as she then did) Beer brewed with *Well-Water*; and her Health is even now so far owing to this Management, that an Error in it is unavoidably follow'd with the wonted Complaints.

For these Reasons *Pliny* (o) tells us, that *those Waters are condemn'd in the first Place, which when Boiled do incrustate the sides of the Vessels*; and that our *Well-Waters* do this, no Body who looks into the *Tea-Kettles* of our Gentlewomen can be ignorant.

And indeed in Ancient Times, when Physick was more a Science, which is now more a Trade, as that Part of it, which relates to *Diet* was more carefully studied, than it is now-a-days; so this Point particularly of which we are treating was of so great Moment, that *Hippocrates*, who wrote the best Book (p) on the Subject that ever was Publish'd, has in a great Measure accounted not only for the Diseases, but even for the Temper and Disposition of the People of several Countries, from the Difference of the *Waters* with which Nature has supplied them.

(n) *Ibid.* Sect. 3. Ap. 13. *Flatus nil aliud est quam rude perspirabile.*

(o) Lib. 31. c. 3. *Damnantur imprimis Fontes quorum Aqua decocta crassis obducunt Vasa crustis.*

(p) *De Aere, Locis, & Aquis.*

The Explication of those Figures which are not Explained in the Treatise.

FIG. 1. Represents the Head of the *Viper* in its natural Bigness, with the Mouth open, and Fangs erected.

- (a) Marks the Poisonous *Fang*.
- (b) The *Eye*.
- (c) The Hole of one *Nostril*.
- (d) The *Larynx*.
- (e) The Forked *Tongue*.

*All the other Figures relating to
the Viper are drawn larger
than the Life.*

Fig. 7, & 8. Exhibit some Muscles, which serve for the Motion of the Jaws.

(a, Fig. 7.) *Elevator Maxillæ Inferioris.*

(b) *Depressor ejusdem.*

(c) *Depressor Dentis Venenosi.*

(d) A strong Ligament fastened by one Extremity to the Spinal *Apophysis* of the second *Vertebra* of the Neck, and by the other to the end of the *Elevator Maxillæ Inferioris*.

(a, Fig. 8.) A Muscle, which being fixt to the Extremity of both Jaws, serves to pull them backwards, and may be call'd *Retractor*.

(b) The Internal side of the *Depressor Dentis Venenosi*.

(c) *Elevator Dentis Venenosi.*

(d) The extremity of the lower Jaw.

(e e) *Flexores Capitis.*

(f) The

Explication of the Figures.

(f) The Internal Part of the Skin covered with some Muscular Fibres.

Fig. 17. Shews the Head of the *Scolopendra*.

(a a) The Wounding Claws.

(b) The Mouth.

(c c) The two first Feet.

Fig. 18. The Weapons of the *Nhamdu* in their natural Bigness.



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