

Zymologia physica. Or a brief philosophical discourse of fermentation, from a new hypothesis of acidum and sulphur. Whereby the phenomena of ... hot-baths ... are solv'd ... With an additional discourse of the sulphur-bath at Knarsbrough ... / [W. Simpson].

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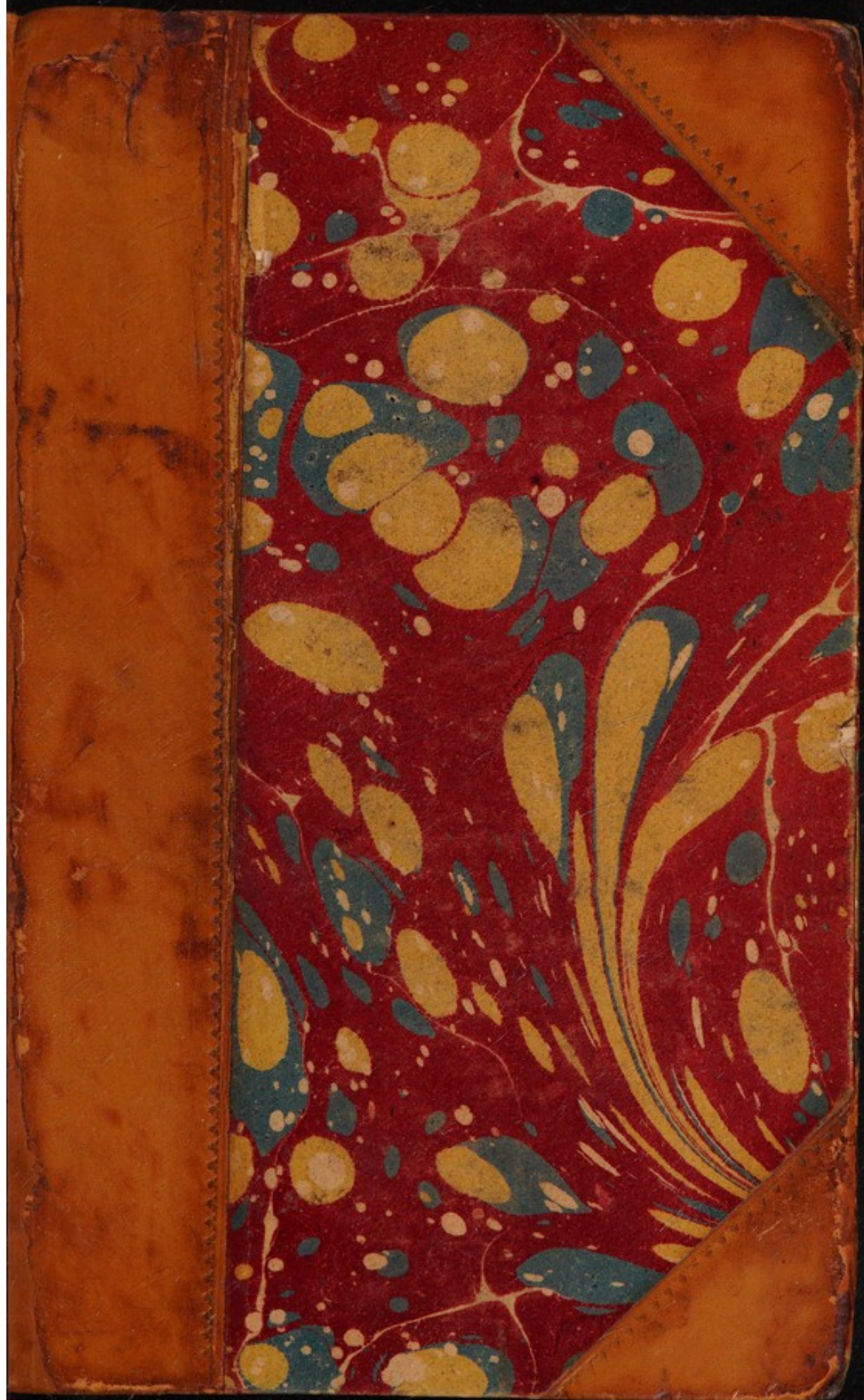
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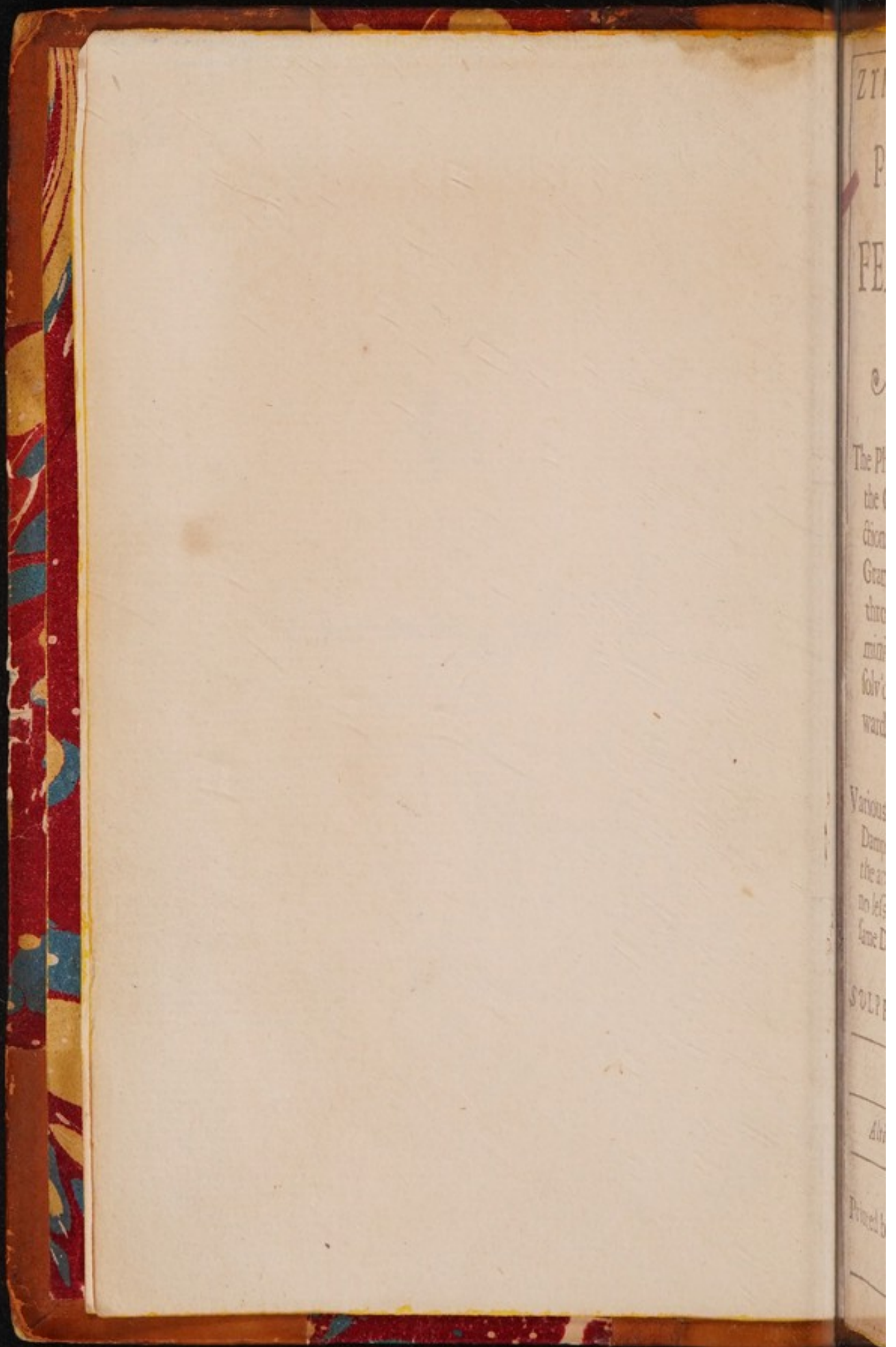
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Z Y M O L O G I A P H Y S I C A.

Or a brief

Philosophical Discourse
OF
FERMENTATION,

From a new Hypothesis of

Acidum and *Sulphur*.

W H E R E B Y

The Phænomena of all natural *Hot-Baths*,
the Generation of *Minerals*, the Produ-
ction of many *Acidulae* or *Spaw-waters*, the
Grand apparances of *Heat*, *Fire*, and *Light*,
throughout the triplicity of Natures Do-
minions, in the productions of Bodies, are
solv'd from the intestine duellings and in-
ward collisions of the foresaid principles.

Whereby also

Various other subterranean *Phænomena*, as
Damps, Earth-quakes, Eruptions, &c. likewise
the apparances of *Meteors*, &c. and divers other
no less remarkable then entertaining, are from the
same Doctrine of Fermentation genuinely solv'd.

With an additional Discourse of the

SULPHUR-BATH at KNARSBROUGH.

By W. SIMPSON, M. D.

Altiora cogitando nobilitatur mens humana.

L O N D O N,

Printed by T. R. & N. T. for W. Cooper at the Pelican in Little-Britain, 1675.

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TO THE
Right Honourable
THE
PRESIDENT & FELLOWS
OF THE
ROYAL SOCIETY.

The following

DISCOURSE
OF
FERMENTATION

Is most Humbly

Presented

BY

THE AUTHOR
W. SIMPSON.

TO THE
Right Honourable
THE
PRESIDENT & FELLOWS
OF THE
ROYAL SOCIETY.
The following
DISCOURSE
OF
PERMUTATION
As was formerly
presented
BY
THE AUTHOR
W. SIMPSON.



THE
PREFACE
TO THE
READER.

H*E that attempts any thing that is new, whether in Natural Philosophy, or other Sciences, ought with the fam'd Archimedes, to beg a sure footing; and he that builds had no less need to lay a good Foundation, least in the former he be driven back, and in the latter, the fabrick by over-hanging, indanger its fall by its own weight. What care I have taken herein, I am now likely to run the hazard of thy carping or candid interpretation, the common fate to all Books.*

We here present to thy view, (Candid Reader, if such thou art) a small Scheme (such as it is)

The Preface

is) of the principles of Nature, which though few, yet probably very teeming : We offer here a little draught of those pregnant mechanical agents, Nature (we suppose) useth in the Formations and Transformations of all bodies, drawn as near as we can to the life ; which at present we have compriz'd into this Epitomiz'd bulk, least by the swelling of its Volume, thou shouldst conjecture its Title before thou readest its name. I have been not a little cautious in the modelling this small Plat-form, (though perhaps not without its Chinks and Chasmes, discernable to a curious prying Eye) by which (if it take) a larger draught probably may afterwards be drawn ; having endeavoured to calculate this Physiological Scheme, according to the meridian of an inquisitive searching Age.

When I had well nigh finish'd another piece, intituled Lithologia Physica ; as also another, which bears in its front Halologia Chymica, (both writ in Latin) two as considerable Subjects (I mean Petrification and Salification) as I could then pitch upon, both grounded upon a different Hypothesis then was yet extant : before (I say) I had compleated the two foresaid Tracts, it came into my mind, to give a little compendious account of a new Hypothesis I had often ruminated upon, which I thought I could not better do, then by undertaking thereby to solve some of the most remarkable and entertaining Phæno-

To the Reader.

Phænomena of Nature, such as are natural Hot. Baths, the generation of Minerals, the appearances of Heat, Fire and Light, &c. which therefore we made the subject matter of this ensuing Discourse: and do therein ever and anon, refer to what we write in those other mentioned pieces.

And when I had well nigh finished this small tract, I began to look about me, and to consider on which of the Philosophers side I was (seeing they by their various and different Hypotheses are apt, instar Audabaturn, to fight in the dark) I could not tell of a good while, till at length I considered, that the great Hypocrates himself has given touches thereof, while in his Book de Dicta he tells us, Constituuntur tum omnia animantia, tum homo ipse ex duobus, igne & aqua: And that our Doctrine doth coincide with his contententia, contenta, & impetum facientia: The contententia are vasa & viscera: The contenta are Fluids, viz. Water the material principle of bodies: The impetum facientia are Ferments, or Acidum and Sulphur put into an intestine collision or Fermentation: And as he tells us all things are made of Fire and Water; and that these two are sufficient for all generations: so he adds, that Fire gives motion, and Water nutrition: which how it agrees with our Hypothesis,

Tach. 84.

Jord.

114.

De Dicta

lib. 1.

The Preface

pothesis, let the ensuing Discourse speak for it self.

So that it appears that Fermentation in our sense, is the same with his Spiritus impetum faciens with his τῶν πρὸ θεῶν. Fire hid in bodies, Its also the same with that Ætherial matter, the Panspermion of other abstruse Philosophers, that divinioris auræ particula implanted by God (the Parent of Nature) in Water; which from seminal originals, produce, by a genuine expansion, all concrete bodies: its likewise the same which the noble Helmont calls semina rerum. Those indeed foecunda semina rerum, which as the Poet goes on,

Vivaci nutrita solo, ceu matris in alvo,
creverunt.

And by the more recent Spagirical Physiologists its called Spirit, or a combination of Spirit, Salt, and Sulphur: Its what Tach. clar. Tachenius intends by his Acidum p. 40. pinguae & filius solis, &c.

And lastly, (to name no more) its what in a more plain dialect has been represented to us by the Poets from the ancient sage Philosophers, where one of them saith,

Quippe

To the Reader.

Quippe ubi temperie sumpsere humorq;
colorq;
concipiunt ; & ab his oruntur cuncta
duobus.

When I had viewed the many high roads and broad tracks (distinguished by the first tracers, and bore their names) at the first sight each seem'd large enough, and promised a fair passage into the beautiful Garden of Nature. But I found, that as often as I took along them, though I went on pretty merrily at first, because the path was well beaten, store had gone that way, yet I had not gone long, ere I perceiv'd still they ended and spent themselves into a wide barren Common, where I was ever and anon bewildred, and at a loss whither to turn: so that amidst such difficulties of Rocks, Precipices, Hilly-places, &c. I was glad I got safe off: at length I espied a little narrow way that had been little beaten, so that the footings of those who had tract it was scarce discernable; and it lay off from all the rest of the broad paths: so that (after I had try'd in vain most of the rest) I took into that, kept in it as well as I could, which was difficult to do from its foresaid narrowness, and its being unbeaten: and although I now and then deviated, yet I found I was not stray'd so wide, but that with some trouble I got in again; and following this path, it led me directly

The Preface

rectly into the amiable Garden of Nature: where, what contemplation I made, what prospects I took of those curiosities and rarities I met with, let this ensuing discourse give some foretasts, which as it finds admittance into the World, may give encouragement to publish more.

And here I might take the liberty to assure the World, that nothing doth give a man a fairer prospect into the inward recesses and secret retirements of Nature, nor doth offer a better view into Natures Land-skips, nor doth more open the Cabbinet of her choicest rarities, then that most admirable Mistress of Arts and Sciences, the noble Chymia, that clavigera arcanorum naturæ, which gives admittance into the surprizing Arcana of Nature, whose entertaining Phœnomena in her genuine encheiresis, are such as may strike admiration (not to say amazement) in the Artist: I mean not here that spurious brood of swarming Chymists, those fumivenduli, who fill the World full of smoak and Noise, who are but indeed the blemishes of that noble Mistress; the spots in that solar Beauty, the soils that set off the Lustre of the legitimate Sons of Art, who will shine with an oriental Lustre amidst such empty Clouds.

He indeed that would be a diligent searcher of Nature (thereby to become useful in his generation) must not disdain the soiling his Fingers with Coals; nor think it below him to converse
with

To the Reader.

with the meanest of mechanicks, but may take time to wipe his Fingers while he is refining his notions, and rectifying his contemplations by remarking the obvious Phœnomena of his or others works.

If this Essay hold good, as its probable in the main it may, it will in great likelihood be as an introduction to further and more clearer discoveries in the knowledge of the hidden mechanical agents, imploy'd by the divine hand in the fabrick of all bodies: and gives great probability of being an in-lett into a better understanding of the causes and efficientes of Diseases, and their Cures, then at the first can easily be apprehended: and in general may be as a foundation towards further improvements in all manner of Physiology or Natural Philosophy.

We would not presume to say, that all other Hypotheses ought to truckle (far be it) but shall leave the Peripateticks quadriga of Elements, with their first and second qualities, their matter and form, &c. The Epicurean or Corpuscularian Doctrine, founded upon Matter, Figure, and Motion, the Figures depending upon those of round, quadrate, acute, cylindrical striate, &c. of Atoms, making a pleasant Methe-matical Scheme, adorn'd by the curious notions of Cartesius and others: The quinary of the late Spagyrist, The ternary of the Chymists (although that in a genuine acceptation is the most
plan-

The Preface

plausible) *The Binary of the Tachenians, &c.* But shall I say, leave each of the foresaid to the judicious, to compare with this, and to judge of according to their worth and intrinsick value.

And onely shall refer to the computation of the unbyass'd Reader, whether an ingenious person may not be inabled to take a further prospect into the nature of things, and be capable of making better inspections into the insides thereof, and of taking larger measures towards a further and future improvement, then from any other yet extant: where, although I should be found wandering, yet would not (Candid Reader) despair of thy favourable aspect, and that upon the very foresaid reasons, viz. both of the uncothness and untractedness of the path, having neither guid nor leader, yea scarce any Land-marks, but what was set up by the industrious labours of the Spagyricall Science, whose ne plus ultra Pillars are beyond our hopes of ever reaching.

I would here once for all say, that I onely propound my Hypothesis as a modest Essay towards the further improvement of that noble Doctrine of Fermentation: For not being satisfied with any thing I have yet seen extant upon that Subject, has given me occasion to search further into the nature and causes thereof: not being content with a bare ipse dixit, or to sit down under the dogmatical placets of Authors, at the foot of
such

To the Reader.

uch Gamaliels, gave my self scope to trace nature (if I could) in her more hidden paths and secret tracts.

And indeed the onely right way of establishing any sort of Hypothesis, is first to procure a sett of paralel experiments, and to be furnished with a competent stock of mechanical Trials, which are so well to be contriv'd, as to accord amongst themselves in their most remarkable appearances; and this is to be observ'd in the erecting any Hypothesis, whether Physicks, Medicks, or any material branch of either, as the true basis to build upon, consulting in the one the experiments, in the other, the observations of ingenious persons, in order to the raising such a structure as will not easily fall, and of confirming such a Theory as will abide the test of after ages.

Now how ours of Fermentation square herewith, I must appeal to the judicious Reader; For after we had laid a great many of experiments together, and had found where, in their most observable Phœnomena they hit and centred; by an induction I say of which particular experiments, conspiring in the reasons and causes of their main solutions, we began to propose to our selves an Hypothesis which might best suit therewith, and most genuinely result therefrom, and found from its congenialness to the principles of Nature, not onely to hold good in those which at first fell under our consideration, but

The Preface, &c.

but also in others which afterwards occur'd to our thoughts, and that from the consonancy and consistency of Nature to her self in all her actions, both in the genesis and analysis of bodies.

And now, kind Reader, (that I may conclude) thou hast viewed the front, and pass'd the Portal, if thou has taken any pleasure therein, and art at leisure, my advice is, that thou forthwith enter, and I would lead thee by the hand into the building it self; consider the materials, look at the foundation, pry (though not too narrowly) into the cement, pass through every Room, observe the proportion and symmetry of the parts; and if thou canst not otherwise come to a resolve in thy judgment, yet at least guess at the design from the contrivance of the plot: if thou say it wants finishing work, we confess it, by acknowledging it to be the first, and therefore more rude draught: if thou say our Lights are too much shaded, we say so too, owning our weakness in that Art; if, that our Fires which should warm, dry, and do other offices to the Natives, are too much clouded with fumes, we will not contend: onely beg of thee, by putting things into a just ballance, to weigh them well before thou pass thy severest judgment, and thou wilt oblige him to concern himself further in the like matters, who remains Thine

W. S.

BIBLIOPOLA LECTORI.

Gentle Reader,

THe Authors more earnest occasions not permitting him time to wait upon the Press, hath occasioned some literal mistakes; and although small ones, yet will not the exact curiosity of the Author pass them by, but that I must lay them open to thy view, and crave thy Correction. But more especially I beg yours and the Authors excuse for a more considerable mistake by me committed, in returning to the Printer a wrong Paragraph in page 11. an attonement for which I have endeavoured to make, by giving you the corrected one, which you will find Printed at the end of this discourse.

V A L E.

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A
Philosophical Discourse
OF
FERMENTATION.

CHAP. I.

WE shall not here ravel into the opinion of others concerning this great doctrine of *Fermentation*, which whether we look upon in a more large sence, as the very *Basis* of *Natures* workings in the formations and transformations of *Bodies*, or in a more strict, limiting it (as some Authors do) to the bare confinements of some animal and vegetable juices: If the former, it might come in competition with all other sorts of Principles, laid down in the various kinds of Hypotheses by divers *Physiologists*, whether *Peripateticks*, *Epicureans*, *Cartesians*, (which is but the latter polish'd) *Paracelsians*, *Helmontions*, *Willefians*, *Tachenians*, &c. and so might require a larger discourse then here we intend: If the latter, we stint and straiten *Nature* in her more ample work of generations;

B

making

making her square to our strait-lac'd and byas'd notions: We shall in neither sence, I say, take an occasion to examine the Opinions and Judgments of others, referring that task to another place. But shall without any unnecessary Prologue fall to our intended work.

Only we would premise, that whereas the *Corpuscularians* (who are now the most recent *Physiologists*) suppose matter under the consideration of *motion* and *figure*, to be the competent Elements and Principles of *Bodies*, we shall anon shew, that by the power of *Fermentation*, one part of matter *mechanically* indivisible, may for ought we know be splitt and sub-divided by a subtile comminution into 1000. perhaps 10000 parts: now whatsoever *figure* these (not almost but altogether) unimaginable minute parts have or may be supposed to have, yet can signifie nothing in the *fabrick* of *Bodies*, till they jump together again or coincide into a stricter compage: So that such parcels of matter as come nearest to a *mechanical division*, or at least come nearest to be perceptable to the acutest Organs of our Sense, fortified by *artificial contrivances*, are such as we ought chiefly to look after, and to consider as principles in order to the *genesis* and *analysis* of *Bodies*.

Nor are we to look at the *Elements* of *Bodies* as confin'd to such narrow limits, that thence of necessity they should be pent and thrust:

thrust up into indivisible figur'd points: So that matter under the notion of figure, as of round, square, cubes, &c. in Physically indivisible points, cannot truly and in a genuine *Physiological* sense, be reputed the Elements of bodies: For the reason, suppose, of extension of matter in the concretion of Bodies, consists, (we conjecture) chiefly, if not solely, in a coagulating texture of plyable parts of matter, wrought up before while in *Succo Soluto*, by *Fermentation*: and not only extension but divisibility of matter previous to extension in the production of *concretes*, we ascribe to the same cause: so that whatever the *Corpuscularians*, attribute to *motion*, *divisibility*, and *figure* or *size* of *particles* of *matter* in order to make up the Elements of Bodies, we see no other cause but to ascribe to matter, *viz.* (*water* or *watery particles*) set into a Fermentative motion, which without any more ado, performs the whole business, as we shall in the sequel of this discourse illustrate, this being premis'd.

The Method we intend to insist upon and to trace in order to the right understanding, and towards prosecuting the due improvements of the doctrine of *Fermentation*, according to our *Hypothesis*, will be first to explain what we mean by *Fermentation*, giving as concise a definition as the nature thereof will admit; next, to signify of what large extent it is in the

whole round of *Natures* workings, which will be elucidated by an induction of particulars, viz. how the *Phænomena* of *hot Baths*, the production of *Minerals*, the origin of some *Acidulae*, or *Spaw waters*, the grand apparances of *Heat*, *Fire*, and *Light*, throughout all *Concretes*, whether in the familie of *Minerals*, *Animals*, or *Vegetables*; also how many other sorts of *Phænomena*, obvious in the large field of *Nature*, may without straining be solv'd from the true principles thereof, consonant to *Nature* in all her workings.

In the handling of the first, we may take leave to say, That *Fermentation* in the true genuine sence thereof, is nothing else, but an *intestine Collision* or *mutual wrestling* betwixt *Acidum* and *Sulphur*, put together by *Nature*, (or by *Art* in imitation of *Nature*) and set in a combating motion, in order to the production of some *Concrete*, or to some other equivalent end, whereby, if not interrupted, in liquid juices, heterogenities are separated: whose first on-sets are sometimes, especially in the *Embrio-State* of some things, slow and indernable motions, whilst in other Stades they pass through, they arrive at more brisk frettings, and yet heightened, may sometimes arise to actual *flagration*, as we shall shew afterward: And that *nature* (as we shall anon shew) useth these two as the grand *mechanical principles* in the productions of all *concretes*, whether

whether *mineral*, *animal*, or *vegetable*, and that too not onely in their *concretions*, but *reductions*, in their *genesis*, but *analysis* *evolutions* and *revolutions*, *weavings* and *unweavings*, *windings* on and off in all Bodies.

Only, First with this difference in the three-fold *Kingdom* of *Nature*, that tho the *acids* of *vegetables* be different from those of *animals*, and both from those of *minerals*, retaining a *specific* difference amongst themselves, whereby they constantly keep up the *bad* e of their *distinction* in their several *Classes*, yet all are in a true (and not metaphorical) sence, *acids*, the like may be said of their *Sulphurs*, which are truly (and not analogically) *Sulphurs*.

And Secondly, with this difference amongst the same *Acids* and *Sulphurs*, as they are considered under the notion of the *genesis* and production of *Bodies*, from what the same are in the right understanding of the *analysis*, *reductions* and *unweavings* of *Concretés*. So that *nature* hereby is every where uniform to her self, and that too from the *consonancy* and *harmony* of her *principles* : We say therefore and shall prove in the series of our following discourse, that there are no *concretions* of *Bodies*, as they assume their birth from the legitimate broodings of *nature* in all *seeds* and *feminal* offsprings, without the concurring *efficients* and *principles* of *Fermentation*, which

as they are hid and close shut up in the very *primordial seedlings* of things, and are known to us only *a posteriori* (inasmuch as they are indiscernable *a priori*, but by an intuitive knowledge) yet *ex ungue leonem*, we may easily take their measures from those Scantlings we can trace in their footings.

Now for the better rendring our Doctrine of *Fermentation* intelligible, viz. how *nature* by the foresaid *principles* set to work in the very *primordials of things*, goes on (if not interrupted) in a *linear process* towards the *productions* thereof, we shall begin with the *mineral Kingdom* : where we shall illustrate the veracity of our *principles of Fermentation*, by thence solving the *Phenomena* of *hot Baths*, the productions of *minerals*, and other *subterranean apparances*, as they will in course fall in our way.

In order to the right understanding of *hot Baths*, and to demonstrate they have their *original* from *Fermentation of mineral juices*, our method will be to lay down *two positions*, the first whereof is, that there is no *hot Bath* without *Sulphur*. The Second, That an *Acid* is necessarily requisite in all *mineral Fermentations*; and that all *Acids* so concern'd, are either native or super-induc'd, also to shew what we mean by *Sulphur*, and how *hot Baths* differ chiefly according to the difference of their *Sulphurs* : And which amongst them are not

safely

safely to be taken *inwardly* and which are : Then to shew how from the foresaid *principles* put together into an intestine *collision* and *Fermentation*, the waters that pass through them, must necessarily become *hot*, and this is then to be confirm'd by an induction of *mechanical Experiments*, also to shew how *Sulphur* by *Fermentation*, becomes *comminuted volatiz'd*, and capable of *Solution* in *Water*, as happens in all *hot Baths*, and to signifie a paralel betwixt *mineral* and *vegitable Fermentations*, &c.

CHAP. II.

AS to the truth of the first *position*, viz. that there is no *hot Bath* without *Sulphur*, appears, because as there is no *heat* without *Fermentation* of *mineral juices* (I mean as to *subterraneals*) as we shall make evident afterwards, so no *Fermentation* without *Sulphur*; For although indeed from mixtures of *Acids* and *Alcalies*, (whether fixt or volatile) *Fermentation* and *Heat* doth necessarily result: yet because they are artificially produced; and next, because it will be difficult to find out the sources of these *heats*, and the true genuine *causes* of such *Fermentations*, from the *variety* of those *efficients*, I mean *alcalies*: for notwithstanding there be plenty of *alcalizate*

alcalies, (as I may call them to distinguish from *lixivial*) wrapt up in the texture of *Petrifick concretions*, yet there must be store of very *Corrosive acids*, that can be sufficient to cause so great a *Fermentation*, which we may never expect to find: Therefore *Tachenius* his *Hypothesis* of *acids* and *alcalies*, will not do our work, as being too narrow in the *foundation* to raise so large a *structure* of *Philosophy* upon, as genuinely to solve the various *Phænomena* of *nature*, and particularly in this apparance of *hot Baths*, as anon will be more evident.

By *Sulphur* I do not confine my self in my *Hypothesis* to that particular *mineral Concrete* call'd *Sulphur* or *Brimstone*, which although that be a Subject in whose concretion more plenty of that matter I call *Sulphur* is interwoven, or rather coagulated, then in any other: yet by that term, I do not only mean what is *flammable* in that body; but also the like *analogous flammable* matter in other *minerals* or *metals*, as to *minerals* whether in *Antimony*, *native Cinnaber*, *Arsneck*, *Auripigmentum*, *Marcasites*, *Pyrites*, *Succinum*, *Gates Lythanthrax*, &c. As to *metals* in *Lead*, *Tin*, *Iron*, *Copper*, and *Quick-silver*, or in both, *viz. Vitriols*, which are *metals*, especially *Mars* and *Venus* reduced into that form by the help of *mineral acids*; I say I do not only mean what is *flammable* in the foresaid *Bodies*, or may be separated in a *combustable matter*: But also I include all
bitumen

bitumen and *unctuous matter*; whether reposed in *Earth, Stones*, or the like: As to which *Sulphurs*, even in all *combustible Concretes*, we know not that ever they appear sincere, but always more or less complicated with their *connate acids*, and upon every sort of *Fermentation*, (as we shall shew more afterwards) whether in the slow or quick, low or high degrees thereof in *vegetation, animation, mineralization, ignition* and *flagration*, they continually wind off, and do *tenuēs evanescere in auras*.

And also in the fore said *Bodies* wherein *Sulphur* predominates, or is separable, an *acidum* is plainly discoverable to be the *inmate* or *companion* thereof, as is obvious by the burning of *Brimstone*, the *Sulphur* of *Antimony*, &c. which by condensing the fumes, give an *acid spirit* (which whether all combustible matters amongst *animals, vegetables, and minerals*, will yeild peculiar sorts of *acids*, I may elsewhere treat) yet because the *Sulphurous principle* hath the preheminance in such concretions or *unctuous Liquors*, we shall therefore discourse of them under the notion of *Sulphur*.

Now to prove that *Sulphur*, either crude or volatile, is found in most, if not all known *hot Baths*, let us consult what *Authors* say hereon: who have seen and made observations upon them.

Thus in the *aqua Aponensis* that fam'd *hot Bath* near *Padua*, so much discours'd by *Fallopius*,

pius, certo collegi (saith he) &c. *vaporem*
Sulphureum in illa aqua Aponensi contineri, and
 saith further, *est aqua ferventissima, & dum*
calida est sapit Sulphur & Bitumen, &c. The
 learned Dr. Ed. Browne fellow of the Royall
Society in his *Travels* tells us his observations ::
 ‘*Sulphur* (saith he) which is in great quan-
 ‘tities in many *hot Springs*, flyeth away con-
 ‘tinually, and is not to be found in them, iff
 ‘you boyle or evaporate the *Bath-water* : and
 ‘therefore to discover it, I thought it more
 ‘rational to look out of the water, then into
 ‘it ; for upon many places which were over
 ‘the *Baths*, and received the Steams of the
 ‘*hot water*, I have seen *Sulphur* stick : And to
 ‘satisfie my curiosity further herein, I caused
 ‘once a Pipe to be opened at *Baden in Austria*,
 ‘through which the *hot water* continually ran,
 ‘and took with my hand from the upper part
 ‘of the Pipe, divers Boxes full of a substance
 ‘scarce to be distinguished from *Flower of*
 ‘*Brimstone*.

Thus we see how *Sulphur* dissolv'd in these
Baths doth sometimes precipitate along the
 sides of the Channells through which it runs,
 as also being *volatiz'd* doth pass away (I mean
 the purer part) in *vapors* or *steams* insensibly,
 till arrested by some particular bodies, it settles
 and sticks thereto : Thus the foresaid *Author*
 observed, ‘That walking about one day in
 ‘the *lower Bath* at *Baden*, and leaning over the

‘balli-

' Ballisters, perceived that his Buttons, and
 ' what else he wore that was *Silver*, were all
 ' turned yellow of a fair *Gold* colour, although
 ' he was at some distance from the *Water* :
 ' whereupon he tryed this *Experiment*, viz. of
 ' hanging money over the *Bath* at a foot di-
 ' stance, or at a greater, and found it coloured
 ' in a minutes time, and that which was nearer,
 ' in half a minute.

Next we are to consider how these *Thermæ*
 or *hot Baths* differ amongst themselves (which
 as we conceive) chiefly proceeds from the
 difference and great variety of *Sulphurs* or *Mi-
 neral Bodies*, wherein are wrapt up a diversity
 of *Sulphurs*, through which they pass, and
 with which they are impregnated, together
 with some other *mineral parts* which they take
 in, either at the place of *Fermentation*, or af-
 terwards in their *passage*. For *Sulphurs* (which
 we suppose to be chiefly concerned in all *mine-
 ral Fermentations* differ much amongst them-
 selves, *common Brimstone* being different from
 that of *Antimony*, and that from the *Sulphur*
 of *Vitriol*, *Pyrites*, and other *mineral Marca-
 sites*, all which are yet different from *Arseni-
 cal Sulphurs*, and from *bituminous matters*, one
 sort or other of which are most what the pre-
 dominant ingredient and *mineral principle* of
 these *hot Baths*.

Hence it is that some of these *Sulphurous*
waters, may with good success in order to the
 cure

cure of some diseases, be taken *inwardly*, others not, Those that may not, are generally such whose *Sulphurs* are *Antimonial*, *Arsenical* or *Bituminous*, or at least border upon such *minerals* as are allyed thereto; of which are the generality of *hot Baths*, and in particular those of our own Nation, of which the *Somerset-shire* being the hottest, are found altogether unfit for inward uses, are not *safely* to be drunk, inasmuch as they are impregnated (as I conceive) with *antimonial*, or perhaps *bituminous Sulphur*, or the *Sulphur* of some *Pyrites* or other *Marcasite*, a kin to *Antimony* or *Bitumen*, which lodgeth in the bowels of those great *Mountains*, at the Foot or Center of which those *hot Baths* break forth: for the *acid* which concurs necessarily (as we shall shew afterwards) to those *Fermentations*, as an indispensable principle, opens the body of those *Sulphurs*, or detains them whilst *in fieri* in their *crude nature*, and thereby renders them wholly noxious for inward use, as we could further illustrate, but that we hast.

Nor is *Buxton Bath* in *Darby-shire* (from the same cause, although in a remiss degree) fit for taking *inwardly*: inasmuch as that according to all probability, partakes of a *bituminous Sulphur*, and that I gather from the plenty of a *bituminous* or oylie substance, got out of the very Clefts of the Stones in the *Peake*, yea this *bituminous* or oylie matter is found

found in the very Pores, Clefts and *Cavities* of the *Stones* themselves, as was communicated to me from the judicious, and my worthy Friend Mr. *Jossop*, whose Father (as he acquainted me) got two Spoonfuls out of one crevice in a Stone, which *bituminous matter* is lodg'd not only in those *stones*, but also in a sort of light *lithanthrax* : which rub'd (being a smooth polite body) is *Electrical* (as I have found by trial) which distilled, yields an *oyle* and *acid spirit*, almost like that of *Amber*, as the ingenious Mr. *Fisher* inform'd me he found by trial, yea the same *bitumen* is imbib'd into a *fungus matter*, which Dr. *Lister* supposeth (and that very likely) to be rotten wood long buried in the earth, into which this oylie matter or *bitumen* hath sunk, which keeps (as I have found) continually moist, tho kept in a dry place. I say, its very probable that the *Sulphurous principle* of *Buxton Bath*, hath its determination from this sort of *bitumen*; And as to those Sulphurous waters which may safely be taken inwardly, are chiefly the *Sulphur-well* at *Knarsbrough*, of which we shall further discourse in a Chapter by it self afterwards.

And as to the different degrees of heat in *Baths*, may proceed either from the more remiss or intense *Fermentation* of *mineral juices*, or from the different place of *Fermentation*, as it may be deep within the *bowels* of the *Earth*,

or

or near the place of its *Exit*, thus if the *Fermentation* happen to be far within the Earth, and so remote from the place of Erruption, that the *Sulphur* thence become much whatt *precipitated*, or left in the *colander* or filter off Sand, through which it passeth, and the *acidum* thereby so dinted as to become very *languid* (if at all perceptable) in the Water, and yet by reason of its closeness from the air, may retain somewhat of its first conceived warmth, of which sort are those *Sulphur Baths* near *Villock* in *Carinthia*, which are gently warm, (as the learned Dr. *Browne* notes in his book of *Travels*) as also as I suppose, *Buxton Bath* in *Darby-shire*, whilst in other parts of the earth, the foresaid *Fermentation* may be strong, both from the plenty of the two combating principles, as also from their nearness to the place of breaking forth, of which sort are those at *Glass-Hitten*, *Eisenbacke*, both not far from *Schemnitz* in *Hungary* (where are *silver mines*) also those of *Stubn* near *Newsol* in the same Countrey, those at *Baden* in *Austria*, and especially ours at the *Bath* in *Sommerfet-shire*.

We say also, that *Fermentation* of *mineral juices* is most necessarily requisite to the producing of all *hot Baths*, and consequently all *hot Baths* depend thereon, because hereby is made a *comminution* of *Sulphurous*, or other *bituminous juices*, which thence become communicable to, and dissolvable in ordinary
Spring

Spring-water, for hereby the *Sulphur* is sever'd into volatile parts, easily permeating the body of *water*. The paralel of what is produced by *Fermentation* in *vegatables* to what is performed by the same amongst *mineral juices* in order to the making *hot Baths*, is not inconsiderable, whether we look at the *agents*, or at *Fermentation* its self, or lastly at the effects, as to the agents, which here are requisite to perform *mineral Fermentations*, we shall demonstrate afterwards to be no other, then *mineral acids* and *mineral Sulphurs intoris mineralibus*: That also *Acids* and *Sulphurs* (to wit of their own kind) are the true *agents* in the performing all *vegetable Fermentations*, we may elsewhere *ex instituto* discourse: as to *Fermentation* it self, which whether in *minerals* or *vegatables*, is nothing else but an intestine motion of the essential constituent principles of *Acidum* and *Sulphur*, which is in a more remis or intense degree, and the heat consequently more or less, according to the slower or more brisk on-sets and inward *struglings* of those *combittant principles*; Lastly, the paralel will hold good in the effects of *Fermentation*. Thus as the effects of the sensible *Fermentation* in all *vegetable Fermentative Liquors* is the *comminution* and *volatization* of their *Sulphurs*, as that what before such sensible *Fermentation* was *separable* in the form of an *Oyle* by bare infusions and distillations in ordinary *water*, is now by the

the *comminution* of previous *Fermentation*, so divided, sub-divided, and volatiz'd, as that these *vegetable Sulphurs* will not only arise by the gentlest heat, but will also easily dissolve in any *water* or common *vehicle*; As we plainly see that any *vinous Spirit* made from vegetables by *Fermentation*, will easily mix with ordinary *water*: which the *oyles* of those *vegetables* separated before *Fermentation* would not do; So likewise the effects of those sensible (at least by their heat) *Fermentations* in *mineral Fermentative juices*, is no other than the *comminution* and *volatization* of their otherwise *crude Sulphurs*, For what is it (would I ask) that can render *Sulphur* and bituminous *juices* capable of incorporating with *Spring-water*? Seeing that neither fire (which what that is in a true *Physiological* sense according to our *Hypothesis*, we may elsewhere declare) in the vulgar notion thereof, nor *Salts* (I mean *fixed* or *volatile*) can alone perform that work, For by fire if in open Vessels, *Brimstone* being burnt, it riseth with a fume condensable into an *acid Sulphurous Liquor*, witness the oyle of *Sulphur per Campanam*, made by *flagration*, and in close Vessels, it makes no alteration, arising only in *Flowers*, which are nothing else but the entire body of *Brimstone*, unaltered or opened: and as to *fixt vegetable Salts*, those indeed open the body of Common *Sulphur*, or Sulphur of any of the *minerals*,

rals, so as to make them more capable of dissolving in those *congenial menstrea's* of Oyle, or *vinous Spirits*, but do not at all procure their solution in common water, for *water* being poured to any of the foresaid solutions of *Sulphur*, made either with Oyles or *vinous Spirits* by fixt *Salts*, do forthwith *lactescere*, causing a precipitation of the very body of *Sulphur* in a milkie form call'd *lac Sulphuris*; So that it remains that nothing else short of *acid juices*, can perform this great work of *dissolving* mineral *Sulphurs*, so as to make them mingable with water; which is performed one of these three ways, *viz.* either by bare *solution*, *distillation*, or *Fermentation*; in all which the *acidum* must have the preheminance before such sort of alteration upon *Sulphur* can be made; thus as it is *ex intuitu Sulphuris*, that all *metals* are dissolvable in the *Stigian* or other proper *menstrea*, which being taken in pieces by *acids* (together with their *congenial Sulphurs*) the *mercurial* and other parts complicated in the texture of that body, doth *colliquescere*: So likewise it is *ex intuitu acidorum* that all *mineral Sulphurs.*, or Sulphurous *Concretes*, do either dissolve in water, or are capable of *distillation* into *Liquors*; or lastly, do undergo *Fermentation* and the products thereof.

First, As to *solution* in water thus *vitriol* or *vitriolin marcasites*, which contain plenty

of *Sulphur* do either *per se*, or expos'd to the *air*, become capable of *dissolving* most what: in *water*, and that from the prevalency of their *acids* above their *Sulphurous principle*, whereby the *Sulphur* lurks under the mask of the *acid*.

Secondly, As to their *distillation*, I mean of *Sulphurs* in the form of *Liquors*, that happens also from the powerfulness of their *acids* assisted by the *acidum* of fire, us'd in such *distillations*, whereby the *Acidum* and *Sulphur* do *colliquescere* into a *corrosive Liquor*, as appears in *Oyle of Vitriol*.

And Lastly, This *Acido-Sulphurous-Liquor*, (and others of the like nature prepared as: afore said, by *distillation*) if diluted by the: addition of a little *water*, or of any oylie *Liquor*, or *vinous Spirit* be mixed therewith, the: *Sulphur* is presently set upon by the *acid*, from: whose mutual *assaults* ariseth a strong *Fermentation*, making the *Glass* intensely *hot*, and: thereby sometimes comes near to an actual *flagration*: So that it is the *acidum* variously: treating the *Sulphur*, whence all these varieties: of operations proceed; And by this last work: of *Fermentation*, the *Sulphur* is more *comminuted*, *volatiz'd*, and altered, then by either of: the two former. Its true indeed, that *fixt al-*
calies, or *Calx vive* (being analogous to the: former) doth so work upon the body of: common *Sulphur*, or *Sulphur of some minerals*,
and

and thereby opens it, so as meeting with an *acid juice*, may make a resemblance of some *Sulphur waters*, as we have elsewhere largely discours'd in our *Hydrologia Chymica*, concerning the *Sulphur-well* at *Knarsbrough*, which is without doubt, I mean the *precipitation* by the *supervening acid*, the cause of the strong smell of this and some other the like waters.

Amongst the causes assigned by divers *Authors* of the heat in *natural Baths*, those of *subterranean fires* are not the least, which because we have by sufficient arguments at large exploded in our *Hydrologia Chymica*, shall now therefore wave: But the great and most authentick opinion is that of *Dr. Jordens* in his book of *natural Baths*, which by many learned persons, hath (and that not unworthily) the kind acceptance, and the most general applause which is grounded upon a *Fermentation* from a *seminary Spirit* of *minerals*, in the bowels of the earth, meeting with convenient matter, from which Spirit acting upon the matter in *generation* of *minerals*, is caused that *heat* which perpetuates *hot Baths*.

It would be too tedious a task, for this intended short tract, now to wade into a deep examination of the *Hypothesis* of this learned man, I shall only say (leaving the rest of that doctrine in its own worth) that had that judicious person been better acquainted with the understanding of the true and genuine

sense of *Fermentation*, would no doubt have polish'd his notions much better then we find them, and would have told us wherever *Fermentation* was found (in whichsoever of the triplicity of *natures Kingdoms*) that there necessarily must concur the *principles* of *Fermentation*; and that *Sulphur* or Bituminous matter (being a kin to *Sulphur*) must be one of those principles, as to the *mineral Kingdom*, and consequently be an indispensable ingredient in all *hot Baths*: For *Fermentation* can no more exist without its own principles, then fire can without *combustible matter* (or the principles of firing) nor then *animal* bodies can be sustained without their peculiar *Ferments*, which what analogy these, *viz.* *vegetable* and *animal juices* in their *Fermentations*, as to their constituent principles bear to those of *minerals*, we may elsewhere give an account.

Onely here we shall take occasion to answer that grand objection the foresaid ingenious *Author* makes against *Sulphur*, being the cause of *heat* in *Baths*: For though we do not assert, that *Sulphur* singly considered, is the cause of *Fermentation* or *Heat*, but that it is one of the principles of *Fermentation*: yet we judge that objection toucheth upon the Verge of our *Hypothesis*, and therefore worthy our solution: The Objection is, That if *Sulphur* can give *actual heat* to our *Baths*, it must *burn*; the like he saith of *bitumen*, that unless it be

be kindled, it can yeild no heat to our *Baths*.

I answer, That hereby it is obvious, that the foresaid *Author* did not thoroughly understand the true *efficients* of *Fermentation* in *mineral juices*; for if he had, the question had been beyond dispute; for though *Sulphur* or common *Brimstone* in its *concrete substance*, is not the *Sulphurous principle nature* useth in the producing of *Fermentation* in the primary *disseminate juices*, where such things are in *Embrio*, or in *solutis principijs*; yet even that very concrete body, whether in the form of *Brimstone*, or complicated within the texture of other *minerals*, *Pyrites*, &c. is by the supervening of a powerful *acidum*, capable of *Fermentation*, and thence of imparting its more subtile *aporrhoea* or *steame* (by the comminution of the foresaid *Fermentation*) and susceptible of the virtues thereof: So that it appears, that *Sulphur* may be one of the *efficients* of *heat* in *Baths*; and yet its *flagration* not requisite at all: the same we may safely say of *Bitumen*.

Now as we have endeavoured to prove *Sulphur* whether *in succo soluto* in the very primordial shapings or generations of *minerals*, or the same reduced from mineral concretions by the superinduction of *congenial acids*, to be one of the two ingredients or mechanical *Organs nature* useth in *mineral Fermentations*: This therefore leads me to our second position, *viz.*

CHAP. III.

THat there is no *Fermentation* amongst *mineral juices*, wherein an *acid* is not concern'd : Or thus, That an *acid* is necessarily requisite in all *mineral Fermentations* : By *acidum* here I mean one of these two sorts, (*viz.*) are such as are imbred in the same *mineral concretion*, whilst in *succo soluto*, &c. in the beginnings of its generation : Or Secondly, a superinduc'd *acidum*, which is powerful in the reductions of minerals already concrete ; so that if we have our eye upon *Fermentation* from mineral concrete bodies, which have already past their *Embrio-State*, and are come to the solidity of compleat bodies ; then by *acidum* we do not mean such a one as is intrinsic, connatural to, and implanted in all Brimstones and *mineral Sulphurs*, more or less, for no *Sulphur* nor *Sulphurous* body as such, can alone be the cause of *Fermentation* or heat in the Earth : but an *extrinsic* supervening *acid*, which must by reduction set those *minerals* by a kinship or consanguinity of parts into *Fermentation de novo*.

Now therefore it remains to prove, that there are *acid juices* in the *bowells* of the *Earth*, and that these are either *embryonative* to the

same

same *mineral* where the *Sulphur* is, or else peculiar to some other bodies by which the transient waters become *acnated*, which if the former, then the *Acidum* and *Sulphur* being *natives* of the same *mineral*, do more easily by their mutual *contact* and *intestine* struglings, cause a *Fermentation*, even whilst the *minerals* are in *solutis principijs*, which being constant, those waters which pass through them must as certainly and constantly be *heated*. So that from the unerring rules of *nature* from perpetuating the cause, the effect must be no less : The *acid* which causeth the latter sort of *Fermentation* we shall shortly touch upon.

First then, the *acids* of the former *classis* will be apparent to us, if we consider that there are no *minerals* produced in their peculiar *beds*, in the intrails of the *Earth*, without a previous *Fermentation* from their congenial principles of *Acidum* and *Sulphur*. For our *Hypothesis* concerning the generation of *minerals* is grounded upon *Acid* and *Sulphur*; from which foundation we say, that these two being *actually* put into *motion* by the *mineral seed* in *Embrio*, distinguished according to the *lubet* of the *divine fiat*, in the great *wheel-work* of *generation*, do by their mutual innate *wrestlings*, cause a *Fermentation*, and this to be one (yea the chief) cause of *heat* in *natural Baths*.

These in-dwelling *acids*, I say, are manifest,

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and

and easily discoverable to us *a posteriori*, from their not difficult separations out of the bodies of most known *minerals*, thus we see plenty of an *acidum* separable from common *Brimstone* by bare *flagration*, and the sleight artifice of condensing those fumes: witness the Oyle of *Sulphur per Campanam*, which is *acid*: Thus also we have separated an *acidum* from *Saturn Ore*; and know how to do the same from *Antimony*, both which are perform'd two manner of ways, *viz.* First, By separating their *Sulphurs*, (which I have done both from the Ore of *Saturn*, as also from the *minera* of *Antimony*) which by *flagration* like common *Brimstone*, yield an *acid*. Secondly, By *distilling* the foresaid *minerals* (I mean *Lead Ore*, and *Antimony*) *per se* in close Vessels by a peculiar way, may be drawn an *acid*.

Thus likewise out of both *Vitriol* and *Alom*, as also from common *fossil* (which is all one, *marine*) *Salt* and *Nitre* by bare *distillation* in close Vessels are frequently *acids* drawn, which are singly or joyntly thence preparable, witness *Spirit* or Oyle of *Vitriol*, *Aqua fortis*, *Spirit of Salt*, *Spirit of Nitre*, &c. all of them sufficiently *acid*. Thus out of all the *Pyrites* may an *acid* be separated; yea further, out of *bitumens*, *amber*, *jet*, (which is *kennel coal*) and other sorts of *Lythanthrax*, may by *distillation* an *acid Spirit* or *Liquor* be easily separated.

pared. Thus my ingenious Friend Mr. Fisher hath separated an *acidum* out of a concrete *bitumen* got out of *Lead-mines* in the *Peake* in *Derby-shire* (not far from *Buxton hot Bath*) which is an *Electrical Concrete*, as also hath done the like from the rest of the last recited *mineral bodies*: And the like *acidum* hath been drawn from a *bituminous fungus* found in those parts.

Now come we to treat of our *second* sort of *acidum*, which is one of the chief ingredients or principles of our latter sort of *Fermentation* to be numbred amongst the causes of some *hot Baths*, and that is a *superinduc'd acidum*, viz. the current of a living Spring (as such are called) in its *subterranean* passages, meeting with some *Salts* in *Embrio* or *Bed* of *Earth*, impregnated with *acid juices*, of which sort are all or most of the *mineral Salts*, whilst in *fieri* before they by a further maturity reach the state of concretion, I say passing through these *Beds*, becomes (by reason of its facile *imbibition* of such *juices*) *acuated* therewith, and then falling into a *bed* of *Brimstone*, or other *minerals* or *pyrites*, &c. impregnated with *Sulphur*, begins a solution thereof, so raiseth a *Fermentation* betwixt the *Sulphur* and the *supervening acid*: which gives *heat* to the *water*; and becomes more or less *hot*, according to the more or less powerfulness of the *Acid* and *Sulphur* as it passeth: As also

accor-

according to the nearness or remoteness of the *waters exit* from the source of *Fermentation*: which *acid* dividing, subtilizing, and volatizing the *Sulphur*, doth brake it into such small parts, as that it becomes (I mean as to the purest part thereof) dissolvable in *water* (according as we have more largely explain'd above) and thence it is (I mean from the *Fermentation* made from *Acid* and *Sulphur*, whether perform'd the former or latter way) that all *hot Baths* have somewhat of *Sulphur* in them more or less.

This last sort of *Fermentation*, which I may call (if we have respect to the already concrete body of *Sulphur*, or *Sulphurous minerals*, and that not improperly) *Fermentation* at the Second hand, I say, is no less to be performed by *minerals* then *vegetables*: For as amongst *vegetables*, Corn, when ripe and reap'd, its *fermenting* principles of *vegetation* (as we may elsewhere shew how all *vegetation* is nothing else but a *natural* slow-pac'd *Fermentation* from each plants peculiar principles of *Acid* and *Sulphur*) are shut up, and would constantly remain dormant, till it either be committed to the ground, in order to fresh *vegetation* and *multiplication* of its *species*, or be malted, whereby its *vegetative Fermentation* is perverted, and the same principles driven on to another design of *fermenting* in water after *malting*, in order to the making of our *drink*:
where-

wherein both (*viz.* Vegetation and Malting) the same *fermentative* principles are kept afoot though to different ends.

So likewise it happens (by a parity of principles amongst *minerals*, where when the *Fermentation* necessarily in their production sometimes terminate in *concretion*, in which the *Sulphurous principle* (being prevalent) most what *coagulates* the *acidum*, and both with some other *heterogenious* parts, combine to the making up this or the other *mineral Sulphurous concrete*; I say there in that concrete the *principles* of *Fermentation* cease to act, and so would (if unexcited) remain always dormant, untill by a *congenial* powerful supervening *acid*, the *intrinseck principles* be put into a fresh intestine *strugling* or regular *motion*, which we call *Fermentation*, which *beating* the transient *waters*, becomes the efficient cause of some natural *hot Baths*.

CHAP. IV.

HAVING already shewed that *Acidum* and *Sulphur* are the chief ingredients of *hot Baths*, as the essential principles thereof: Now come we to demonstrate how and in what manner the waters in *hot Baths* become *hot*: which to do, we must endeavour to shew, that
some

some sorts of *acids* have so powerful an operation upon *Sulphurs*, or Sulphurous concretes, as that being *actually* set a work, or put into *motion*, are sufficient causes of *Fermentation* in *mineral juices*; and next, that *heat* (which will necessarily follow) is the immediate result of such *Fermentation*.

The First we shall elucidate with an induction of many paralel instances, whereby we shall perform two things at once, *viz.* both illustrate our doctrine of *Fermentation*, grounded upon the genuine *principles* of *Acidum* and *Sulphur*, as also solve the *Phænomena* of the occurring instances: The first *mechanical* instance shall be, the solution of any *metall* (except Gold) in an *Aqua fortis*, and of Gold it self in an *Aqua Regis*, which are no sooner put together (both being duely qualified) but the *action* of *Fermentation* is plain to any eye, in the dissolving or breaking to pieces that *metal*: what it is that causeth *Solution* and *Fermentation*, which immediately happens upon the working of the *solvent* on the *solvend*: It is not (as I conceive) from the complications of the *fluid Salt* in the *menstruum*, with the *fixt Salt* in the *metal*, whereby the metallick *compage* is broke, and the *particles* thence hid in the pores of the *menstruum*, according to the judgement of the learned *Dr. Willis*. Nor need we with him imagine a *vitriolick Salt* in *Silver*, or an *armoniack* in Gold,

Gold, but is it not rather the Sulphur in the metal, and the *acidum* of the *menstruum*; for the sake of which Sulphur the *mercurial* part is also broken to pieces, and the whole by that *Fermentative motion* dissolv'd: *cujus Sulphuris intuitu totum liquefcit metallum*, in which corrosion or solution of the imperfect metals in *Aqua fortis*, or the like corrosive *menstrua*, there is no such great danger of breaking the Glass if stopped, as happens inevitably in the solution of the Sulphur of the more crude minerals, the reason of which is from the more fixity those Sulphurs arrive to by metallization, from what they are in unripe *marcasites* or minerals. Hence we may certainly conclude, that in the Fermentation requisite for hot Baths no metals are concern'd; and that both because of the more fixity of their Sulphurs, as also from the deficiency of such corrosive *menstrua* in the earth: for nothing short of an *Aqua fortis* or *Aqua Regis* can make a Fermentation with a metal. Hence also nothing but minerals (or liquid bituminous juices) wherein the connate Sulphur is of a more loose compage, also more volatile, and consequently easily fermentable by more languid acids, are the proper and essential ingredients of hot Baths; where we may observe both by the preceding, and by this following instance, That the Sulphur in the metals acting upon the acids, or vice versa, are the true causes of corrosive Fermentations, and

and thence of *heat*. Thus the *caput mort'* of *viridaris* (from which I had according to *Zuelfer*, drawn off the *concentred acetum*) being a subtile calx of *Venus*, I mixed with an equal quantity of *Sal armon*: (in order to the preparing a sort of that (vulgarly called) *ens veneris*) which mixture (being well impropriated by a sufficient triture) within less then one quarter of an hour caused so strong a *heat* as I could scarce get it into the *retort* without burning my hand.

The next instance therefore shall come nearer to the matter in hand, and that shall be concerning *Sulphurs* more *Crude*, as they stand related to the *minerals*. Thus in the affusion of *Aqua Regis* upon *Antimony*, or Spirit of *Nitre* upon *butirum Antimonij*, where the *acidum* of the *menstruum* acting upon, and struggling with the crude *Sulphur*, either of crude solitary *Antimony*, or of the same carryed up by *Salts* in the form of a *butirum*, doth cause a very strong *Fermentation*, where the *Sulphur* by the assaults of those corrosive *acid Spirits* grows so high in its *Fermentation*, as that it almost takes *flame*, passing off with a strong stifling and incoarcible *arsenical vapour*, by the former of which prepared with common Salt, my ingenious Friend *Mr. Wilkinson* and my self have after *Fermentation* separated a *Sulphur* out of *Antimony*, not unlike the common greener sort of *Brimstone*.

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That the *Fermentation* caus'd in the last of which experiments (I mean betwixt *Spirit of Nitre*, and *Butter of Antimony*) is not (as some might urge) from the *Salts* in the *Sublimate*, mixing with the *acidum* in the *menstruum*, appeareth, because the same *menstruum* poured upon the same *Salts*, while incorporated with *Mercury* in the form of *Sublimate*, causeth no such *Fermentation*; yea, on the contrary, I have seen *Sublimate* (wherein the foresaid *Salts* are lodg'd, which are in *butirum Antimonij*) dissolve in an *acid menstruum*, without the least tumultuous *Ebullition*, even almost like (and perhaps neer as soon) as Ice in warm water.

Another *mechanical* instance shall be from the pouring an *Aqua Regis* upon well dry'd *Danzick vitriol*, upon which well blanch'd, I poured the foresaid *menstruum*, from whose mixture (being made *per vices*) such a strong impetuous *Fermentation*, with thick red fumes was caused, as that it seemed to come little short of *actual fire*, causing an *intense heat*: Now that it was the *Sulphur* in the *vitriol*, which meeting with the *acids* in the *menstruum*, produced that *violent Fermentation* and *Heat*, is evident, because out of a pound and a half of well dry'd *vitriol* after the *Fermentation* was over, and that the fumes had passed off in a thick cloud, there remained after the *solution* in a *distillation* in a coated Glass retort (being

(being at length urg'd with a very strong fire) scarce five Ounces of a Spongy red coloured *cap' mort'* totally insipid. The like may be performed by *acids* upon any of the *Pyrites*, or other *imperfect minerals*, whose native *Sulphur* being crude, hangs but loosely in the *compage* of such *concretes*.

That this foresaid *Fermentation* proceeds not (as some may object) from the *Salts* in the *Vitriol*, is evident, because if the *Salt* of *Vitriol* prepared by *Fire* (by whose stress the *Sulphur* is either banished or fixt) be mixed with such sort of *acid menſtrum*, it causeth no *Fermentation*: besides which, this *Fermentation* happens betwixt the *acidum* of the *menſtrum*, and the *Sulphur* of the *body* dissolv'd, where there is no suspicion of *im- planted Salts*, (other then what is *acid*) which the foresaid instance of *Fermentation* from *aqua regia* upon *crude Antimony*, sufficiently evinceth.

Lastly, As *acids* working upon the *Sulphur* of *metals*, cause a *Fermentation*, and thereby their *solution*, and setting upon *minerals* (which comes nearer to our purpose) doth cause a most strong *Fermentation*, unhinging their *Sulphurs*, which being unripe, are the more apt to *ferment*; So likewise meeting with *bituminous juices*, they do in like manner, become the *efficients* of *Fermentation*, which sort of *bituminous Oyles*, I account to be of a middle nature

nature betwixt *mineral* and *vegetable Sulphurs*, and therefore we shall *illustrate* the manner of their *Fermentation* with *acids* by *vegetable Sulphurs*.

And so *mineral acids* mixed with *vegetable Sulphurs*, cause *Fermentation* this threefold way, *viz.* First, as meeting with them in a more solid substance, as with *turpentine*, *rosin*, *resinous gumms*; or Secondly, in a more liquid form, as of *Oyles*; or Lastly, in a *comminuti-*
on of those *Oyles* into highly rectified *vinous Spirits*, where the *vegetable Sulphurs* are *com-*
minuted and *subtiliz'd* by *Fermentation* into smaller parts.

Thus as to the first, *aqua fortis*, with *turpentine*, *rosins*, or *resinous gumms*, makes a *Fermentation*, which happens from their *implanted Sulphurs*, (mask in that solid form) and the *acidum* in the *menstruum*. Hence it is, that some *resinous gumms*, for instance *Camphire*, will dissolve in *Spirit of wine*, or *aqua fortis* singly; but not joyn'tly, the reason whereof seems to be this, that in the former it dissolves from the *analogy* of *Sulphurs* (*comminuted* and *volatiz'd Sul-*
phurs the more easily permeating from the *nim-*
bleness of their parts, the like *Sulphurs* lurking in more *solid forms*) which indeed is the reason why *vinous Spirits* are the proper *menstrua* for dissolving many *resinous woods*, *roots*, *gumms* and *inspissated juices*, as of *Turbith*,
D Fallap,

Jallap, Mecoacan, Scamony, Myrrh, Aloes, &c. by extracting their *resinous* or *sulphurous* parts. In the latter, (I mean *aqua fortis*) *Camphire* dissolves from the *acidum* of the *menstruum*, and from the same cause, (*viz.* of *acids* working upon *Sulphurs*) it is, that other *resinous gums* do also dissolve in *acids*, as we find *Ammoniacum, Galbanum, Tachamahaca, &c.* do in *Vinegar*. But these two *menstrua's* being mixed, after *Fermentation* degenerate into a *quid neutrum*, will not then dissolve *Camphire*, as the ingenuous *Dr. Lister* hath tryed.

As to the second sort, *Oyle of Vitriol* being mixed with *Oyle of Turpentine*, causeth a *strong Fermentation* and *Heat*; and by *distillation* gives plenty of a *Brimstone*: which *Fermentation* and *Seperation* of *Sulphur* being rightly understood, is (as we judge) from no other cause, then from the *acidity* in the *Vitriol*, working upon the *vegetable Sulphur* in the *Oyle*, and thence the *Fermentation*, (according to our *Hypothesis*) whereupon having deserted its own *mineral Sulphur*, contained in it self, gives cause of the facile *seperation* of its formerly implanted *Brimstone*.

Lastly, Thus *Spirit of Nitre*, or *Oyle of Vitriol*, being mixed with a highly rectified *vinous Spirit*, (which is prepared from the *Fermenting juice* of *Grapes*, or with any other *vegetable fermentative Spirit*, doth presently
cause

cause a *violent Fermentation*, which *heats* the Glass (its done in) so intensely, as that it can no more be touched then *fire*; whose cause (as I apprehend) is no other then from the strong *acidity* in the *menstrua*, which meeting with the highly graduated *Sulphur* of *Vegitables*, in those *admirable depurated* and *volatiz'd Liquors*, the one frets upon the other, causing that *intestine collision*, which we call *Fermentation*, whence immediately results the *heat*: which *Fermentation* betwixt the *Acidum* and the *Sulphur* in that *violent hurricane* of *rapid motion*, wheels off along with it a great part of the *Sulphur* contain'd in the *corrosive acid menstruum*.

Another argument why the *Fermentation* in *mineral juices*, is the cause of *heats* in *Baths*, may be taken from the *perpetuation* of their cause; for seeing no other *incessant cause* can satisfactorily be assigned, which may in all things so well square with the nature of *hot Baths*, as the aforesaid, therefore till a more *rational cause* can be found out, (if any such there be in nature) it may not be unacceptable to the ingenious.

Now that their cause is certain and constant (according to our deposited *Hypothesis* of *Fermentation* of *minerals* in their production) is evident from their continual *generation*; for where once begun, they cease not to

perpetuate their Offspring: which is evident from the observation of *Mine-works*. Thus *Salt-peeter men* find, that when they have extracted *Salt-peeter* out of a floor of Earth one year, within three or four years after, they find more *Salt-peeter* generated there; and work it over again, the like is observed (as *Dr. Jorden* notes) in *Alom* or *Copperass* or *Vitriol*. And this is not only usual to all *minerals*, but also the same may be said of *metals*: For the *Tinners* in *Cornewall* have experience (as the foresaid Author well observes) of *Pitts*, which have been filled up with Earth after they have wrought out all the *Tin* they could find in them, and within thirty years they have opened them again, and found more *Tin* generated: The like hath been observed in *Iron*, as *Gaudentius Merula* reports of *Ilva*, an *Island* in the *Adriatick Sea*, under the *Venetians*, where *Iron* breeds continually as fast as they can work it, which is confirm'd by *Agricola* and *Baccius*, and by *Virgil*, who saith of it,

Insula inexhaustis Chalybum generosa metallis.

The like is found at *Saga* in *Lygis*, where they dig over their *Iron mines* every tenth year: *Mathesius* also gives examples in almost all sorts of *minerals* and *metals*, which he hath observed

ved to grow and regenerate. *Erastus* (as *Dr. Jorden* notes) affirms, that he saw in *S. Joachims Dale*, silver grown upon a beam of wood, which was placed in the Pit to support the works: The like of reproductions of *metals*, is also observed in the *Lead-mines* at *Mendip* and the *Peake*, which do not onely stretch further in extent of ground, then hath been observed heretofore, but also are renewed in the same ground, which hath been formerly wrought, which we have touch'd upon in our *Hydrological Essays*.

Wherefore seeing *minerals* are continually generated, their constitutive *principles* in their *fermental operation*, must as constantly be at work, especially where concretion is interrupted by a continual flux of *water*, as happens in the source of most of these *hot Baths*.

Now where the seeds of *minerals* are once begun, that their active *principles* are set a work, in order to the heaving forth a body answerable to the type *implanted* in the *primordials* thereof. If this happens, I say, where *water* in his *subterraneous passages* hath its constant current, it can never arrive at the completing of the body according to the intention of *nature*; for although it be always aiming at the perfecting of a solid concretion; yet the constant afflux of *waters*, impedes that attempt, and onely serves to keep the

fermentative principles in a constant motion ; so that *water* doth but set the *inbred principles* of *Acidum* and *Sulphur* more into an *inward struggling*, and makes the *Fermentation* the stronger, and consequently the *greater heat*, a very pertinent instance, which may lead us to a better and more familiar understanding, how this *Fermentation* is promoted by *water*, we may (not unaptly represent by *Oyle* of *Vitrioll* and *Water* ; for a little *water* being put thereto,, it presently sets the *fermental principles* of *Acidum* and *Sulphur* (connatural to that *Oyle*) into a strong *Ebullition* or *Fermentation*, whence results so great a *heat* as the *Glass* (its done in) is scarce tollerable to the hand ; especially if the *Oyle* be well rectified : whereas, before the addition of *water*, the *Glass* (wherein was the *Oyle*) was cold to touch, the *principles* lying *dormant* from the *thickness* of the *Liquor*, and its tendency towards the *concretion* of a more *solid body* ; but upon the addition of a little *water*, it thins that *Liquor*, at least in some *measure*, and so puts the foresaid *principles* into *Fermentation* : And that in the production or generation of *minerals* ; *Fermentation* of their implanted *principles* is chiefly concern'd, is further evident in what *Agricola* and *Eraſtus* saith from the *observation* of *Mine-works*, who affirm, That in many places they find their *Mines* so hot, as they can hardly

ly touch them; from the same reason of Fermentation it is, that the *minera* of *Allom* or *Vitriol*, being broke and expos'd to the air, contract a *strong heat*, which sometimes may arise to that height, as to cause an *actual ignition*, by which, not long since, a *Barne* at *Tee-land* near *Hallifax* was burnt; and from the same cause the *minera* of *Tin-Glass* being expos'd to the moist *air* will become *very hot*; for upon the access of *moisture* in the *air*, the *intrinsick acids* of the foresaid *minerals* are dissolv'd, which as they dissolve *work* upon their implanted *Sulphurs*, from whose mutual *Collision* and *Colliquation* is caus'd the foresaid *Fermentation* and *Heat*.

CHAP. V.

HAVING thus delivered our *Hypothesis* of the causes of *hot Baths*, from the Fermentation of *mineral juices*, whose *mechanical* and *efficient principles* consist in an *Acidum* and *Sulphur*, it will not be difficult from hence to solve various other *subterranean phenomena*, such as are *damps*, (and from thence the *reasons* of *poysonous Springs, Baths, Pools, Lakes*) also *Earth-quakes, Erruptions, &c.*

First, As to *Damps*, to me they seem to be nothing else but certain *gusts* or *steams* arising from *mineral Fermentations*, which are more or less *noxious* or *mortal*, by how much they proceed from *minerals*, whose *Sulphurs* are more or less *venemous*: for if either a *Fermentation* happen in the very *generation* of some *poysonous mineral*, as suppose *Arsenick*, *Risogalla*, *Auripigmentum*, *Sandaracha*, *Rusma*, *Cadmia*, &c. from the intestine *struglings* of their innate *Acidum* or *Sulphur*; or if it happens from the supervening of an *acidum* upon the *minera* of any of the aforesaid *poysonous juices*, I say from either way an *effluviū* doth forthwith *arise*, which (being the product of *Fermentation*) is very *subtile*, and thereby can easily *permeate* the *Cranies* of the *Earth*, and reach at a great *distance* from the first *source* of *Fermentation*, which is able by its *Sulphurous Arsenical* odour, not only to *extinguish* a *Candle* or *Lamp*, but also *exsufflate* or puff out the very *vital taper* of men or other *animals*, that it meeteth with in *subterranean passages*, whence many men have *suddenly perished* by the breath *thereof* in *Mines*: yea so strong is it sometimes, or in some places, that it *infects* some *waters* that lie over it, or come within the *orb* of its *action*; whence *poisonous Springs*, *Baths*, *Pools*, *Lakes*, &c. take their *begining*, which will *kill* suddenly, as at *Circum* in *Thra-*

cia, Fons Neptunius in Terracina, at Perant by Mompelier: the Lake Avernus, the Cave of Charon by Naples, &c. yea, from hence those waters take their original, which by their mortal odours kill Fowl that fly over them, of which sort are the foresaid Lake Avernus, as also the vapours arising from Charons den, between Naples and Puteolum, &c.

Next to which, the *Phænomena* of Earthquakes are (from the aforeſaid principles) not difficult to ſolve, if we in rendring an account thereof, ſhall ſay, that they are likely to happen, when ſome *Sulphur* or *Sulphurous body*, either in *Liquid* or *Concrete*, meets with a fermenting *acidum* in the bowels of the *Earth*, in ſome narrow paſſages, where, when that *elasticity* and *exploſiveness* of *Sulphur* by a *ſuper-vening acid* is *excited*, and being pent up in the *straights* of the *Earth*, cannot eaſily get forth, forceth and preſſeth on all hands upon the *adjacent bulkes*, heaves and liſts like a *mole* in its *ſubterraneous workings*, and thence cauſeth that *terræ tremor*, which may not improperly (amongſt the reſt) be illuſtrated by theſe following *instances*: *First*, I took ſloores of *Brimstone* (which is all one with *Crude Brimstone*) two drams, upon which I poured about half an Ounce of that ſort of *aqua regia*, which is called (by Mr. Boyle) *menſtrum peracutum*, which

which though at first, for a while, it kept *quiet*, causing no sensible *ebullition*, but afterwards the *menstruum* began to *work* thereon, and to bring the *Sulphur* to a gellied matter: this Glass I set loosely upon the very surface of my Sand digesting Furnace, whose *heat* was very *soft* and *slow* (possibly the same might happen though it had no *external warmth* at all) yet: although the Glass had a long neck (being a bolt head) and but slightly crack'd, it *broke* all in *pieces*; and with the force thereof broke another Glass by it.

Thus Secondly, by putting one Ounce of *Sal armoniack* to four of *Aqua fortis*, if the Glass Viol be *close stopt*, it will presently with a great noise *break* the Glass into a Thousand *shivers*; for the *acidum* in *Common Salt*, which is in *Sal armoniack*, meeting with the *Sulphur* in the *Aqua fortis*, sets upon it, whereby a *strong Fermentation* is presently raised: which *wanting room*, breaks all in *pieces* before it.

Thus Thirdly, by pouring *Aqua regia* upon *Antimony*, or the *Spirit* of *Nitre* upon *butirum Antimonij*, put into Glasses, or the *strongest* of *Vessells*, and close stopt up, would break them (though never so strong) into many pieces; and that from the foresaid *Fermentation*, which happens from the *acidum* in the *menstruum*, and the *Sulphur*, either in *crude Antimony*, or the *Butter* thereof; many more of which sort
of

of experiments we further illustrate in our *Halologia Chymica*.

Thus also from the aforesaid experiments, may (without any more ado) an account be given of many *Subterraneous Eruptions*: for I have by them at once given a *sufficient demonstration* (as I think) both of the *reasons* and *causes* of *Earth-quakes*, and also of *Eruptions*, inasmuch as that *Fermentation* from *mineral juices* made in straight *meanders* of the *Earth*, when it cannot find *vent*, if moderately strong, they only cause *terra tremor*; but if very *violent*, even nigh an actual *flagration*, then the greater the weight of *Earth*, *Rocks*, or other *matter* is, which lieth upon it, the *stronger* and more *hideous* are the *Eruptions*: breaking in *pieces* all before it. So that I suppose all *Eruptions* and *Subterranean belchings*, to proceed from one of these two causes, *viz.* either from *Subterranean fires* of *Sulphurous minerals* actually, but accidentally *kindled*, witness those *Vulcano's* of *Ætna*, *Visuvius*, *Strongilo*, &c. of which we have discoursed in our *Hydrological Essayes*, or else from *Subterranean Fermentations*, amongst which, some may possibly rise so *high* and *strong* from the great plenty of *Sulphur* and *Acids*, set into an *actual Ebullition*, as that they may (by the *air* which may probably reach them through some small *crevices*) actually *tāke fire* and *burn*. Thus besides the fore-
said

said instances, if *Spirit of Wine* be mixed with *Spirit of Nitre*, or be added to a *mixture* of *Oyle of Vitriol*, and *Spirit of Nitre*, maketh an exceeding *strong Fermentation*, even almost into an *actual flame*; and the Glass will be intensely *fiery hot*, as that ones hand may as long endure a *hot cole* as it, which if pent up, would for want of room to *expand* it self in its *Elastic power*, would I say, by its *explosive force*, break all before it.

In the next place, we shall endeavour to *demonstrate*, how, from the premised Doctrine of *mineral Fermentations*, may also, not onely *Brimstone* or other *mineral concrete Sulphurs* be generated *de novo*, in some parts of the *Earth*, but likewise how many of the *fontes acidi* may thence take their *original*. As to the generation of *concrete Sulphurs*, we suppose it thus, *viz.* when or where a *strong Fermentation* happens from *mineral juices*, whilst in *Embrio*; and that there is no immediate *current of waters* to carry off the looser part of the *principles*, as they *ferment* (as happens in all *hot Baths*, as we have before *sufficiently declared*) which not being *pent up*, as happens in the most usual *Earth-quakes* and *Eruptions*, as aforesaid, but finding room enough in the most potent places of the *Earth*, *percolates* some more loose *bed of Earth*, and thereby leaves that *Sulphur* (which was carryed up along with

with the fermenting steam) as it were in the filter; For that the *acidum* being prevalent in the foresaid Fermentation, may in those steams it ariseth with the Sulphur, in some peculiar colanders of the Earth, desert its former companion, may somewhat appear to us, by pouring Oyle of Vitriol upon Antimony, or the *minera* thereof, and distilling it thence. The Sulphur in the Oyle after Fermentation, becomes separated, and as it were percolated, by the body of the Antimony, while the *acidum* ariseth more simple, leaving the Sulphur behind, which afterward by a stronger fire is carryed up in the form of Brimstone, taking along with it (through the congenialness of parts) some of the Sulphur of Antimony.

Next to which, how many of the *fontes acidi*, may from the foresaid Fermentation of mineral juices, take their original, we shall thus explain, viz. by supposing that in some mineral Fermentations, whilst in Embrio (and where no current of waters nor strait passages happen, for causes aforesaid) the Ebullition from their *Acidum* and Sulphur, may be so intense, as that thereby a fresh *acidum* may be ingendred, or the former multiplied (*vires acquirit eundo*) with deserting Sulphur its companion in the colander of some Earths, may be sublim'd and carryed in steams (as a thinner and more subtile *acidum*, at a great distance

stance from the *Source*) where afterwards, touching upon and *irreoreating* some *Earth*, or some *Stamina* of the *mineral beds* of *Iron*, or *Alom-stone*, impregnates them to further uses :: So that where a *current* of *water* toucheth either upon that *Earth*, and afterwards upon either of the foresaid *minera's*, or doth touch upon those *minera's* impregnated with the afore said *acidity*, I say, either way are made: *vitriolin* or *aluminous waters* or *spaws*.

Now that an *acid* may (after the foresaid manner) thus ascend from *fermenting juices*, barely from the *Ebullition* of the *principles*, even without any *extrinsick heat*, will appear from this following *mechanical experiment*, viz.

I poured six Ounces of rectified *Spirit* of *Wine* upon half a pound of *Spirit* of *Nitre*, which I put into a double *bolt head*, with a pretty *long neck*, after a while, as soon as the *vinous Sulphur* in the *Spirit* of *Wine*, had set the *Acidum* and *Sulphur* of the *Spirit* of *Nitre* a work, they caused such a *furious Fermentation*, that it *drive* up the *stopple*, and *forc'd* it self forth up to the *top* of the *Room*, whereby a great part was lost, whereas, if the *Glass* had been very close stopt, it would without doubt have *broke* the *Glass* into *shivers*: to what was sav'd, I added of the same ingredients of each four Ounces, it began, after a while, to fall into a *strong fermenting Ebullition*, so boyl'd, and

and bubbled forth very *fiercely*, and sent forth a *strong fume*, which heated the *Glass* so intensely, as I could not hold the very top of it in my hand, then I set a small *Glass-head* over the *Glass*, to condence some of the *fumes*; which I found gave a very *smart acid Spirit*, not but that there are other causes of some of the foreſaid *acidulate Spaw-waters*, concerning which, we have at large diſcourſed in our two books of *Hydrologia Chymica*, and its *Vindication*.

And now that I have laid down my *Hypothesis* of the causes of *hot Baths* (branch'd into many ſorts) *ſubterranean Damps*, *Earthquakes*, *Eruptions*, *Regeneration* of ſome *Sulphurous concretes*, and of the *original* of ſome of the *fontes acidi*, all from the *Fermentation* of *mineral juices*, as aforeſaid; which how well grounded, and how further *improveable*, I ſhall leave to the unbiassed reader to *examine* and *judge*; as alſo to conſider, whether from the ſame *Hypothesis* or ſuppoſition of cauſes, may (and that not impertinently) be ſolved the *Phænomena* of the *diverſity* of *Winds*, the *viciffitudes* of *heat* and *cold*, the reaſons of *Snow*, *Hail*, *Meteors*, and other *apparances*, common to, and peculiarly obvious in the *Atmoſphere*. So here, I would take an occaſion from the nature of the foreſaid *Fermentation*, to inſiſt a little upon the

two

two grand *Phænomena's* of *heat* and *light*, found in concrete bodies from the same principles.

CHAP. VI.

I Shall not here (by climbing so high) insist upon the causes of *heat* and *light*, in that great and inexhaustible *Fountain* thereof, the *Sun*; whether its perpetual *Spring*, and incessant *emanation*, may not consist in a peculiar *Fermentation* of its own, set a work by the *divine Fiat*, and kept a foot by a continual *circulation* of *æthereal matter*, concerning which, we may *elsewhere* modestly propound our *thoughts*, nor shall I descend so low, as to treat any further of the *causes* of *heat* in those known *subterranean Vulcano's*.

But shall at present make it my *task* in *short* to shew, First, That *Fermentation* is made from the *mutual strugglings* and *intestine combatings* of *Acid* and *Sulphur*, in all *juices* and *concrete bodies* where it is *evident*: And how *heat* is produced from *Fermentation* in all such bodies where it is found. Secondly, To shew how from the same *principles*, and after what manner, *light* is made.

That *Fermentation* and *Ebullition* in *mineral juices*,

juices, whether naturally or artificially prepared, proceed not from the *contrariety* of *Salts* (as many *worthy persons* urge) is evident, because there is no such *Ebullition* amongst *Salts*, but what are from the *contrariety* and *struglings* of *Acids* and *Alcalies*, whereas no man ever yet could make it appear that those *minerals* either in *succo*, or in *actual concretion*, contain'd any sort of *Alcalies*, either *fixed* or *volatile*. But on the contrary its most certain, from *irrefragable experiments*, that *Sulphurs* and *Acids* are separable from them all.

And as before we have shewed, the *Fermentation* of *minerals* to consist in the *collision* and *intestine wrestlings* of their *Acid* and *Sulphur*, as the causes of *hot Baths*, &c. So the *Fermentation* in *animals* is no less observable to proceed from the like inward *struglings* of their imbred *Acid* and *Sulphur*, continually (till they dye) kept on foot in the body of *animals*, and that will appear, if we consider their implanted *acid juices* (the very *foundation* of all *Ferments*) and the daily occurrence of such sort of *Food*, in whose texture both *Acid* and *Sulphur*, chiefly *Sulphur*, doth reside, in order to the keeping those *Ferments* at work, for the *nourishing* and *upholding* the *fabrick* of those *bodies*.

The first wheel (as I may say) of these *Ferments*, or the *primordial Stamina* of *acids*

in animal bodies (after their formation) are placed in the *Stomack*, where the *Fermentation* begins from the native *acidum*, acting upon the *acquired Sulphur* of nutritive food, and is carried on into the *second* digestion into the *intestines*, where a fresh gentle *acidum* from the *pancreatick juice*, and a *Sulphur* from the *Gaule*, sent thither by the *ductus biliaris*, promote and assist a further *Fermentation*, and thence carried into the *blood*, where the same principles of *Fermentation*, together with a *volatile Salt*, complicated with the *Sulphur* and *Acidum*, are still at work, and undergo new *separations* and *depurations*, as also acquire new helps of *volatization* from the continually inspired *Air* into the *Lungs*, (through which the *blood* passeth) which still promotes the begun *Fermentation*, in order to the *circulation* thereof, and nourishment of the *whole*.

So that the *native acid juice* of the *Stomack*, is not in a strict sense a *Ferment*, till such times as it finds some *Sulphurous food*, upon which, as its proper subject, it begins to work; and then upon its action, collision, and mutual struggling with the *Sulphur* in the assum'd aliment, begins the *Fermentation*, which being *vital*, we suppose to be the very first spring of *heat* in the *animal body*, after it hath passed its *Embriotic* state.

Yea, all the rest of the *Fermentations* in the
body.

body, are but the *continuations* of this *Fermentation* begun in the *Stomack*; for the *blood* is made up of that *Chyle*, which by *Fermentation* is wrought in the *Stomack*, retaining so much of its *first principles* of *Acid* and *Sulphur*, mixed in a just *temperature* (assisted with the *pancreatick* and *bilous juices*) as may be sufficient to keep that *Liquor* still in a *Fermentative motion*, such as may help to supply with a new off-spring of *animal Spirits* (the very product of that *Fermentation*) as also to fill up the *interstices* of that *matter*, or those *parts*, which are *continually* upon the *wheel*, winding off through the *perspirable Portals* of the *body*, as we may elsewhere, God willing, take an occasion further to discourse.

How powerful a *menstruum* this *Stomachial acid* (the first efficient of heat) is, doth appear both by the great force of *working* upon, and *dissolving* all *alimentary things*, which are all of them such, as wherein *Sulphur*, whether *vegetable* or *animal*, is more or less *complicated*, and *cujus intuitu*, viz. for the sake of which, all the rest wrapt up in the same *concrete*, are also *dissolved*, as likewise doth appear from those strong *vellications* of the *Nerves* and *Tunicks* of the *Stomack* upon *hunger*, being a nothing else but that aforesaid *acid menstruum*, preying upon the next *adjacent parts*, through the want of some *Sulphurous* subject to *work* upon.

That *Sulphurous concretes*, whether *animal* or *vegital*, are the proper Subjects for the *native acidum* of the Stomack to work upon, in order to *Fermentation*, is clear; because neither *Stone*, *Clay*, *Earth*, *Marle*, *Wood*, nor such like, wherein are no *Sulphurous parts*, or at least, such as are not *congenial* to the fore-said *acidum*, can become capable of being food, inasmuch as no *genuine Fermentation* (essentially necessary to the upholding the *fabrick* of an *animal body*) can thence be made.

Not now further to shew, how *Fermentation* begun in the *Stomack*, and carryed on in the *blood*, and other *humours*, is not onely the *efficient cause*, and *effectual source* of *heat*, but also of all *animal Spirits*, carryed thence by the *conduit-pipes* of the *Nerves*, into the *habit* of the *body*, in order to the performing those peculiar *functions* of sense and motion, both (*viz. heat* and *animal Spirits*) being the immediate *products* of *animal Fermentations*.

We say, that in the circle of *natures operations*, throughout her *triplicity* of *bodies*, there is no such thing as *Spirits separable*, but what are the *immediate* results of *Fermentation*: For, however, among some *Physiologists*, they are reputed *inter principia corporum*: yet according to our *Hypothesis*, they are no *principles*, but the *posterior products* of *Fermentation*, and appear in bodies according to the *slow* or *quick*,

quick, low or high degrees of *Fermentation*, from whence proceed their threefold order in the productions of *concretes*: For either these *Fermentations* are to be considered in their *primordials*, or first workings in *bodies*, in order to the *fabrick* thereof, and so the *Spirits* which thence result are in a low depressed state, deeply *immers'd* in corporeal bulk, as appears in *vegetables*, &c. in their state of *Infancy* and *Crudity*.

Or Secondly, These *Fermentations* are to be considered in the further *progreſs*, and closer *interweaving's* of the *principles*, whereby they become to be more *quick* and *high*; the *Sulphur* gradually *softening* and *sweetning* their *connate acids*, and thence the bodies wherein those *Fermentations* happen, becomes more *pregnant* with *Spirits*, being now more plentifully *ingendred*, and more *easily* set at liberty by the power of *Fermentation*, then before: And this is evident in *all things* brought on to *maturity*, and becomes sensibly *apparent* chiefly in *all odorous Plants* and *Fruits*.

Or Lastly, They are to be considered in the more sensible *brisk conflicts* of the *principles*, even after the *bodies* they work in are brought to *maturity*, one *dulcifying* the other, by the *concurring causes* of solar heat, &c. the *principles*, I say, being yet kept on in *motion* in

all fermentable juices and grains, do produce the greatest plenty of *Spirits*, which being set at liberty, are all those we call *vinous Spirits*, in animals those we call *animal Spirits*, the genuine product of *vital* and *animal Fermentations*, and in *minerals* their *Spirits* in some places after heating transient waters for hot Baths, appear in *volatiz'd Sulphurs*, otherwhere in *subtile acids*, as the causes of some *acidulæ*; and elsewhere in *aporrhæa*, *steams*, &c. (as elsewhere we have shewed) Thus in all fruits, brought on to *maturity*, and all grains ripened for the *harvest*, the *principles* in their mutual *Collisions* are so pregnant, as that by being put nearer together (which happens by their being *juiced* or *malted*, they are thereby set a work into a sensible *Fermentation*, as appears in all fermentable juices and malted grains, the immediate result of both which, are *vinous Spirits*.

Thus in all natural *animal Fermentations* of their *juices*, requisite for *circulation* of the *blood*, nourishment of the *body*, and for the performing other *functions* peculiar thereto, the *animal principles* are so pregnant, as in their continual *wrestlings* and inward *collisions*, incessantly to produce such a *stock* of *Spirits*, as being rightly *disposed*, and carryed in their proper *Conduits*, the *Nerves* are sufficient to the *absolving* the functions of *sense* and *motion*:
And

And the like in their kind may be said of *minerals*, concerning which, *viz.* the origin of *animal Spirits* from the fore said *Fermentation*, we may elsewhere largely discourse.

We shall only say at present, that as the *natural Fermentations* in *animal bodies*, are produced from the *intestine collisions* and inward struglings betwixt the *native acid* of the *Stomack* (fortified perhaps by some *connatural acidum* in the aliment) and the acquired *Sulphur* of *nutritive concretes*, separating *Heterogenities*, and graduating themselves by *successive depurations*, till they in their proper *juices*, perform those *circulations* requisite to the peculiar *functions* of the *body*. So likewise from the *Catastrophe* of the natural, and superinduction of other not *congenial acids*, may be made such *mortifications*, *precipitations* and *depravations* of the genuine *ferments*, and such new *complications* betwixt the *recent acid*, and the *Sulphur* in the otherwise natural *fermenting juices*, as to lay a foundation of new *spurious Fermentations*, the causes of *Feavers* of all sorts.

Not to say here, how most, yea, (for ought I know) all sorts of *Feavers*, are nothing else but *spurious Fermentations* of the *blood*, and other *juices* of the *body*, distinguishable, or (if I may say) *specificated* by variety of *acids*, not *congenial*, but wholly disagreeable,

gradually heightening the natural, and otherwise slow pac'd *genuine Fermentations* : whose various degrees of *Feavers* are most what *differenced* or *specificated* from the low or high, slower or quicker degrees of *spurious Fermentation* : or to speak in a more plain *dialect*, how *Feavers* are various sorts, or different degrees of *inflammations* of the *blood* and other *juices*. For an *inflammation*, according to our *Hypothesis*, is nothing else but a heightening of *Fermentation* from a more strong *collision* of the *principles*, whereby, from their *mutual wrestlings*, they arrive to the height of *causticks* (which as we shew elsewhere, differ from *corrosives*, onely from the difference of their *acids*) such I mean, as in a lower degree pleurising from an inflammatory transposition of the fiery particles of the *blood* upon the *pleura*, and in a higher degree, as are the plague and pestilential *Feavers*, which are *Feavers* in their highest inflammatory and fiery degree, witness the *Anthraxes*, *Carbuncles*, and other *pestilential badges*, which shew perfect *Eschars* upon the skin, as if perform'd by *canteries Lixivial*, or fiery : which are with due caution to be cured by such *ways* and *methods*, as allay that *furious fiery Ebullition* by *Phlebotomy*, and gentle breathing *Sweats* : but here we must cut short, intending (as this finds acceptance) a fuller and more free *discourse* of

of the nature of *Feavers*, how essentially *specified*, and what *methods* accordingly they best *yield too*; concerning which, we may (*Deo dante*) treat in another place.

Onely this (by the by) we would observe, that amongst *animal juices*, those from *vegetables* made by *animal Ferments*, suppose *Milk*, by the various actions of the *innate* or *adventitious acids*, upon their inbred *Sulphurs*, happen different products: First therefore, as to the *coagulations* and *alterations*, to be made from the inbred *acidum* thereof.

Thus *Milk*, while in an equal temperature of its *constituent ingredients*, undergoes no separation of parts, remaining in an *uniform Liquor*, but being expos'd to the *Air*, after a while the *innate acidum* of the *Milk*, being acuated by that of the *Air*, makes a *spontaneous* separation of a *cremor* from the more thin part, which *Cream* having some *acidum* in it, (as we elsewhere prove, that all *Cremors*, *Oyles*, *Fatts*, *Axungia's*, &c. are but different disguises of *animal Sulphurs*, have their implanted *acids*) by keeping, grows more *sour*, this by concussion of the parts (in that motion we call *Churmin*) undergoes a *Fermentation* of its kind; from whence happens another sort of *separation*, viz. into *Butter*, (which is *Sulphur* in another form then before) and a more ferous part, call'd *Butter-milk*.

And

And as *Milk* after the separation of *Cream*, by longer standing, comes to a *thick*, and almost *gellyed consistence* (by Countrey people call'd *Loppard*) and by a little heat splits into *Curd* and *Whey* : so *Butter-milk*, if kept long, will come to the like *consistence* ; but if *heated*, the *acidum* presently *coagulates* the *Curdy* part : if that coagulation be made in *heat* after the mixture of *New-Milk*, the *acidum* in the *Butter-milk*, *coagulates* both the *Curdy* parts of its own, as also *Butirous* and *Curdy* parts of the *New-milk*, into that sort of *sour coagulum* call'd *hatted Milk*, which is more or less *sour*, according to the prevalency of the *acidum*, or more or less affusion of *New-Milk*.

And Lastly, As the foresaid *alterations* are made from the various *coagulations* of *Milk* from its implanted *acid*. So likewise other sorts of *coagulations* thereof are produced from *additional acids* : Thus any *Fermentative potable Liquor*, as *Wine*, *Ale*, *Beer*, *Syder*, &c. mixed with *Milk*, the *acidum* in such *Liquors* coagulates the *Sulphurous* parts into a *Curd*, separable from the *serus Liquor* ; the like will a few drops of any *acid juice* do, whether *vegetable* or *mineral*, as of *Vinegar*, *Vitriol*, *Sulphur*, *Salt*, &c. yea, the *runnet* which is made up of *Milk* coagulated by the *Stomichal acid* of an *animal*, which by keeping, *sours* yet more, and is made up with *Salt* to preserve it

it from decaying, by the addition I say of the foreſaid *acid ferment*, or *animal Runnet*, to *Milk* eſpecially in *heat*, is made that *coagulation* of the *Sulphurous* and *Curdy parts*, out of which our *Cheese* is uſually made.

So that from the different actions of the *acid* (whether native or additional) upon the *Sulphur*, are produc'd thoſe uſual *concretions*, or rather *coagulations* of *Butter* and *Curds*, ſeparable from the more *liquid serum*: which *Butter* has alſo its connate *acid*, which is the cauſe of its *liquidity* in *heat*, and *coagulation* in *cold*, as we could ſufficiently demonſtrate the *liquidity* and *coagulation* of ſuch, the *ſucculency* and *concretion*, the ſoftneſs and hardneſs of other ſort of bodies, chiefly to depend upon the various modes of *acids*, either conſidered in *Fermentation* or *Concretion*, and as aſſiſted by other concurring cauſes, chiefly of the *Air*, which we now with difficulty, and chiefly for brevity ſake, refer to another place.

We might (if willing to enlarge) take an occaſion here amongſt *animal Ferments*, to inſiſt upon the *cauſes* and *reaſons* of thoſe ſtrange-ly ſurprizing *effects* reſulting from the invigorated *Ferments* of ſome *venemous animals*, and ſhew, that all their *poyſonous properties* conſiſt chiefly and ſolely in the *Ferments* of their *juices*, which may be invigorated to
that

that height, as to become *poysonous Fires*, which by a bite (or the like) getting admission into the *blood* of a *humane body*, will, according to the *degrees* of their *exasperation*, make their *transits* in the bearing down, and mortifying our *animal Spirits*.

Hence those *fiery Serpents* we read of, were probably such whose *Fermental principles* was by *exasperation* wrought to that height, as to become a *venemous Fire*, by whose least *entrance* into the *blood* by their *sting*, or the like, did presently *mortifie* the *Spirits* of those who were *bitten*, whereby they were *suddenly killed*.

And to shew, that as the *strength* of our *bodies* depends upon the *energie* of the *animal Spirits*, the product of *vital Fermentation*, according to whose remiss or intense *degrees* of *depuration*, *sublimation*, and *eradiation* in their proper *Channels* the *Nerves*, the *weakness* or *vigour*, yea the whole *crasis* of the body *subsists*, (Diseases generally prevailing upon us from their *various assaults* which are made upon these in their *original source* of production, I mean in the *fermentable juices* of the body) so likewise the *Spirits* of *venemous animals* (the product also of the *Fermentation* peculiar to their *juices*) being by *exasperation* so subtiliz'd, as that they are highly *invigorated*, and beyond *imagination Spiritua-*
liz'd

liz'd, do by their *sudden fiery vibrating* motion, (if admitted) make their transits *quasi ictu oculi*, through our *Fermenting juices*, presently arrest our *Spirits*, and by *coagulations*, and other manner of *mortifications*, suspends their generation and motion, which being *precipitated* and *born down*, and the future *vibrations* of the *vital Acidum* and *Sulphur* mortified, must needs bring on death, which is nothing else but a *period* put to the mutual *collisions* of the *vital principles*.

Where we might shew, that the *deleterious properties* of *venemous Animals*, as *Vipers*, *Adders*, *Snakes*, *Scorpions*, &c. reside not at all in their flesh, because they may and are frequently *eaten*, not onely without *harm*, but also in some cases with *good success*, but in their *peculiar Ferments* (consisting (according to our supposition) of *Acidum* and *Sulphur* of their kinds) which being capable of *exasperations* and *heightenings*, are also as lyable to have their *Spirits invigorated*, insomuch as the more those *animals* are *angred* (as I may say) the *stronger* the *Fermentation*, and the more *subtile* the *Spirits* are, yea the more *mortal* their *fire*, which bearing the *character* of their *material principles*, have the foresaid *sudden mortifying influence* upon our *vital juices*, and the *Spirits* thereof.

We might also shew, how those sorts of

Fer-

Ferments in their strong *inveterating motions*, do sometimes fix themselves upon some *peculiar matter*, or *coagulated juice* in their bodies, where the *Ferments* lurk as in a *seminary*; and this is the reason why that *matter* vomited by some sort of *venemous Scorpions*, (If I mistake not) called *Gecco*, upon their being whipt and hung up (thereby having their *Ferments exasperated*) is used by the *Indians* as a *speedy death* to their *malefactors*, by *pricking* the *skin* under one *Nayle* of the *hand*, and applying a little quantity thereof to it, which immediately thereby getting *entrance* into the *blood*, presently *suspends* the *Fermentation* thereof, *mortifies* the *Spirits*, killing them presently; yea, at *Macassar* a *Town* in the *Island Celebes*, belonging to the *Molucco Islands*, there is a sort of *poyson* (whether made by the fore said *artifice* from *inraged venemous animals* I know not) which the *King* of that place uses for *expeditious killing* those he would *dispatch* out of the way, by applying it to any *breach* of the *skin*, it immediately from its *Fermental corrosive poyson*, not only *kills*, but *burns* the whole *body* into a *corruptive putrilage*; concerning which, and many other things of the like nature, we now for brevity sake willingly desist to enlarge.

CHAP. VII.

HAVING in brief thus signified the causes of the *Fermentations* in *animals*, to consist in a brief, but suitable intestine dwellings betwixt the two principles *Acid* and *Sulphur*, which coincide *in puncto vitalo*, according to our *Hypothesis*, and that their *heat* is immediately thence produced.

In the next place, let us consider whether the same *Hypothesis* may not hold good in the due explicating the *Phænomena* in that other *kingdom* of *nature*, I mean the *vegetable*, where (besides what we have already said) *vegetation* in our account, is no other then a gentle *vibration*, and slender *collision* of the *Vegitable Acid & Sulphur*, from which two principles, put into a *wrestling motion* in every seed, after the loosening its body or husk in the *lessas terræ*, is begun the *vegetable Fermentation*, which ceaseth not till the body (shap'd according to the *form* of those *minute Types*, wrapt up in the *seedlings*) and in some obvious to the eye, assisted by good *microscopes*, is brought in all its *pourtrayings* upon the *visible Stage* of the *World*.

And from this *Fermentation*, set afoot in the
very

very *primordials*, *seedlings*, and first hewings of *vegetable forms*, are deducable all the *observable Phænomena* of *vegetables*; for not onely *vegetation* it self consists in a slow-pac'd *motion* of the foresaid principles, set into a slender easie *Fermentation*, but also their *colours*, *sapours*, *odours*, also other *medicinal qualifications*, and their propagation by *Seeds*, and their future *Fermentations*, as of *Corn*, *Grapes*, and *Fruits*, &c. in order to our *Bread* and *Drink*, are referable to the various *intestine wrestlings* off the inbred *Acid* and *Sulphur*.

First, As to *Vegetation* it self, we have already *hinted*, how its performed by a *secret Fermentation* from the inward *combating* of their peculiar *Acids* and *Sulphurs*.

Secondly, What are *Colours* but the *ludicra Sulphuris*? the sportings of *vegetable Sulphurs*, from whose *interweavings* and *coagulations* upon their *genuine acids*, are struck those *beautiful colours* which so gratefully salute our *Opticks*, and that by making such alterations in the texture of the parts, as to admit those various reflections and refractions of *Light*, and causing such mixtures of *Shades* and *Lights*, as lively to represent those amiable, and no less admirable appearances of *Colours* to our *Eye*.

Thirdly, What are their *Sapours* but the deductions of *Plants* by their peculiar *vegetative Fermentations*, to any equal temperature, where-

whereby they become *pleasant* or *ungrateful* to the *Palate*, and whereby those that are for *food* become *nutritive*; whose *grateful gust* in all, especially *Fruits* brought on to *maturity*, signify the *soft sweetnings* of their *Acids*, by the ripenings of their *Sulphurs*; whereby they become *fit objects* for the *Ferment* of the *Stomack* to turn into *nutritive juices*, *quod sapit, nutrit*, is from this ground most certainly true.

Fourthly, Again, what are all *odours* of *Vegetables*, but the *efflorescence* of their *Sulphurs* from *vegetative Fermentations*, whereby, from the continual hits and incessant touches of the *native acid* upon the *Sulphur*, the *Sulphur* thereby becomes in part so *comminuted* and *volatiz'd* by that gentle *Fermentation*, as to pass off (especially in the more *odorons Plants*) in a sensible *aporrhoea*, able to smite the *Nostrils* at a great distance; So that *Vegetable odours* are the immediate products of *intrinsick Fermentation*, which by how much the nob'ler the *specifick Sulphur* is, and by how much the higher graduated, the more gratefully are we *accosted* by its *odour*, and at the greater distance it is *carried*.

Fifthly, How much the *medicinal* properties of *vegetables* depend upon the foreſaid *Fermentation*, will not be unaptly represented by observing their chief dependance upon their *Sulphurs*: For what is it in most *vegeta-*

bles that we seek after, or that doth the work, but the *Sulphurous* and *Oylie* principle, which is no otherwise brought on to *maturity*, but by the *uninterrupted collision* and *inward wrestlings* with its *connate acid*, whereby it sweetens the *Acid*, is it self *volatiz'd* and *graduated*. and most what complicated with a *volatile Salt*, the product thereof.

Sixthly, As to the *propagation* of *vegetables* by *Seeds*, how that also is performed by the foresaid *Fermentation*, will be evident, if we consider, That as *Fermentation* in *vegetables* begins in a *seminal punctum*, wherein is delineated all the *organical parts* (if I may so say) the whole *plant-Embrio*, (being by the great and most skilful contriver of *nature*) epitomiz'd into a *punctum* mechanically indivisible, onely discoverable to the Eye, in some *Seeds*, by the help of good *Glasses*, according to the excellent and curious *micro-scopical observations* of the worthy *Malpigi*. So I say it ceaseth not till it *terminates* in a new *seminal punctum*, its set afoot in the very first motions of *Seed*, and ends not till it have by the same *wrestlings* of *Acid* and *Sulphur*, produced a new *Seed*, or rather a new *Cloathing* for the *Seed*, nor doth it then cease to be a *Ferment*, onely lies *dormant*, close shut up, as in a *Prison*, in the *busk* of the *Seed*, till it be set awork again by being put into a *proper matrix* or *analogous moisture*.

moisture, and then the *compage* of its body is loosed, the Prison doors are set open, and the *Embrio* Captive set at liberty: yea, if *Fermentation* of *vegetables* was duely understood, and carefully attended, it would never cease to act, during the *world*: for if when by *Fermentation* the two *principles* concentrates themselves in *puncto*, shaping a new *domicil* (for their retirement a while, till other assisting causes, according to the appointment of *God*, conspire at their due seasons) should then immediately be committed to its proper *matrix*, the *Fermentation* would keep onwards in its pace, which being continually observ'd, would never cease to act. But because *God* the great Builder of all things, hath limited the *Fermentations* and *Productions* of all *vegetables* to certain seasons, therefore do the *principles* take sanctuary for a time in those *visible* grains and husks we see; which husks, although to us they seem *new Seed*, yet they are but new Cloathings at the best, to that *inward Seed*, which ceaseth not, and from this *Fountain* it was, that *Paracelsus* and *Helmont* truly tell us, that *essentia rerum non pereunt*.

And indeed we cannot but look upon *Seeds*, or *Seminary principles*, in all things thence producible, as *Embrio-Anchorites*, concentrated and thrust up (by the great skilful Builder and Contriver of all things) into small parcells

of *matter*, which (at least in some) are *mechanically* (I dare not, nor indeed can say *Physically*) *indivisible*: Now that these *Plant-Embrios* are so minute in most, as to escape any *mechanical division*, and in some so *inconspicuous*, as not to be *discernable* by the most curious, assisted by the best and most skilfully contriv'd *Glasses*, is very evident to those who are very *inquisitive* herein: And yett these so minute points, *mechanically indivisible* (which is worth our remarking) being put into their proper *matrix*, or having a competent *moisture* allowed them, do by a slow *Fermentative motion*, compitible to all *vegetation*, begin to make *intestine collisions* and inward *wrestlings* of their inbred principles of *Acid* and *Sulphur*, whereby that little parcel of *matter*, so small as not to be *obvious* (at least in some) to the Eye, assisted as aforesaid, is by the power of its implanted *Ferment*, capable of being *split* and *subdivided* into plenty of yet more *minute parts*.

Lastly, (for at present we only design *transient sleight touches* upon each) That the *Fermentations* of *vegetables*, as of *Corn*, *Grapes*, *Fruits*, &c. in order to the preparing our *Bread* and *Drink*, depends upon the foresaid *collisions* and inward *strugglings* of the two principles *Acid* and *Sulphur*, is hence evident, because if the *Acidum* of *Paste*, *Must*, *Wint*, or the like *Fermentables*

mentable Liquors, be by the addition of any other thing *precipitated*, altered, or mortified, then will those *Liquors* never *Ferment*. Thus if *quick-lime*, coral, *Crabs Eyes*, or any sort of *fixt livial Alcalies*, be added thereto, either before it begin, will prevent, or if while *Fermenting*, will cause the *Fermentation* to cease.

Ferments are so obvious in the preparing our *Bread* and *Drink*, as that usually *Fermentation*, (through the defect of the right understanding the *nature* and due *improvement* thereof) hath been *imputed* to few other things. The brisk *effervescence* of *Wines*, which work without any additional *Ferments*, owe their *Fermentative motion* to no other, then to the *quick struglings*, and inbred *collisions* of their *native Acid* and *Sulphur*; a great part of whose *superfluous Acidum* and *Sulphur*, complicated with a *volatile Salt*, together with other *Heterogenities*, are, during *Fermentation*, rejected and precipitated in the form of *Tartar* (of which more in our *Halologia*) The rest from a genuine wrestling of the principles compose an equal temper, and generous potable *Liquor*, viz. *Wine*, the noblest of *vegetable Fermentable juices*. The like may be said of all other *vegetable Fermentative Liquors*, such as are *Ale*, *Beer*, *Syder*, &c.

If the *effervescence* of *Wines* prove strong, either from the too *brisk assaults* of the inbred

Acidum and *Sulphur*, (as sometimes happens in new *Wines*) or from the reimbibition of the formerly deposited *Tartar*, or rejected rich *Lee* or *Fæces*, (both well saturate with the foresaid principles) or from too great agitation, or immoderate warmth, or some heterogeneous *Acids*, as of different sort of *Grapes* prest into one *mustum*, or from the addition of *Mercury sublimite* (wherewith sometimes it is adulterated) or the like ; if I say, from any of the foresaid ways, *Wines* be set into a Fermentative motion *de novo*, and put into a high effervescence, the remedy chiefly consists, either in the racking it oft, whereby the contracted fervour is to be abated, and future imbibitions are to be prevented ; or by precipitations of the foresaid *Tartarous particles*, or extraneous bodies, which is to be performed by affusion of plenty of *Milk*, or such sort of *Liquors* ; by which, not only such kind of precipitations are well performed, but also doth help to allay those *Fermentations* too much exalted from agitation by *Carriage* ; or which happens from immoderate heat, by attempering, and softening inordinate exaltations.

And as this is to be done in *Wines*, whose principles are too active ; so on the contrary, in the great impoverishment of *Wines* from the depressed state of the principles, somewhat of a like *Ferment* should be added, such, I mean,

as may not only *acuate* the *dormant principles*, but also may *inspire* a new sort of *Ferment*, congenial to the former, of which kind, is a *well impregnated Tartar*, or *strong Lee* to be put thereto, or a *Fermental Syrup* compos'd from a *generous Wine*, *Sugar*, or some *Aromatics*, to bring on a fresh *Fermentation*, or a little *Fermenting Wine*, freshly working upon its *Lees*; if in *Ale*, which wants a due *Fermentation*, either a little fresh *Ferment*, I mean the *flores Cerevisiae*, call'd *Yeast* or *Barn*, or a little new working *Ale* is to be added, especially after a *cohobation* of *fresh Malt*, or upon *Malt* once by *infusion* extracted; or some dust of *Malt*, and some *sliced Ginger*; or *Eggs* well beat; but to return:

Yet some of these will not easily *Ferment per se*, but require an *additional Ferment* to excite their *implanted Acidum* and *Sulphur*, into a brisk motion or *strugling*, which we call *Fermentation*. Thus in the making *Ale* or *Beer*, from the *infusion* or *juice* of *Malt*, a congenial *Ferment*, viz. *Yeast* or *Barn* (which is *flos Cerevisiae*, or the seedling of its *Fermentation*, able from its *Symbolical principle*, to propagate *ad infinitum*, of which more elsewhere) is to be added, to rouse up the like *principles* of *Acid* and *Sulphur*, in the *foresaid juice*, to a *Fermentative motion*.

Thus also in the preparing the *potable Liquor*

from *Sugar* (which if done with *Birch-water*, makes it the more *medicinal*) a *Ferment* off *Yeast*, or the like, is to be added, which sets the foresaid *principles* in the *Sugar*, into a *Fermental motion*, whereby it becomes a good *potable Liquor*, bearing some resemblance to *Wine*: Now that there is *Acidum* and *Sulphur* in *Sugars*, *Grapes*, *Apples*, *Berries*, *Cherries*, and other *Fruits* and *Grains*, is very *obvious*: First, As to their *Acids*, those are plainly discoverable both by the *facile degenerating* off *Liquors* or *Juices* hence made into *Acids* or *Vinegars*, if I may so call them; thus *Sugar-Canes*, laid by in *Troughs*, becomes very *Acid*, and so of the rest: As also by their *distillation*, as appears in the *distillation* of the *Floors* off *Wheat*, *Wrye*, &c. which give an *acid Spirit*; so all *Fruits*, *Sugars*, *Honey*, &c. which by *Fermentation* are capable of becoming *potable Liquors*, by *distillation* yield an *acidum*, witness the *acid Spirit* of *Sugar*, *Wheat*, *Honey*, &c. Your *Bread* distilled yields an *acid Liquor*, chiefly from the added *Ferment*, which sets the *Acidum* of the *Corn* more at liberty; from both which proceeds that *acid menstruum* taken notice of by the honourable *Boyle*, which will draw a *tincture* from *Stybiūm*, as we have try'd.

And as to *Sulphurs*, they are demonstrable to be in all the foresaid *Fruits*, *Sugars*, *Grains*, &c..

&c. First, By their *Vinegars*, in all which lurk an *Oyle*, separable by *Art* two or three ways, as we shew in our *Lithologia* and *Halologia*: For when the *Acid* prevails, it dissolves the *Sulphur per minima*, and hides it in it self, under the mask of an *Acetum*. 2ly. By *Distillation*, as when urg'd by stress of *Fire*, they give besides their *acid Spirit*, an *Oyle*, which from the forcible *actings* of the *Acid* upon the *Sulphur*, and some *terrestrial parts*, by the violence of *Fire* makes it become *Empyrhumatical*, (as in our *Halologia* we further enlarge.) 3ly. By *Putrification* and *Distillation* they give an *Oyle*. 4ly. By *Fermentation* and *Distillation*, whereby they become *vinous Spirits*, whose *Sulphur* is discernable from their *flagrability*. And Lastly, (to omit what might probably be done in order to the separating genuine *Oyles* from some of them by bare *Distillations* in *water*) by their *evaperations* of their *juices*, and *extractions* by *vinous Spirits*, whereby their *tinctures* are drawn, which are nothing else but *specimens* of their *Sulphurs*.

As to *Corn*, suppose *Wheat*, or any other *Grain*, the same principles of *Fermentation* are evident; for when wrought into a *masse* with *water*, and the addition of a little vegetable *Ferment*, suppose *Yeast*; this by the *congruity* and *congenialness* of its parts to the *similar Ferments* implanted in that *Grain*, lets it in-

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to motion ; for all additional *Ferments* do no more but *excite* the *principles* of *Fermentation*, native to the body, or Liquor to be *Fermented* : for neither *Yeast* put to water, nor *Old Leaven* put to powder of Stone, mixt with water, will cause either of them to work for want of *Symbolical principles*.

Yet this last Paragraph we are to ballance with this following *consideration*, and that is to *illustrate* the reason why *Corn* (for instance *Wheat*) sprouted by overmuch *wet* in the reaping, or *moisture* by bad laying up, will not make good *Bread*, at least, other sorts of *Table Food*, because hereby the *vegetative principles* of *Acid* and *Sulphur* are excited, which should either go on in order to propagation by *vegetation* or *germination*, or that design of *nature* being perverted by *artificial malting*, might thence be used for preparing a *Fermentable*, and afterwards *potable Liquor* : but being imploy'd for other purposes, from the *activity* of the *principles*, already set into a vegetative *Fermental motion*, as soon as they feel the *Heat* retaining their vegetative sprouting *motion*, break the *Prison doors* ; and in short, if the *heat* was answerable, would *Sprout* and *Grow* ; but because the *heat* is stronger then is required for such purposes, it onely makes the *Mass Fat*, or become more *Florid* ; and thence it is that such *paste* bakes not solid and

and firm, but falls and runs in the Oven, as being more fit for making *Malt* then *Bread*, or other such *Food*.

CHAP. VIII.

NOW that there is some gentle warmth in all *vegetable Fermentations*, undiscernable to our senses, is apparent, because the same *principles* of *Fermentation* being invigorated in their brisk *intestine duellings*, may become sensibly hot, witness the heat of *steep'd Barley*, laid on a heap in order to *Malting*, which if neglected for want of turning and ventilation by *Air*, will become so *hot*, as one cannot induce his hand long in it: Yea, and from the same *principles*, yet heightned in their *inward Collisions*, may an actual burning Fire be produced: Witness *Corn* wet, laid in *heaps* in *Chambers* if neglected, will take *Fire*: Also *Mows* of *Corn* laid up too *moist* and *close*, have been *Fired*. So likewise a *Rick* of *Hay* is sometimes *burnt* to *Ashes*, from the *violent* and *furious Fermentations* of its *principles*, and that from its *moistness* and *closeness*, setting its *principles* of *Acids* and *Sulphur* into a *violent motion*, so as to break forth into *actual Flame*.

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Not to say here how *Acids* are sweetened by *Sulphurs*, and sometimes *coagulate* into a neutral body: For although all *Fermentation* is certainly (at least according to our *Hypothesis*) caus'd from the *Collisions* and inward *combatings* of *Acids* and *Sulphurs* in the production of things: yet as *Acids* amongst bodies (as I have before, and may more largely hereafter shew) *differ* amongst themselves, so they make *different assaults*, and are variously reacted by *Sulphurs*, whence both, by their mutual *actions*, undergo various *changes* and different modifications amongst bodies in their *transformations*.

And as some *Acids* ferment with their *Sulphurs* in an inward wrestling, the *Sulphurs* afterwards as they *predominate* upon the wheel of *operation*, softening, sweetening, and ripening their *Acids*, making gentle *coagulations* in their *naturations*, both amongst *animals*, *vegetables*, yea, and *Minerals* too (although more obvious in the two former) so likewise some *Sulphurs* ferment with some *Acids*, while with others they combine in a natural texture, to confirm which we shall onely (because in haste) give this single *mechanical example*, which shall be in *Mercury* or *Quick-silver*, to which if a *spirit* of *Nitre* or *Aqua fortis* be added, the mixture presently *ferments* from the *collision* of the *Sulphur* in the *Mercury*, and the *Acids* in

in the *Menstruum*, whereby the compage there is broken from the intimate commixture of the *Sulphur* with its *Mercurial* parts, whence a *Solution* of the whole: But if in lieu of that *corrosive Menstruum*, the dry Salts (of which that *Menstruum* by a *colliquating fluor* with their inbred *Sulphurs* by *Fire* is made) be mixed and sublimed together, there happens no *Fermentation*, but arise in a *corrosive Sublimate*; to which, if such a due proportion of fresh *Mercury* be added and re-sublim'd, they coagulate and sweeten each other into a *solid concretion* of a neutral texture, which is that trite preparation we call *Mercurius dulcis*, in which the *acid Salts* of *Vitriol* and common Salt is so dulcified by their interweavings with the *Sulphur* of the *Quick-silver*, as that it will not coagulate *Milk*, and so becomes (being well prepared) a very harmless and innocent *Medicine*: whilst the same *sublimate* (thus *sweetened* by the *Sulphur* of its *Mercury* freshly added) if therewith *Antimony* in lieu of *Quick-silver* be mixed, the same *acid Salts*, meeting with a different *Sulphur* in *Antimony* then in *Mercury*, falls into a *colliquation* and fretting *Fermentation*, causing a great *heat*, and becomes a strong corrosive.

And as from the *difference* of *Acids* amongst themselves, and their various assaults upon their *Sulphurs*, cause various changes in the
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genesis and transformations of Bodies, both in the texture of *Liquors*, and the *concretions* of Bodies: So from various modes of aggression of our *principles*, justleing differently, according to various applications, are produc'd varieties of *effects*, which are discoverable from the difference of *Spirits* thence separable, which in some (at least upon rectification) smite our Organs of *sense* with great variety, as will appear these following ways: Thus, First, If the *principles* are set awork in the *seminals* of things, in a generative way, as suppose in *Vegetation*, here the *principles* by an *evolution*, expand themselves in a slow but genuine *Fermentation*, whose effects (I mean their *Spirits*) most what guise themselves in the *minute effluvia* of *odours*, especially in *odorous Plants*, and that chiefly in the opening of the *Flower* (though in many through the whole plant) when the *sulphur* is by circulation (as I may say) so *subliliz'd* by its connate *acid*, as to pass off in a *subtile Steam*, for hereby the *acid* not onely strikes the *colour*, (according to the varieties of *Acids* acting upon their proper *Sulphur*) but also causeth an *expansion* and *emanation* of subtile parts. Secondly, If this *Fermentative Vegetation* be carryed on to the maturation of *Fruits*, and in their *Juices* the foresaid *principles* be again set awork, they then make different assaults, combining in
other

other manner of *collisions* then before, as is evident from the *vinous Spirits* thence easily separable, which partake much of the *volatiz'd Sulphur*. Thirdly, Thus if during *Fermentation*, any quantity of a plant (suppose *Wormwood*, *Mugwort*, *Tansy*, &c.) should be gathered and laid together in heaps: Here the *principles* make new and different *collisions* then before, making retrograde *motions*, which tend to a *putredness* of the *Plants*, the product of which *Fermentation* is a volatile *Urinous Spirit*, as appears by Distillation thereof: which is so strong in some *Plants*, as that it doth very discernable *ferire nares*, as I have felt in the *Glastum* or *Wood*, prepared by that artifice of putrefactive *Fermentation*, yea, the workers thereof told me, that when after a *previous preparation* (by Grinding and exposing to the Air in *Cakes*) they are laid in *heaps*, the *Fermentation* is so very strong, as the *Urinous Spirits* thence issuing, are scarce tolerable to those that are near it: which last named *Spirits* are as much a product of that sort of *Fermentation*, as the two former are of theirs; and therefore as we are not to guess at the quantity of *vinous Spirits*, separable by that *Fermentation* peculiar to those *Fermental juices*, as if *pre-existent*; nor of *Odours* in *Plants*, as aforehand, in their *minute seedlings* before the openings of those powers by their
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own vegetative *Fermentation*: so neither indeed ought we to esteem those *vinous Spirits*, pre-existent in the *Plants* before *putrefaction*.

And as the different modes of the *principles*, *aggressions*, and *collisions*, cause various sorts of *Fermentations*, and different kinds of *Spirits*, thence separable in the *Vegital*; so likewise with some variation, they do the like in the *animal Family*, I mean, that according to the various methods of the *principles* mutual combatings, different sorts of *Spirits* thence *result*: thus from the intestine *strugglings* betwixt the *native Acidum* of the *Stomack*, and the *Sulphur* in the Food begun in the *Stomack*, carried on by the *intermediate Ferments*, and compleated in the blood, are produced those sorts of *Spirits* we call *animal*.

Thus from the same *principles* acting upon each other in a retrograde motion, which is that we vulgarly call *putrefaction*, are all other sorts produc'd; and so of the rest, which we shall not now enlarge upon; and as to what results from *mineral Fermentation*, we have elsewhere discours'd.

That *moisture* or *water* (the former of which is but the latter rarified) is absolutely necessary, both to the setting the *principles* of *Fermentation* a work, as also to the keeping them afoot even in all such *motions*, from the very lowest degree of *vegetable Fermentation*, to the

the highest of *actual flagration*, is evident in most things throughout the series of *natures triplicity*; thus Vegetables necessarily require *moisture*, not onely to set, but also to keep their *principles of Fermentation* in a constant *Spring*. Thus the *Ferments* of our Stomacks do really need the pouring down of *Water, Wine, Ale, Beer*, or other *potable Liquors*, for the perpetuating and invigorating their *active principles*.

And hence, for ought we know, may be the reason why a *Glass of Water*, taken after a plentiful *repast*, is found to help the *digestion*, by setting the *Fermentation* awork, which otherwise, by the glut of *Food* might be interrupted, and that too by diluting the assum'd *aliment*, and so setting the *Acidum* of the Stomack and *Sulphur* of the food into a mutual *collision*, even as a little water poured to the thick *Oyle* of *Vitriol*, by diluting, sets the inward *principles of Acidum and Sulphur* into a *Fermentation*, thence producing a considerable *heat*, as we elsewhere further treat.

So likewise do the *principles of mineral Ferments*, in their source no less require the continual afflux of *Water*, in order to the heightening their *heat*, and making of *hot Baths*: Thus also *Brass Lumps* (which are a sort of *vitriolin marcasite*) laid in heaps, do from the *moisture* of the Air, or *sprinkling of water*,
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suffer their *principles* of *Acid* and *Sulphur*, by their mutual *collisions*, to be set a work, which are *invigorated* to that height, as to rise to an actual *flagration*.

The same will *Metal-Coals*, *Mines* of *Tin-Glass*, *Alom*, &c. do, and that from the identity of causes with the former: So likewise *moist Hay*, *Corn* in *Green* or *Moist Sheafs*, *Corn Steeped* or otherwise *Moistened*, do all of them from the same heightening of the *action* of their *principles* by *moisture*, conceive *heat*, yea take *fire* too, as is abovesaid. So that wherever *Fermentation* happens, and that there is plenty of *moisture* or *water*, there the *Fermentation* is considerably heightened, as may be illustrated by all the foresaid instances. And wherever there is *heat*, proceeding from the same *principles* of *Acidum* and *Sulphur*, if these by the addition of *moisture* become sufficiently *intended*, will certainly cause *Fire*.

Yea perhaps *fire* it self, I mean, the *culinary* made up, and fed with *combustible concretes*, doth as necessarily require a *moisture* in the *Air*, to the performing its quick rapid *Fermentation* of *ignition* and *flagration*, so as to make the *principles liquid* in the very act of *flagration*, yea that *mineral corrosive Fires* do require the addition of *moisture* or *water*, upon no other account, then for the *dissolving* and putting into *Fermentation*, their corrosive *Acids* and

and *Sulphurs*, is evident, not only in the Oyle of *Vitriol*, but also in the *Stigian waters*, viz. *Spirit of Nitre*, *Aqua fortis*, and *Aqua regia*, the two former of which being the same thing, as made from the same principles of *Acid* and *Sulphur*, (dissolv'd by the help of fire in water, as we further declare in our *Halologia*) all which are *corroding menstrea's*, or liquid burning fretting fires, which while in the form of *dry Salts* or *Sulphurs* separated, are not at all apt to make such *corrosions* of *Metals*, *Minera's*, &c.

For according to our *Hypothesis*, *corrosive menstrea*, are not made from *Salts* in *fluor*, nor are they bare *acetous Liquors*, or *Saline particles* driven by force of fire, from the *embraces* of their own *Earth*, as the learned Dr. *Willis* would have them, but are an *Acid* and *Sulphur* brought over in a *Liquid form*: That they are all *Acids*, needs no proof; and that they have all *Sulphurs*, may very easily be made to appear, by the *resinous*, *oylie*, or other *Sulphureous* separations to be made from all of them, even from the leanest, I mean *distilled Vinegar*, (as we demonstrate in our *Lythologia Physica*, and *Halologia*) so that *Acidum* and *Sulphur* by stress of *Fire*, raising up some *Liquid* or *watery parts*, fall into a *fluor*, and thereby become *corrosive menstrea*: For *mineral Salts* never become *corrosives*, till their

Sulphurs and Acids colliquate, and that they do, either by *distillation* from stress of fire, the *acidum* of the fire assisting their *colliquations*, as is evident in the making of the *Stygian*, and other *corrosive menstrua*, or by *Fermentation*, as appears in the mixture of *Mercury sublimate*, and *crude Antimony*, or *regulus of Antimony*, where the *acidum* of the Salts, catch hold of the Sulphur in the *crude* or *reguline Antimony*, and cause a *Fermentation*, colliquating together, or rather by their *colliquations*, cause a *Fermentation*, which you will; for we see upon the *Fermentation*, the mass of Salts and *Antimony* flow together, appearing in a liquid, although *thick form*, which *Colliquation* and *Fermentation* is perform'd, without the least specimen of any *alkali*, or *quid alcali analogum*: to which many ingenious persons (for want of a true *Basis* and right *Ariadne's Thread* to extricate them from difficulties) are driven to take Shelter in the solving these and the like *Phænomena*.

And not onely *corrosives*, but *causticks* also, we suppose (according to our *Hypothesis*) to consist both of them chiefly in the *vigour* of *Acids*, raised to the height of *Fermentation*, and to differ onely in this, that *causticks* are made from the *acidum* of *Fire*, and that either as in its own *rapid motion* of *Fermentation*, happening betwixt the *Acidum* and

Sulphur

phur of the combustible concrete, or as its *Acidum* is fixt *inter cremandum* upon such sort of bodies as can grasp hold of, and detain it in its intrails, of which are all sorts of fixt *Alcalies* (as they are call'd) *minium, calx viva, &c.* whereas *Corrosives* are made from the acids of *Minerals*, complicated with their *Sulphurs*, and heightened by *Fire*, which by the medium of an ingeint moisture, or by a *colliquation* betwixt themselves, become liquid corrosive *Menstrua*; of which, more elsewhere: And of whose manner of workings in the solution of *Metals*, we have above given a short account, according to our deposited *Thesis*.

Yea, and that some *Acids* and *Sulphurs* will *colliquesce*, even without the help of *Fire* in *distillation*; and in that *colliquation* will cause a strong *Fermentation* and intense heat, is evident from the mixture of *Antimony*, or the *regulus* of *Antimony* and *mercury sublimate*, with dry powders, will melt (being mixed) as if fused in a *crucible*.

We shall not here say, how by the *Fermentations* of our foresaid principles, all vegetable and animal concretes, (for the texture of whose bodies, water, as a material principle, is absolutely requisite, and which is wrought up into those bodies in their natural generation) are continually, by a constant wheeling off, after a little rotation in the *Air*, in the great *capitellum*

of the *Atmosphere*, turn'd into *water* again, or into *watery vapours*, which are but *water rarified*, and how that *watery vapour* is as one spring in the *Air*, for the setting all other *Fermentations* a work; not onely useful towards the actual *flagration* of *combustable matter*, maintaining thereby the great *round* and *circulation* of *generations* and *reductions* of all *bodies*. But also from the same *moisture* in the *Air*, carried thither in the great *circulation*, and fed by incessant *subterranean steams*, arising especially from *Springy* and other *watery places*, which whether in the form of *Dews*, helps to feed *Corn* and *Grass*, kept back by long *droughts*, or whether wrapt up more invisibly in the *Air*, doth yet reach some of the *tender veins* of other *vegetables*, or uniteth with the slender *fibers* of their *roots*, plac'd in *Sandy*, *Gritty*, or other *barren Ground*, and thereby either way by a sort of *filtration*, is communicated to their *Juices*, whence such *Plants* (which otherwise could scarce be thought to receive any sufficient supply from such *barren Soils*) admit of a competent stock of *moisture*, able to carry on their *vegetative Fermentation*, whereby they grow and thrive well: And hence it is, that *Orpin*, and several other *Plants*, onely set in *Sand*, and sometimes sprinkled with *water*, doth from the foresaid *moisture* in the *Air*, *vegetate* and like well.

Nor here to shew how *Air*, after a double manner, *contributes* towards the *Fermentation* both of *animals* and *vegetables*: yea, towards the producing the highest of *Fermentation*, *Fire*; nor shall we take time here to insist upon *water*, as the true *material principle*, indispensibly necessary for the production of all *bodies*, the want of which in the *grand circulation* of *nature*, bring on a *consuming drought* in all *bodies*, whereby those *concretes* (whose *natives* the *principles* are) wither and dye, because their *principles* of *Acidum* and *Sulphur*, having not whereon to work, and model *bodies* with, desert them, taking *wing* into their own *ether*, leaving their former *receptacles* to pine away in a continual *marasme*, and unavoidable *tabers*; Nor to shew, how *water* is indeed as essentially requisite, *materiæ gratia* for *natural*, as *Stone* and *Wood*, are for *artificial fabricks*; whilst the *active principles* of *Acidum* and *Sulphur*, are the inward *artificers*, the implanted *fabers*, yea the hidden *linners*, who by the manuduction of *seeds*, hews out *forms*, *shapes*, and draws forth the *lineaments* and *portraits* of all things, answering *ad vivum* (from the unerring rules of *nature*) their beautiful *antitypes*, invisibly coucht in the *initials* of all *bodies*: But (now studying brevity) shall leave them to a further *discourse*.

From what is premised concerning this our Doctrine of *Fermentation*, how it is performed in all *vegetation*, as being the lowest orb (in the whole round world of *nature*) it moves in, and yet is the true beginnings of all *fire* in *bodies*; and that the most *violent* of *fires*, is no other then this *Fermentation* in the most rapid manner; the *principles* furiously driving upon each other, will be evident, and very obviouse from this following *mechanical experiment*. Take the subtile æthereal *spirit* of *Venice Turpentine* four Ounces, (which is nothing else but the *Sulphur* of that *vegetable resinous gumm*, comminuted and subtiliz'd by gentle *distillation*, and intimately marryed to a *defecate implanted acid*) as also *Aqua fortis* six Ounces, both recently drawn, mix them together in a *Glass-Viol*, and they will presently fall into a *furious Fermentation*, which will arise to that height, as actually amongst the *thick clouds* of fumes to *burn* and *blaze out* of, and above the *Orifice* of the *Glass* in a *visible flame*.

Now what is *observable* in this *Fire*, thus by the foresaid *mechanick* produced, and whence the causes, the same may truly (we think) be said of all other *fires* in *combustable concretess*, for here the *Acidum* in the *Aqua fortis* (lately made) is very strong, closeth with the *Acid* in the *spirit* of *Turpentine*, immediately set upon the *Sulphur* in the same *vegetable Oyle* Liquor

Liquor, which *Sulphur* being congenial (as *Sulphurs* usually are to each other) to that in the *Aqua fortis*, increaseth in its vigour, whereby both the *Acid* and the *Sulphur*, even in both *Liquors* become fortified, and forthwith fall into an intestine Collision, whence the *Fermentation* begins, which being by the purity and sincerity of the principles, more and more heightened and invigorated, (having no heterogeneous matter to interrupt their inward duellings) at length arise to that degree, as to colligate into an actual fluid flame, which is the very same cause we elsewhere assign to the production of all usual *Fire* in combustible concretes, only with this difference, that in such flagrations, conceived from the immediate conflicts of the principles, there are not, as I said, those heterogenities interwoven, as in other combustible concretes, set into that rapid motion by kindling or firing.

Thus I say these actual flagrations, whether from the furious assaults of fiery acido-Sulphurous *Liquors*, as is apparent from the foresaid mechanical experiment, or from *Acids* and *Sulphurs*, set into intestine conflicts in combustible concretes, as is evident in all usual *Fire*, is no other then our foresaid *Fermentation* in a most violent hurry, the principles acting furiously upon each other; while other slower *Fires* are maintain'd by sleigher, and more gentle touches of the

the same *principles*. Hence methinks, when I behold the *varieties* of *Vegetables*, I cannot but esteem them as so many *igniculi*, little *Fires*, shewing their various lustre in their *peculiar colours*.

Yea to me the whole *appearance* of *nature* in the *concretions* of most *bodies* throughout the *triplicity* of her *dominions* (some *Petrificks*, and such like *anomalous* productions excepted) is nothing else but so many *Lamps* burning in *water*, each of them distinguishing a *parcel* thereof, into this or the other *visible figuration* which we commonly call *bodies* or *concretes*, so that the *Philosophers ignis aqua*, I mean, both their *Mercury*, and the grand *Solvent* the *Alchabest*, in which the *ignis Sophorum* is *artificially implanted* in the *mercurial* or *watery juices*, is but an *Epitome* of what *nature* in the great volume of the *World*, sets down in *Folio*; yea, is no otherwise preparable by art, then what (to a *Philosophick eye*) *nature* is constantly *performing* in its great orb of *productions*.

And as each *Body* carries its *central Fire* shut up in its *Bosom*, expanded or blown up by the *evolution* of its *seminals*, depending upon the implanted active *principles* of *Fermentation*; so likewise that adventitious *heat*, which helps to foster *Fermentation*, (in such *juices* or *concretions*, where the *active principles* seem to be *immur'd*, in the weighty bulk of *terrestrial*

strial parts) ought in its degree to be gentle, soft, and symbolical to the *Fermentative principles* : which if it exceed, in lieu of cherishing, dissipates the *nimble agents*, and spoils the act of *Fermentation*, and this is evident, not onely in the *concretions* and *maturation*s of *Fruits*, but in the *Fermentations* of *potable Liquors*.

Thus as to the First, *Fruits* while upon the *Trees*, by the help of the *Sun*, have their *vegetative Fermentations* compleated by the *Sulphurs*, sweetening and maturing their *Acids*, the like is done (though nothing nigh so well) in *Fruits* taken off the *Trees* before they be ripe, and laid by in *Straw*, *Hay*, or the like, whereby the *warmth* of the *Air*, there formerly begun *Fermentation*, is in some *measure* carryed on to *maturation* : whereas, if exposed to a more *warmth*, or a greater degree of *heat*, if done in *Water*, they are *Codled* ; if before the *Fire*, they are *Roasted* : In both which, although somewhat *sweetened* from what they were, yet are far short of the *pleasant gust* and *delicate colour* they arrive at, by their more natural and gentle *maturing heat*.

Thus if any *Grain*, suppose *Barley*, &c. be *steeped*, and afterwards laid in *heaps* till it contract a *spontaneous heat* : this very *heat* transcending that which is *peculiar* to its own *vegetative Fermentation* suspends, or rather indeed
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perverts the intention of *nature*, whereby it will never so vegetate afterwards, as to go on to a *propagation* by *seed*, but onely if permitted (by neglect of turning) will shoot forth a *spurious branch*, call'd vulgarly an *Acre-spire*.

Thus as to the last, *Fermentative Liquors*, if they have any other *heat* but what results from the *collisions* of their own active *principles*, or at least in degree is *congenial* thereto, then the intention of *nature* is perverted by the *dissipations* of the *principles* of *Fermentation*, or at least, by the graduations of the *Acid* above the *Sulphur*, as appears in heating the *Fermentative Liquor* too much, or in putting it up too warm in the *Vessels*: the like happens (I mean a *dissipation* of the *Fermentative agents*, or an *exorbitancy* of the *Acidum*) in hot seasons, or with the *percussions* of the *Air* by the noise of *Guns* or *Thunder*, or from *insolation*, or the like; In all which the *crasis* of *Fermentable Liquors* are perverted, and the *Acidum* by overpowering the *Sulphur*, grows exorbitant, subverting the temperature of the whole.

C H A P. IX.

HAVING thus sleightly (for brevities sake) run through the reasons and causes of *Fermentation*, from the lowest to the highest degree thereof, in all *natural productions* throughout the threefold *kingdom* of *Nature*, and shewed those from the *genuine causes* and *natural principles*, to be the *fountain* of *Heat* in and amongst *bodies*: Now come we to consider of some other *sorts* of *Heat*, that seem to arise either from other manner of *Fermentations*, or from other *causes*: of which are all *Fermentations* or *Ebullitions* made betwixt *Acids* and all kinds of *Alcalies*, whether *lixivial* or *alcalizate*, *fixed* or *volatile*; the *Fermentation* and *Heat* obvious in *quicklime*, made by the *affusion* of *water*, heat also caus'd from the *collision* and *attrition* of solid bodies. For indeed, from a due *examination* I find, there is no *Heat* produc'd amongst *bodies* (I mean from their own *intestine principles*) what sort soever it be, but what is referable of one of these two, *viz.* either *Acids* and *Sulphurs*, or to *Acids* and *Alcalies*: The first is the *natural cause* of *Heat* as thence springing from its *genuine source*, which admits of degrees even to *actual flagration*:

tion : The other is *artificial*, and never arrives to the height of the former.

I found therefore upon due consideration, that the foresaid *Fermentations* and *Heat* reckoned amongst those which arise betwixt *Acids*, and some sorts of *Alcalies*, might be solv'd from one of these two *causes*, viz. either from our deposited *principles* of *Acid* and *Sulphur*, or from a *mutual fretting* betwixt *Acids* and *urinous Spirits* : Thus we suppose (and elsewhere in our *Lithologio Physica* illustrate) in all *Petrifick* concretions, somewhat of a *Sulphurous principle* lockt up in the strickt texture of the *petrifying native Alcali* ; which when an *acid menstruum* comes to terebrate, finding the *Sulphur* its proper object, closeth therewith ; and from their *mutual strugglings*, happens the solution of the *body* ; thence proceeds the *Ebullition*, and consequently in some (where it is strong) *Warmth* : For we suppose a *Sulphur* or *Sulphurous principle*, to be as a *cement*, to bind up the *petrifick Alcali* in all or most of *stony concretions*.

Thus also we suppose in all *fixt lixivial Alcalies*, (or *fixt Salts* as they are vulgarly called) a *Sulphurous principle*, to be close shut up in the texture thereof ; and that every *fixt lixivial Alcali*, is a new compage of the same *præ-existent principles*, produc'd and bound up by the *Acidum* of *Fire*, where the *Acidum*
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and *Sulphur* are so interwoven with a *volatile urinous Spirit* or *Salt*, as that by force of *Fire* they do *colliquescere*, melt down into a body dissolvable *per deliquium*, which is generally esteemed a *simple Salt*, but having discours'd largely thereof in our *Halologia*, shall now wave it, and onely say, that these fixt *Alcalies* (vulgarly reputed *solitary Salts*) being new textures of the *intrinsic principles*, do by that *neutrality* of *Essence* they are wrought into by the *Fire*, from new *complications*, I say, do make *different assaults* upon *Acids* then before.

Hence it is, that upon a double account, as I said, that *Acids* mixed with these *Alcalies* may cause an *effervescence*, viz. either as meeting with the *Sulphur* close bound up with the *Acid* and *urinous Spirit* or *Salt* in the compage of the *Alkali*, and so to cause an *Ebullition* and *Heat*, according to our foresaid *principles*; or as meeting with the *volatile urinous Salt* close rivetted with the *Sulphur* and *Acid*, may either way cause an *effervescence*.

Onely this difference (which is considerable) is to be noted betwixt these *Fermentations* made between *Acids* and *Sulphurs* as they happen in *petrifick concretions*, and *fixt lixivial Alcalies*; from those which happen in the general course of *nature*, inasmuch as *Fermentations* which are set awork amongst *animals*, *vegetables*, yea, and many *minerals*, do produce

a quite different effect from those lately cited, as appears in *animal Fermentations*, their effects are the production of *animal Spirits*, &c. In vegetable *Fermentations* their effects are either such which immediately result from the *slow pac'd motion* of the principles, viz. *Vegetation*, *Volatization* of their *Sulphurs*, *Odours*, &c. or are the effects of the more sensible *Fermentations* in all *vegetable juices*, in order to *potable Liquors*, which are *vinous Spirits*, or the effects of *mineral Fermentations*, which is done in the *bowels* of the *Earth*, where no current of *water* happens) are the productions of *mineral concretes*, &c. If where *waters* have their *Channels* (in their great *circulation*) their effects are *hot Baths*, &c. Or Lastly, if the *Fermentation* be from *mineral bodies*, and *corrosive menstrea*, the effects are *stifling fumes*, &c. All which in their different classes happen from the looseness of the *compage* of their *Sulphurs*, and from their *facile inclination* to *volatization*. But in the late cited *effervescences* betwixt *Acids* and *Alcalies*, whether in *Petrifick* or *lixivial Salts*, their *Sulphurs* being naturally *fixed*, as in *Stony concretions*, and are made so in *lixivial alcalies* : So that although *Acids* may touch upon them, and cause a little *fretting effervescence*, yet cannot *volatize* them ; therefore upon their *collision* and *Ebullition*, we find no different *hoo*

to smite our *Nostrils*, the usual *products* of other *Fermentations*.

And then as to *volatile Alcalies*, which put to *Acids*, cause a *fretting heat*, they do consist of an *Acid* and an *urinous Spirit* (as in our *Halologia* we further demonstrate) which being *complicated* together, retains so much of the *Acidum*, as is sufficient to its *concretion* into a *saline form*, and yet is so much *subjugated* by the *Urinous Spirit*, as to be overpowered thereby; and from the neutrality of their *nature* to cause the foresaid *effervescence*, being mixed with *Acids*.

In the next place, as to the reasons of *Fermentation* contracted in *quick-lime*, from the *affusion* of *water*; in short thus, we suppose (and think to demonstrate) that *heat* to proceed from a *Fermentation*, betwixt *Salts* of a different *nature*; which upon the *affusion* of *water* are dissolv'd, and thereby set into an *actual struggling*. These different *Salts* are an *Alkali* and an *Acidum*: Now that *fixt alkali-zate Alcalies* (not *lixivial* of *Plants*) are disseminated in the *bowels* of the *Earth*, to which *petrified concretions* chiefly owe their *original*, we at large shew in our *Lithologia Physica*; and that such a sort of *Alkali* is implanted in *calx vive* (which in the *calcination* required to the making thereof, becomes yet heightened) is evident, First, by its *mortify-*

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ing and sweetening *Acids*, witness its being put to water acidulated with *Spirit* of Salt, *Nitre* &c. the acidity will presently be altered, and mortified: next by its closing *Acids* wrapt up in the texture of another body, as appears by its mixture with *Sal armoniack*, where its *Alkali*, (for it can be no other) catcheth hold of the *Acidum* of *Sal marine*, and so breaks the compage of the *Armoniack Salt*, setting the volatile *Urinous Spirit* at liberty. Thirdly by the heat it makes (after extinction by infusion of water) with an acid *Spirit*, as when *Spirit* of *Vitriol* is poured upon *extinguish'd Lime*, a heat is thence caused. Lastly, By the observing that the water of its extinction, will serve to open the body of *mineral Sulphur*, by boiling them together, which it will do almost as well as if the water had been acuated with fixt *lixivial Salts*: both which work upon *mineral Sulphurs* by their *Acids*, as we shall demonstrate more clearly afterwards.

And as to the *Acidum* in *quick-lime*, we say it owes its original to no other then to that *Fire*, contracted in the calcination of the *Stone* and that it was not pre-existent before calcination. Now that *Fire* in the actual flagration of combustible bodies, doth (in that violent Fermentation of its principles) fix its *acidum* (while the *Sulphurous principle* wheels off into the Air) upon some bodies it meets withal

suitably

suitable for the reception thereof; and how that from the difference of *Acids* in several *combustable concretes* by *flagration*, intangling themselves with, and *fixing* upon other *bodies*, different effects are produced: I might confirm by many instances.

The former is evident (amongst the rest) in the *reverberatory calcination* of *Lead*, in its preparation into *minium*, where the *Acidum* in the flame of *Wood*, centers and fixeth it self upon the *Lead*, and gives considerable increase of *weight* thereto: So in like manner (to come nearer to our purpose) the *Acidum* of *Cole* in the *calcination* of *Lime-stone*, doth by a continued *reverberation*, fix it self in the *cra-*
nies and inward *recesses* thereof: Thus in the *calcination* of *Vitriol* by the *rayes* of the *Sun*, in the preparation of the *Sympathetick powder*, the *pondus* thereby becomes increased.

And then as to the latter, *viz.* the different effect upon *bodies* from the variety of *Acids* in actual *ignition* or *flagration*, either *fixing* themselves thereon, or at least by some *sleighter intrusions*, shewing a different operation, we could demonstrate from our *observations* upon burning of *Bricks*, hardening of *Iron* or *Steel*, *calcinations* of *minerals* and *metals*, various *reverberations*, and many other *mechanical operations*, (solely owing their original to the difference of the fore said *Acid*,) nor to say

here, how amongst other *Phænomena*, the difference of *colours* amongst *minerals* and *metals*, contracted by *calcinations* and *reverberations*, owe their *original* to this source of *varieties* of *Acids* in different sorts of *Fires*, which for brevity sake we now omit, referring to a further *discourse* thereof in another place.

By the power of the foresaid *Acidum* in *quick-lime*, communicated thereto by *Fire*, in the *calcination* thereof, it is, that the *water* of *Lime* will perform what other more usual *Acids* cannot; for instance, That *Lime-water* mixed with any *volatile Urinous Salt*, and distilled therefrom, fixeth, yea, turns the *Salts* into an insipid powder, or *indissoluble calx*, concerning which, the ingenuous *Zuelfer* writes, *notes, quin etiam* (saith he, speaking of this very thing) *huic aquæ recenti salia volatilia jungerem, moxq; vidi effectum, sc. salium dictorum totalem destructionem, & eorum in calcem vel pulverem insipidum indissolubilem, omnino odore, & sapore, privatum, ignisq; violentiam in posterum strenue sustinentem, conversionum*. The like probably would *minium* do to the same *volatile Salts*, if mixed therewith, and that from the same cause, *viz.* the *Acidum* contracted by the *Fire*, and from the same *Acidum* it is also, that *water* of *Lime* cast plentifully upon *boiling Milk*, will curdle it. And from these two, *viz.* the *Alkali* and *Acidum* (which

we have demonstrated to be in *quick-Lime*) put into a *strugling fretting motion*, by their *solution* in *water*, is (according to our *Hypothesis*) the very cause of *heat*, obvious in *quick-Lime*: For unless these two be dissolved, no *Fermentation* happens, and consequently no *heat*. Hence it is, that although rectified *Spirit of Wine*, *Spirit of Turpentine*, or other such like *Sulphureous Liquors* be added, yet cause no *heat*, because they are not competent *menstrua*, nor suitable *Liquors* for the dissolving the foresaid *Alkali* and *Acidum*, from whose *solution* and *combating motion*, proceeds the *heat*: But we have at large *discourst* upon that subject in our *Lithologia Physica*, to which I refer the Reader therefore shall now forbear further to insist thereon.

CHAP. X.

Lastly, as to *heat*, and sometimes *ignition*, which is caused from the *collisions* and *attritions* of hard solid bodies, we may without any difficulty *solve* from our formerly deposited *principles*: As (for instance) that *heat* and *ignition* which proceed from the *attritions* and *percussions* of *Flint* and *Steel*, the *attritions* of *Steele* and *Wood*, of *Steel* and *Pyrites*, or any other *Gritt* or *Free-stone*: The at-

trititions of either sappy or dry wood, as happens in the *violent motion* of the Axis, or *Wheels* of *Coaches*, *Chariots*, *Wagons* or *Mills*: all which *Phænomena* we can well (and we think rationally) charge to the account of our former *Hypothesis*, viz. That they are performed no other way, then by a quick and sudden *excitation* of the *implanted principles* of *Acid* and *Sulphur*, being by percussion, allision or attrition put into a speedy *Fermentation*.

For the better understanding whereof, we are to consider both the *nature* and *temperament* of those *bodies*, as also the manner of the production of *Heat* or *Fire* therefrom, as to the first, they are all of them such, in whose texture our *principles* of *Fermentation*, viz. *Acid* and *Sulphur*, lye scattered and interspers'd; what are *Flints* and other *Pyrites*, but *stony concretions*, who have a *Sulphurous principle* for their *cement*, which lyeth close shut up in their bodies, especially in some of them, the *flagrable Sulphur* is so fast *locked up*, as that it appears not by any usual manner of way: unless either by *attrition* of other *bodies* (wherein an *Acid* and *Sulphur* hang more loosely, viz. *Iron* or *Steel*) or by the *solution* of some powerful *menstruum*, such as the *grand solvent* the *Alchabest*: whilst others of them have their *Sulphur* more easily *extricated*: of which last sort it is *G. Fabricius* speaks when he saith

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that out of any the *Pyrites*; *equo excutitur ignis, excoquitur etiam Sulphur.*

What is *Iron* or *Steel* (the latter being but the former hardened) but a *metal* wherein eminently (above the rest of *metals*) doth appear an *Acidum*? witness its easie mouldering into *Rust*, being a natural *calcination* thereof by the bare *acid moisture* of the *Air*: For what *Fire* by its *Acidum*, doth to *Iron*, loosening the *innate acidum* thereof by actual *calcination*, the same in a longer tract of time doth the *connate acidum* of the *Air* to the *inbred acid* of *Iron*, which then working upon the *native Sulphur* doth unhinge it, and so together taketh in pieces the whole *body* into a *crocus*; And although *Copper* hath also an implanted *acidum* (the chief cause of its contracting an *erugo* in the *Air*) yet it is not so easily *extravertable* by the *acidum* in the *Air*, and therefore *defends* it self the better from the *injuries* thereof.

Lastly, (not now to name any more) what is *Wood*, whether in a *sappy Branch* or *dry* (but *firm*) stick, but the more strong *concretions* of *vegetable juices*, wherein the foresaid *principles* of *Acid* and *Sulphur* are, in the one *freshly acting* in the work of *vegetation*, and in the other *lye dormant* under the bonds of *coagulation*: So that if the same *principles* be actuated and accelerated in their *motions*, as they are by sudden *collisions* and *attritions*, they may

thereby be put into stronger *Fermentations*; and at length be *invigorated* to that height, as actually to take *Fire*: which (according to our *Hypothesis*) is the very reason why a *Green Branch* or Stick, by strong and frequent *attritions* (one part upon another) will *Fire*; also why the *Axis*, *Staves*, or *Wheels* of *Coaches*, *Wagons*, and *Mills*, will from strong and violent *motions* and *attritions*, take *Fire* and burn. The like may be said concerning all the other foregoing Subjects, as to the causes, or manner of their *striking Fire*; which now we shall insist no longer upon: only this (by the by) I would take notice of (before I have done with this matter) that *frications* (which are slight attritions) of the parts of the body, which by the *Ancients* were much in use, towards the assisting the cure of many Diseases, whose peccant matter lay much in the habit of the body, were grounded upon this very reason, *viz.* that they thereby help'd the *Fermentation* of the *blood*, and other *dormant juices*, which lay *coagulated* in the outward parts of the body, benumbing the *Nerves*, *Muscles*, and other outward parts; and that if *Physicians* would now more frequent the use thereof, might probably find an advantage thereby in order to the *Cure* of *Diseases* by invigorating those dorming *Ferments*, putting them into *action*, whereby the *offending matter* might the better be *discuss'd* and *evaporated*.

CHAP.

CHAP. XI.

THus having (as compendiously as we could) run through the causes of *Heat* and *Fire*, as the result from all sorts of *Fermentations*, in the triplicity of *natures Empire*: and shewed *Heat* to be *Fire* in a *remiss*, and *Fire Heat* in an *intenc'd* degree, or if you will a slow or more quick *motion* of the *principles* (I mean *Fermentations*) solves both; and shewed also these *Fermentations* to proceed from a wrestling of *Acidum* and *Sulphur*, excepting those made from an intestine struggling of *Acidum*, and a fixt *Alkali*, or *Acidum* and *Urinous Spirits*: Now come we to the last thing we propounded, and that is, how from our deposited *Doctrine* of *Fermentation*, to solve that other grand *Phænomena*, viz. *Light*.

Not now to treat of *Light* as it is *communicable* to us from the great *Fountain* thereof, the *Sun*, which, as we suppose, consists in an *illumination* of *Air* by a perpetual emanation or *eradiation* of *solar beams*, springing from an incessant, but peculiar *Fermentation* in the body of the *Sun*, and fostered by an unwearyed *circulation* of *Æthereal matter*, *Light* and *Heat*, as proceeding from the great *source* thereof,

thereof, we conceive to differ only in this, viz. That *Light* is the bare *illumination* of the medium the *Air*, by a direct *progressive motion* of *Æthereal matter*, from the foresaid *Fermentation*, as the proper *object* of the *Eye*, and by which all other things are seen, while *heat* is the *reflection* or *reverberatory motion* of the same *luminous beams* (proceeding from the said *Fermentation*) from the *Earth* or other *solid bodies*, affecting (by that *Fermentative motion*) our *Organs of feeling*, concerning which, we may elsewhere modestly propose our opinion.

Our design at present is, onely to discourse of the *nature* and *manner* of such sort of *Lights*, which we find amongst *bodies* we usually converse with upon the *Earth*, and within the verge of our *Atmosphere*: which are as followeth, viz. the *Light* of culinary *Fire*; I mean, of most usual *combustable concretes*, the *Light* of all *Sulphurous matters*, whether in the form of *mineral Sulphurs*, *Gumms*, *Rosins*, *Turpentine*, *Axungia's*, &c. or in liquids of *Bitumen*, *Oyles*, *vinous Spirits*, &c. The *Light* of rotten *Wood*, long dry'd *Fish*, as *Codds*, &c. who have an *incipient putrefaction*; The *Light* of *Glow-worms*, *Cats-Eyes*, *Light* from attrition of *Wood* green or dry, which have thereby taken *Fire*, from the attrition or percussion of *Steel* and *Flint*, or any *Pyrites*, from the friction or

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pectation of *animals*: such as are Light from the Combing a *Womans* head (as sometimes hath been known) Light struck in the *currying* of a *Horse*; and that Light I have seen from a sudden *frication* upon a *Catts-Back*; of some *Liquors* the Light of *subterranean Lamps*; the perpetual Light preparable by the *exuberate Mercury* of the *Philosophers*, graduated by *circulation* and *cobobation*, according to our English *Anonymus*, who had seen it done.

The Light of some *precious Stones*, as *Carbuncles*; some sort of *Diamonds*, magnetical of Light, as the *Bononian-stone*, prepared by an artificial *calcination*. Lastly, The Light of *meteors*, amongst which may be reckoned *Lightening*, *flashes of Fire*, or Light seen in Storms upon the Sea, also those *luminous meteors* which in great Storms at Sea are seen to cleave to the *tops of Maine Masts*, and at the *Sterns of Ships*, by the *Ancients* call'd *Castor* and *Pollux*, by our English-men *corpus-Ants*, and very probably is the same with that *meteor* we call *ignis fatuus*, of which, as also concerning the Light seen upon the impressions of footings in the *Sand* upon *Sea-shores*: we shall shortly speak more.

All which give Light in the Dark, *viz.* in the *Air* not *illuminated* by any Light from the *Sun*; so that we may say of things that occur

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to our sight, that they carry Fire and Light in their Bellies, and that by an *excitation* of their intrinſick *Ferments*, their *inside tapores* are ſet above board : It remains therefore that we try theſe Lights, and examine whether all or moſt of them, may not (according to our *Hypotheſis*) be ſolv'd from various degrees of *Fermentation*, grounded upon our *principles* of *Acidum* and *Sulphur*, from various cauſes differently *excited*.

We ſhall begin with that which is moſt *obvious*, viz. *culinary Fire*, and examine how Light is produced therefrom : no ſooner are the inbred *Acidum* and *Sulphur* of any *comburable concrete*, ſet into a violent *Fermentation*, kindled by the *Fire* or *ſymbolical Fermentation* (already in actual motion) put to it, but forthwith by the help of the *Air*, the *principles* are ſet into a *rapid inteſtine motion* : which yet more and more being ſharpened by the *Air*, ariſeth by *degrees* to that pitch, as to fall into an *actual ignition* ; and from thence being yet more *thin'd* by the *interweavings* of the *Air*, breaks forth into *flagration*, or *ignition* with *Flame* ; *Fire* and *Flame* ſeem to differ only in this, that in the *ſtruglings* of the *principles*, and thereby in the rejecting the *heterogenites*, the *Air* is more *complicated* in making *Flame*, then in bare *ignition*, *Flame* being but *Fire*, *rarified* by the *intertexture* of *Air*, which
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by such *ravifaction* of a dark cloudy smoke or fume, makes a *diaphanous Flame*.

Air is necessary for *ignition* and *flagration* upon a double account: First, from its *moisture* (brought into it from the grand *Fermentation* and *Circulation* of other *Bodies*) whereby the *principles* of Firing become more *liquid*, and thence fall into a more intently furious and colliquating *Fermentation*, according to that of *Silenus* the *Epicurean*, brought in by *Virgil*, *semina terrarum*, &c. --- *Et liquidi simul ignis*; next by its own peculiarly, plyable, penetrative, and circulating *nature*, whereby it insinuates into every of the *principles actings*, keeping them in a constant agitation, thereby maintaining their *wheel of motion*, as long as any *combustable matter* remains, and is well put together.

So that by the first qualification, *Air* by its spongy nature, imbibes *moisture*, wheeling off from other *bodies* in their incessant *Fermentation*, and thereby becomes qualified for keeping other *Fermentations* afoot, and then by its other *qualification* of penetration, and being as a *Fan* to blow off the loose *Corns*, (as I may say) or *heterogenious matter*, ingendred by the foresaid *rapid Fermentation*: And by both it becomes truly capable of assisting the *principles* of *Acidum* and *Sulphur* in their furious *combating*, as thereby to turn vast *bulkie bodies* of

of combustible matter, first into *Fire* and *Flame*, and at last (by winding off) into *water*, leaving some few *Ashes*, wherein remain some *Salt*, and in some *vegetable concretes*, the *seedling* of the former body: For all combustible bodies, are by this agitation of the *innate Acidum* and *Sulphur*, with the co-operation of the *Air* (in that double foresaid respect) reduced after a little rotation into the *Air*, to *water* again; And although *Fire* moistens no bodies put thereto, yet doth it really go off, not onely in a *liquid*, but *humid form*, witness the condens'd *steams* of *mineral Sulphur*, or *Brimstone*, burning under a *Glass campana*, is sav'd in an *acid Liquor*, also *Spirit of Wine*, fired and condensed by such an *artifice*, appears in an *insipid water*: yea, for ought I know, the like might happen (with some small variation) to most combustible bodies, if their *fumes* were *condensed* by such a contrivance: however the *Air* at the long run *condenceth* all those *steams* (*Fire* wheeleth off in) into *water*.

This being premis'd, we say that the highest degree of *Fermentation*, whereby the *principles* are put into a *rapid motion*, maketh *Fire*, and that is done by the help of *Air* as aforesaid, which *Fire* of *ignition* gives *Light* by a continual winding off in *luminous rayes*, springing from the foresaid *Fermentation*, and that by
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the further *complications* of Air, interwoven in the texture of *Fire*, whereby the otherwise *gross fumes* gains a more *Æthereal liquidity*, is that we call *Flame*, which is yet more *luminous* than bare *ignition*.

Not here to insist, whether *Light*, either of the *Sun*, or other *luminous bodies*, be made any other way then by *refraction*; for although the *rayes* of the *Sun* make their *exit* in *right lines* from the source of their *Fermentative motion*: yet being to wade through a *fluid medium*, I mean our *Atmosphere*, where, ever and anon hitting upon *liquid particles* of *rarified water*, born up by a *Columnne* of the same, extended perhaps as far as the *surface* of the *Earth*, (and may be further) must needs have their *Lines* broke, their *Files* disordered, and their *Rayes* much altered, being put into *oblique motions*, amongst such a *Sea of watery atoms*: Notwithstanding which *refraction*, a *luminous body* may not undergo any sensible variation as to *locality*, and that because our *Eye* is plac'd in the same *medium* with the *luminous body*, (if such as represented to us here below) And as to the *Sun*, perhaps that may be the very reason of the difference betwixt the apparent and real place thereof: whereas, an object so *scituate*, as to have the reflecting *luminous rayes* to pass through two *mediums* of different textures, must need sustain a greater diffe-

difference, as to the *locality* thereof, witness an *oar* part immerst in *water*, part out, or a piece of *Silver* in a *Bason* of *water*. But a *luminous body*, becoming such by having its *principles* of *Acid* and *Sulphur*, heightened by a furious *Fermentation*, and being plac'd in the same *medium* with our *Eye*, the *luminous rayes* continually winding off in that *rapid motion* of the combating *principles*, although (I say) they make their *Exit* in *right Lines* from the *Source* of their *motion*, (viz. the body they issue from) yet must they be continually *hitting* upon *watery Atoms* they meet with in the *Air*, which are many times back'd with strong *Cylinders* of the same, whence they are *distorted* from their *right Lines*, and become *refracted* from each of the adjacent *watery bulla's*, where-by, for ought we know, the *rayes* of such *bodies* in their *illuminating motion*, may become the more *intended*, then if they should have reach'd the *Eye* in *right Lines*, directly from the *object*.

For hereby those *watery particles* may become as so many *minute apake Specula's*, by which, each of these *luminous rayes*, being once broke from its *direct line*, becomes by various *reflections* and *refractions* multiplyed, first hitting upon one, then slanting off another, and so *ad infinitum*, yet retaining their first *impulse* from the *Fermentation* or *transmissi-*

on from the *luminous bodies*, whereby those rayes of *Light* are infinitely increased in their *illuminating property*, easily communicating a *diaphaneity* to the adjacent and *ambient Air*, to confirm which, we may observe how notably a *stream of watery particles* cast from a *Spring*, through a *Cylinder of Sun-beams* (the eye being placed in the shade) cutting it at *Angles*, intends the *Light* thereof, make by *reflections* and *refractions* new appearances of *Light*.

CHAP. XII.

Thus much concerning *Light*, as proceeding from *culinary Fire*, or from ordinary *combustable concretes*, put into that rapid furious *Fermentation* we call *Fire*: The same we may say of the causes of *Light* in all *sulphurous matters*, whether in the dry form of *mineral Sulphurs*, *resinous Gumms*, *Turpentine*, &c. or in *Liquids*, as *Bitumen*, *Oyles*, *Vinous Spirits*, &c. All of them in their *flagration* or *flammability* requiring *Air*, and that in the double acceptation thereof, as aforesaid. We shall therefore in short take leave to say, that these have their intrinsic *principles of Acid and Sulphur*, set awork into an *actual flagration*,

tion, by being kindled by some *congenial* fiery *Fermentation*, and that by the assistance of the Air both as a Sponge and as a Fan, especially the last, which thereby not onely promotes the *incipient Fermentation*, but also is necessarily required for the *perpetuation* thereof, as long as any of the *principles* remain yet unwounded off by *flagration*.

That there is an *acid principle* in all these, we may elsewhere prove by demonstrable and undenyable arguments, &c. That there is also a *Sulphurous principle*, no eye will doubt it upon beholding their *flagration*, inasmuch, according to the vulgar acceptation, *Sulphur* must be in all *combustable matters*, onely we may observe, this difference there is betwixt common *culinary combustable matters*, and those last named, *viz.* That the first are complicated with more *heterogenous matter*, wrapped up in the texture of those *concretes*; the latter are more *simple*, come nearer to the *nature* of the *principles* themselves, and therefore are the more readily and easily *flagrable*, and consequently sooner give their *exuberant Light* to which the Air hath more easie admittance towards the keeping the *principles* at work, and to the facile boying them up in a constant *luminous aerial flame*, burning without glowing, or any considerable residence of a *Caput mort'*, especially in some *Oyles*, and in all rectified *vinous Spirits*.

The same may be said of *Light*, arising from attrition of Wood green or dry, which having its *inward principles* of *Acid* and *Sulphur* rouz'd up by so *quick a motion* as attrition produceth, gives the same appearances of Fire and Light, and that from the same causes, as that which is done by *actual flagration* from other external *Fire* added thereto.

So likewise the same may be urg'd in the solving the *Phænomenon* of *Light*, arising from *attrition* or *percussion* of *Steel* and *Flints*, or any *Grit-stone* or *Pyrites*; for as by that sudden motion of attrition or percussion, the *acidum* of the *Steel* and the *Sulphur* in the *Flints* or *Pyrites*, are set into a *rapid Fermentation*, whence (as we have shewed before) ariseth *Fire*: So *Light* being the immediate product and result of *Fire*, must needs appear. Wherefore the causes of *Fire* and *Light* arising thence, are the same with those produc'd from others more obvious, onely are differently put into *action*, yea the *Air* is as much interested in the *excitation* of the one, as the other: And that according to the qualifications and manner aforesaid.

Nor need we go much further for solving the reasons of *Light*, which appeareth from *frication* or *percussion* of some *animals*; such as *Light* from the *Combing* of a *Womans head*, (as hath been known) that struck in the *curry-*

ing some *Horses*, and that from a sudden *frication* of a *Cats back*, if we consider the two first, as depending upon the *peculiar texture* and singular *disposition* of the *Fermentative juices*; For it is not all individuals of either of the *species*, from which that appearance of *Light* is *obvious*; but onely those in whose *constitution* the *principles* arise, or are graduated to a peculiar *efflorescence*, in the very *formation* or genuine *production* of *animal Spirits*, carryed by the *nervous juices*, as their proper *vehicle*, into the habit of the *body*, which being *excited* by that sudden *motion* of *pectation*, &c. readily by the help of the *Air*, give those quick *flashes* of *Light*. And as to the last, *viz.* the striking *Flame* or *Light* from a *Cats back* by *frication* in the *dark* (as I have sometimes taken pleasure to see done) that I cannot otherwise impute, then also to proceed from the peculiar *graduation* of the *principles Acids* and *Sulphur*, in the texture of that *animal*, and what is done by that sleight artifice in exciting the *efflorescence* of the *principles* in a luminous *flame*, may (for ought we know) be done naturally by a brisk, but slender woven *Fermentation*, perform'd either in the texture of their *eyes*, or rather in the very *fabrick* of their *animal Spirits*, being a brisk *floridnes* of those *juices*, proceeding from a most depurate and heightly *volatiz'd Sulphur*, carryed away to the

the *Eyes* by the *optick Nerves*, from whence we suppose it is that their *Eyes shine* and give Light in the dark.

Which last I am induc'd to believe, *viz.* That this *luminous efflorescence*, peculiarly resides in the *animal Spirits*, even in all the fore-said instances, carryed by the *nervous juices* into the habit of the body, because (in the last instance) the *frication* being made along the *Spina*, running down the *vertebre* of the back, excites that *volatile* and highly depurated *Sulphur*, into a *luminous flame*: whence its very probable, that many other *animals*, especially those which are highly fed, and whose *animal Spirits* are of a *fine spun texture*, having their *Sulphur* highly *volatiz'd*, would I say upon trial be found, (from the fore-said causes excited by *attrition*, *pestation*, or the like) to give the same *luminous flame*.

In the next place, we come to give the reasons of Light in *rotten Wood*, and *dry'd Fish*, &c. where we are to observe, that as in the causes of Light afore-said, from the *principles* of *Acid* and *Sulphur*, variously put into *motion*, being excited into a *Fermentation* divers ways: So amongst the rest, this by *putrefaction* is not the least; for Wood shines not till its *principles* of *Acid* and *Sulphur*, by a retrograde motion, fall into a *new sort of Fermentation*, whereby it winds off what the *principles* in

their *generative Fermentation* wound on, viz. unravels its own *Clew*, taking in pieces what the other built up, in which *putrifick analysis*, the foresaid *principles* make different assaults upon each other, by the *intermission* of *moisture* in the Air, fortified perhaps with an *acidity*, repugnant to that of the concrete : And as *moisture* in the Air, is necessary towards the promoting *Fermentation* in a generative way ; so likewise as necessary to the helping forward the destructive or retrogressive *Fermentation* in taking bodies in pieces.

For *putrefaction* always begins where the *principles* terminate their actions in *generative motions*, viz. upon the *external superficies*, or *outward rims* of all Bodies, where the ambient Air touch them, and thence begin their *retrograde motion* in the natural *analysis* of Bodies ; which is evident from this observation, viz. That I know by an *artificial exclusion* of Air, how to preserve most (perhaps all) sorts of *Fruits*, newly taken off the *Trees*, as supposed *Gooseberries*, *Apricots*, *Damsons*, *Cherries*, &c. so that in *January* I have had *Tarts* made of them to entertain Strangers with, as we else do where in our *Lithologia Physica* further shew

So that it is from a peculiar sort of *Fermentation* betwixt the *Acidum* and *Sulphur* in the unhingeing the compage of the concrete

whence

whence proceeds the flaming brightness of rotten Wood; For the *principles* are not all wound off, but onely are a going off in a *luminous brightness*, whence also proceeds its facile *susception* of Fire from any Spark thereof: insomuch, as the last Threds of *natures unraveling* in the reduction of bodies by *putrefaction*, (especially in some) is of the finest sort, the *volatile Sulphur* winding it self off (by slender *vibrations* from the *connate acid*) in a subtile but *luminous rotation*.

The like account may be given of Light, from some sorts of *Fish*, hung up till they undergo an *incipient putrefaction*: For while their *principles* of *Acid* and *Sulphur*, do by the *moisture* in the Air, undergo a *putrefactive Fermentation*, the *Sulphur* by those retrograde motions, becomes more *volatiz'd*, and by gentle touches from its *inbred Acid*, winds off in a *luminous flame*: In which supposition we are the more confirm'd, inasmuch, as they *shine* not till a sleight *putrefaction* of their *juices* be already begun: To which may be added, that in their *putrefactive reductions*, a *mucilage* is made to appear, which is the *receptacle*, and as it were *sperme*, wherein the two *principles* do the better shew themselves in their *vibrations* and *luminous productions*: which *mucilage* the *Fish* imbib'd and incorporated into its self, (according to all probability) from the

estuations of the Sea, upon Storms and Tempests, of which we shall speak further below.

As to the Light from *Glo-worms*, its probable that sort of insect takes its *original* from the *putrid juice* or excrements of some *animall* or other insect, wherein the *principles* are *winding off* in a slender texture of an *eradiating brightness*, which juice that insect yet *retains* : For I look upon the slender woven *flame* inherent in *Glo-worms*, and other fore-said *putrid juices* to proceed from a mutual, but gentle *vibration* of the *principles* in their *retrograde motion* ; which although without any *sensible heat* (that it has none, we dare not say) yet *ceteris paribus*, to be in some measure answerable (as to the *ground of the causes*) to that *flame*, made from the *principles* in their *generative motion*, heightened by *frication*, *attrition*, or the like, into a burning *luminous flame*.

CH A P. XIII.

NOW come we to treat of the production of *luminous Meteors*, and to enquire into the causes of their Light ; such I mean, as happen within the compass of the *Atmosphere* : For the better understanding whereof, we are

first to conceive of the *Earth*, as a body, in whose *intrails* various *Fermentations* (especially such as relate to *minerals*) are continually at work to the compleating the generation of *Minerals* and *Metals* to the making *Hot-Baths*, the producing the *fontes acidi*; and to the perpetuating other grand *Phænomena* of Nature: Next, that these *Fermentations* of *subterranean juices* (I mean as to the effects thereof) terminate not always upon the external *cortex* of the *Earth*; but are continually breath forth: whose *subtiliz'd* and *volatiz'd particles*, (especially the *Sulphureous*) are incessantly passing off in the slenderest of textures, viz. in a subtile *aporrhæa*, or invisible *steame* into the *Atmosphere*, filling it with plenty of *agil nimble parts*, floating in the Air, as in their proper *Sea*, and dissolv'd therein, as in their peculiar *fluid menstruum*.

Also we are to conceive, that the *Atmosphere* doth not onely lodge plenty of the fore-said *effluvia*, arising from *mineral*, but likewise from *animal* and *vegetable Fermentations*, wheeling off in *tenuous combinations*, and slender woven nexures, (undiscernable to our Eyes, although fortified by the best *microscopes*) whereby the Air becomes the common receptacle of *innumerable multitudes* and *swarms* (as I may say) of *volatiz'd Acid* and *Sulphurous particles*, not onely issuing through the pores

pores of the *Earth*, but also from other bodies upon the surface thereof, continually spending themselves in insensible *effluvia*, kept a foot by their *unwearyed Fermentations*.

In which consideration we are to apprehend of the *Earth*, not onely as the common *matrix*, impregnated with those intestine *Fermentations* from *mineral juices*; but also as from whose *exuberant lap*, plenty of other more simple, and sometimes sensible (I mean *watery*) *steams*, are, especially from *springie places*, continually issuing forth: insomuch, as those last are discernable to a curious eye, intently looking upon the surface of the *Earth*, a little after *Sun-rise*, the eye being somewhat elevated above the *Level* of the *ground*, and directed towards the *Sun*, by which *curious observation*, Springs themselves are sometimes found out.

And as the *Earth* in the consideration aforesaid, so also every particular *concrete* has its *Atmosphere*, more or less extending its *orb* of *activity*, according to the quick or slow pac'd *inward Fermentations*, I mean, according to the more brisk or flat *onsets* and *encounters* of their principles *Acid* and *Sulphur*: And further, that many of those slender woven *combinations*, are by reason of their tenuity, so indissipable, as to retain the *specimen* of their *first original*, even after long, at least succedane-

daneous rotations in the *Atmosphere*, whereby they become capable of performing other *effects*, to which they are naturally propence, from the *occurrence* of other *co-working* causes, as is evident in many *unusual effects* in or from the Air, whose causes, lying so remote from our senses, we do not easily apprehend, concerning which, we have not time now to reckon.

These *considerations* being premis'd, it will not be difficult hence to solve the *Phænomena* of those short liv'd *luminous* textures, *Meteors*: wherewe shall not need to our help, to call in, either the *exhalations* of the *Peripateticks*, because grounded upon improbable causes, amongst which that of the supposition of *extrinsical heat*, as the efficient, is not the least: Or the *Cartesian Globuly*: Or *Gassendus*, his *Glomeres*, being supposed complications of *Nitro-vitriolick-Sulphurous-steams*: Or *Nitro-aereal particles*, common to the Air and Nitre, according to the *Hypothesis* of a late Author. Nor lastly shall we call in any other *Hypothesis* to contribute to our assistance: But shall study to trace the *footings* of our own *principles*, although making their way through (as yet) hidden and unknown paths; making our *free inquest*, whether *Meteors*, may not from our forelaid *principle*, be genuinely and satisfactorily solv'd.

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We say therefore, that amongst the *Mineral* and other *Apporrhea*, the *Sulphurous*, especially the *Acido-Nitro-Sulphurous* are not the least; which mustering in *long-droughts*, when the Clouds *ride high*, being born up at those *seasons* by a stronger *elasticity* of the Air, upheld by strong and long *Columns* thereof, and one Cloud being higher then another, by its own weight (and wanting stress of Air to bear it up) falls upon the *subsiding*; which by the sudden *percussion* of the Air, makes that *explosive motion* or *crack* we call *Thunder*, together with a *rushing wind*, which usually attends those *Thunder-claps*, which is nothing else but a pressure of Air, circulating from the *coincidence* of the two *Clouds*: Now by the sudden *allision* of the foresaid *Clouds* upon the *Acido-Nitro-Sulphurous-complications*, floating in the *Atmosphere* (as aforesaid) heightens them into a *quick vibration*, and *momentary flagration*, we call *Lightening*; which although it be done in the very same *moment* with the *crack*, as proceeding both from the same causes with different respects; yet because *luminous percussions* do more *quickly* make their *transits* through the *medium*, therefore it is sooner *seen*, then the other *heard*, (as might further be illustrated, if I would now insist upon it.)

So that *Lightening* owes its causes to the sudden *percussions*, or *attritions* of the *Acido-Nitro-Sulphurous apporrhea* in the Air, made by the sudden falling of one *Cloud* upon another: which we cannot better represent by *similitude* to our *understanding*, then by the observation of a sudden *flash* of *Fire* or *Light*, struck from the allision of a *Flint* and *Steel*: For the thin *Acido-Nitro-Sulphurous textures*, are in that part (as well as in others) of the *Atmosphere*, which is comprehended betwixt two *Clouds*, and the *percussion* of the Air, as also of those foresaid *minute effluvia*, wheeling in the Air, make them to appear in a *sudden flash*, as happens from the foresaid *allision* of *Flints* and *Steel*.

Not here to insist upon the reasons, why (according to our *Hypothesis*) *Lightening* is sometimes so *penetratively powerful*, as to kill *men*, or other *animals*, without the least appearance of any *bones broke*, or breach of *skin*; How so piercing and liquifactive a *canstick*, as to melt a *Sword* in the *Scabbath* (which sometimes has been known) while the *Scabbath* it self has remain'd safe? Why it comes with such *force* and *fury*, as sometimes to tear up by the *Roots* the strongest *Oaks*, and other *Trees* of *mighty bulk*; and other-while breaks and splits the bodies of huge *Trees*; throws down *Houses*, overturns *Wind-Mills*,
and

and causeth other the like *Cataſtrophies*, dismal and frightful to behold: witness amongst the rest, the late sad and dreadful calamity, which happened from *Lightening* and *Thunder* the last year, in several Citties in *Holland*, but chiefly in *Utrecht*; which although that, and the like, be Judgements from GOD, yet are not without their natural causes.

And from the foresaid *Acido-Sulphurous effluvia*, passing through the Sea, and sometimes gliding upon the surface thereof, happens those sudden flashes of *Fire* or *Light*, taken notice of by some *Sea-men*, by them seen in *Storms* upon the Sea, shining in the Night like *Fire*, being struck up by sudden percussions betwixt *Air* and *Water* from the furiousness of *Storms*; whose *corruscation* is observ'd in more plenty, during the collisions of *Clouds*, *Winds* and *Seas*, whence *Storms* and *Tempests* then at any other season.

The like may be said as to the causes of those *luminous*, but narrow-siz'd *Meteors*; which in great *Storms* at *Sea*, are seen by *Mariners* to cleave to the Masts and Sterns of Ships, anciently called *Castor* and *Pollux*, by our Sea-Men *Corpus-ants*; in both which, the foresaid *aporrhoea*, whether floating in the Sea, or Air, conterminous to the Sea, being agitated, the one into a *Fermentative* flagration, or thin-woven flame, the other into a figur'd *Meteor*;

in both, I say, the foresaid *Acido-Sulphurous effluviū* is struck up into a *luminous flame*, by the fore-nam'd *attritions* and *percussions*.

Which last, I mean the *Corpus-ants*, are very probably (as my ingenious Friend J. R. well observes) the very same *Meteor*, upon the Land, we call *ignis fatuus*, which seemeth to run before people, and is sometimes in *Storms* seen to cleave to *Horses Maines*; which I say is very likely to be carryed by *Storms* ashore to inland places, and that too at remote distances from the Sea: which *ignis fatuus*, or *noctivagus*, is observ'd in greater plenty in or upon *Storms*, and more rare in a *clear* and *serene* Skie.

And lastly, (to name no more) we may reckon that sort of *Light*, to be from the same causes with that of *Meteors*, which my foresaid ingenious Friend (whose unsuspected veracity in matter of fact, is sufficiently obliging to me, to be credulous of his relation) has observ'd to appear in *dark Nights*, upon walking on the *Sea-shore*, in every impression of his *Foot*, upon the lifting up his *Heel*, he espied a *Light*, or *sparkling brightness*, with which being surpriz'd, and desirous to know what, and whence it was, fetch'd a *Lanthorn* and *Candle*, took up in his hand some of that *matter* which gave the *Light*, which he found to be a *mucid matter fere instar pituitæ*, and that

that he had often seen this *matter*, which was a *pellucid recrement*, cast off upon the Shore, from a boyling Sea *estuating* with Storms.

So that it should seem, as if by the *percussions* and *attritions*, betwixt *Wind* and *Seas*, made by Storms, upon the *mutual collisions* of the aforesaid *principles*, or *effluvia*, whether in *Water* or *Atmosphere*, or both, not onely the foresaid sudden *appearances* of *Meteors* happen, but also by the *estuating* of the Seas, a *mucilaginous matter* is ingendred, wherein as a *sperme*, those forenamed *luminous effluvia* (I mean such as are struck up by *percussion* and *attrition*) fix themselves, which sometimes is *hovering* in the Air, and cleaves to *Masts* or other parts of *Ships*; other while is caried off by *Storms* upon the *Sea-Coasts*, and thence further in *Land*, gives those *appearances* of *ignis fatuus* and the like: and sometimes, or in part is rejected upon the Shore, and gives cause for that foresaid *Phænomenon* of *Light* in the *impressions* or *footings* upon the *Sands*, after Storms are over; and may contribute to the making some sorts of *Fish*, upon their *putrefactive resolutions*, give that usual appearance of *Light*, according to the account we have given thereof above.

We might here take an occasion of insisting upon other sorts of *Meteors*, as *Mill-dews*, *Blastings*, &c. all which proceed from the same

Acido-

Acido-sulphurous effluvia, floating in the *Atmosphere*, and struck up, by the *mutual attritions* and *collisions* of *winds*, *clouds*, and the like; being carried in certain *Channels* or *Peroledi* of the *Air*, to the producing their *usual effects*, but shall now wave any further discourse thereof.

CHAP. XIV.

NEXT to which, we come to enquire into the reasons of *Light* from *precious Stones*; of which there are three sorts, which will give *light*: first such as shew their *native lustre*, by shining in the *dark*, without any previous *excitation*; of which sort are *native Carbuncles*. Secondly, Such as need a previous *frication* to the exciting their *Light* and *Lustre*: of which are some peculiar sorts of *Diamonds*; Or lastly, Such as are *magnetical* by a preparatory *calcination*, of which sort is the *Bononian stone*.

As to the first, *viz.* That of *Carbuncles*, the cause of whose *luminous rays* we can no other-wise attribute, then to the *irradiation* of a glaucious incombustible *Sulphur*, disseminated through its whole body, *imbibed* in, and *fixed* to, a most *defecate* matter, (imbib'd, I say, whilst

whilst that exquisitely pure *petrifick matter*, was yet in its *pristine juice*) through which that highly graduated *tincture*, or Philosophick *Sulphur*, is incessantly *vibrated* ; concerning which we have discours'd more at large in our *Lithologia Physica*.

The same we may say of some sorts of *Diamonds*, onely with this difference, that these to shew their *Lustre*, require a gentle *excitation* by a *previous friction*, whereby the fore-said *luminous* incombustible *Sulphur* gets more at liberty, and darts forth the better.

Now that some particular sort of these do by a gentle *friction* shew their *lustre* in the *dark*, I have from the *autopsie* of my worthy Friend Mr. *Shippen* : Yea that some sorts of *Diamonds* are not onely *luminous*, but also *electrical* of a Needle after a previous *excitation* by *friction*, I am assur'd by the *honourable Boyle*, who acquainted me, he has had one of that sort : As also, that the *King* (as he told me) has one that will do the same very remarkably.

As to the cause of *Light* in those which by a foregoing *calcinatory* preparation, become *magnetical* of *Light*, of which sort is the *Bonian stone*, (and perhaps others might be found out, that by the like artifice would perform the same.) It depends, I say, on, and proceeds c^{on} from, the *peculiar texture* of such

such sort of *Stones*, so wrought upon and altered by the *Fire*, as not onely to *imbibe* as it were, the *rayes* of the *Sun*, but also for a time to *fix them*, suffering them leisurely to go off again, and so become by *fresh impregnation*, capable of performing the like *emissions* of *Light ad Lubitum*: concerning which *Light* issuing from the three foresaid noble *petrifick bodies*, we insist more largely in our *Lithologia Physica*, to which (when extant) we refer the Reader.

And as to the *Light of subterranean Lamps*, although those be generally reputed (and that too by very learned and intelligent persons) amongst *Chymera's*, suppos'd to be merely *fictiones*, yet I am not altogether of their *opinion*; but do think, there is a possibility in *nature* for them to have been really performed. Now the reason why it is generally concluded in the negative, is taken from the defect of *Air* in those close *caverns*; inasmuch as all sorts of vulgarly known *Fire*, need the *access* of *Air* to the keeping up that *rapid motion* in *combustable bodies*, which being secluded, those *Fires* thence depending, of necessity must dye.

But we suppose, and in part know, that there is lodged in most, especially in some particular bodies, an *incombustible Sulphur*, known chiefly to the *Adepti*, to whose invigorating

actions, and enlivening *operations*, the outward *Air* of our *Atmosphere* doth not at all contribute, yea during some particular *seasons* of *working*, ought wholly to be *excluded*. To confirm the *possibility* in *nature* of such kind of *Fire* that may be maintained and perpetuated without *Air*, I might add, that I have with my own Eyes seen a *Flame* or *Fire* in the *cavity* of a *Glass*, which as soon as the *Stopple* was taken forth, became (contrary to the *Genius* of all *vulgar Fires*) immediately *extinguished*: So why might not those sorts of *Lamps* recorded in *History*, to have been performed by the *Ancients*, (viz. amongst the *Romans*, who might probably have the *Art* from the *Grecians*, and those from the *Ægyptians*) have been *Fed* with such kind of *Fire*, even in the greatest *seclusions* of *Air*, and upon their being expos'd thereto, when found, might as easily and speedily *extinguish*: concerning which, we may probably elsewhere further enlarge.

Lastly, as to the *perpetual Light*, preparable by the *Philosophers* exuberate *Mercury*, graduated by *circulation* and *cohobation*, as also a *luminous Liquor* demonstrable by *Art*: upon which we shall not now insist, both because we do not pretend to be a Master of any such thing; as also because we have touched thereon in our *Lithologia Physica*.

CHAR.

CHAP. XV.

THus having compendiously run through the great *varieties* of *Fermentations* in the threefold *Kingdom* of *Nature*, and shewed the various *Phænomena* of *Light* in different bodies, in that part of the *Scene* of *visibles* we converse with, solvable by our *principles* from different causes, put into various *motions*. Now it remains to conclude this *Doctrine* of *Fermentation*, first by elucidating our *principles* from *collateral authority* : Next, by shewing how from the great *variety* of *Acids* acting upon *Sulphurs*, may divers other *Phænomena* be naturally solv'd.

As to the first, *viz.* to confirm and illustrate our *principles* to be in all *concretes* throughout the triplicity of *natures Empire*, besides what we have in brief said, and reserve also for a *further discourse*, we might here bring in the *Authority* of the great *Hypocrates*, and some others of the *Ancients*, to shew how this *concordia discors*, the *principles* I mean of *Acidum* and *Sulphur*, contracted into *Seedlings*, are interspers'd in the *seminals* of all things ; whence by such kind of *Fermentation* (as aforesaid) all things *vegetate*, come to their

acme and decline; yea, from which the whole Scene of *visible concretions*, are by a certain struggling from their *central Fires*, brought into *action*, lively pourtray'd upon the Stage of the World.

But because we take an occasion in our Epistle to touch thereon, we shall forbear; and at present onely add the authority of the intelligent, learned, and worthy *Borichius*, who in his late piece *de Hermetis, Ægyptiorum, & Chymicorum sapientia*, a tract highly valuable, and worthy the perusal by all ingenuous persons) in one place, as if measuring forth our *principles*, saith to this purpose, *viz.* Nul-

P. 413. *lum animal ostendi potest, ex quo oleum [& hoc est animalium Sulphur] educi nequeat; nullum, ex quo nihil aciduli possit seperari: nulla planta, quæ non vel oleum vehat, vel spiritum admoto igne flammantem; nulla, quæ non pressu succum profundat, si sibi permittatur, in acidum quiddam sponte abiturum. Metallica ut robustioris temperamenti, Sulphure & Mercurio non carent, equidem hoc primum illis cum animalibus & plantis commune est, quod rara minera illa sit, quæ Sulphur verum & flammaturum solícite inquirentibus non offerat; nulla, quæ ingeniose in alcohol tenuata, & aeri, si opus est, tantillum exposita, distillatione non spiritum acidulum expromat.*

Not here to insist on what the learned Dr. Willis saith in this matter in his Doctrine of Fermentation, who as he urgeth, *ob salis fluorem* (how rightly let others judge) so we, *ob acidi pre-* dominium, *vinum, lac, sanguis, cerevisia, edulia prius grata & dulcia, quando corrumpi incipiunt, ingrate acescunt.* To which we shall add the suffrage of the industrious Tachenius (a consideration highly worth his own due and well-weighing inspection) *Lac* (saith he) *sponte acescit, sicut & reliqui succi tum vegetabilium quam animalium, cum in putrefactionem tendunt: imo nil putrere neq; generari potest novi, nisi precedat aciditas.*

De Ferm.
p. 10.

Hip. Chym.
p. 90, 91.

As to the last thing propounded in order to the concluding this discourse: we might say, that *Acids* in order to the *concretions* and *reductions*, *coagulations* and *liquifications*, *condensations* and *rarifications*, *solidity* and *fluidity*, and other various *modifications* of *bodies*, differently denominated, according to the different impressions they make upon our *sensual Organs*; I say, *Acids* in the *solving* the fore-said appearances of *bodies* in the main, fall under a double consideration, *viz.* either as *active* and *fluid*, or *passive* and *consistent*.

Under the first, *viz.* while its *active*, and so its *succulent, liquid, or fluid*, after which man-

ner it appears in all *actual Fermentations*, whence immediately result those grand *distinctions* of concrete bodies, known to us under the notion of *animals, vegetables, and minerals*; which *Fermentation* is previous to all manner of *concretions* in the *triplicity* of *natures workings* (as we have in the foregoing *discourse* briefly illustrated) For while *vegetation* amongst *Plants, animation* in the compofure of *juices*, and thence of the structure of *animal bodies*, and *mineralization* in order to *Hot-Baths*, are perform'd; the *Acids* concern'd, must, I say, of necessity be *fluid* and actually *succulent*; otherwise a stop or lett would immediately be impos'd upon the *workings* of *nature* in the *formations* and *transformations* of bodies, and consequently would cease to propagate themselves.

For no growth or accretion of parts in the *genesis* of *natural bodies* is perform'd, without a *succulent Fermentation*, where an *Acid* is in an *actual, yea fluid motion*: From which *succulency* of *Acids* together with intermediate *coagulations* and *hardenings*, perform'd at due seasons, all concrete bodies in the threefold *Kingdom* of *nature* are produc'd: and from these two, *viz. Acids in succis solutis*, working upon their *inbred Sulphurs* by a natural *Fermentation*, and from the *concretions* of these *juices* by the help of the *ambient Air*, always

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(in the *generation* of bodies) conspiring to such effects, I say from the *motion* of *liquid acid juices*, and their *weavings* by *concretion* seasonably perform'd, it is, that from very *minute seedlings*, Plants are brought on to great bigness.

Thus from *Oak-Seedlings*, call'd *Acorns*, (whose *seminal* part lyeth in a very small and inconsiderable compass) may be produced too, and is daily growing to be, great *bulkie Oaks*: So that when we see a vast spreading *Oak*, and look at a small *seedling*, whence such in process of time, is produc'd: if we consider what has been done, and which way *nature* has so busied her self, as to bring forth so *disproportionable* a bulk to the little plant *Embrio* compriz'd in the *seedling*: we cannot, I say, chuse but view the *inward agents*, set at work in the *epitomiz'd Oak*, in a *fluid state*, which by the expansive motions of their *juices* in their natural *Fermentative vegetation*, as they come to the *Air*, become thereby woven into *Stems* and *Leaves*, and by further hardenings, are *condenced* and *incrusted* in part into *Wood* and *Bark*: So that by the concretions of the *Sap* (wherein the *principles* are in a *liquid state* of *Fermentation*) carryed up betwixt the *Bole* and *Bark*, are made considerable *increase* in *Bulk*, till at length it swell to that *huge stature*, we see many of them grow too.

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As to the *bulk* it self of an *Oak*, *Ash*, &c. it oweth its *original* (as well as all other *concretions* do) materially to *water*: But that water should be *form'd*, *coagulated*, and put on the shape of an *Oak*, *Ash*, &c. that is wholly ascribable to the *intrinsic* agents or *intestine principles* of *Acid* and *Sulphur*, set in the *seedling* into a *Fermentative motion*, displayed into that *figure* by the manuduction and evolution of the contracted and shut up *Seed*, carryed up and conveyed by their *proper Vessels*, whether by the names of *veins*, *arteries*, &c. with their accompanied *Air Vessels*, according to the ingenuous *Malpigi*, and our Countreyman *Dr. Grew*. What we have said of an *Oak* is compatible *suo modo* to all other *vegetables*.

Then as to the other consideration *Acids* fall under, in order to the *fabrick of bodies*, whether in the form of *natural* or *artificial concretions*, viz. as it is *passive*, or becomes *consistent*, so it stands in *opposition* to *fluidity*, or rather is the complement thereof, determining it into *solid bodies*: For we see no other cause to which *natural concretions*, *coagulations*, *incrustations*, *consolidations*, *congelations*, &c. comprized under the *notion* of *binders* up of *bodies*, can or ought to be more genuinely refer'd then to *Acids*, under this consideration: what I pray are *Stalks*, *Leaves*, *Husks*, *Grains*, &c. of *Plants* or lesser *vegetables*, but the *Acidum*

dum woven and condens'd (with some *sulphurous* parts) into those *forms* by the access of *Air*? what are the *bole*, *bark*, and *branches* of *Trees*, or larger siz'd *vegetables*, but the *concretions* and *hardenings* of the *native Acid* *juices*, together with the inclosure of some *sulphurous* parts, by the co-operation of *external Air*? what the *Fruits* of *Trees*, but the *coagulations* of *Acids*, sweetened by their *Sulphurs*, thereby brought on to *maturity*, and thence made fit for other *Fermentations*, in order to *potable Liquors*?

What, amongst *animals*, is *flesh* and *muscular* parts, but the *coagulation* of the *blood* and other *humours*, to whose *constitution* a genuine *Acidum* in a due proportion is *essentially requisite*? What the *Bones*, but parts *consolidated* from implanted *Acids*, in whose *coagulation* or *condensation*, some *sulphurous* parts are also taken in? And as in the natural constitution of the *body*, and *encrasie* of the *humours*, *Acids* are chiefly concern'd in the *concretions*, *coagulations* and *consolidations* of the parts; so likewise in the *dyscrasie* of *animal juices*, and *preternatural concretions* and *indurations*, &c. of the *body*, *Acids* are primarily concern'd: Thus what are *Fistula's*, but *callosity* and *obdurate hardness* of the *inward parts*, viz. the *veins*, *arteries*, &c. being hardened by a *spurious Acidum* lodg'd in those particular

lar parts? What are the *podagrical Tophi* and *Nodi*, but the *Synovia* of the *Joints*, hardened and congealed by a *gouty Acidum*, fixing it self by *coagulation* upon those parts? What are *hard tumours*, but swellings from *Scorbutick Acids*, or from *Acids* of some badly cured *Disease*, lurking in its *Acid seminary* for a time, till other concurring causes sets the *spurious Ferment* more a work, and by the predominant *Acidum* (the general *faber* of pains and dolours) the *Vessels* are obstructed, and the *humours* of some particular parts *coagulated* into those *obdurate swellings*. Lastly, What is the *Stone* in the *Gaul, Bladder*, or other parts of a *humane*, or other *animal body*, but chiefly an *Acidum* fixed upon a *petrified Earth*, and *urinous Alkali* or *volatile Salt*, taking in some *Sulphurous parts*, but especially, as I say, bound up, or knit together by the *vinculum* of an *Acid*: Of which, further in our *Lithologia Physica*.

Amongst *Minerals*, What are all *fossil* and other *mineral Salts*, but *concretions* chiefly perform'd by the power of *Acids* in the bowels of the *Earth*? In particular, what are *Sal marine*, *Vitriol*, *Alom* and *Nitre*, but *concretions* of *acid juices*? And indeed what are the generality of *artificial Salts*, or such as are made by *mixture*, but such in whose texture *Acids* are chiefly and primarily concern'd, and with-

out:

out which scarce any saline concretion at all doth appear? What are *Stones* made in the bowels of the *Earth*, but *liquid* subterranean *juices* of *alcalizate*, or other proper matter, arrested by *acid steams*, arising from some *Fermentation* of *mineral juices*, which together pass into those *petrified* concretions; as we sufficiently (and that *de industria*) demonstrate in our *Lithologia Physica* and *Halologia Chymica*.

What are *Minerals* themselves (being *immature Metals*, having the *principles* of *Metals* but after a *crude, volatile, imperfect manner*) such as *Brimstone*, *Antimony*, *Pyrites*, *Auripigmentum*, &c. but *Sulphurous* concretions, bound up by their *intrinsic acids*, taking into their compage other *Heterogenities*, as we have in short above declared, and may more at large, God willing, in another place. Yea, to go higher, what are the *Metals*, but a *metallick Sulphur*, bound up by a peculiar implanted *Acidum*, in the *mercurial juices*, whose mixture being not perfect, through a *complication* of some *heterogenities*, makes the imperfect, but those being removed by a closer bond of the *metallick principles*, gives the perfect *Metals*, unseparable and unalterable by the power of the strongest culinary *Fire*.

We might go yet further, and ask what is the *Philosophers Elixir*, (if such there be in
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rerum natura) but such a close weaving of *metallick principles*, (whose *Acidum* is intimately and inseparably united) all so highly graduated, as to become a *fixt coagulated tincture*, of so extensive a *nature*, as to be able to make *quick transits* through, and thereby to hinge into its own *fixity* and *purity*, other *imperfect metallick bodies*?

So that upon a serious inquiry with our Eye directly levelled into the *works of nature*, we cannot but conclude; First, That all manner of *coagulations*, *congelations*, *condensations*, *salifications*, *petrifications*, yea all sorts of *concretions of bodies* (or of *juices into bodies*) are primarily ascribable to *Acids*, as their grand *faber*, of which we discourse largely, and demonstrate (we think) clearly in our two fore-said Tracts. Secondly, That by these fore-said *coagulations*, *salifications*, *petrifications*, and other *concretions*, the *connate Acidum* doth so combine with the *Sulphurous parts* it closeth with, as that both pass into a *quid tertium*, or neutral result, partaking of both, and yet distinguishable by neither: insomuch as the *Acidum* by such sort of *coagulations* and *concretions*, looseth its Sting, and becomes thereby altogether unperceptable: And hence is the reason why although *Acids* be the very *foundation* of all *coagulations* & other *concretions of bodies*, yet are themselves, as to our gust, in many things

things the least discoverable; which because we cannot easily get to the insides of bodies in their natural productions, shall therefore endeavour to *demonstrate* and *illustrate* by *artificial mixtures*, resembling the *natural*.

Thus in mixing the *Runnet* or usual *Ferment* to *New-Milk* upon *heat*, or while warm after *Milking*, the *acidity* of the *Runnet*, not only makes the *Milk* split into *Curds* and *Whey*, but is it self so *coagulated* with the *Curds*, as not to become perceptable at all: so that *Cheese* is nothing else but a *neutrum*, or *neutral result* from an *Acid*, and curdling parts of *Milk*, coagulated together, while *Cream* is the *Sulphurous* parts of *Milk*; and *Butter* is the *coagulum* of that *Cream*, separated by a slender *Fermentation* procured by the motion of *Churming*; which very *coagulation* of *Butter* is from a combination of some small quantity of *Acidum* with the *Sulphurous* parts.

Thus also from the *Acidum* in *Wines* (of all sorts) in *Ale*, *Beer*, *Syder*, &c. being poured upon warm or boiled *Milk*; from the *Acidum*, I say, in any of the foresaid *Liquors* it is, that the *Milk* separateth into *Curds* and *Whey*, or *posset-drink*; the former of which are made lighter or stiffer, according to the difference of the *Acids*, and various manner of application of the *ingredients*; in which *Curds*, the *acidum* of the *Fermentable Liquor*

is

is wholly *coagulated*, which is a good way of mortifying or correcting all sorts of *fretting Acids*, whether in bad *Wines*, or other *Liquors*, which all fix (if there be *Milk* enough) in the *Curd*: and yet that *Curd* is a neutral, and the *Acid* not at all perceptible therein; yea in case of bad *Wines* or other *Drinks*, where the *Acedum* is too eager and *fretting*, to those who do not care for *Posset-drink*, and yet would not loose their *Wines*, or other *Liquors*, I would (being prompted from the foresaid cause) propound as an expedient, to put a spoonful or two of *boyling Milk* upon a Pint or Quart of such sort of *Liquors*, stir it about, if the *Curd* rise to the top to *skim* it off, if not to run it through a *filter*, whereby it will become *clear*: and so you have corrected your *Wines*, &c. and made them fit for *drinking*, or in lieu of that to put a *toft* of old Wheat bread therein, which will imbibe much of the *superfluous Acidum*, and make the *Drink* thereby more wholesome.

From the foresaid cause of *Acids* it is also, that Fat congeals in *animals*, which is but the *Sulphur* of the *blood congealed* by its own, or at least acquired *Acidum* of the *Air*: which after melting by *heat*, (whereby the *Acid* becomes *fluid*) congeals again in cold, into that consistence called *Saem* or *Tallow*; and from the *facile congelation* of the *Sulphurous parts* of the
blood

blood in some animals, from the *acidum* under either or both considerations, *viz.* of native, or acquired from the *Air*, it is, that for instance *Conies* and *Field-fare*, become *Fatter* in Frosty weather: and from the like cause, the *Fat* of *Land-animals* is hard (as the ingenious *Dr. Grew* notes in his *discourse* of mixture) while that of *Fish* is very soft, and in great part *runs* to *Oyle*, *viz.* because the first sort are expos'd to the *acidum* floating in the *Air*, and thereby continually (to proper ends) inspired: and the latter, being always *immers'd* in *water*, is much what depriv'd of that congealing *aereal acidum*.

And as *Acids* are remarkable in the various *concretions* of *animals*, *viz.* in the coagulations into *Flesh*, consolidations into *Bones*, congelations into *Fat*, &c. whereby they shew their different operations upon various *juices* of *animal bodies*; and thereby also combine into neutral results as *aforesaid*: so likewise, the same is evident amongst *vegetables*: Thus express'd *Oyles*, especially when the *innate acidum* so prevails by some *acquirements* from the *aereal*, do by keeping, grow *rancid* and *thick*; as also is further apparent in the mixture of *acid Spirit of Nitre*, with *Oyle Olive*; whereby the vegetable *Oyle* is *coagulated*, and made *consistent*, being congealed thereby into a *white Fat* or *Butter* (as *Dr. Grew* observeth.)

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And as *nature* produceth *Rosins* and *Gums* in Plants and Trees, congealing the *juices* off wounded *Stems*, *Boles*, *Stalks*, *Heads*, &c. by the *acidum* of the *Air*, according to the disposition and genius of the Plants, whence *Rosins*, as of *Turpentine Scamony*, &c. *Gums*, as *Camphire*, *Opium*, &c. so in like manner *Art* in imitation of *Nature*, and from the same principles, can produce somewhat equivalent thereto: Thus if the *acid Oyle* of *Vitriol* be mixed with the *Oyle* of *Anise-seeds*, the *vegetable Oyle* is immediately (by the *acidum* in the *mineral distill'd Liqueur*) congeal'd into a perfect *Rosin*.

Yea, and by the addition of *Acids* to some *vegetable Oyles*, may be resembled the production of *Turpentine*: Thus *Oyle* of *Vitriol* added to the distill'd *Oyles* of *Turpentine*, *Nutmegs*, *Juniper*, &c. after *Fermentation* become of a consistence altogether emulating usual *Turpentine*, without the least appearance of *Oyle* swimming on them; nay, although *Spirit of Wine* be afterwards added, yet will it cause no *separation* of any of the *Oyle*: But the contrary happens, if you add *Spirit of Wine* to an *essential Oyle*, before mixture with the *Oyle* of *Vitriol*; for then the *Spirit of Wine* and *Oyle* of *Vitriol* unite, and reject the *essential Oyle* to the *superficies*: So that the reason why distill'd *Oyles* by the foresaid artifi-

fices

fice, subside in the form of a *liquid Turpentine*, is because, that upon *Fermentation* from the foresaid mixture, the *Oyles* receive such an alteration, by suffering their *volatile parts* to go off, as that what remains, combining with the *Acidum* of the *Vitriol*, becomes thence more a *Turpentine* than an *Oyle*, and consequently, as heavier, must subside, although *Spirit of Wine* be put thereto, which otherwise would *swim* above it.

So that from the premisses it will naturally follow, that *Turpentines* are indeed but *liquid Rosins*; and *Rosins*, no other then concrete *Turpentines*, and further, that *Turpentines* are *Oyles* incrassated or condensed by addition of *Acids*: yea all, but several disguises of *Sulphur*, altered according to different degrees of *Acids*, and their various assaults upon *Sulphurs*.

Its worth (by the by) our *observation*, that even from the mixture of some *Acids* and *Sulphurs*, sanguification (I mean as to its *tincture*) may as well be imitated and shadowed forth unto us, as from those of *volatile Alcalies* and *Sulphurs*: Thus the *acid Oyle* of *Vitriol*, mixed with the *essential Oyles*, either of *Turpentine*, *Juniper*, *Nutmegs*, or *Amber*, *Strikes* (besides the *Fermentation* and intense heat they cause) a deep blood red colour, as I have tryed; And I do not know yet,

but that even *Alcalies*, whether *fixt* or *volatile*, may from the same reason of their hidden and shut up *Acids*, intend the *colours* of Sulphurous *vegetables*: concerning which *Acids* we elsewhere touch: yea, and from the same operation of the genuine *Acids* upon their proper *Sulphurs*, in the great work of *vegetative Fermentation*, are struck those various, and no less *admirable colours*, in the great field of *vegetables*, as we have hinted before.

And to conclude, as we have shewed *water* to be the *material principle* of all *concretions*: so the *distinction* and *specification* thereof, depends upon *Fires* or *Ferments*, lodg'd and hid in the inwards of *Seeds*: which *Fires* or *Ferments* are differenced from the great variety, chiefly of *Acids*, not onely in *Fermentation*, but *Concretion*, in *Fluidity* but *Solidity*, and consistency of bodies: For whats the *tapestrey* of *vegetables*, in their peculiar verdure, span-gled with an *amicab'le lustre*, but so many *central Fires* or *Ferments*, at first hid in their *seminals*, and afterwards by the co-operation of other conspiring causes, displayed into almost infinitely variety of *Plants*, branching themselves in their different, delicate, and beautiful *colours*? And what are *animals*, but *vital Lamps* burning in *bodies*; and yet those bodies no otherwise consum'd, but by the glowing, dwindling, and at last extinguishing off those

those *vital tapers*? whereby not onely *animals*, but also *vegetables* are apt (besides their common putrilage from plenty of moisture) to spend themselves (by the declining of the foresaid *Ferments*) in *hecticks* and wearing *marasmes*, which *vital Ferments* are more noble then the *vegetable*, because working in greater varieties of Vessels, and therefore the more highly by *circulation*, sublim'd and graduated into *animal Spirits*, the ultimate product of *vital Ferments*, yea in humane bodies is the very *vinculum* of the *rational Soul* (that Heaven born Creature) to the body, being its *vehicle*: here a large Field is open, where I could freely let my thoughts and pen run; but shall at present set up my staff, and content my self (although unwilling) in drawing the Curtaine over the rest, and indeed at length, after many conclusions, make an End.

F I N I S.

*This following Paragraph is to
be inserted instead of that in
page 11. line 29.*

HENCE it is, that some of those *Sulphurous--*
hot-waters, may with good success, in
order to the *Cure* of some *Diseases*, be taken
inwardly, others not; Those that may, are
generally such, whose *Sulphurs* are either
from *Common Brimstone*, *Vitriol*, or *Antimony*,
or from *Marcasites* and *Pyrites* bordering
thereon: of which sort (among the rest)
are those of the *Bath* in *Somerset-shire*, which
take their *original* from such kind of *Minerals*,
or *Mineral juices*, lodg'd in the *bowels* of those
great *Mountains*, at the *foot* or *centre* whereof
those *Baths* break forth; which although of
late are found to be *successful* in the *Cure* of
some *Diseases*; yet its very *suspicious*, they in-
jure other persons, who, without good ad-
vice, *drink* those *waters*; so that as to a uni-
versally medicinal water, they come far short
of the *Sulphur-water* at *Knarsbrough* in *York-*
shire. And indeed these *hot-Sulphur-Bath-wa-*
ters, ought to be *drunk* with a great deal of
caution, and but by some persons, and that too
in *extraordinary cases*, yea in no wise to be
drunk

drunk as a general healing water. Those Sulphurous hot-waters, which are altogether improper for inward use, are such as are impregnate with the Sulphurs of Bitumen, Arsneck, Rissogalla, &c. or with the Minera's thereof, or at least with such Marcasites as participate therewith, they are such as we elsewhere name. Now the acidum which necessarily concurs to those Fermentations, as an indispensable Sulphur, opens the bodies of those Sulphurs, and thereby either detains them while in fieri, in succis solutis, or from concretions reduce them to such; by either way, renders some wholesome and healing, others noxious for inward use, according to the difference of the foresaid Sulphurs.

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A
DISCOURSE
OF THE
Sulphur-Bath
A T
KNARSBROUGH
I N
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B Y
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*A Discourse of the Sulphur-
Bath at Knarsbrough, con-
cerning its Causes and Vir-
tues.*

THat I may not be injurious to what I have already writ in my two former Books, entituled *Hydrologia Chymica* and *Hydrological Essays*, concerning the *Sulphur-Well* at Knarsbrough, as a *mineral water* of great use in its virtues inwardly taken. But now designing an account thereof, as a *Bath* for outward use, shall therefore, in order to the better understanding of what I aim at, here resume so much of my former *discourse*, concerning the *Essential ingredients*, and *necessary principles* of that *Water*; together with an addition of some more recent *observations*, as may serve to illustrate what I now intend to be my present task: Our method will be as followeth.

2 A Discourse of the Sulphur-Bath.

1. To lay down the constitutive ingredients or *mineral principles* of that *Water*.

2. To shew the process (as near as we can apprehend) *Nature* useth in the preparing this *excellent water*.

3. To shew the difference betwixt this and other natural *Hot-Baths*, as in their original and inbred *principles*; so also in some sort as to their virtues.

4. To shew how, and by what means, the *Sulphur* (as the chief *mineral ingredient* in this water) is so opened, as to become, not only so subtile, as thence to be solvable *odore tenuis* therein; but also so *volatile*, as to pass off in a continual *steame*, and insensible *effluvium*.

5. How this *Sulphur-water* comes not much short, as to its *original principles*, nor is much (if at all) inferiour in its efficacy, to some other *Sulphur-waters*, which are *Hot-Baths*; inas-much as this is lately found to be *successful* for *outward applications*, as well as those by late *observation* are remark'd for inward use.

6. To shew, that the artificial heating of the *Sulphur-water*, bears some analogy to the *inbred heat* of other *Baths*, as they come hot out of the Earth.

7. To shew, how *Art* may imitate *Nature*, (but yet from the same *principles*) in the resemblance of most *Baths*, viz. how to prepare such *Baths* artificially, as are natural.

Lastly,

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Lastly, To inquire how and after what manner this *Sulphur-water* performs those expected helps, as a *Bath*: where, in short, will be illustrated its various virtues in order to the help of several *Maladies*.

First, As to the constituent ingredients or *mineral principles* of this *water*: We say they are compriz'd in these three, viz. 1. A *marine* or *fossil Salt*. 2. A *Sulphurous Apporrhea* or *steam* of *Sulphur*. Lastly, A little *aluminous acidity*. As to the first, viz. *Salt*, is apparent both from its brackish taste, as also from what remains upon its *distillation* or *evaporation*; of which we find betwixt one and two drams in a quart thereof: as we further shew in our *Hydrologia Chymica*, &c.

2. As to the *Sulphurous principle*, thats manifest, 1. From its Taste and Smell; as also from its hogo upon the *risings* and *regurgitations* of the Stomack, after taking thereof. 2. From its colouring of *Silver* dipt therein; which it doth as readily as the solution or washings of *crocus metallorum* from the *Sulphur* of the *Antimony*; or as the solution of *common Brimstone* in the preparing *Lac Sulphuris*, both being made from the *Acids* of *alcalizate Salts*, as will appear (although a paradox) more clearly anon.

And lastly, from its colouring of *Silver* by its very *Steams*, as we shall shew more afterwards.

Now

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Now the question may be ask'd, whence this *mineral water* has its *Sulphur*? I answer, that there are plenty of *vitriolin Marcasites* well saturate with *Sulphur*, out of which I have, by an artifice (taught in my *Hydrological Essays*) separated perfect *Brimstone*, which melted into *magdalions* or rolls, are not distinguishable any manner of way from the common: besides which *Marcasites* (found not far off this Spring) the very adjacent *Earth* is full of *Brimstone*.

Lastly, As to the ingredient of *Alom*, its discoverable these ways following, first from the *Alom-Bed* through which this *water* at last passeth, or at least toucheth upon, as is obvious to any eye that will look at it, being close adjoyning to the *exit* of the *water*.

2. By its *acidity* in the *water*, as is evident from its curdling of *Milk*: for the *Salt* separated from the *Sulphur-water*, being put into boyling *Milk*, will make it shil into *Curds* and *Whey*, as if some *acidum* was poured thereto, which *common Salt* will not do; for we try'd both, and that in the same proportion, and found the *Sulphur Salt* to cause a speedy *separation*, and that in great quantity; and the common *Salt* made a little *separation*, of a *lighter coagulum*, but did not make it shil, or alter the seeming colour or consistence of the *Milk*: And lastly, if the powder of *Coral* or *Crabs*

Crabs-Eyes be put thereto, they imbibe or mortify the acidity of the *Alom*, and cause a *Milkeness* from the *volatile Sulphur*.

And as the three aforesaid ingredients are found to be the *constitutive principles* of this *water*, so that neither *vitriol* nor *nitre* (however some imagine the contrary) are contain'd therein, is evident, first as to *vitriol* (which gives the most suspicion from the plenty of its *Marcasites*, found not far from the *Well*) because it will strike no *tincture* with *Galls*, as we shall shortly further evince: And as to *Nitre*, there is not the least suspicion, either from what is *separable* from the *water*, nor from any *mineral glebe* adjacent thereto, that we have yet discovered.

Secondly, As to the process *Nature* useth in the preparing this excellent *mineral water*, or the manner of her mixing the foresaid ingredients, by her *Chymistry* in the bowels of the *Earth*, in order to the making up the forenamed *Sulphur-Bath*: In short thus, a *water Spring*, suppose, passing through or by a *minera* of *fossil Salt*, part of which it dissolves, and afterwards in its current either *meeting* with some *acid juice*, whether of *vitriol* or of other *mineral glebes*, becomes impregnate therewith, and obviating, or rather supervening a *Sulphurous Mineral*, from the concurrence of which two, happens a *Fermentation*: or else,

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else, this Saline Solution comes upon a *minera*, whether that of *vitriol*, or what other soever it be, in the *meanders* of the *Earth*, whose *principles* are yet *crude*, and onely *embrionatus*; whereupon it sets those native and congenit *principles* awork, into a *Fermentation*, either way, I say, it becomes capable of raising that intestine motion, we call *Fermentation*, and thence of so subtilizing and volatizing the *Sulphur*, as to make it solvable in *water*, (as we have illustrated more demonstrably above in our *Doctrine of Hot-Baths*.) But not staying here, because of the continual afflux and pressure of *water*, at length it passeth through an *Alom-bed*, whose *acidity* precipitates in great part the body of the *dissolv'd Sulphur*; in which very *precipitation* happens its fatid smell, and *Sulphurous hogo*, which onely passing through a slender *Colander* of Sand, retains its lately contracted odour; where it filters off from the more *gross* precipitated *body*, and so makes its *exit*.

Which gives great probability of *heat* in the source of its *original mixture*, and that if the *Spring* did immediately after that *Solution* and *Fermentation* break forth, it would be *hot*, at least *warm*, after the manner of other *Hot-Baths*; but being carryed on in a longer line, in its *subterranean current*, before it breaks forth, *looseth* that *heat* contracted upon the

Fer-

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Fermentation of the aforesaid mineral juices.

And this is likewise remarkable concerning *Alom* interested in the fabrick of this water, viz. that I have (as often as I pleas'd to make the experiment) taken some of the *succulent Alom* slate or stone (found close by the *Well*) which has had the *Salt* discernably extraver-
ted, which when I scrap'd into simple water, would with *Galls* forthwith strike a deep *Purple*: after the manner which the *succulent Alom-stone* doth, which is got upon the *Scar-brough Bank*, near that *Spaw* [about which our great controversie, concerning that wa-
ters being *aluminous*, and not *vitriolin*, did chiefly depend] which experiment I have se-
veral times shewed to persons no less *ingenious* than *inquisitive*.

I also order'd an infusion to be made of some of the same *Alom-stones* in above a Gallon of *fresh water*, then to be *evaporated* to about half a Pint, which filtred, I evaporated fur-
ther in *Balneo M.* to try if it would shoot per se, but it would not, onely came to a soft sort of *matter* or *mellago*.

3. As to the third thing propounded, viz. the difference betwixt this and other natural *Hot-Baths* in their *original principles*, and *primary causes*: We think that from what has already been said, and especially what yet re-
mains to be discours'd of, in the next, and

M

other

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other *succeeding proposals*, that the difference of these from other *Sulphurous waters*, both as to their *origin* and *virtues*, will sufficiently be declared: And that *Sulphur* (of one sort or other) is chiefly concern'd in the fabrick of all *Hot-Baths*, and other *Sulphurous waters*, completing with other *concurring juices*, the essence of them both.

4. As to the fourth proposal, *viz.* how, and by what means, the *Sulphur* (as the chief *mineral ingredient* in this water) is so opened, as to become, not onely so *subtile*, as thence to be solvable *odore tenuis*, but also so *volatile*, as to pass off in a *continual steam*, and *insensible effluviu*m; For the great query is, how *Sulphur* may be so opened, as to make the *Sulphurwell*, and other *Sulphurous waters* of the like nature.

While I was therefore seriously ruminating upon this matter, *viz.* what it was that might truly be said to open the body of *crude Sulphur*, whether it was an *Acid* or an *Alkali*, I began to consider how many ways, and by what means, it was usually so opened, as to make a solution in any *Liquor*: First I considered it was solvable for the most part in all *Oyles*, by the help of *Fire*: and that I imagin'd happened from the analogy of parts, betwixt *Oyles* and *Sulphurs*; both of them being chiefly *Sulphurs* under a disguise, the one in a concrete, the other

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the other in a *liquid form*; both of them also in their bellies hiding their *intrinsic Acids*, the Oylie or Sulphurous parts of both by Fire melting together, in the fluid form of a Balsome, while the *acidum*, chiefly of the Sulphur, being thereby in part separated, doth condescend into a saline form, under the appearance of crystals, as is obvious in the preparing the Balsome of mineral Sulphur or Brimstone.

And as *vinous Spirits* are vegetable Sulphurs, comminuted and subtiliz'd by Fermentation; so these are also *succedaneous* to Oyles, in the solutions of Brimstone, yet need previous preparations by fixt Alkalies, (as they are called) for being so spiritualiz'd, are not such apt *menstrua* for solutions of crude Minerals, as Oyles are, although either of them are powerful enough for making very strong and furious Fermentations with the aforesaid mineral Sulphurs, once by their congenial Acids, brought, by help of Fire, into a *fluor*, in the form of corrosive *menstrua*: witness the high ebullitions betwixt *vinous Spirits* or Oyles, and Spirit of Nitre, Aqua-fortis, Oyle of Vitriol, &c. some of them so very furious in their Fermentation, as to arise to an actual flagration (as we elsewhere demonstrate.)

So that crude Sulphurs, unopened by the acuations of the *acidum* of Fire, (which also

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sharpen the implanted *Acids* of such *Minerals*) do dissolve quietly without any tumult; (if done leasurely) and melt together into one *Balsamick Liquor*, (though if hastily done with a pretty *smart Fire*, they make a *crackling noise*) whereas the foresaid *mineral Sulphurs* being *subtiliz'd* by their own *Acids*, fortified by the *acidum* of *Fire*, in their *distillation*, are brought thereby into a *fluor* off both *principles*, and if then mixed with the foresaid *vegetable Sulphurs*, contract a furious *Fermentation*, from the fresh *collisions*, betwixt *Acids* and *Sulphurs*, and if close shut up, would break in pieces the strongest Vessels art could contrive.

And as the foresaid solutions of *mineral Sulphurs*, are perform'd by *Oyles* and *vinous Spirits*, from analogy of parts ; I considered whether other sorts of solutions of *crude Brimstone*, or the like *Sulphurous Minerals*, might not also be done, by the like analogy, and then I pondered upon the *alterations* made upon *Brimstone*, &c. by *sixt alcalies* (which how properly call'd, we shew in our *Halologia*) and *quick-lime*, and by well weighing the matter, found, that as *Brimstone* was dissolvable in *Oyle* and *Spirit of Wine*, as aforesaid, so *sixt alcalies* work upon *Sulphurs*, no otherwise then as they are *acido-sulphurous Salts*.

For

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For I considered that *volatile Alcalies*, such as are all *urinous Spirits*, work not at all upon, nor cause any alteration in *Sulphurs*: therefore it must needs follow, that wherein *fixt* and *volatile alcalies* do agree, or in that property, which is common to them both, I mean, their *precipitating faculty*, neither of them is concern'd in the *solutions* of *Brimstone*, and that is common, both to *fixt* and *volatile Alcalies*, to precipitate, what *Acids* have dissolv'd. Now the reason why *urinous Spirits*, I mean *volatile Alcalies* (as they are call'd) do not at all work upon *Brimstone*, is, because they contain so very slender a texture of *Acids*, and no *Sulphurs* (if highly rectified) and therefore are incapable by analogy of working upon the aforesaid *bodies*: how *fixt Alcalies* are a new compage of their own native *Acids* and *Sulphurs*, together with the intertexture of *urinous Spirits*, (from whence proceeds its precipitating faculty) all bound up by the *acidum* of the *Fire*, (which is their *vinculum*) and not a *simple Salt*, we elsewhere in our *History* of *Tartar*, declare more at large.

While I was pondering upon this matter, at length methought I espyed a great *harmony* in *natures works*; I saw that she perform'd the same *solutions* of *mineral Sulphurs*, in some parts of the *bowels* of the *Earth*, by her own *men-*

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strua of *Acids*, prepared by her dextrous *Art* of *Chymistry* (the very foundation and exemplar of all we call *Artificial*) as she did in other actions, reputed (amongst most Authors) *Heteroclites* ; and was the same in the latter, as the former ; and from hence I saw, that reputed *causticks*, I mean *fixt lixivial Alkalies*, were no other then *Acids*, viz. of the *Fire*, fixt upon bodies : so that I found *nature* *symbolical* in all her *actions*, and always consonant to her own *principles*.

And that I might improve this *notion* the better, (not taken notice of by any other Author I know) I began to make a *strict scrutiny* into the *nature* of *fixt Alkalies* ; I considered, First, That the more *Fire* they endured, and the higher they were *calcin'd*, and the sooner us'd after *calcination*, the stronger and more fiery *Causticks* they were.

2. That they would never *calcine* to a strong *Salt*, unless perform'd in *open Vessels* or *Crucibles*, where the *Fire* might more immediately touch upon them, and *concentre* its own *acidum*.

3. That if after they were *cold*, and kept from the *Air*, and then *Spirit of Wine* or *Water* was put therero, thence a *heat* was presently produc'd, which as I conceive, was from no other cause then this, viz. That either of the *Liquors*, sets the *acidum*, contracted from the *Fire*, and the *Sulphur* or *volatile Alcaly* in

in the Salt, into a sudden *Fermentation*, dissolving, and so putting them into an *intestine collision*.

4. And fourthly I considered, That the longer these Salts were expos'd to the Air, even to a solution *per deliquium*, the more mild and soft in operation they become; losing thereby gradually their *Acids* imbibed from the Fire; insomuch as by often solution *per deliquium*, the compage of that Salt, from the *vinculum* of the fiery Acid, is taken off, as that the whole may thence be reduc'd into an *insipid Water* and *Earth* (and no *Arcanum* neither.)

Lastly, That although these fixt *lixivial Salts*, do make strong *Ebullitions* with *Acids* put to them, yet that happens, either betwixt the additional acid, and the Sulphur in the Salt, or betwixt it, and the *volatile alcaly*, bound up in the *artificial concretion*: That there are *Sulphurs* in those Salts, or new textures of Plants, appears from their *lixivial* or *saponary* property: and that there are also *volatile alcalies*, is evident from their precipitating faculty, and from their *intestine struggling* with acids.

To which may be added this observation, that after *fixt alcalies* have lost the *acidum* contracted from Fire, (which they do by keeping, and sometimes exposing to the air, together

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ther with the addition of somewhat which dints the foresaid *Acidum*) may then by Art, be made to split into Oyle and *urinous Spirit*, or *volatile Salt*.

As to that great objection against the *acidity* of *fixt lixivial Alcalies*, viz. the precipitation of such solutions made with *Alcalies* by *Acids*, inasmuch as it is generally observ'd, that what solutions *Alcalies* make, are most promptly *precipitated* by *Acids*. I answer, First, That although what more simple, I mean, *volatile Alcalies* do dissolve, are precipitated very readily by *Acids*, & *vice versa*, yet where *Alcalies* are more complicated, and interwoven with other essential parts, there the *precipitation* by *Acids*, of what those already have dissolv'd, are in no wise wholly ascribable to them as *alcalies*, but equally compitible to other parts in the concretion.

And in the next place I answer, that even some *acids* are capable of *precipitating* what others have *dissolv'd*; to prove and illustrate which, I try'd this following instance, viz. I took a clear solution of *saccharum Saturni*, which I had prepared with *distilled Vinegar*, which no man will deny to be an *Acid*; upon which I poured a pretty smart *Spirit of Vitriol*, whereupon it presently became *Milkie*, and caus'd a *precipitation* of a pure *white calx* of *Saturn*, which *precipitation* may also be done with *Spirit of Salt*. The

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The same likewise will *Spirit* of Salt do, poured upon a solution of *refin'd Silver*, made in double its weight of *Aqua fortis*, in preparing that admirable anomolous neutral concretion, call'd *Luna Cornea*, mentioned by the honorable Boyle in his *origin of forms*: and not onely *Spirit* of Salt but also *Oyle* of *Vitriol* will cause the like *precipitation*.

Whence its obvious to any eye, that what some *Acids* dissolve, others may precipitate from the *congenealness* of the *solvend*, to one *solvend* more then another: For both those wherein the *solutions* of the *metals* were made, viz. *Spirit* of *Vinegar* and *Aqua-fortis*, are as undoubtedly *acids*, as those which cause the *precipitations*, viz. *Spirit* of *Vitriol*, and *Spirit* of Salt.

So that the precipitation of bodies depend not upon *acid* or *alcalizate Liquors*, as such; but upon the *consanguinity* (if I may so say) of *bodies* or *solvents*, to *liquors* or *solvents*, viz. whilst an *acid* having dissolv'd one *body*, meeting with another *akin* thereto, lets the former fall, and from an abstruce *affinity* of parts, *dissolves* the latter.

From whence it need not seem *heterodox*, (although to the most it may, as yet, a *paradox*) to say, that *fixt Alcalies* open the bodies of *mineral Sulphurs*, as they are *acido-Sulphurous Salts*; and that chiefly as they partake

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take of the *acidum* of Fire, assum'd by *calcination*; and that *precipitations* of the same *solutions* may be perform'd (and that too without the least absurdity in *Philosophy*) by other supervening *Acids*, as we have even now demonstrated.

As I observ'd all *sixt* *Alcalies* made out of *Vegetables*, to work upon *Mineral Sulphurs*, on the account of their being *Acido-Sulphurous-Salts*; so I could not otherwise (whilst I look'd upon the matter with a very intent eye) judge of *calx vive*; whose manner of operation, in opening the bodies of *Brimstone*, and other *Mineral Sulphurs*, I could not charge to any other then its *Acid*, which it had contracted from the *Fire*, in the very *calcination* of that sort of Stone, call'd *Lapis calcarius*, (*viz.* Free-stone or Lime-stone) which that it chiefly partakes of the *Acidum* of Fire, and thereby performs not only that, but various other effects, we have already in short demonstrated, and shall further in *Lithologia Physica*.

From the premisses it will easily appear, in confirmation of our former *Doctrine*, that all solutions of *Mineral Sulphurs* in the bowels of the *Earth*, are made by their *peculiar Acids*; and that other solutions made by *Art*, are but from the same *principles* under other *disguises*; Therefore that which opens the body of Sulphur

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phur in these *Mineral Marcasites*, through which this *water* (we treat of) runs, must of necessity be an *Acidum*, which afterwards is precipitated by another *Acid* of the *Alom-bed*, through which at last it passeth.

As to that *experiment* we gave to illustrate the cause and manner of making that *water*, by opening those *vitriolin Marcasites* with *quicklime*, in our *Hydrological Essays*, although we there imputed it to the *alkali*; yet now from second and more mature thoughts, grounded upon experiment, as aforesaid, find it otherwise; where we profess such an avowed *proselyteship* to truth (sufficiently amiable and worthy in it self) as upon nearer apprehensions thereof, grounded upon better weighed principles, to decline what we have formerly at greater distance in any matter opiniated, and in this particular, have thence reason to wave the former, and to ascribe the solution of this great *Phænomenon* to the latter, viz. to the *Acid* in *calx vive*, which, in some measure, bears an *analogy* with that *Acidum*, nature useth by her own *Chymistry*, in the intrails of the *Earth*, for the solutions and extractions of *Sulphurs*.

As to the 5th thing proposed to discourse of in this our *method*, viz. how this *water* comes not much short, as to its *original principles*, nor is much inferiour in its efficacy, to some other

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other *Sulphurous waters*, which are *Hot-Baths*, which is evident (besides what has already been said) by the sequel thereof, *viz.* because the manner of use of both, in respect of what they have been, are now reciprocal; those of *Hot-Baths* being formerly chiefly known for *outward*, and these for *inward use*. But now of late are found, the former in some cases to be successful for inward use; the latter by *observation*, are now eminently remarkable for *outward application*: so that the manner of use of them *per se* considered, is inverted, and in a mutual respect, is reciprocal.

As to the *virtues* of those *Hot-Baths* (which are lately found remarkable for inward as well as outward use) I mean especially those of our *own Country*, the Reader may consult Dr. *Jorden* his *discourse of Natural Baths*, and of late the *Physicians*, who have and yet do attend those *waters*.

As to the *virtues* of this *Sulphur-water* (our present Theme) as to the use thereof as an inward *Medicine*, the Reader may consult Dr. *French* his Book, and the patient the *Physicians* there. It remains now to speak of it in relation to outward use, as a *Bath*, and this leads me to the next considerable, *viz.*

6. That *artificial heating* of the *water*, bears some *analogy* to the *inbred heat* of those other *Baths*, as they come *hot* out of the *Earth*.

To

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To the illustrating of which we are to consider *Sulphur* or *Brimstone* (according to our former Doctrine, that it may become *solvable* in *water*, is either to be *comminuted* and *volatiz'd* by the native or superinduc'd *Acids*, and that by a brisk *Fermentation* from the mutual *collisions* of the two *principles*, whence the heat of *natural Baths*, as aforesaid, or else the *Sulphur*, by sleighter *touches*, and slenderer *vibrations* from congenial *Acids*, becomes *solvable* in a *preterlabent water*, whose *heat* therefore (if any) in the source of *Fermentation*, is but gentle: yet by that sleight solution of *Sulphur*, it becomes capable of precipitation by another *Acid*, (*viz.* of *Alom*) as happens in this *water* we treat of: That a body of *Brimstone* is precipitated is evident from Dr. Neals observation, concerning a crust of *Brimstone* which he found under the *Stones* of the *Old-Well* at the removing them, through whose crevices the *water* sprang: and that the *Acidity* by which the precipitation is made, is from the *Alom*, doth as clearly appear from the *Aluminous black Stones*, found in the further digging for a better *Spring*. Now what remains in the *water* after the foresaid precipitation, is no other then the *aporrhœa*, or *subtile affluviū* of *Sulphur*, which being dispersed through the whole body of the *water*, is always upon the wing, flying off continually.

This

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This *effluvium* of Sulphur complicated with Salt in the body of the water, although it be very *volatile*, (as I said) yet that it may the better *permeate* our bodies, in order to the performing those expected helps, its necessary (as to outward use) that the waters should be heated, by which the *volatile parts* are put into a more *vigorous motion*, and made capable of *penetrating* our *juices* the better: For although in *frigido*, the Sulphurous parts are by a volatility continually winding off, yet by heating, its put into a more lively *action*, and made more readily *Fermentable* with the humours of our bodies.

Now that the Sulphur in this water consists of tenuous parts, and very *volatile*, is evident (besides what already has been said) by this following *observation*, viz. that during the time I Bath'd therein, and afterwards went to Bed, having laid my *Silver-studded Watch* upon the Table, thereby to observe the time of *Bathing* and *Sweating*, I found the *steam* of the heated water had guilded it at such a distance; and is so *conspicuous*, as to change the colour, (as I have observ'd) of the *Brass-Candlesticks* which stood in the next room to the Bath. Yea, although this be very *volatile*, yet that it doth not suddenly take *wing*, is hence evident, because after three hours time, that the water had been heated, when I got up, I dipt a Six-pence

pence therein, which it still guilded very readily.

7. As to the *artificial* resemblance of *Sulphur Baths* by imitation of *Nature*: First as to *Hot-Baths*, that indeed we fall short in, because its the *work* of *Nature* in the great *Fermentation* of *Mineral juices*, in order to the production of *Mineral concretes*: And seeing *Art* doth of necessity always *petere principia* from *Nature*, and that those *principles* are *seminal*, therefore not to be imitated by *Art*; But inasmuch as all *Fermentation* amongst *Minerals*, (as we have formerly shew'd) consists in the *inward conflicts* of *Mineral Acids* and *Sulphurs*, and that according to the different assaults of the said *Acids*, upon varieties of *Sulphurs*, depend the *specification* or formal difference of *Mineral Waters*; so in particular this *Water* being chiefly compos'd of a *Sulphur*, wrought upon by an *Acid*, and afterwards precipitated by another; the resemblance by *Art* must be from the same sort of *principles*, grounded upon the natural: Thus what an *Acid*, (native or superinduc'd) performs upon *Mineral Sulphur*, in order to the making that *Mineral Solution*, required for the *natural composure* of this *Water*; The same will the *Acidum* of *calx vive*, or of *fixt Alcalies* do *suo modo* to *Common Brimstone*, or other *Mineral Sulphurous Concretions*, as aforesaid.

And

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And lastly, As to the virtues hereof: This *Water* being gradually heated (as is said) becomes a *Bath*, whose *Sulphur* hereby first penetrates the better into our *Fermental juices*, exciting them, if languid through *Hydropick Acids*, or spurious, through *Scorbutick Acids*, in the one by helping (with other concurring Medicaments) to remove obstructions from *coagulated Acids*; in the other, by precipitating, altering and sweetening *Scorbutick Acids*, the cause of pains and particular tumours.

2. Hereby it the better reacheth to dint that *Fermental Acor* of the *Gout*, impress'd upon the *Synovia* of the *Joints*, so easily communicable to the *adjacent Nerves*; hence is the reason why its found so effectual for the *Scurvey*, *Gout*, &c. viz. because these forenamed Diseases are chiefly determined and specified by *Acids*, coagulated upon different humours and parts: For its the Essential efficacy (if I may so say) of a subtiliz'd *Sulphur* to dint *Acids*, and thereby to resolve such as are coagulated; so that to me the *discussion* of all tumours, whether *Scorbutick* or others, depend upon the *resolving* those coagulated *Acids*, the intimate and real efficient thereof; No sooner doth a Spurious predominant *Acid* coagulate any portion of the *blood*, or other *juice* in any part of the body, but presently

an

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an obstruction of those parts happen, more or less, according to the intense or remiss degree of the prevalent *Acid*, which as it falls out in Vessels or Bowels reputed more or less noble, viz. intensely or remissly concerned in the *fabrick* and *circulation* of *vital juices*, and *animal Spirits*, so it becomes the patron of different sorts of Diseases; some whereof easily bending to more facile *methods* of *Cure*; others more stubborn (of which are the last mentioned) not yielding but to more volatile, subtiliz'd, and penetrative *Sulphurs*, such as are in this and other *Sulphurous Baths*.

By which (I mean our *Sulphur-Bath*) *Scorbutick* and *Podagrick* Patients have received considerable relief: for which cause, many persons, finding thereby so much alleviation of the otherwise grievous Symptoms, and such a mitigation of the severity of future fits of the *Gout*, (I mean as to what they might have expected, without such a previous help) do voluntarily make their *annual returns* to the *Bath*: of which I could give several instances, but that it doth not suit my present design.

3. By the use of this *Bath*, the blood and humours are *purified*, whence it becomes proper for *Blotches*, *Scabs*, *Itches*, *Elephantiasis*, or *Bastard Leprosie*, and other *Scorbutick impurities* of the *Blood*; For it procures most excellent *Sweats*, whereby the other impure

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Acids

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Acids, (which are precipitated or cast off from the *Blood* in its *circulation*, and topically fixed upon this or the other *external part*) are loosened, dissolv'd, or mortifi'd; which deprav'd *Acids* lodge in the habit of the body, having their very *Roots fixed* in the ultimate digestion, vitiating the *Blood* and *Latex*, sent thither for the ordinary nutriment of the body, in the common circulation thereof; yea, they are sometimes so fixed upon their own *Roots*, as to transmute the otherwise *alimentary juice*, by their *Ferments*, into those *external impurities*: which they do as really as a *Crab-tree-scions*, or *Bud*, ingrafted into a good *Apple-stock*, doth (from its own *seminal Ferment*) turn the *juice* of the *Stock*, into the nature and property of a *Crab*: So that in such *external vitiating* of the *humours*, which are onely skin deep, the applications in order to *Cure* or *Abstorsion*, must be such as can mortifie, dissolve, alter or correct the foresaid *externally scituated Acids*, which may be, and is, most aptly perform'd by this *Sulphur-Bath*.

So that in many the like cases, where those *Acids* are most *pertinacious*, and the *Maladies* thence have taken *deepest root*, viz. in the *Elephantasis*, *Psora*, *Leprosie*, &c. the most common and usual *Purges* and *Diaphoreticks*, are altogether *insignificant*, because they reach not those deeply impress'd *Acids*, nor correct those

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those *spurious Ferments*, seated, yea rooted in the *habit* of the *body*; which such *subtiliz'd Sulphurs*, as are in this *Bath* skilfully applyed (with other assisting Medicines) are apt chiefly to perform.

Amongst which *external impurities*, the *Lues Venerea* (being made by carnal contract) may not improperly be reckoned; which consists in a peculiar sort (in its kind) of a contagious *Fermental Acid*, thence communicable to the *juices* of the *body*, especially where the *contagious Ferment*, by the first contract, entered; which by its *corroding acor*, as a caustick, fretting and inflaming those *tender parts*, or *coagulating* the *juices* of some particular parts (brought thither by an afflux of humours) into *venereal tumours*, whose restless *Ferments* yet lodge in their Bellies, or inwards, in both become the *Authors* of *Nocturnal pains*, *polutions*, &c. to the dinting of which *spurious Fermental acor*, (the cause of the aforesaid dolours) the just mulct of that Sin must be chiefly aim'd at, in the curing thereof: which besides other *Diaphoreticks*, may very well be perform'd by the help of this *Bath*: And that too, because *Sulphurs*, (especially such as are *prepared* and *volatiz'd* by the *admirable Chymistry* of Nature in the body or bowels of the Earth) do *sweeten* and *mortifie* all such sort of *Acids*: For which purpose,
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in order to the Cure thereof, not only *Bathing*, (and some other assisting *Diaphoreticks*) but also the *drinking* the same *water* is requisite.

4. By the use of this *Bath*, the *nervous maladies* are also much helped, of which sort are *Cramps*, *Convulsions*, *Palsies*, *Apoplexies*, being caused from the various *seisures* upon these *juices*, also from the *contorsions* and *disablements* of the *Vessels* or *Conduit-pipes*, (the *Nerves*) those *juices* are circulated, or at least carryed in, being the *Organs* wherein the *animal Spirits* move in order to sense, motion, and other *vital functions*, proper thereto, whose tone are altered, contorted, contracted, or relax'd by several sorts of supervening *Acids*, sent up in *flatulent steams*, resulting from some spurious subordinate *Fermentation*, whose *Acids* being strong, have prevail'd, and by a sort of *sublimation* are at length *fixt* upon those *animal Cords*, causing obstructions, contractions, relaxations, &c. (according to the *morbid Acids*) the causes of Diseases relating to the *genus nervosum*.

Now as *Acids* are the cause why *Nerves* undergo those various *alterations* in their *tone* or *texture*, by contractions, relaxations, &c. and in their *juices* by coagulations, and thence obstructions, or other debilitudes, whereby the volatile nimble *animal Spirits* become *interrupted* in their *motion*, being block'd up by
such

such sort of *coagulations* : so in order to the Cure of these Diseases, such *Medicaments* and *Methods* are to be inquired into, as may *dint*, *alter*, and *dulcifie* such kinds of *Acids*, and thence may loosen the *contracted*, smooth and make even the *contorted*, may strengthen the *relaxed Cords*, yea and may every way answer the *indications* of the deprav'd *tones* of those *animal pendula's* or *vital strings*, whereby the imprisoned *Spirits*, (the immediate product of *vital Fermentation* may again be set at liberty, and all the *animal functions* be restored to their *pristine state* : of which sort are our *Sulphur-Bath*, which by correcting the *Acids*, supple and soften the *contracted*, strengthen and bind up the *weak*, and very much repair, in the *maine*, the deprav'd *tone* of the *genus Nervosum*.

Lastly, By the use of this *Bath*, the contraction of the tendons, and musculous parts, I mean *stiffness* of the *Limbs*, *Joynts*, &c. (where the contraction is not too fixed) are often remedied : For these outward maladies being caused through some rejected *Acids*, which wanting a due *Fermentative motion* to give them wing by *perspiration*, are *coagulated* or *hardened* (partly by the assistance of the Air) in the external parts; but by the *Sulphur* in the *Bath*, the pores being opened, and they dissolv'd, and put into *motion*,
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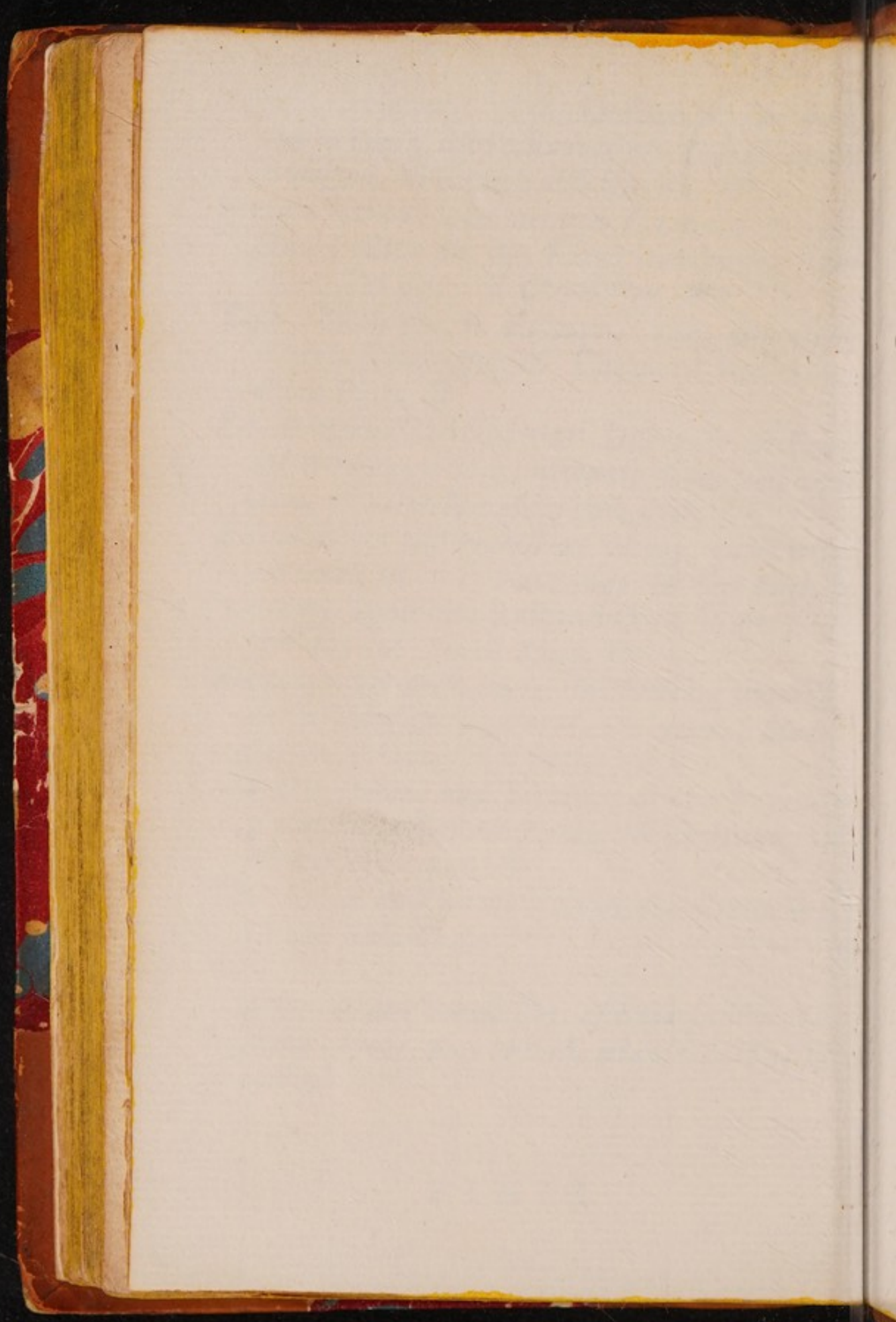
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