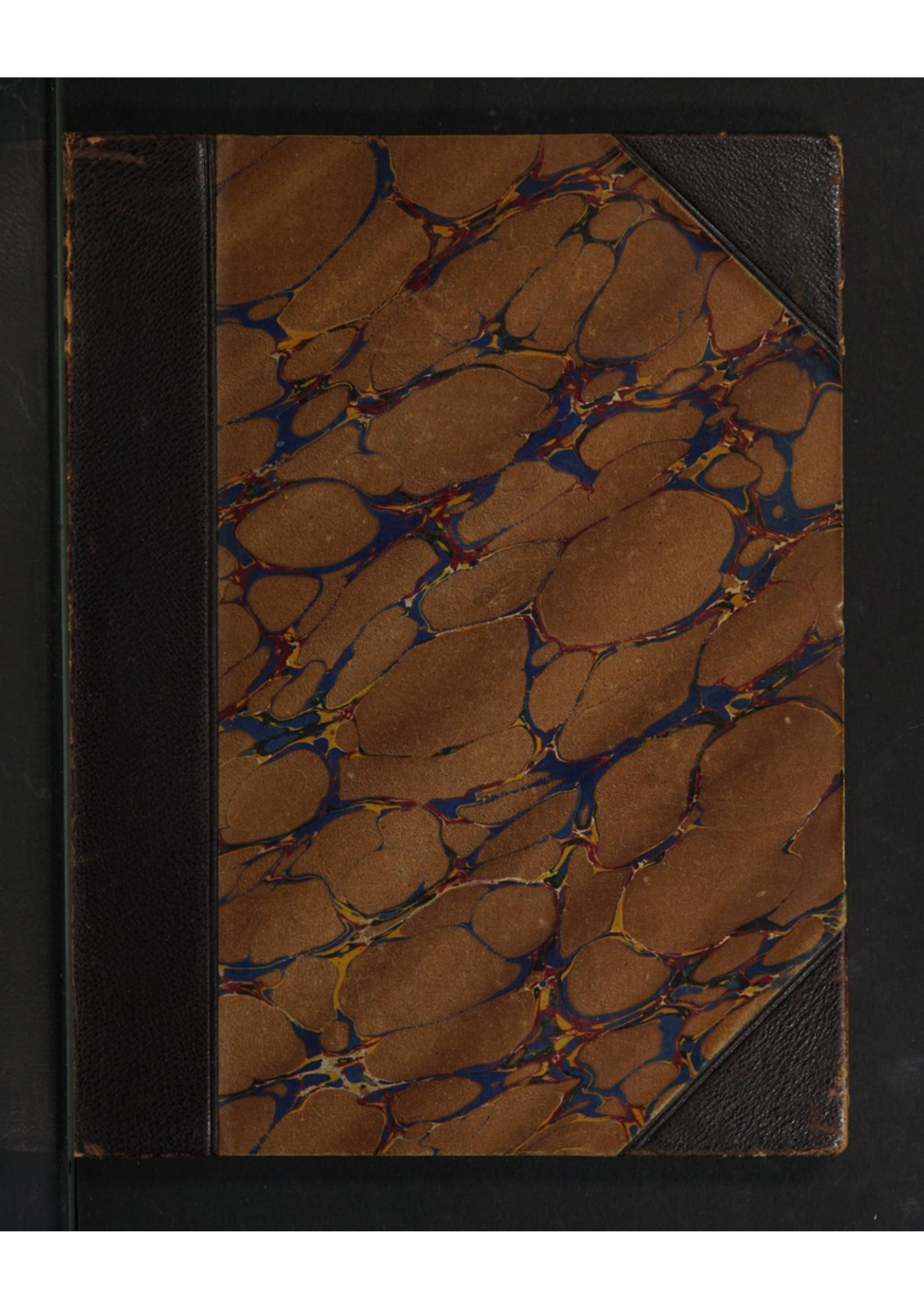
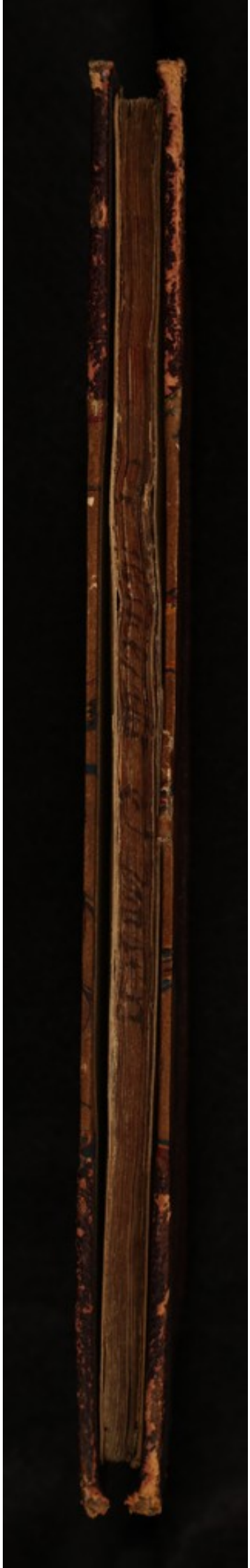
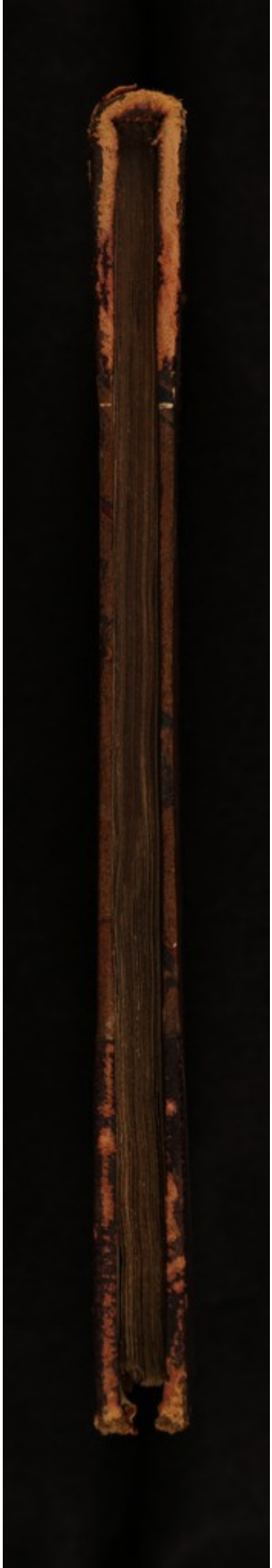
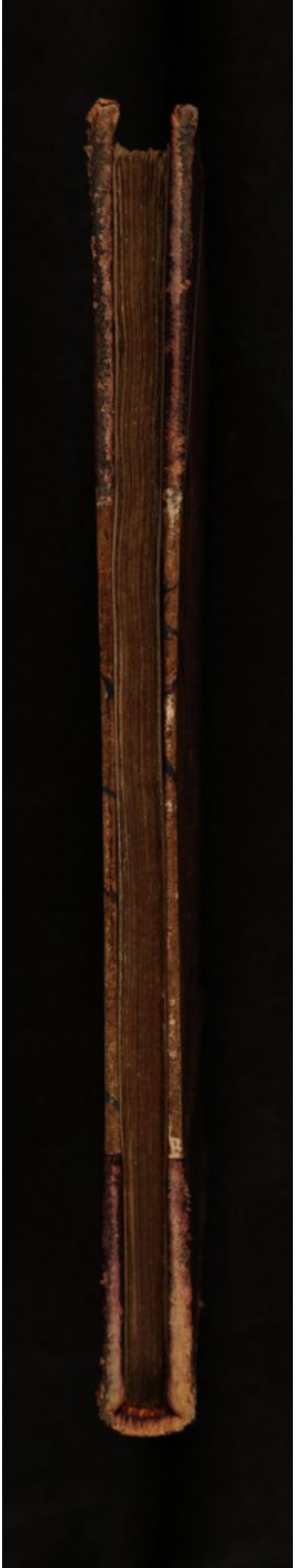
A discourse of naturall bathes, and minerall waters. Wherein first the originall of fountaines in generall is declared. Then the nature and differences of minerals, with examples of particular bathes from most of them. Next the generation of minerals in the earth, from whence both the actuall heate of bathes, and their vertues are proved to proceede. Also by what meanes minerall waters are to be examined and discovered. And lastly, of the nature and uses of the bathes, but especially of our bathes at Bathe in Sommersetshire / [Edward Jorden].



DISCOURSE OF BATHES — IORDEN. 1571







A DISCOVRSE OF NATVRALL BATHES. AND MINERALL WATERS.

Wherein first the originall of Fountaines in generall is declared.

Then the nature and differences of Minerals, with examples of particular Bathes from most of them.

Next the generation of Minerals in the earth, from whence both the actuall heate of Bathes, and their vertues are proued to proceede.

Also by what meanes Minerall Waters are to be examined and discouered.

And lastly, of the nature and vses of Bathes, but especially of our Bathes at *Bathe* in *Sommersetshire*.

By ED. IORDEN *Dr. in Physicke.*

LONDON:
Printed by THOMAS HARPER.
1631.

TO THE RIGHT HONOVRABLE, SIR FRANCIS COTTINGTON, Baronet, Chancellour of the Exchequer, and one of his Maiesties most Honourable Priuy COVNCELL.

THe profitable vse of Bathes, both for necessity and comfort, is such, and so well confirmed from all antiquity, as I need not labour to illustrate it more; onely it hath beene the ill hap of our Country Bathes to lye more obscure then any other throughout Christendome, although they deserue as well as the best, because very few haue written any thing of them, and those haue either not mentioned, or but slightly passed ouer the maine points concerning their causes and originals; contenting themselues with an empericall vse of them. This hath made me through the instigation also of some of my worthy friends, to attempt somewhat in this kinde: which if it giue not satisfaction according to my desire, yet it may be a prouocation to some others, to

perfect that which I haue begun. And seeing I doe it for the vse of my Country, I haue neglected curious ornaments to garnish it withall, but haue clad it in a plaine suit of our country Cloath, without welt or gard: not desiring it should shew it selfe in forraine parts: *Mea cymba legat littus.*

But in this mine vndertaking, I finde my selfe exposed to many censures, both concerning some paradoxicall opinions in Philosophy, which notwithstanding I deliuer not *gratis*, but confirmed with good grounds of reason and authorities: as also concerning the reformation of our Bathes, which doe daily suffer many indignities more waies then I haue mentioned, vnder the tyranny of ignorance, imposture, priuate respects, wants, factions, disorder, &c. so as they are not able to display their vertues, and doe that good for which God hath sent them to vs: and all for want of such good gouernement as other Bathes doe enioy. I blame not our City herein, vnto whose care the ordering of these Bathes is committed, the disorders and defects being such as are out of their verge, and neither in their power, nor in their knowledge to redresse. For they haue sufficiently testified their

desire

desire of reforming all such abuses, when they voluntarily did ioyne in petitioning the late King *Iames* of blessed memory, to that end: by whose death this petition also dyed. And they knew well that it must be superiour power that must effect it. In these respects I haue need of some noble and eminent Patron to protect both me and my Bathes, whose cause I take vpon me to plead, and to aduance, according to their due desert: but especially for the Bathes sake, which I desire may flourish to the vtmost extent of benefit to the people; and to haue all impediments remoued out of their way, which may hinder them in the progresse of their vertues. This is the cause Sir, why I presume to dedicate these my labours to your Honour, who hauing obserued in forraigne parts, the vses and gouernements of all sorts, and being both by the fauour of his Maiestie well able, and by your noble disposition well inclined and willing to maintaine good order and discipline, will, I doubt not, excuse this boldnesse, and pardon my presumption. Consider Sir, that this is your natiue Country, which naturally euery man doth affect to aduance; and these Bathes are the principall Iewels of your Country, & able to make it more famous

then any other parts of this Kingdome, and in aduancing them, to aduance your name to all poſterity. Wherefore howſoeuer my ſelfe deſerue but ſmall reſpect from you, yet I beſeech you reſpect the Bathes of your Country, and me as a welwiſher vnto them.

And as the common opinion of your great worth and abilities, haue moued mee to this boldneſſe, ſo the particular fauours of your Noble Lady, and the encouragement of your learned Phyſitian, Maſter Doctor *Baſkeruill*, mine eſpeciall friend, who hath ſpurred mee on to this worke, haue remoued out of my minde all ſuſpition of miſconſtruction. But that as mine intent hath beene meerely the enlarging of the knowledge of thoſe poynts concerning Bathes, and more eſpecially of our Bathes in Sommerſetſhire; ſo you will be pleaſed to accept of this publike inuitation by mee to doe your Country good, and your ſelfe honour, which I wiſh may neuer be diſioyned. And to mee it will be no ſmall encouragement to deuote my ſelfe and my beſt endeauours to your ſeruice. So I humbly take leaue this 23. *Aprilis* 1631.

Your Lordſhips moſt humble Seruant,

ED. IORDEN.

Libellum istum DE AQVIS MEDICATIS, *à Doctissimo* IORDANO *antiquissimo Collega nostro scriptum multiplici eruditione & nouarum subtilitatum varia supellectile refertissimum, legimus, & qui ab omnibus tam Philosophis quam Medicis legatur dignissimum iudicauimus.*

IOHANNES ARGENT *Collegij Medicorum Londinensium Præsidens.*

IOHANNES GIFFORD.

SIMON BASKERVILLE.

THOMAS RIDGELEY.

In laudem operis.

PArue alacri passu liber, Liber, ibis in orbem;
Dentesque spernes liuidos.
Authores pandit, sua dat Iordanus, & vsu
Quæsita multo protulit.
Aëra qui totus, Flammas meditatur, & vndas,
Terram, metalla discutit.
Quicquid in his veteres, docuit quicquid Nouus Author,
Celeri notauit pollice.
At sua dum exponit, lucem dat, operta recludit,
Pennâque fertur liberâ.
Perge liber: gratus gratum volueris in Æuum
Lympha calentes dum fluent.

Ed. Lapworth, M. D.

In laudem Authoris.

NVmine diuino Iordan medicabile flumen
Dicitur, è gelido licèt illud frigore constet:
Tu Iordane decus medicorum, candide Doctor,
Lumine diuino gnarus discernere causas
Ægris corporibus nôsti depellere morbos;
Intima seclusæ penetrâsti viscera terræ,
Thermarum vires aperis, reseraque metalla:
De gremio Telluris aquas manare fluentes
Qua ratione doces, nobis priùs abdita pandis
Scrutando Physices arcana indagine mira,
Nec caperis famâ, nec inani laudis amore,
Vt patriæ prosis, dignaru promere lucem:
Qui memorauerunt, vel qui modò Balnea tractant,
Non sunt te meliùs meriti, vel iudice Momo.

Io. Dauntesey.

OF NATVRALL BATHES, AND MINERALL WATERS.

Cap. 1.

Explication of the word Bathe. The scope and argument of this Booke. The ancient vse and esteeme of Bathes among the Romans. The moderne vse of them among the Turkes. Of medicinable Bathes, and minerall Waters. How esteemed by Greekes, Latines, Arabians, & other nations.

THE word *Bathe* or *Balneum* is of larger extent then I purpose to discourse of: for it being the name of a forme of remedie applied to the body, it may be framed either out of liquid things, or solid substances, or vapours.

Liquid Substances are Water, Milke, Must, Wine, Oyle:

Oyle: ſolid ſubſtances are Sand, Salt, preſſed Grapes, Corne, &c. vapours are Stuffes and hot houſes.

My intent is onely to treate of waters, and principally of thoſe which be called Minerall, whether they bee vſed in Bath or in Potion, &c.

Pancirollus de deperd. itis.

Theſe kinde of watrie Bathes haue beene in vſe from all antiquity, and held in great eſteeme. Among the ancient Romans there were no Buildings more magnificent then their Bathes, whereof there are reported to haue beene in *Rome*, 856. The chiefeſt of theſe were the *Anthonin*, and *Diocleſian* Bathes; the walles whereof were of admirable height, with an infinite number of marble Pillars, erected for oſtentation, and not to ſupport any thing, 1000 Seates to ſit in; Their *Caldaria*, *Lepidaria*, *Frigidaria*, moſt ſumptuous and ſtately: the whole fabricke ſo large and ſpacious, as they reſembled rather Cities then Houſes. And ſo it might well be, when as there were imployed for the building of the *Diocleſian* Bathes, as *Baccius* ſaith, 4000. men, but *Salmuth* ſaith, 14000. for ſome yeares together. They were placed where now the Church of Saint *Angelo* ſtands.

Bellonius obſervat. lib. 3. cap. 34.

The Turkes at this day retaine that ancient cuſtome of the Romans, and are in nothing more profuſe, then in their Temples and Bathes, which are like vnto great Pallaces, and in euery Citie very frequent: And yet both the Romans and the Turkes vſed thoſe Bathes onely for pleaſure, and delicacy, and cleanlineſſe: the Romans going barelegged, and their waies duſty, had need of often waſhing: and the Turkes lying in their cloathes, ſubiect to Lice and wormes, if it were not for their often bathing.

Now if thoſe Nations would beſtow ſo much vpon their Bathes of delicacie and pleaſure, which were onely of pure water; wee haue much more reaſon to adorne

our

our minerall Bathes; which (beſides the former vſes) are alſo medicinall and very ſoueraigne for many diſeaſes, conſiſting of wholeſome minerals, and approued for many hundred yeares, of many who could not otherwiſe be recouered. At the leaſt wiſe if wee doe not beautifie and adorne them, yet we ſhould ſo accommodate them, as they might ſerue for the vtmoſt extent of benefit to ſuch as neede them.

For there is nothing in our profeſſion of Phyſicke more vſefull, nor in the workes of nature more admirable, (man onely excepted, which *Plato* cals the great miracle) then naturall Bathes, and minerall Waters. The nature and cauſes whereof haue beene ſo hard to diſcouer, as our ancient Authors haue written little of them, holding them to be ſacred or holy, either for that they iudged them to haue their vertue immediately from God, or at leaſt from the celeſtiall Bodies; from whence, both their actuall heate was thought to be kindled, by lightnings or ſuch like impreſſions, and other admirable vertues, and ſometimes contrary effects deriued, which appeare in them: Alſo diuers miracles haue beene aſcribed vnto thoſe naturall Bathes, to confirme the opinion of a ſupernaturall power in them, as *Guaynerius* reports of the Bathes of *Aque* in *Italy*: and *Langius* out of *Athenæus*, concerning the Bathes of *Edepſus*, which both loſt their vertue for a time. The one by the Magiſtrates prohibiting poore diſeaſed people to vſe them, the other by impoſing a taxation vpon them: but vpon the reformation of thoſe abuſes, were reſtored to their former vertues againe.

Cap 2. Epiſt. 53. lib. 2.

I neede not herein auerring the opinion of Diuinitie which was held to be in Bathes, make any mention of the Poole of *Bethesda*, written of by Saint *Iohn*, and *Nonnus* the Poet: nor of the riuer *Iordan*, which cured

Naman the *Assyrian* of his Leprosie: being indeede true miracles, and done by a supernaturall power: yet it is likely that those and such like examples bred in the mindes of men a reuerend and diuine opinion of all Bathes: especially where they saw such strange effects as they could not well reduce to naturall causes.

And this hath beene the cause that in old time these minerall fountaines haue beene consecrated vnto certaine dieties: as *Hamon* in *Libya*, vnto *Iupiter*: *Thermopyla*, vnto *Hercules*, by *Lallas* among the *Troglodits*, another to the *Sun*, &c. And at this day we haue diuers Bathes which carry the names of Sunne, Moone, and Saints: and many Townes and Cities named from the Bathes in them: as *Therma* in *Macedonia* & *Sicily*, *Thermidea* in *Rhodes*, *Aquæ* in *Italy*, *Aquisgran* in *Germany*, *Baden* in *Heluetia*: and our ancient Citie of Bathe in Sommersetshire, in honour whereof I haue especially vndertaken this labour, and I perswade my selfe, that among the infinite number of Bathes and minerall waters which are in Europe, there are none of more vniuersall vse for curing of diseases, nor any more commodious for entertainement of sicke persons, then these are.

Besides this sacred conceit of Bathes, wherewith in ancient times, the mindes of men were possest, we may adde this, that the nature of Minerals was not so well discouered by them, as it hath beene since: and therefore wee finde very little written of this argument, either in *Aristotle* or *Hippocrates*, or in *Galen*, who wrote most copiously in all other points of Physicke, yet concerning this hath little; and neuer gaue any of these waters to drinke inwardly, although hee acknowledgeth that they were in vse: and for outward vses, held them all to be potentially hot.

De tuenda sanit. lib. 4. cap. 4.

After these Grecians, the ancient Latines and Arabians

bians succeeded: *Pliny*, *Celsus*, *Seneca*, *Lucretius*, *Auicen*, *Rhasis*, *Seraphio*, *Auerrhoes*, in whom wee finde some small mention of naturall Bathes, and some vse of Salt and nitrous, and Aluminous waters, but nothing of worth towards the discouerie of the naturall causes of them. It is likely they did passe it ouer slightly, either by reason of the difficulty in searching out the causes of them, or that they iudged them meerely metaphysicall. But in later times the nature and generation of Minerals (from whom the Bathes proceede, and from whence the Bathes proceede, and from whence the whole doctrine of them both for their qualities, and differences, originals and vse, must be deriued) being better looked into, and obseruations taken from such as daily labour in the bowels of the earth, for the search of Mines, or such as afterwards prepare them for our necessarie vses; we haue attayned to better knowledge in this kinde, then the Ancients could haue, although in all new discoueries there will be defects for succeeding ages to supply, so it fals out in this: *Dies Diem docet: Alpham Beta corrigit.* And although *Agricola*, *Fullopius*, *Baccius*, *Mathesius*, *Solinander*, *Libanius*, &c. haue added much vnto that which was formerly knowne in this point, and reformed many errors and mistakings in former writers: yet they haue left many things imperfect, doubtfull, obscure, controuerted, and perhaps false, as may appeare in the discourse following. I doe reuerence all their worths, as from whom I haue learned many things which else I could hardly haue attained vnto; and I acknowledge them to haue beene excellent instruments for the aduancement of learning: yet I hope it may bee as free for me without imputation of arrogancie to publish my conceits herein, as it hath beene for them, or may be for any other: *Hanc veniam petimusque damusque*

que viciſsim. My end and ſtudie is the common good, and the bettering of this knowledge: and if I ſhall bring any further light to increaſe that, I ſhall be glad: otherwiſe my intent being to ſearch out the truth, and not to contradict others, it will or ought to be a ſufficient protection for mee, wherefore I come to diſcourſe of Minerall waters.

Cap. 2.

Definition of Minerall waters. The nature whereof cannot be vnderſtood, except firſt conſideration be had concerning ſimple water. Of which in this Chapter are ſhewed the qualities and vſe.

Libanius de iudicio aquarum miner. cap. 1.

Minerall waters are ſuch, as beſides their owne ſimple nature, haue receiued and imbibed ſome other qualitie or ſubſtance from Subterraneall Mynes. I ſay, beſides their owne nature, becauſe they retaine ſtill their liquidneſſe and cold, and moyſture, although for a time they may be actually hot from an externall impreſſion of heate, which being gone, they returne to their former cold againe. I ſay imbybed, to diſtinguiſh them from confuſed waters: as earth may bee confuſed with water, but not imbybed, and will ſinke to the bottome againe: whereas ſuch things as are imbybed, are ſo mixed with the water, as it retaines them, and is vnited with it: being either Spirits, or diſſoluble Iuyces, or tinctures; I ſay from Subterraneall mynes, to diſtinguiſh them from animall or vegetable ſubſtances, as infuſions or decoctions of hearbs, fleſh, &c.

Seeing then that the Baſis of theſe Bathes or minerall fountaines, is water, we muſt firſt conſider the nature of ſimple water, and from thence wee ſhall better iudge of Minerall

Minerall Waters and their differences.

By ſimple water I doe not meane the Element of water, for that is no where to be found among mixt bodies, but I meane ſuch water as is free from any heterogeneall admixture, which may alter either the touch or taſte, or colour, or ſmell, or weight, or conſiſtence, or any other qualitie, which may be diſcerned either by the ſenſes, or by the effects. This water therefore muſt haue his proper colour and taſte, without ſauour, or ſmell, thin, light, cold, and moyſt; if any of theſe properties be wanting, or any redownd, it is mixed and infected. *Baccius lib. 1. cap. 6. Solinander lib. 1. cap. 1.*

Cold and moyſture doe abound in water more then in any other Element. For cold appeares by this, that being heated by any externall cauſe, it ſoone returnes to his cold nature againe, when the cauſe of the heate is remoued. And whereas Ayre is held by the Stoicks to be moſt cold, and confirmed by *Seneca*, and *Libanius*, yet the reaſon they giue for it, doth proue water to bee more cold, becauſe they make the matter of ayre to bee water, and to haue his coldneſſe from thence. But *Ariſtotle* holds the ayre to be hot from the efficient cauſe which rarefied it, being of more validitie to make it hot, then water (the materiall cauſe) to make it cold. *Galen* is of neither ſide, for he doth not iudge it to be hot, neither doth he euer pronounce it to be cold: but by reaſon of his tenuity, apt to be altered either by heat or cold. As for moyſture, *Ariſtotle* holds the Ayre to be moſt moiſt, and water moſt cold. *Galen* holds Water to bee moſt moyſt. *Ariſtotles* reaſon for the predominance of moyſture in Ayre, is, becauſe it is moſt hardly contained within his bounds: but the termination of things, proceedes from their oppoſite qualities, as moyſture is terminated by dryneſſe, and dryneſſe by moyſture: and dryneſſe doth as eaſily terminate moyſture, as moyſture doth *Solinander lib 1. cap. 3. Queſt nat. 2. Liban. pyrotech. cap. 20. Meteor. 4. De vſu partium lib. 8. cap. 3. De ortu & inter lib. 2. & meteor. 4. cap. 1 & 4. Gal. de ſimpl. med. fac. lib. 12 cap. 8. Item de Elementis.*

doth terminate dryneſſe. And this difficulty of termination in Ayre, may more properly bee aſcribed to his thinneſſe and tenuity of parts, then to his moyſture. For dry exhalations will extend themſelues as well as moyſt vapours; and as it is denſity that compacts, ſo it is rarity that extends. Fire it ſelfe is hardly bounded, and yet, not moyſt. Thoſe that would reconcile theſe differences, doe alledge that *Galen* ſpeakes as a Phyſitian, and meant that water was *humidiſſimum medicamentum: Ariſtotle* as a Philoſopher meant it to be *humidiſſimum elementum.* But this reconciliation giues little ſatisfaction. For how could water be *humidiſſimum medicamentum*, if it were not *humidiſſimum elementum?* We ſpeake of the proper operation of water according to his naturall qualitie, and not as it may worke by accident. Thinneſſe and leuitie are two other qualities of ſimple water, which *Hippocrates* commends, and addes this experiment in another place, that it is quickly hot, and quickly cold. *Galen* addes another experiment in the quicke boyling of Peaſen or Beanes. And it is requiſite that water ſhould haue theſe qualities, in regard of the manifold and neceſſarie vſes of it, both for Man and Beaſt, and Plants: inſomuch, as there is no liuing for any creature, where there is no water. It was our firſt drinke to quench our thirſt, and to diſtribute our nouriſhment as a *vehiculum*, which it doth by his tenuitie; and after the inuention of Wine, it was mixed therewith, as *Virgil* ſaith of *Bacchus, poculaque inuentis Acheloia miſcuit vuis*; where, by *Acheloia*, he meanes not onely the water of the Riuer Achelous in Etolia, but all other waters, as *Macrobius* proues out of *Ariſtophanes* and *Ephorus*. And ſince the planting of Vineyards, ſeeing all Countries could not beare Grapes, *Bacchus* alſo taught the world to make *vinum è frugibus* with water, as *Diodorus Siculus*

Valeſius cont. lib. 1. cap 2.

De aere, aquis & locis. De morbis popular. lib. 2. ſect. 2.

Bruerinus de re cibaria lib. 16. cap. 7.

Saturnal. lib. 5. cap. 18.

Siculus reports, from whence the Egyptians had their *Zithum* and *Curmi*, the Spaniards their *Cerea*, the Turkes their *Cowſet*, and wee our *Ale* and *Beere*; all which are extracted out of Corne, by the pureneſſe and tenuitie of water. By meanes whereof wee haue our Brothes, Syrupes, Apozemes, &c. extracted with it, as a fit menſtruum to receiue the faculties of all medicaments and nouriſhments, eſpecially the ſecond qualities, and therefore it was anciently called *Panſpermia*: beſides the manifold vſes in waſhing, dying, &c. of which I will not diſcourſe farther. Leuitie is another note of pure water, alledged by many, and ſerues well to diſtinguiſh it from many mixed waters, whether wee reſpect the weight of it, or the moleſtation which it breedes in the bowels. This difference of weight is hardly diſcerned by ballance, both becauſe ſimple waters doe very little differ in this point, and alſo many mixt waters, if they be onely infected with Spirits, and not corporall ſubſtances, retaine the ſame proportion of heauineſſe with ſimple water: and alſo becauſe it is hard to haue great ballances ſo exact, as a ſmall difference may be diſcerned by them, yet *Agricola* reports that a cotyle of the water of Pyrene and Euleus, did weigh a dram leſſe then the water of Euphrates, or Tigris, and therefore the Kings of Perſia vſed to drinke of it, and held it in great account, as alſo the water of the Riuer Coaſpis. Thus much for the qualities which ſimple water ſhould haue; for ſuch as it ſhould not haue, I ſhall not need to ſpend time in diſcourſe, being either ſuch as the ſenſes will diſcouer, if it bee in taſte, colour, ſmell, or touch; or the effects, if it be purgatiue, vomitory, venomous, &c.

Rerum anti-quar. lib. 4. c. 2.

Baccius lib. 1. c. 7

De nat. eor. quæ effl. è terra lib. 1. cap. 15.

Langius Epiſt. lib. 1. Epiſt. 31.

Cap. 3.

Of the three originals of simple waters.

Baccius lib. 1. cap. 3. 4. Agric: de ortu & cauſis ſubterr. lib. 1. cap. 1. 2. 3. 4. 5. 6. 7. 8. 9. Solinander lib. 2. cap. 1. & lib. 12 cap. 3.

NOw it followeth that we ſhew from whence theſe waters haue their originall, which is no other then of the mixt waters, ſauing that the mixt waters doe participate with ſome minerals which are imbybed in them.

They haue three ſeuerall Originals: the one from moyſt vapours congealed by cold in the ayre: the ſecond from the earth; the third by percolation from the Sea.

For the firſt, it is certaine that our Springs and Riuers doe receiue great ſupply of waters from the Ayre, where vapours being congealed by cold, doe fall downe vpon the earth in raine, or ſnow, or haile, whereby the ground is not onely made fertile, but our Springs are reuiued, and our Riuers increaſed. As wee ſee the Rein and Danubius to ſwell more in ſummer then in winter, becauſe then the ſnow which continually lyeth vpon the Alpes, doth melt by the heate of the ſunne, and fils thoſe Riuers, which haue their Originals from thence vp to the brinkes. Alſo we ſee daily after much raine, our ſmall Lakes and Riuers to be very high. Alſo vpon much dryth our Springs faile vs in many places, which vpon ſtore of raine doe ſupply vs againe with water. And this is the cauſe that in moſt parts of Africa, neere the Equinoctiall, where it raines little, they haue little water; and many times in two or three dayes iourney, can hardly finde to quench their thirſts and their Camels. *Leo Africanus* ſpeakes of an Army wherein were many Camels, which in their marching, comming to a Riuer (perhaps it was but a Brooke) did drinke it dry. So that

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we must acknowledge that the earth receiues much water this way. But how this should serue the bowels of the earth with sufficiencie for the generations there, and for perpetuall springs, is very doubtfull; whereas *Seneca* saith that these waters doe not pierce aboue ten foot into the earth: neither if there were passages for it into the bowels of the earth, can the hundred part of it be imployed this way, but is rudely conueyed by Riuers into the Sea. Wherefore although much water bee yeelded to the superficies of the earth by raine, and snow, and haile from the ayre, yet not sufficient to maintaine perpetuall Springs; seeing many times, and in many countries these aeriall supplies are wanting, or very spare, and yet the Springs the same. Wherefore *Aristotle* his opinion, which attributes all to aeriall water and vapours, from thence, is iustly reiected by *Agricola*, and by our country-man Master *Lydiat*. So that wee must finde out some other Originals, or else wee shall want water for the manifold vses the earth hath of it: from the earth they make another originall of perpetuall Springs and Riuers, seeing the first seemes to be ordained by nature onely for the irrigation of the superficies of the earth, which else would be in most places destitute of water, where Springs are not, and so would be barren, plants and trees wanting due moysture for their nourishment. Wherefore for the perpetuitie of fountaines, and for Subterraneall generations, which cannot proceede without water, they haue imagined a generation of water within the earth; some holding that the earth it selfe is conuerted into water, as elements are held to be mutable and conuertable, the one into the other. But neither fire will be conuerted into any other element, being superiour vnto the rest, and not to be mastered by cold, which onely must be the agent of the conuersion

Quæst. natur. lib. 3. cap. 7.

2 Meteorol. & 13.

De ortu & causis subt. lib 1. c 6; De orig. font. cap. 1.

of it by condenſation: neither will earth be conuerted into water, for either heate or cold muſt conuert it. Heate cannot doe it, although it rarifie and attenuate, both for that it conſumes moyſture, and alſo becauſe water is cold, which it ſhould not be, if it were made by heat; for euery naturall Agent workes to that end that it may make the Patient like it ſelfe: and heate may conuert earth into fume and dry exhalations, but not into water, for all water which is not eternall, is from cold; likewiſe cold cannot conuert earth into water, becauſe cold doth congeale, condenſe, and congregate, and indurate, and not diſſolue and attenuate, &c. as wee ſee in Amber and Gummes. Others will haue great receptacles of ayre within the earth, which flying vp and downe, is congealed by the coldneſſe of Rockes into water, to ſupply all wants. Others imagine huge Lakes and Ciſternes, primarilie framd in the earth, and ſupplied with water, either from vapour or ayre, or from the ſea; which water either by agitation, by winds, or by impulſion from the ſea, or by compreſſion of Rocks, is eleuated to the Superficies of the earth: or els vapours from thence, made by attenuation, either from the Sun and Starres, or from Subterraneall fire kindled vpon Sulpher and Bitumen; which vapours aſcending to the tops of mountaines, are there congealed into water by the coldneſſe of the Rockes; where there muſt be other Ceſternes or Caſtles in the ayre to feede the inferiour Springs. Theſe and ſuch like deuices are produced for the maintaining of their Originall; which as they are all inſufficient to afford ſuch a proportion of water as is requiſite, ſo moſt of them are ſo improbable, and full of deſperate difficulties, as I am vnwilling to ſpend time in the rehearſing of them, or their Authors, much more vnwilling in confuting of them, to trouble my ſelfe, and offend

Ariſtot. 4. meteor. cap. 10. & vltimo.

Valeſius de ſacra philoſoph. paſſim.

offend my Reader, onely the poynt of Subterraneall fire which hath taken deepeſt impreſſion in moſt mens mindes, I ſhall ſpeake of hereafter, when I come to ſhew the cauſes of the actuall heate of Springs. The third Originall is from the Sea, a ſufficient ſtorehouſe for all vſes, and whereunto the other two may be referred. For that which fals from the ayre, and that which is bred in the earth, doe proceed principally from the Sea. *Agricola* for feare of wanting water for his Springs, is contented to admit of all theſe Originals, although he relyeth leaſt vpon the Sea, becauſe he knowes not how to bring it vp to the heads of his fountaines, but is contented it ſhould ſerue for lower places neare the Sea coſte. As I remember I haue ſeene in Zeland at Weſtcapell, freſh Springs colated from the Sea, through bankes of ſand. But I make no doubt but that the Sea water may ſerue all other Springs and Riuers whatſoeuer, although both farre remote from the Sea, and high in ſituation. Neither ſhall we neede to flye for helpe to thoſe monſtrous conceits of Agitation, Compulſion, Compreſſion, Suction, Attraction by the Sunne, &c. But holding the ſacred Canon of the Scriptures, that all Riuers are from the Sea, &c. I perſwade my ſelfe, that there is a naturall reaſon for the eleuating of theſe waters vnto the heads of Fountaines and Riuers, although it hath not yet beene diſcouered. For thoſe opinions formerly mentioned will not hold water.

De ortu & cauſis ſubter. lib. 1. cap. 5. & 9.

Eccleſiaſtes 1.

My conceit therefore is this, that as we ſee in *Siphunculis*, that water being put in at one end, will riſe vp in the other pipe, as high as the leuell of the water (whether by his waight, or by the correſpondence with his leuell, I will not diſpute) ſo it may be in the bowels of the earth; conſidering that the paſſages there are more firme to maintaine the continuitie of the water with the

Sea, then any leaden pipes can be, being compaſſed on euery ſide with many Rockes: as we ſee in *Venis, fibris & commiſſuris ſaxorum.* Now although perhaps this water enters into the earth very deepe, yet the leuell of it muſt anſwer to the ſuperficies of the Sea, which is likely to be as high as the ſuperficies of the Land, ſeeing the natural place of waters is aboue the earth. And although neere the Coaſts it bee depreſſed and lower then the Shoare, yet there is reaſon for that, becauſe it is terminated by the dry and ſolid body of the earth: as we ſee in a Cup or Bowle of water filled to the top, we may put in a great bulke of ſiluer in pieces, and yet it will not run ouer, but be heightened aboue the brims of the bowle. If this be euident in ſo ſmall a proportion, we may imagine it to bee much more in the vaſt Ocean: and our Springs being commonly at the foot of hils, may well be inferiour to the Globe of the Sea, if any bee higher, they may perhaps be fed from raine and ſnow falling vpon the mountaines. But if *Ioſephus a Coſta*, his aſſertion bee true, that the Sea towards the Equinoctiall, is higher then towards the Poles, then the leuell of the Sea may bee much higher then the top of our higheſt hils, but this is a doubtfull aſſertion: yet I dare beleeue that if it were poſſible to immure a Spring without admiſſion of ayre, which might breake the continuitie with the Sea, our Springs might be raiſed much higher. At Saint *Winifrids* Well in Flintſhire, though there be no high land neere it, yet the Springs riſe with ſuch a violence, and ſo plentifully, that within a ſtones caſt, it driues a Mill. It is likely that this Spring might be raiſed much higher. And whereas we ſee that Riuers doe run downewards to the Sea *per decliue*, it doth not proue the Sea to be lower then the Land, but onely neere the ſhore where it is terminated, and in lieu of this it hath

ſcope

scope assigned it to fill vp the Globe, and so to be as high as the Land, if not higher. For if a measure should bee taken of the Globe of the earth, it must be taken from the tops of the Mountaines, and from the highest of the Sea, and not from the Vallies, nor from the Sea-coasts. This conceit of mine I was fearefull to publish, and therefore had written vnto Master *Brigges*, mine ancient friend, for his aduice in it, being a point wherein he was well studied: but before my Letter came to Oxford, he was dead. But now I haue aduentured to publish it, to stir vp others to search out the causes hereof, better then hath yet beene discouered. *Exors ipse secandi, fungor vice cotis.*

Cap. 4.

Diuision of Minerall Waters. Minerals described. Their kindes recited. Of earth, simple and mixed. Whether it giue any medicinable qualitie to water. And so of the rest in the following Chapters.

THus much of simple waters, and their originals, which may serue as *Polycletus* his rule to iudge mixed and infected waters by: as *Galen* in many places speakes of an exact and sound constitution of body, as a rule to discerne distempered and disproportionated bodies. And thus much in explication of the *Genus*, in the definition of Minerall waters.

Now I come to Minerall Waters, and to the other part of the definition which wee call difference, &c. from Subterraneall Mynes by Imbibition.

These Minerall waters are either simple or compound; simple, which partake but with some one Subterraneall Minerall; compound, which partake with moe

moe then one. And theſe waters partake with Minerals, either as they are confuſed with them, or as they are perfectly mixed. Alſo theſe minerall waters, whether ſimple or compound, are actually either hot or cold; the reaſon whereof muſt proceede from ſome Subterraneall cauſe, as ſhall be ſhewed hereafter.

Wherefore wee muſt firſt know the nature of theſe Subterraneall Minerals, and their generation, from whence Minerall waters receiue their difference, from common ſimple water, before wee can iudge of the nature and qualitie of them, either Actuall or Potentiall.

By Minerals, we vnderſtand all Inanimat perfect bodies, bred in Mynes within the bowels of the earth. I dare not vndertake to muſter theſe in due order by Dicotomyes, ſeeing neither *Agricola* nor *Fullopius*, nor *Libanius*, nor any other that I know, haue exactly done it, nor ſatisfied either others or themſelues in it: and ſeeing there are diuers Minerals lately diſcouered, and perhaps more may bee hereafter, which haue not beene knowne in former times, and therefore not mentioned; as *Calaem* in the Eaſt Indies, *Ruſma* and *terra ghetta* in Turkey, &c. Wherefore I will make bold to reckon them vp as they come to hand in ſeauen rankes.

The firſt ſhall be Earth.

Earth whether it bebred *ab exhalatione ſicca refrigerata*, or *ex miſtis per putredinem in fimum cõuerſis*, or *ex lapidibus ſole aut calore coctis & deinde aqua ſolutis, &c.* it is all inconcrete. As a little water gleweth it together in *Lutum*, ſo a great deale diſſolues it. But this is no proper diſſolution, but onely a diſioyning of parts by Imbybing the moyſture which conioyned them, into a greater proportion of water; for waters doe naturally runne together, like drops of quickſiluer, or melted mettall. Wherefore ſeeing the moyſture which is in

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the earth, is not naturall, bur aduentitious, not vnited essentially, but onely mixed accidentally, it may well be called an *inconcrete* substance, whose moysture is easily drawne from it, being readie to vnite it selfe with other moysture, and leaue his old body as it found it, that is, dust: yet so as that water retaines with it some taste or qualitie which it receiued from the earth. This dust is neither a simple body, as Elements are, nor permanent in one and the same kinde: but as it participates with *animales vegetables*, and minerals, so it is apt to bee transmuted into any of them, being both Mother and Nurse to all terrestriall bodies. *Agric. de nat. fossil. lib. 1. cap 4.*

Simple earth, if it be not mixed with other substances, is dry and cold, and Astringent. But if it bee mixed, as commonly it is, it altereth his qualitie according to the mixture. Mine intent is to write of it as it is simple, and so of the rest.

Simple earth yeelds but a muddie water of it selfe, and of no vse in Physicke, but if it be mixed with other Minerals, it makes the water to participate with the quality of those Minerals also. As if it be mixed with niter, as in Fullers earth and Marle, it makes the water abstergent like Soape. If with Allum or Copperesse, astringent and more deficcatiue, as in all sorts of Boles. If with Bitumen, fattie and Vnctious, as in Turfe and Peate, &c. We haue diuers examples of all sorts. The Bath of Mount Othon in Italy is full of clay, which is a kinde of Bole. The Bath Caldaria, full of Ocre. The Bath of Saint *Peter* full of a yellow earth, tincted belike with some other Minerals. Wherefore these are to bee iudged of according to the seuerall Minerals which they containe. But seeing earth it selfe makes little impression into water, neither doe wee make any Physicall vse of waters, which containe nothing but earth, I neede not spend any time about them. *Baccius lib. 5. cap. 1.*

Cap. 5.
Of Stone.

De metallis cap. 6.

THe ſecond ſhall be Stone. Stone is another Minerall ſubſtance, concrete and more heauie then earth, and our Minerall men confound themſelues much in the definition of it. Wherefore *Fallopius* implores the helpe of *Marcus Antonius Iunica* about it, as one of the moſt difficult points in Philoſophie: but in the end, defines it by his want of diſſolution, either by heate or moyſture. And whereas it is manifeſt that ſome Stones will melt, he imputes it to the admixture of ſome mettall, among which he receiueth glaſſe. Others define it by his hardneſſe, wherein commonly it goeth beyond other Minerals. But you ſhall haue ſome ſtones ſofter then ſome of thoſe, and therefore the definition is not good. Others by this, that being broken or calcind, they will not bee conſolidated againe into their former conſiſtence or ſhape. But for breaking, the reaſon of that, is want of fuſion; for without fuſion or ignition, which is a kinde or degree of fuſion; Mettals alſo being broken, will not be conſolidated into the ſame Maſſe againe. And there is no more difference in nature or eſſence, betweene a whole ſtone and a broken, then there is betweene a maſſe of Mettall, and the powder or filings of the ſame: As for calcination, other minerals may bee ſo far calcind, and brought to a Crocus by fire, as they will be irreducible, therefore this is not proper to ſtone. Wherefore I am of *Fallopius* his opinion in this point, and the rather becauſe otherwiſe there would ſeeme to be a ſpecies in nature wanting, if there were not Minerall Species wanting, diſſolution by heate or moyſture, as well as there are, hauing ſuch diſſolution. And this *vacuum* which nature

nature abhorres, is not onely to be vnderstood of a locall vacuitie, but also of a want of such species as are in natures power to produce, for the ornament of the world. For if it be a naturall passion to be dissolued, it is likewise a naturall passion not to bee dissolued: and if some things will bee dissolued both by heate and moysture, as Salts, why should there not be other substances which will be dissolued by neither of them. And this must be stone, for nature affords none other. Moreouer according to *Aristotle: Quæ concreuerunt a frigido & a calido, a nullo istorum dissoluuntur.* Of this kinde are Stones which could neuer attaine to such puritie as many of them haue, if they were not congealed by heate as well as by cold. Also vnder what species shall we comprehend, Diamonds, Talcum, *Magnetis, Glymmer, Katzensilber, pyrimachus, amiantus, alumen plumosum, saxum arenarium mortuum, &c.* if not among Stones? yet these are confessed to be inuincible by fire or water. Also all pretious Stones, the more noble and pretious they are, the more they resist dissolution either by fire or water: for this qualitie sheweth the perfection of their mixture. True it is that some stones wilbe dissolued by fire or water, and therefore *Pliny* and *Agricola* diuide Stones into fusible and infusible: but this is in regard of other substances bred in the stone; which if it be Metall, the fusion will be Metallin: If Niter or meane Minerals, it will bee vitrificatorie. As *Pliny* reports of the inuention of Glasse by certaine Merchants, who melting Niter vpon the sand in Siria, where with clods of Niter they had made a furnace for their necessary vse; found that cleere mettall which we call glasse, *Ecce liquato nitro cum arenis visi sunt riui fluxisse nobilis liquoris:*

If Sulphur, as in *pyrite*, it will likewise melt and strike

fire. And whereas the ſtriking of fire out of a flint or pyrits, is held by all men to proceede from the kindling of ayre, by the colliſion of two hard ſubſtances together, they are miſtaken. For then Diamonds, Chryſtall Glaſſe, &c. ſhould ſtrike fire as well as flints, but it is the Sulpher contained in them: And *G. Fabricius* in his obſeruations, although hee obſerues not the reaſon of this fire, yet he confeſſeth that out of any Pyrites *è quo excutitur ignis, etiam excoquitur ſulphur. Pliny* giues the reaſon of the name, *quia ineſt ignis illi.* The like we obſerue in Indian Canes, and ſome Woods that are vnctuous, and full of oyle, which will yeeld fire by frication, or colliſion, not by kindling the ayre thereby, but the inflamable oyle in them. If other concrete iuyce bee mixed with ſtone, as Salt, Allum, Vitrioll, &c. it makes them to relent in water or moyſt ayre; and theſe ſtones are neuer good to build withall. But let vs take ſtone as it is in it ſelfe, without the admixture of other Minerals, and we ſhall find it to be indiſſoluble and inuincible, either by fire or water. Metallurgians and Refyners may make vſe of this for their Shirbs, Tiegles, Hearths, Teſts, &c. Stones are naturally dry and cold, and aſtringent like a concrete earth.

Eraſtus diſput. part. 2. pag. 205.

Simple Stones which haue no other Minerals mixed with them, and are come to their perfection, being indiſſoluble, either by fire or water, can yeeld no qualitie or vertue to Bathes, and therefore hee that ſeekes to dtaw any vertue from ſtone into water, doth *lapidem lauare*, that is, labour in vaine. But by reaſon of admixtures, they may, or whileſt they are *ſucco lapideſcente*, before they are concreted. For if it be certaine that metals may yeeld vertue to Bathes, being alike indiſſoluble by water, there is no reaſon but Stones alſo may. *Fullopius* is againſt it in both, but contradicted by *Iulius Cæſar*,

Cæsar, *Claudius*, and diuers others; yet hee confesseth that *Balneum montis Grotti*, hath *Gypsum*: and *Gesner* affirmes the same of the Baths of Eugesta. Also he findes *ramenta marmoris in Balneo Corsenæ & Agnano*, but he iudgeth that they receiue no qualitie but from the iuyce, and I doubt not but he is in the right. And for *succus lapidescens*, we haue many examples in *Agro Pisano & Lucensi* in Italy, in Auernia in France, where this iuyce is so plentifully brought by a cleare Spring, that after it is congealed, the people digge the stones, and haue made a great bridge of them. Also neere Vienna in Sauoy, in a village called Giaret, is a cleare fountaine which turnes to stones as hard as flints: *Pliny* makes mention of the like Springs in Eubea, which are hot: and *Vitruuius* of the like at Hieropolis in Phrygia: Also *Iosephus a Costa* of the like hot Springs in Guaniauilica in Peru, which turnes to stone, whereof they build their houses. *Anthonio de Herreza*, *cap.* 20. tels of the same Spring at Guainia velica, which turnes to stone as it ariseth, and kils those that drinke of it. Also this *Succus lapidescens* is obserued in the Bathes of Apono, where it is conuerted into stone vpon the sides of the Bath. Also in the Bath of Rancolani, where this iuyce is not confused, but perfectly mixed with the water, & being imbybed by plants, it hardens them like stone. *Baccius* tels vs of a Caue by Fileg in Transiluania, which turnes water into stone. The like is found at Glainstaynes in Scotland, as *Hector Boetius* reports. In England also we haue many fountaines which turne wood into stone: which must be by reason of this *succus lapidescens* mixed with the water. Corall also being a plant, and nourished with this iuyce, turnes to a stone: so doth the seede of Lithospermon or Gromell. Thus much of stone.

In ingressu ad infirmos p. 373. *Venusius in consilio pro Petro Picardo.* *Baccius etym:*

Lib. 6. *c.* 14

Cap. 6.

Of Bitumen. His kindes, qualities. Of Camfor in particular. That Bitumen is predominant in the waters of Bathe.

NExt I come to those Minerals which we call *Bitumina*, which are Minerall substances that burne and waste in the fire without metallin fusion, or ingression. The greatest affinitie they haue, is with Sulphur: but this hath ingression into mettall, and Bitumen hath none. Of this kinde some are solid, and some liquid. Solid, as *Succinum, gagates, ambra, camphora, terra ampelitis, Lithanthrax, siue carbo fossilis, &c.* Liquid, as *petroleum* and *naphtha*. All these are great fuels to fire, especially those that are liquid, which are thought to draw fire vnto them, if it be within their *effluuium*: So *Pliny* reports that *Medea* burnt *Creusa* by anoynting her Garland with Naphtha: and *Strabo* tels how *Alexanders* Bath-master, *Athenophanes*, had almost burnt *Stephanus*, a boy in the Bath, by sprinkling Naphtha vpon him, if it had not beene suddenly quenched. And this is that iuyce or thicke water which *Plato* in *Timeo* reckons among fires, and which the Egyptians vsed in their sacrifices, and was hidden by the Iewish Priests in a dry pit for 70. yeares, and afterwards found by *Nehemias*.

Machab. 2. 1.

But whereas it is a common receiued opinion, that some of these *Bitumina* will burne in water, I cannot beleeue it: although *Plynie* and *Agricola*, and most that haue written since, out of them doe auerre it, and bring arguments and examples to proue it. For although water were a fewell to fire, as oyle is, yet there can bee no fire without ayre, and water excludes ayre: and so doth oyle,

oyle, if the fire be beneath it, and couered with it. As for their arguments, they say that Bitumen being besprinckled with water, burnes more, and therefore water is a fewell to it: as we see that Smiths cast water vpon their Sea-cole in their Forges: but the reason of this is because their Coale being small like dust, the water makes it to cake and bake together, where otherwise the blast would blow it away: also it hinders the quicke burning of it, and so makes it continue the longer: so in a *Vulcano* after raine, they finde the fire to burne more, when the Bitumen is small, and in dust. Although this may be a reason of it, that the Lyme which hath there beene calcined, being by raine dissolued, increaseth the fire. And whereas they say that water will kindle Bitumen, and quench Sulphur, it is not so: neither doth their example of Wilde-fire proue it. For in Wild-fire, besides Bitumen and Campher, there is quicke Lyme, which by reason of the sodaine dissolution of his Salt, by the affusion of water, is apt to kindle any combustible matter; not by reason of any Bitumen in the Lyme, as some imagine, nor of any *Empyreuma* which the fire hath left in it, as *Tracastorius* thinks: for, how can there be any Bitumen left in the Lyme (if there were any at first) after calcination: the fire would haue consumed that before any thing else. And as for any *Empyreuma*, it is certaine that the more any thing is burnt, although the fire leaue an adustion in it, the lesse apt it is to burne againe, especially being burnt and calcind *ad calcem aut cineres*, where all the combustible matter is spent. Wherefore it must needs bee by the violent motion which is in the suddaine dissolution of the salt in it, as appeares by the crackling it makes: *Et ex motu fit calor.* The like we obserue in *Pyrite sterili* whereof they make Vitrioll, which being broken and laid vp in

De sympath. & antipath. cap. 10.

in heapes, and moyſtned with water, will gather heat, and kindle any combuſtible matter put to it. The like alſo we finde in Allum myne, &c. where thoſe minerall iuyces being concrete in the Myne, when they come to ſuddaine diſſolution doe grow hot, and will kindle fuell. And as for the example of the ſalt Lake whereof *Agricola* writes, betweene *Strapela* and *Seburgh*, which burnes the fiſhermens nets if they be put neare the bottome: and of the like *Sputa*, in *Media*, mentioned by *Strabo*, which burnes clothes put into it: I take that to be by reaſon of the corroſiue quality of the ſalt which frets them, being ſtronger neare the bottome; and not from Bitumen, as *Agricola* thinks. The like I iudge of the Lake by *Denſtadt* in *Turingia*. And it is very probable that ſalt being heauier then water, wilbe moſt towards the bottome: as it is reported of the fountaine *Achilleus* in *Mileto*, whoſe water is very ſweet and freſh aboue, and very ſalt towards the bottome. So is the water of *Agnano* in *Italy*, as M. *Sandys* reports in his trauels. And the more heauy and terreſtriall any ſalt is, the more corroſiue it is: and ſo contrariwiſe, the more corroſiue, the more heauy. *Ariſtotle* affirmes the ſea water to be more ſalt at the bottome then aboue: and ſo doth *Pliny*, who likewiſe makes mention of the Lake *Aſcanius* in *Chalcide*, whoſe top is ſweet, and bottome nitrous. *Baccius* writes the like of a Well neare *Toletum* in *Spaine*, the water whereof is ſweet aboue, and corroſiue beneath: which he iudgeth to be from Quick-ſiluer. *Fullopius* is alſo of opinion, that Bitumen doth not only burne in water, but is nouriſhed by water, becauſe it makes the fire to laſt longer. But I haue ſhewed the reaſon of that before. And for the burning in water, he ſhould haue ſaid vpon the water; for there it wil burn as long as it ſwimmeth; but dip it vnder the water, and it is preſently extinguiſhed. And

Denat. cor. q. effiu. è terra. l 4. c. 22.

Meteor. 2.

Lib 6. c. 111

De Thermis. c. 5.

And whereas some report that Queene *Anne* of blessed memory, being in our Kings Bath, there arose a flame of fire like a candle from the bottome of the Bath to the top neare vnto her, they must giue mee leaue not to beleeue it, but rather to thinke they were mistaken: for, I am not bound to beleeue any thing against reason, which God hath giuen mee to bee my guide. It might haue beene some bubble of winde which is frequent in our Bathes, or some Bitumious matter not dissolued in the water did arise, and being at the top, dissolue it selfe vpon the surface in the forme of a circle: but it could not be kindled. And if it might bee kindled in the water (which were impossible) yet in all likelyhood it would haue burnt better aboue the water then within it, and not be presently extinct, as they report. These *Bitumiana* (excepting Camfer) are potentially hot and dry in the second or third degree; but concerning Camfer there are two doubts. First, whether it be a Bitumen or a Gum. Secondly, whether it be hot or cold. The Arabians affirme it to bee the Gum of a huge tree with white leaues, vnder whose shadow many wild beasts may lie: and that after earthquakes there is great plenty found; that it is in quality cold and dry in the third degree; some late writers follow them in their opinion of a Gum, as *Mathiolus*, *Amatus Lusitanus*, *Garrius ab horto*, *&c.* *Platearius* holds it to bee the iuyce of an herbe. But we must consider that they make two sorts of Camfer, the one of *Borneo*, the other of *Chyna*. For that of *Chyna* they confesse it is adulterated with Bitumen: and that is the only Camfer in vse with vs. But that of *Borneo* to bee a simple Gum, and that a pound of this is valued as deare as an hundred pound weight of the other. So that all the doubt lyeth in this Camfer of *Borneo*; which whether it be a Gum

Serapio de simp. med. c. 344. Aviten. lib 1. tract. 1. c. 2. Item l. 2. tract. 2. cap. 133. Item de med. cordial. tract. 2. cap. 3.

or no, is ſtill in controuerſie. For the Arabians not trading into thoſe parts, had the notice hereof only from others, as *Serapio* and *Auicen* doe confeſſe: and *Amatus Luſitanus* ſaith that the inhabitans will not ſuffer ſtrangers to come aſhore to ſee it. So as we haue beene kept in ignorance a long time from the true knowledge of it. And *Garrius ab horto* tels vs, that all his knowledge of it, is but by relation: himſelfe not being able to trauell to ſee it; partly by reaſon of his age, and partly for his continuall imployment about the Viceroy. Only *Eduardus Barboſa* reports that he did ſee the place in *Borneo*, and found it to be of a minerall nature. I procured ſome of that Camfer to be brought from thence by my worthy friend Captaine *Beſt*, but whether it be a Gum or a Bitumen, by the view I cannot diſcerne. But if it be a Gum, why ſhould it abound more after earthquakes? and why ſhould it burne and not diſſolue in water? No Gums will burne, and all Gums will diſſolue in water: and earthquakes make no trees fruitfull, but may caſt forth minerals. That there is a naturall Bitumious Camphire, I make no doubt: and *Agricola* proues it ſufficiently: And the Bath in *Romandiola* neare *Rhegium* ſhewes it. Alſo the Well by *Muntzbach* where *Taberni montani* ſaith there is mineral Camphir. *Averroes* ſaith it is *affinis Bitumini*.

In Dioſcoridem Cap. de maſtich.

Lib. 1 Cap. 9.

De nat. foſſil. lib. 4. cap. 2.

Theſaur. exqui. lib. 1. cap. 2.

Now for the qualities of it, the moſt generall and trueſt opinion is, that it is cold and dry. *Matthiolus* iudgeth it to be hot for three eſpeciall reaſons. Firſt, becauſe it burnes, and is a great fuell to fire. If this argument bee good, then flax, and ſtraw, and paper, and touchwood, and ſpunck ſhould be hot, for they are apt fuels to fire. Secondly, becauſe it is *odorata*, and hee holds all *odorata* to be *calida*: *Galen* is of another opinion, and holds the iudgement of ſimples by ſauour to be vncertaine

Comment. in Dioſc. et Epiſt. l. 3. Thaddæo Nemico.

De ſimpl. med. facult. l. 6. c. 2.

certaine. And as for Campher, *Galen* knew it not. *Avicen* saith expreſſely of Campher, that although it bee *odorata*, yet it is *frigida*. And if *Matthiolus* his reaſon were good, then Roſes, and Violets, and Vinegar ſhould be hot; for they are *odorata*. It is true that all ſauors ariſe from heat, as *Galen* ſaith, and all compounded bodies haue ſome hot parts: but wee ſpeake of the predominancy in the ſubiect. Thirdly, becauſe it bytes the tongue. So doth iuyce of Limons, and Barberies, and Vinegar, &c. and yet they are cold. Wherefore I conclude our Campher to be a Bitumen, and in quality cold and dry; and of very ſubtill parts. Theſe *Bitumina* being vnctuous and oylie, diſſolue not of themſelues in water, without the helpe of ſome minerall iuyce, but may be confuſed with it. And wee haue many fountaines and lakes which participate with them. In Shropſhire at *Pitchford* is a ſpring that caſteth forth Bitumen ſwimming vpon the water. The like we read of in *Auernia* in *France* betweene *Claremond* and *Monferan*, where the people gather it for their vſes. In *Italy* there are many fountaines yeelding Bitumen, at *Maianum*, and *Saſſoli*, and *Salſa*, and *Herculanum* at the foot of the mountaine *Veſuuium*, at *Baia*, and alſo at the cape of S. *Helena*, and in the Iſle of *Woolfs* there are fountaines of pitchie Bitumen, which are vſed to pitch ropes and tackling, as *Ioſephus à coſta* reports. And we haue that famous lake *Aſphaltites* in *Iudæa* ſo full of Bitumen, that it hardly ſuffers any thing to ſincke in it. The riuer *Liparis* in *Cilicia* by reaſon of a ſpring neare *Solos* is ſo full of liquid Bitumen, as they which ſwim or waſh in it ſeeme to be anointed with oyle. Alſo there are Bitumious ſprings in *Saxony* at *Bruno*, in *Sweuia*, the lake *Tegera* at *Gerſedorf* vnder the mount *Iurat*; In *Aſia* by *Tralleis* and *Niſſa*. Alſo in the Weſt Indies there

Lib. 1. tract. 1. c. 2.

Bellonius de Naphtha c. 7.

Agric. de nat. eor. quæ effiu. è terra. l. 1. c. 7.

are many found which they put to vse for shipping. And this Bitumen is the chiefe ingredient in our Baths at Bath in Somersetshire, although dilated with much Niter, which makes the solution the better, and the water more cleare. That Bitumen is predominant in these our Baths, may bee proued by the effects, because wee finde them exceedingly to comfor the nerues, supple the ioynts, dry vp rheumes, cure Palsies, and Contractions, being distincty vsed, tinct siluer into the colour of gold, &c. Also by the Bitumeous sauour of them, and by the neighbourhood of Cole mines in those parts. All which doe argue Bitumen to abound in them. And whereas Doctor *William Turner* in his treatise of these Baths, thinketh Brimstone to bee the chiefe minerall, and Copper next; I am out of his opinion. The actuall heat is no argument of Brimstone, as shall bee shewed when I come to that point: nether doth the sauour bewray it. But his reason for Copper is very weake. He found a Marchesit vpon one of the hils, which hee thought to hould Copper. But Marchesits although they shew yellow, yet they seldome hold Copper, or any other metall. But his discourse hath perswaded *Iohn Bauhinus* to publish it confidently to the world. I shall haue occasion to speake more of this hereafter. And thus much of *Bitumina*.

De thermis Boll. li. 3. c. 1.

CAP.

Cap. 7.

Of Minerall iuyces concrete: called by the Alchimists, Salts. The foure principall sorts of them; Salt, Niter, Allum, Vitrioll.

A Fourth sort of minerals are concrete iuyces which are minerall substances dissoluble in water. These the Alchimists call Salts, and are the meanes of communicating all other minerals with water. For as water is apt to dissolue and extract vegetables, so are these concrete iuyces apt to dissolue and extract minerall substances. And although they are found sometimes liquid being dissolued by moisture: yet we call them concrete, because they will be concrete when the aduentitious moisture is remoued. Our minerall Authors doe make many sorts of these according to the seuerall minerals which they imbibe: but in truth they may bee all reduced to foure heads; Salt, Niter, Allum, and Vitrioll. And each of these hath diuers species, as *Geber* and *Casulpinus* say of Salt, *quot genera calcium, tot genera salium.* Concerning Vitrioll there may bee some doubt whether it be a distinct species from Allum, and and haue receiued only some tincture from Copper, or Iron, or from some of their brood, which are called excrements. For in distilling oyle of Vitrioll, the lute wherewith the glasses are ioyned, will yeeld perfect Allum. And Vitrioll being boyld ariseth in balls as Allum doth, and shoots like Allum *in globos*; as Salt doth *in tesseras*, and Niter *in stirias*. Among these concrete iuyces *Agricola* reckons Sulphur, Bitumen, Auripigmentum, Sandaracha, Chrisocola, Erugo, Mysi, Sori, Melanteria, &c. But if wee examine them aright, wee shall finde, that either they are not dissoluble in water as

Libauius in Syntagm. p. 221.

Cæsalpinus de metallis c. 3. l. 1.

concrete iuyces ſhould be, or they are ſome of thoſe iuyces tincted or incorporated with other mineralls. All theſe minerall iuyces are accounted hot, and dry, and aſtringent, and detergent, ſome more, ſome leſſe: and we take it ſo vpon truſt. But this point requires further conſideration and diſtinction.

Salt is aſtringent, detergent, purging, diſperſing, repelling, attenuating, makes an eſcar, and preſerues from putrifaction, as *Dioſcorides* informes vs, and *Galen* confirmes the ſame, adding that it is hot. But we muſt vnderſtand *Galen* with this limitation, *lib. 6. cap.* 30. That the more it is deterſory, the leſſe it is aſtringent. And all aſtringent things are cold, as hee auoucheth, *lib.4. cap.6. Acida, acerba, & aſtringentia omnia frigida.* Now if ſalt be aſtringent, it muſt bee cold by *Galens* owne rule, and it is not enough to ſay it hath warme parts in it, but being an vniforme ſubſtance, wee muſt determine of it *ex prædominio.* Alſo *Galen lib.*1. *Symp. cap.* 4. comparing pure water with ſea water, ſeemes to affirme that ſea water, before it haue receiued any great aduentitious cold, may coole our bodyes. And ſo this place is vnderſtood by *Anthonius Maria Venuſtus in conſilio pro Petro Picardo*, The repelling quality, and the making an eſcar, and the preſeruing from putrifaction, are arguments of drineſſe, and not of heat. For as heat and moyſture are principall agents in generation and corruption; ſo cold and drineſſe in preſeruation. Alſo I ſhould impute the purgatiue and deterſorie qualities in ſalt rather to the tenuity of parts, and the ſtimulation which it hath from thence, then to any heat; for then as *Sennertus* ſaith, all hot things ſhould purge; *Inſtit. lib.* 5. *part.* 1. *cap.* 11. *Valeriala in Gal. de conſtit. artis pag.* 447. And *Meſne Canon. univerſal. cap.* 1. reiects all elementary qualities, temperaments, ſimilitudes, or contrarieties

Dioſc l.5.c.84. De ſimpl.med. facult.l.4. c.20. & l.11.c.50.

contrarieties of ſubſtances, &c. in purging medicines. Alſo Tamarinds, Myrabolans, and Antimony doe purge, and yet are cold, *Venuſtus pag.* 132. But the purgatiue faculty of medicines is from ſtimulation of the expulſiue faculty of the ſtomach and guts, and not from attraction by heat of peculiar humors, as hath beene imagined. Heat may ſerue as an inſtrument to actuate ſtimulation, as cold doth dull and benumbe all faculties, but neither heat nor cold are principall agents in this worke. And whereas Reubarb is thought to purge coller only, Sene and Polipody melancholy, Agarick phlegme, &c. becauſe wee ſee the excrements tincted with the ſame colors, it is a deceit: for theſe purgations doe colour humors in that manner. Yet I doe not deny a diſtinction to be made of purgations in other reſpects. And our ancient Phyſitians through long experience haue found out the right vſe of purging medicines, and their true diſtinctions for ſeuerall vſes for mens bodies: as that ſome doe purge groſſe humors, and ſome thin, ſome are ſtrong, and ſome weake: ſome are comfortable to the ſtomach, or liuer, or ſpleen, &c. and ſome hurtfull to ſome of thoſe parts: ſome are too hot in ſome caſes, and ſome temperate, &c. But they haue not diſcouered the true cauſe of this purging quality: ſome attributing it to a celeſtiall influence, ſome to a hidden quality, which is as much as if they had ſaid nothing: ſome to a Sympathy, Antipathy, &c. For my part I hold the purgatiue quality of mixt bodies to lie principally in the terreſtriall part of them, which is their ſalt: and therefore the Chymiſts vſe to acuate their purging extracts with their proper ſalts. It were much better if they could make their ſalts without calcination: for then they ſhould retaine the taſt of the Simples, which lyeth in the ſalt, and much

much other vertue which the fire consumes in calcination. And I am likewise of opinion, that as their purgatiue-qualitie lyeth in the Salt, so it workes by Stimulation, a qualitie most proper to Salt, whereby it furthers all generations, &c.

Niter doth dry and attenuate more then salt, and although it hath not so much astriction as Salt is said to haue, yet it seemes to coole more then Salt, perhaps because it is of thinner parts, and penetrates more, and that is the reason that it serues better for the dissolution of Mettals. In physicke we finde our Sal nitrum (which is a kinde of it) to coole the body mightily, and therefore vsed in Iuleps: Allum and Vitriol are much alike, but that Vitriol hath a garbe from Copper or yron. These are very astringent, and without doubt cold, whatsoeuer hath beene held of them. The waters or phlegmes distilled from them doe exceedingly coole in Iuleps, as *Quercitan* and *Claudius Dariot* haue obserued, and we also by daily experience doe finde true: by reason of the intense aciditie they haue, being distilled from their Terrestriall parts. Also those *acidula* which the Germans call Saurbrun, proceeding from these iuyces, are much vsed to quench the heate of feuers. It may be obiected, that they are Corrosiues, and will eate into mettall, and therefore must bee hot. But by the same reason, the iuyces of Limmons, Barberies, Howsleeke, &c. should be hot, for they will carue iron. To bite and eate as a Corosiue, are not arguments of heate, but of piercing: Wherefore *Hippocrates* saith, *Frigus vlceribus mordax*, and *frigus est principium destructiuum, vt calor generativum*. And therefore it is more probable that these corrosiues are more cold then hot. These two minerall iuyces are not so readily dissolued in water, as the other two, and will be more easily precipitated by

In pestis Alexic. Dariot de præparat. med. Tract. 2. cap. 23 24.

any

any oppoſite ſubſtance that is more familiar to water. I omit the ſeuerall ſorts of theſe concrete iuyces and their admixtures with other minerals, as impertinent to my purpoſe: wherefore I will ſhew ſome examples of each of them in naturall Springs.

For ſalt Springs, *Ioſephus a Coſta* tels vs of a rare Spring at a farme neere Cuſco in Peru, which as it runs, turnes into very white Salt, without any fire or Art, in great abundance. In Germany are many ſalt fountaines, at Luneburg, Stafford, Saltzburg, Aldondorg, Halſtat, &c. In Italy, *in agro Volaterano*, &c. In Cicily, at Solinantia, is a ſalt Well which is hot; and ſo are the Pegaſæi fonts in Caria. Alſo the fountaine by Medon in Træſen is both ſalt and hot. Our Wiches in Cheſhire are well knowne. There are alſo Riuers of ſalt water by the Caſpian ſtreights, and in Spaine, and Caria, and in Bactria, Ochus and Oxus. Alſo there are ſalt Lakes, as the Tarentin Lakes in Italy, the Lake betweene Strapela and Seburg (mentioned before) In Germany three Lakes, in Cicily, and beſides an infinite number in other Countries, the Lake of Lakes, the Sea. All which receiue their ſaltneſſe from Mynes of ſalt in the earth, which are very frequent and huge in bigneſſe, as may appeare by the Rocks of Salt in Bohemia, in monte Carpato, in Polonia, within two miles of Cracouia, in Heluetia, and Rhetia, where they haue no other ſalt but from the Rocke. As alſo by the Caſpian Straights, are great Rocks of Salt. But *Marcus Paulus Venetus*, tels vs of a Rocke or Mountaine of Salt in *Thaican*, able to furniſh all the World with Salt. So that it is no maruaile that the Sea is ſalt, ſeeing it pierceth into the bowels of the earth, and diſcouereth many great Rockes of Salt which diſſolue in it. And this is the true cauſe of the ſaltneſſe of the Sea. And conſidering the Lib. 3.

great vse of Salt, both for other vses, and for generations, nature hath prouided enough of it, especially in the Sea, which is more fruitfull in that respect, then the Land. Wherefore *Venus* was called Αλιγενὴ : *Est Venus orta Mari.*

Niter is seldome found in Bathes alone, but mixt with other minerals, which it dissolues, and infects the water withall. Yet we reade of a nitrous Lake called Letis, neere Calestria in Macedonia, where they vse to make Niter, and vent it to all parts. So they doe at the Nitrarie in Egypt. Also the Lake Arethusa in Armenia, is full of Niter. At Menis in Phrygia is a Spring of nitrous water which is hot: also in Leonte is a hot nitrous Spring. *Bellonius* makes mention of a Nitrous fountaine neere Belba, and of abundance of Niter vpon a Plaine neere thereunto, which seemes to be that which *Pliny* cals Halmiraga. But he denieth that there is any Mine of Niter vnder the earth, but that all is bred out of the Soyle as an *efflorescens* of the earth: *Baccius* saith the same of Salt-Peter. *Agricola* saith, that as the true Niter is gathered vpon the Playnes of Media aboue the earth, so is Salt-peter found aboue the earth in many places of Saxony: That, Niter is gathered vpon the Plaines of Media, are *Plinys* owne words. *Exiguum fit apud Medos canescentibus siccitate connallibus.* So that it seemeth, his opinion was, that Niter is not bred in a Myne vnder the earth, but in the earth it selfe, as the chiefe fatnesse it hath to further generations. And seeing earth is the mother of all Terrestriall bodies, it is not left vnfurnished with those minerall iuyces, nor ought else that is requisite for the production of species: It hath beene obserued by some, that nitrous water is the best soyle for ground, and brings all Plants to perfection farre sooner then any other dung, and therefore the

Obseruat. l. 3: c. 76, 77.

Lib. 5. c. 7.

Lib. 31. c. 10.

the Egyptians water their Coleworts with Nitrous water, *Nitrosa viridis brassica fiet aqua.* Our Salt-peter men doe finde, that if any fat earth bee couered from raine and sun, so as it spendeth not his strength in producing of Hearbs or Grasse, it will breede plenty of Salt-peter, otherwise it will yeeld none. The difference betweene Salt peter and the ancient Niter, appeares in this, that a pound of Niter being burnt, will leaue foure ounces of ashes; Salt-peter will leaue none. Salt-peter is actually so cold, as being dissolued in water, it is vsed in Rome and Naples to coole their Wine, and doth it as well as yce or snow. Also we vse it inwardly in cooling Iuleps, and therefore it seemes also to bee potentially cold, as *Bellonius* iudgeth. *Martial.*

Now I come to Allum *(Indignum vox ipsa iubet renouare dolorem)* the greatest debitor I haue, and I the best benefactor to it, as shall appeare when I shall think fit to publish the Artifice thereof. In Illua, a myle from Rio, is an Allum fountaine: also there are diuers in Agro Senensi, Volaterano Lucensie, in Italy, *Balneum de villa* is full of Allum: and with vs in Shropshire at Okenyate, are Allum springs, whereof the Dyers of Shrewesbury make vse in stead of Allum. As for allum Mynes, they are frequent almost in all Countries, but the chiefest that are wrought, are at Capsylar in Thracia, at Tolpha neere Ciuita Vectia in Italy, at Commataw by Aussig in Germany, and with vs in Yorkeshire, In Ireland there haue beene Allum workes neere to Armagh, as *Thurmiser* reports: also at Metelin in Spayne. at Mazaron neere Carthage, at Hellespont, Massa, Montrond, Piambin, Volterra, Campiglia, &c. as *Beringaccio Sieneſe* reports. Also there are diuers earths yeelding allum, as at Guyder in Carnaruanshire, at Camfurt in Dorsetshire, and in the Ile of Wyght. But I will contract *Pyrotechnia l. 2. c. 6.*

my selfe for Allum, and come to Vitriol.

Vitriol, as I haue said before, doth participate much with Allum in the manner of shooting or roching, which is *in glebas*, in the hard dissolution and easie congelation, in their arising in balls being burnt, and in their precipitation : in so much as it is probable, that the basis of Vitriol, is nothing but Allum. It is found in minerall waters of two sorts. The one, where the very body and substance is dissolued : as in Cyprus, which *Galen* describes, where the water is greene : also at Smolnicium in Hungary, in Transiluania *ad Carpatum montem*, at Nensola, &c. In which places Copper is ordinarily made out of iron by infusing it in these waters. I will not determine whether this be transmutation of one species into another, as some doe hold, or rather a precipitation of the Copper which was formerly dissolued in the water by meanes of the sharpe Vitriol ; which meeting with Iron, corrodes it, and imbibeth it, rather then the Copper, and so lets the Copper fall, and imbraceth the Iron in place of it. Wee daily see the like in Aqua fortis, which hauing imbibed one metall, will readily embrace another that is more familiar to it, and let fall the first. So Allum or Coppresse water hauing some strong Lixiuium of tartar or other calcind salt put to it, the Allum or Coppresse will presently fall to the bottome, and participate, and giue place to the Lixiuium, as a thing more familiar to water, and of more easie dissolution. But as I say, I will not determine this question, because it is not much pertinent to our businesse. Yet I will not omit the iudgement of *Lazarus Ercker* the Emperours chiefe Mine master in the Kingdome of Bohemia, who professeth that he was long of this opinion, but altered it vpon this reason, That by exact proofe he found more

Simp. med. facul. l. 9. c. 61.

Libau. in Syntag. 3. part. l. 7. Item, singularia part. 1.

Lib. 3. Von. Kupffer ertz.

Copper

Copper ſtricken downe this way by Iron, then the water before did containe, and with the Copper ſome Siluer. The other kinde of Vitriol water is, where not the body and ſubſtance of Vitriol is diſſolued, but the ſpirit, or vapour, or quality communicated to the water: of this ſort are our Vitriol Baths for the moſt part. And theſe are in themſelues wholſome, and are ſowre, if the Vitriol be predominant. Such are moſt of our *Acidulæ*; whereof we haue many in *Viterbio & Volaterano*, *Balneum ad morbum dictum*, Saurbrun by Franckford, *ad Oderam*, &c. theſe are ſowre waters. Alſo from Allum, but milder, alſo from Sulphur, whoſe ſpririt or vapour being burnt, is little differing from the ſpirit of Vitriol, but ſomwhat ſalter. But the moſt part of our *Acidulæ* are from Vitriol. This ſowre ſpirit of Allum, Vitriol, or Sulphur, *Libavius* iudgeth with *Thomas Iordanus* to be in the terreſtriall parts of theſe minerals, becauſe it goes not away by boyling or diſtillation, and therefore to be communicated with water by the corporall ſubſtance or iuyce of them. But that holds not in minerall ſpirits which are heauier then water, as may appeare by euaporation of any water made ſowre with ſpirit of Vitriol or Sulphur, where, after long euaporation, that which remaines will be more ſowre then before euaporation. So it is alſo in Vinegar being a vegetable iuyce. The ſpirit of wine doth certainly ariſe firſt in diſtillation, and the firſt is the beſt, being more volatill then the vapour of water. But this *ſpiritus aceteſus* which is in Sulphur, Allum, Vitriol, and Vinegar, ariſeth laſt; and the more you diſtill away from, it the ſharper it ariſeth; and the ſowrer is that which remayneth. Thus much for Vitriol and concrete iuyces.

Io. Baubinus de thermis l. 2. c. 2.

De iudicio aqu. miner. p. 2. c. 36.

Cap. 8.

Of minerall spirits. Quicksiluer, Sulphur or Brimstone, Arsenick, with his kindes; Cadmia.

A Fift kinde of mineralls are called spirits; these are volatill in the fire, and haue ingression into metals, but no metallin fusion. These are Quicksiluer, Sulphur, Arsenick, Cadmia, Rusma, &c. All which being volatill will easily sublime, and being mixed with metals, as Cadmia is ordinarily to make Brasse, will alter the colour of the metall, and make it lesse fusible, and lesse malleable. I will briefely run ouer the examples of these and their virtues, or qualities, being more obsure and in our Bathes lesse vsefull then the former, and more rare.

Simpl. med. facult. l. 9. c. 59. Quicksiluer was not well knowne to *Galen*, for hee confesseth that hee had no experience of it, and did thinke it to be meerely artificiall, and not naturally bred in the earth. *Dioscorides* makes no mention of the temperature of it, but holds it to be a pernitious venome, and to fret the entrayles: although *Mathiolus* affirmes that it is safely giuen to women to further their deliuerance, and we find it so by often experience, both in that cause, and in Wormes, and in the French Disease and Leprosies, if it be skilfully prepared, and with iudgement administred. *Fallopius* holds it to be one of the miracles of nature. Those that take vpon them to determine of the qualities of it, are much distracted; some reckoing it to be hot and dry, and some cold and moist; and both in a high degree. But in this account they consider not the qualities of the ingredients in the preparation; whether it be sublim'd or precipitated. For my part I know not how to reduce it to the Elementary qualities: neither

Vidus Vidius curat. generatim p. 2. sect. 2. l. 3. c. 13.
Fallopius de metallis c. 37.

ther am I ashamed of mine ignorance in it, seeing no man hitherto hath giuen true satisfaction herein. But for our owne vse where reason failes vs, let vs be guided by experience. We finde by experience, that it cuts, attenuates, penetrates, melts, resolues, purges both *ad centrum & à centro*, heats, cooles, &c, and is a transcendent beyond our rules of Philosophie, and a monster in nature, as *Renodæus* saith. For our purpose it is enough to know whether it will impart any qualitie to water; which *Fallopius*, *Baccius*, *Solinander*, *Bauhinus*, and *Felix Platerus* doe acknowledge. But it giues no taste to it, neither haue we many examples of Baths which containe it. In Serra Morena in Spaine, neare the village Almedien is a Caue, where are many Wels, infected (as is thought) with Quicksiluer, because much of that minerall is extracted from thence, out of a red stone called *Minium nativum*. About fifty miles from thence in Valentiola there is another fountaine called La Naua, of a sharpe taste, and held to proceede from Quicksiluer, and these waters are found wholsome. So are the waters at Almagra and Toletum, and others by the riuer Minius, which are hot. There are many venomous springs attributed to Quicksiluer, as the red fountaine in Ethiopia, others in Boetia, Cæa in Trogloditis, Stix in Archadia, Stix in Thessalia, Licus in Sicilia, &c: which perhaps are from other mineralls, seeing wee finde some from Quicksiluer to be wholsome. For mines of Quicksiluer, we read of many in Bætica, Attica, Ionia, out of a stone which *Pliny* cals *vomica liquoris æterni*. In Germany at Landsberg, at Creucenachum, Schenbach, Beraun aboue Prage Kunningstien, &c. In Scotland, three miles beyond Barwicke, I found a red stone, which I take to be *minium nativum*, seeing *Agricola* makes mention of it in Scotland, but by a mischance could not try it.

Sul-

Sulpher attracts, contracts, resolues, mollifies, discusses, whereby it shewes a manifest heate, though not intense, yet the fume of it is very soure, and therefore must coole and dry: and I perswade my selfe that there is no better fume to correct venomous and infectious ayre, then this of Sulphur, or to remoue infections out of roomes, clothes, bedding, vessels, &c. We must acknowledge parts in all compounded bodies; as Rubarb hath a purgatiue qualitie in the infusion, and an astrictiue in the Terrestriall substance, where the salt hath beene by infusion extracted. The substance of Sulphur is very fat (*Sulphure nihil pinguius*) saith *Felix Platerus*) and this is the cause of his easie taking of fire, and not any propinquitie it hath with fire in the qualitie of heate: for if it were very hot, *Dioscorides* would not commend it *purulenta extußientibus*, the next dore to a Hectick. Also *Galen* saith, that fat things are moderately hot, and are rather nutriments then medicaments. Now for Sulphurous Bathes, they are very frequent, and if we should beleeue some, there are no hot Bathes, but participate with Sulphur, but they are deceiued, as shall appeare hereafter, when we come to shew the true causes of the heate of Bathes. Neither are all sulphurous Bathes hot. *Gesner* reports of a Bath by Zurich, very cold, and yet sulphurous. *Agricola* of another by Buda in Pannonia. In Campania by the Leucogæan hils, are cold Springs full of Brimstone. Also there are hot Bathes without any shew of sulphur that can be discerned, as the Bathes of Petriolum in Italy, the Bathes Caldanellæ and *de Auinione in agro Senensi de Gratta in Viterbiensi, de aquis in pisanis collibus, Divi Iohannis in agro Lucensi in Alsatia*, another not farre from Geberfallerum, &c. All which are very hot, and yet giue no signe of Sulphur either by taste, or smell, or effects. And

yet

yet no doubt there are many Baths hauing a Sulphurious ſmell from other minerals; as from Bitumen, Vitriol, Sandaracha, Allum, &c. which are hardly to be diſcerned (if at all) from Sulphur: So we commonly ſay, if a houſe or a tree bee ſet on fire by lightning, that it ſmels of Brimſtone, when there was no Brimſtone there. Many things combuſted will yeeld a Nitorous ſmell, not diſcernable after burning, what the things were. But there are diuers truly Sulphurous Baths which containe Sulphur, although not perfectly mixt with the water without ſome *medium*, but only confuſed: for perfect Sulphur will not diſſolue in water, no more then Bitumen. The ſpirit of Sulpher may be communicated to water, and ſo may the matter of Sulphur before it hath attained his perfect forme and conſiſtence: otherwiſe it is only confuſed with water, and alters it into a milky colour. *Sulphurea hac albus aqua.* At Baia are diuers hot Sulphurous Baths, and euery where in Hetruria; in Sicily, *in Dioceſi Panormitana*; the Baths of Apono, as *Sauanarola Muntagnana*, and *Fallopius* auers, although *Iohn de Dondis* denieth it; the Bath of Aſtrunum, of Callatura, S. Euphemie, Aquiſgran, *Brigenſis thermæ in Valeſijs Helvetiorum*, *aqua ſancta in Picenis*, and an infinite number euery where. *Baccius* receiues our Baths of Bathe among Sulphurous Baths, from the relation of *Edward Carne* when hee was Embaſſadour to *Iulius tertius*, and *Paulus quartus*. I will not deny ſome touch of Sulphur in them, ſeeing wee finde among Bitumeous coales, ſome which are called metall coales, with certaine yellow vaines which are Sulphur. But the proportion of Sulphur to Bitumen, is very little; and therefore I doe not hold them Sulphurious *à prædominio*. This is enough for Sulphur.

Concerning Arſenick, it is a venomous minerall, and

therefore I neede ſpeake nothing of the Bathes which proceede from it, but that wee take heed of them; It is likely that thoſe venomous waters and vapours which kill ſuddenly, doe proceede from Arſenicke, as at Cicrum in Thracia *fons Neptunius in Terracina*, at Peraut by Mompelier, *the Lake Auernus. The caue of Charon by Naples.* Vnder Arſenicke wee may comprehend Auripigmentum, Riſagalum, Sandaracha, Ruſma, &c. I heare of but one Mine of Ruſma in Ciprus, from whence the Turkes haue it to take off hayre, and it doth it beſt of any thing knowne, as *Bellonius* and *Platerus* reports, and I haue made triall of it oftentimes: The former ſorts of Arſenicke are found *in Miſia Helleſponti in Ponto*, by the Riuer Hippanis, which is made bitter by it. In the leſſer Aſia, betweene Magneſia and Epheſus in Carmania, &c. It is accounted to be extreame hot and putrefying.

Cadmia is either naturall or factitious: The naturall is often dangerous in Germany, as *Agricola* ſaith, eſpecially that which is liquid, which is a ſtrong corroſiue: the other is of the nature of Copper, moderately hot and clenſing, and eſpecially good to cleere the eyes, as Calaminaris and Tutia. It is found in Copper Mynes, and of it ſelfe in Cyprus, as *Gallen* ſaith by the Citie Solos. Alſo in *Agro ſenenſi, vicentino, Bergomenſi*, neere Como, where they make Braſſe with it. Vnder Mendip hils there is much of it. The Bathes of Saint *Caſsian* doe participate with it, and *Cicero* his Bathes neere Baia. Alſo the Bath at Zurich in Heluetia, and Grotta in Viterbio.

Thus much for Spirits.

CAP.

Cap. 9.

Of meane metals, or halfe metals. Bismutum or Tinglasse. Antimony. Bell-metall.

A Sixt sort I make to be meane metals, or halfe metals, which are minerall substances, hauing metalin fusion, but are not malleable as metals are: and therefore being mixt with metals, doe make them brittle. These are *Bismutum*, or *plumbum cinereum*, Anthimony, Bell-metall, which *Gaber* cals *Magnesia*, in dutch, *Speiss*. Calaem also may be reckoned among those, which is a kinde of white metalin Cadmia, brought out of the East Indyes, which hath both metallin ingression, and metallin fusion, but not perfectly malleable. These although they are more volatill then metall, yet by reason of their fusion into a King, are not so easily sublimd as the Spirits.

Bismutum is that wee call Tinglasse, differing both from Tin and Leade. *Candidius nigro, sed plumbo nigrius albo.* It was not knowne to the Ancients, and therefore we can say little of the qualities of it. It is found in England, and in Misnia, and at Sneberg in Germany, and in very few places else. I reade not of any waters that participate with it: neither can I say much of Antimony, but that *Dioscorides* saith it cooles, bindes, opens obstructions, &c. And *Gallen*, that it dryeth and bindeth, and is good for the eyes, &c. But of the purging qualitie they write nothing, although wee finde it to purge violently, both vpwards and downewards: whereupon wee may gather that all purging medicines are not hot, as I haue touched before. *Camden* saith there is a Mine of it in Cumberland: It is found in Italy, *in Thinni montibus, in Senensi agro* in the Countie of

S. Flora, and in Germany in many places. But I reade of no waters that participate with it, vnleſſe wee ſhould iudge all purgatiue waters to be infected with it: as neere Ormus, *Purchas* writes of ſuch a Spring which purgeth.

Parte 3 pag. 72. *Sauonarola in Balneis Romandiolæ,* mentions a Spring at Meldula, which purgeth. Alſo *Balneum Tertutij in agro Piſtorienſi, Fallopio*; alſo the ſowre water of Mendich and Ponterbon doe purge choler, as *Rulandus* ſaith. At Noneſuch we haue alſo a purgatiue Spring, which may participate with Antimony or Niter, or both: But purgatiue waters are rare, vnleſſe it be *ratione ponderis*, by the weight and quantity, and ſo any water may purge, and our Bath waters doe purge in that manner, and by the addition of Salt, which giues ſtimulation vnto it. This our Bath guides doe ordinarily preſcribe to ſuch as will be perſwaded by them, not knowing how it agreeth with their grieſes, nor how it may doe hurt in many reſpects, as oftentimes it doth.

Bell-metall is thought to be a mixture of Tinne and Copper Oares, as *Kentman* iudgeth, and is found in our Tinne and Copper Mynes in Cornewall. I reade of no waters infected with it, nor of any vſe it hath in Phyſicke.

Cap. 10.

Of metals. Gold. Siluer. Iron. Copper. Tinne. Leade.

Fallop. de metallis cap. 10. Libau. de nat. metall. part 3. cap. 5.

THe ſeuenth and laſt ſort are metals, minerall ſubſtances, fuſible and malleable. Theſe are commonly diſtinguiſhed into perfect and imperfect; perfect, becauſe they haue leſſe impuritie or heterogeneitie in them, as gold & Siluer. The reſt are called imperfect, becauſe they are

are full of impurities, and they are either hard or soft. Hard, as those which will indure ignition before they melt, as yron and Copper. Soft, which will not, but melt at the first, as Tinne and Lead.

Gold of all metals is the most solid, and therefore the most heauie, as hauing no impurities or heterogeneall substances mixed with it. And therefore it is not subiect to corruption, as other metals are, neither will it loose any of his substance, either by fire or water, although it should be held in them a long time: so as it is an idle and vaine perswasion that many haue, who thinke by boyling Gold in broth, to get some strength from thence, and so to make the brothes more cordiall. The like I may say of putting Gold into Electuaries or Pils, vnlesse it be in case of Quicksiluer taken into the body, which the Gold by touch may gather to it, otherwise it goes out of the body as it came in, without any concoction or alteration, or diminution. And if it bee dissolued in strong water, it will be reduced againe to his metallin substance, without diminution, much lesse will it be dissolued without corrosiue Spirits, to make *aurum potabile*, as some doe vndertake. *Crollius* doth acknowledge, that there is but one *Menstruum* in the world that may doe it, and that he knowes not. But if we had it dissolued, we are yet vncertaine what the quality of it would be, or what vse to make of it in Physicke; onely because it looseth none of his substance, we know it can doe no hurt, and therefore we vse it for Cautoryes, and to quench it in Beere or Wine, &c. to warme it, or to giue it some astriction from the fire. *Fallopius* in these regards disclaymes it in all minerall waters, as hee doth all other metals: and will not beleeue that any metall doth impart any qualitie vnto water. *Claudius* holds otherwise, and so doth *Baccius*, *Sauonarola*, *Montagnana*, *Ve-*

Baccius lib. 6. cap. 8.

Basilica chimica pag. 204.

De Thermis cap. 8.

In ingressu ad infirmos, pag. 373.

Venuſtus Solinander, and almoſt all that haue written of Bathes. For if we ſhould exclude Metals, wee muſt likewiſe exclude Stones, and Bitumina and Sulpher, and almoſt all minerals, except concrete iuyces. For none of theſe, after they haue attayned to their full conſiſtence, will of themſelues diſſolue in water, without the helpe of ſome concrete iuyce, as a medium to vnite them with the water. But before they haue their full conſiſtence, whilſt they are in *Solutis principijs*, as Earth, Iuyce, or Vapour, they may be communicated with water. Gold is ſo ſparingly bred in the bowels of the earth, as in that reſpect it can hardly furniſh a perpetuall Spring with any quality from it; yet ſome Bathes are held to participate with Gold, as *Ficuncellenſes, Fabariæ, Piperinæ, de Grotta in Viterbio: Sancti Caſſiani de Buxo, &c.*

Siluer comes next in puritie to Gold, but is inferiour vnto it, as appeares by the diſſolution of it, and by the blew tincture which it yeelds, and by the fouling of the fingers, &c. For the qualities of it, there is not much diſcouered. But as all other things of pryce are ſuperſtitiouſly accounted cordiall, ſo is this, eſpecially in hot and moyſt diſtempers of the heart: for it is eſteemed to bee cold, and dry, and aſtringent, and yet emollient. Wee haue no Bathes which doe manifeſtly participate with it: perhaps, by reaſon, nature doth not produce it in ſufficient quantitie to infect waters. *Iohn Bauhinus* thinkes there may be Siluer in the Bathes at Boll: becauſe hee ſaith there was a Pyritis or Marcheſit examined by Doctor *Cadner*, and out of fiftie pound weight of it, hee drew two drams of ſiluer: a very ſmall proportion to ground his opinion vpon.

Theod. Tabernimontanus. p. 2. cap 49.

Iron is the moſt impure of all metals, as we haue it wrought, and will hardly melt as metals ſhould doe, but with additaments and fluſſes. Neither is it ſo malleable,

and

and ductible as other metals are, by reason of his many impurities. Yet wesee that at Damasco they worke and refine it in such sort, at it will melt at a Lampe, and is so tough, as it will hardly breake. And this is not by reason of any especiall Myne differing from other iron Mynes, for they haue no Mynes of yron neere to Damascus, as *Bellonius* reports, but haue it brought thither from diuers other places, onely their art in working and purifying it, is beyond ours. So the Spanish Steele and iron is purer then ours, and wee doe esteeme of Bilbo blades beyond others which are quenched in the Riuer Bilbilis: as *Turnus* his Sword in *Virgill* was quenched in the Riuer Styx.

Ensem quem Dauno ignipotens Deus ipse parenti Ænead. 12.
Fecerat, & Stygia candentem extinxerat undâ.

But the hardning of Steele lyeth not in this point; other waters no doubt may serue as well. But I perswade my selfe that our iron might be made much purer, and perhaps some gold extracted from it which it holds.

Concerning the temperature of Iron and Steele, *Galen* reckons it among earth, and therefore it must bee cold. *Manardus* is absolutely of that opinion, and so are most of our Physitians. Only *Fallopius* holds it to be hot, because *Scribonius Largus* prescribes it in vlcers of the bladder, which it doth cure, not in regard of heating, but drying; for it dryeth and bindeth much, and therefore by *Galens* rule it must bee cold. *Astringentia omnia frigida.* I haue obserued in Iron and Steele two distinct qualities, The one opening, or depilatiue; the other astringent. The opening quality lyeth in a volatill Salt or Niter, which it is full of, the astringent qualitie in the Crocus, or Terrestriall part. These two substances are thus discerned and seuered.

Simpl. lib. 9.
Lib. 16. Epist. 5.
De metallis cap. 20.
Simpl. lib. 4. c. 7.

Take

Take of the fylings of Steele or Iron, and caſt it into the flame of a candle, and you ſhall ſee it to burne like Salt-peter or Roſin. Take theſe fylings, and infuſe them three or foure times in Water or Wine, as wee vſe to make our Chalibert Wines, till the water or wine haue diſſolued all this ſalt, and then dry it and caſt it into the flame, and it ſhall not burne, but the liquor will haue a ſtrong taſte from this Salt. And this is it which opens obſtructions. The aſtringent qualitie lyeth in the Terreſtriall ſubſtance, as is euident, after either, by infuſions, or by calcination, the volutill ſalt is departed from it, that which remaines, is very aſtringent, and ſtayeth all manner of fluxes, &c.

Concerning Bathes participating with Iron, we haue too many examples of them for *Fallopius* to contradict. We may let him inioy his opinion of the *Calderiana*, *Veronenſia & Villenſia Lucenſia*, although it bee againſt the iudgement of all other who haue written of them, and it is hard for him to be confident in a negatiue. Wee haue examples more then enough to proue the qualitie of Iron in our minerall waters. *Balneum Reginæ in agro Piſano*, is actually hot, and from iron. So is *Balneum Sancti Caſſiani in agro Senenſi*: So in *Balneum Ficuncellæ*, *de Ruſſellis*, *Bora in agro. Florent. Brandulæ in agro Regienſi*, *Veſicatoriæ in Tuſcia*, *Iſenbrun* by Leige, Forgenſe in Normandy: the Spa water, Tunbridge water: Briſtoll water by S. *Vincents* Rocke: all which, ſome being hot, and ſome cold, participate with Iron, as may be proued, not onely by the conſent of all writers, which haue made mention of them, but by the Mynes from whence they come, or by their taſte, or by their vertues.

Solinander, pag. 193. Venuſtus, pag. 159. Baccius lib. 6. cap. 3. Sauonarola: Renodæus pag: 306.

Copper comes neereſt to the nature of Iron, but is more pure, and more eaſie of fuſion, and will be almoſt all

all conuerted into Vitrioll. They are conuertible the one into the other, as I haue ſhewed out of *Erker*, in Vitrioll. And by the practiſe at Commataw and Smolnicium. The like alſo hath beene ſhewed in Cornewall, at the Confluence by Maſter *Ruſſell*. *Ariſtotle* alſo tels of a Copper Myne in Thalia, an Iland of the Tyrrhen Sea, which being wrought out, turned to an iron Myne: in this ſimilitude of nature, we cannot but iudge that there is a ſimilitude in qualities, and that Iron being cold, Copper cannot be hot. Temperate it may be, becauſe leſſe aſtringent then Iron, and more clenſing: *Rhaſis* ſaith that it purgeth like a Catharticum, and in his Continent, preſcribes it to purge water in dropſies. Another argument that all purgatiues are not hot; It drieth exceedingly, and attenuates and digeſts. We haue diuers waters which participate with it, which if they be pure from Copper it ſelfe, are very ſafe and wholeſome: but if they be foule, and proceede from the excrements of Copper, they are not wholeſome to drinke. *Balnea Cellenſia ſeu ferina in Martiana Silua*, doe conſiſt of Copper and Allum. The Bath of Fabaria in Rhetia, of Copper and Gold. *Aqua de Grotta in agro Viterbienſi* is full of Copper; ſo is *Aqua Iaſielli*, *Balneum Leucenſe in Valeſijs: Marcus Paulus Venetus*, tels of a greeniſh fountaine in Perſia, which purgeth exceedingly, and is held to come from Copper.

Libau. de nat. metall. c. 10.

Tinne and Lead are two of our Staple commodities which our Countrie yeelds plentifully, not onely for our owne vſe, but to ſupply other Nations. Tinne is bred in Cornwall, and part of Deuonſhire, and in the Iſles of Silly, which from thence were called *Caſſiterides*. It is melted out of little blacke ſtones, which the Dutch call *Zwitter*, with great charge, becauſe they cannot melt it, but with wood coales, which is brought them farre off,

and they are faine to runne it ouer two or three times, before they can get out all the Tinne, and yet much of it is wasted in the blast. I doubt not but it might bee done with Sea-Coale, if they knew the Artifice, and with a great product of Tinne. There is both siluer and gold found in it, but without wasting of the Tinne, wee know no meanes to seuer it. It is in qualitie cold and dry, and yet moues sweat abundantly, as I haue proued.

Lead is melted commonly out of an Oare common to Siluer and Lead, as *Pliny* saith, called *Galena*. And although *Agricola* saith of the villachar Lead, that it holds no Siluer, and therefore fittest for assayes; yet *Lazarus Ercker* contradicts it out of his owne experience. Our Countrie abounds with it euery where, especially at the Peake in Darbishire, and at Mendip in Sommersetshire; Wales also and Cornwall, and Deuon, are full of it, and so is Yorkeshire and Cumberland. The qualities of it are cold and dry. But for these two metals, wee finde no waters which are infected with them. In Lorayne, they haue Bathes called *Plumbaria*, which some thinke by reason of the name, to proceede from Lead: but *Iohn Bauhinus* thinkes they should bee called *plumiers*, as *Pictorius* writes it from the French word *plumer*, *à deplumando*, because they are so hot, as they vse to scald fowles in them, to take off their feathers. Fig. 90.

Thus much for metals, and all other sorts of Minerals, with their seuerall Natures and Bathes infected with any of them. As for mixed Bodies, and flores, and recrements, &c. they are to be referred to the simple bodies from whence they proceede: As *Tutia*, *Pompholix*: *Minium*, *Ceruſſa*, *Sublimatum*, *Præcipitatum*, *&c.*

CAP.

Cap. 11.

Of the generation of metals in the earth. Their seminary spirit, matter.

NOw I must shew the generation of these minerals in the bowels of the earth, which of necessity wee must vnderstand, before wee can shew the reasons how minerall waters receiue either their actuall heat, or their vertues. *Fallop. de metallis cap. 11. Libauius de nat. metal. cap. 12.*

Some haue imagined that metals and minerals were created perfect at the first, seeing there appeares not any seede of them manifestly, as doth of Animals and Vegetables; and seeing their substances are not so fluxible, but more firme and permanent. But as they are subiect to corruption in time, by reason of many impurities, and differing parts in them, so they had need to be repaired by generation.

It appeares in *Genesis*, that Plants were not created perfect at first, but onely in their Seminaries: for *Moses*, Cap. 2: giues a reason why Plants were not come forth of the earth, *scil.* because (as *Tremellius* translates it) there had as yet neither any raine fallen, nor any dew ascended from the earth, whereby they might be produced and nourished: The like we may iudge of minerals, that they were not at first created perfect, but disposed of in such sort, as they should perpetuate themselues in their seuerall kindes. Wherefore it hath euer beene a receiued *Axiome*, among the best Philosophers, that minerals are generated, and experience hath confirmed it in all kindes. Our Salt-peter men finde that when they haue extracted Salt peter out of a floore of earth one yeare, within three or foure yeares after, they finde more Salt-peter generated there, and doe worke it

ouer againe. The like is obſerued in Allum and Coperoſſe.

And for metals, our Tinners in Cornewall haue experience of Pitts which haue beene filled vp with earth after they haue wrought out all the Tinne they could finde in them; and within thirty yeares they haue opened them againe, and found more Tinne generated. The like hath beene obſerued in Iron, as *Gandentius Merula* reports of *Ilua*, an Iland in the Adriaticke Sea, vnder the Venetians, where the Iron breedes continually as faſt as they can worke it, which is confirmed alſo by *Agricola* and *Baccius*: and by *Virgill* who ſaith of it, *Illua inexhauſtis Chalybum generoſa metallis*. The like we reade of at Saga *in Lygijs*, where they dig ouer their Iron Mynes euery tenth yeare. *Iohn Matheſius* giues vs examples, almoſt of all ſorts of minerals and metals, which he hath obſerued to grow and regenerate. The like examples you may finde in *Leonardus Thurneiſerus*. *Eraſtus* affirmes that hee did ſee in *S. Ioachims* dale, ſiluer growne vpon a beame of wood, which was placed in the pit to ſupport the workes: and when it was rotten, the workemen comming to ſet new timber in the place, found the ſiluer ſticking to the old beame. Alſo he reports that in Germany, there hath beene vnripe and vnconcocted ſiluer found in Mynes, which the beſt workemen affirmed, would become perfect ſiluer in thirty yeares. The like *Modeſtinus Fachius*, and *Matheſius* affirme of vnripe and liquid ſiluer; which when the workemen finde, they vſe to ſay *Wee are come too ſoone*. But I neede not produce any more proofes for this purpoſe, as I could out of *Agricola* and *Libauius*, and others, ſeeing our beſt Philoſophers, both ancient and moderne, doe acknowledge that all minerals are generated. The manner of generation of minerals and metals, is the ſame

Lib. 3. c. 19.

In Sarept. conci. 3. 11. &c.

In Alchimia magna. De metallis pag. 17. & 19.

Sebaſt. Foxius l. 3. c. 6. Severinus c. 8. p. 125.]

same in all, as is agreed vpon both by *Plato* and *Aristotle*, and *Theophrastus*: the difference is in the efficient, and in the matter.

For the manner of generation of minerals, although it be alike in all, yet it differs from the generation of animate bodies, whether animals or vegetables, in this, that hauing no seede, they haue no power or instinct of producing other indiuiduals, but haue their species perpetuated *per virtutem seu spiritum semini analogum*, by a spirituall substance proportionable to seede, which is not resident in euery indiuiduall, as it is in animals and Plants, but in their proper wombes. This is the iudgement of *Petrus Severinus*, howsoeuer hee doth obscure it by his Platonicall grandiloquence. And as there is not *Vacuum in Corporibus*, so much lesse in *Speciebus*. For that the Species are perpetuated by new generations, is most certaine, and proued before: that it is not out of the seedes of indiuiduals, is euident by this, that if minerals doe not assimulate nourishment by attraction, retention, concoction, expulsion, &c. for the maintenance of their owne indiuiduall bodies, much lesse are they able to breede a superfluitie of nourishment for seede. And how can they attract and concoct nourishment, and expell excrements, which haue no vaines nor fibres, nor any distinct parts to performe these Offices withall? Moreouer they are not increased as Plants are, by nourishment, whereas the parts already generated, are extended in all proportions by the ingression of nutriment, which fils and enlarges them: but onely are augmented externally vpon the superficies, by superaddition of new matter concocted by the same vertue and spirit, into the same Species.

Cæsalpinus de metal. l. 1. c 2.

Cap. 2.

Erast. disput. part 2. p. 262.

The matter whereof Mineralls are bred, is much controuerted, *Aristotle* makes the humidity of water and

the dryneſſe of earth to bee the matter of all Minerals: the dryneſſe of earth to participate with fire, and the humidity of water with ayre, as *Zabarella* interprets it; ſo that to make a perfect mixt body, the foure Elements doe concurre: and to make the mixture more perfect, theſe muſt be reſolued into vapour or exhalation by the heat of fire, or influence from the Sunne and other Planets, as the efficient cauſe of their generation: but the cauſe of their congelation to bee cold in ſuch bodies as heat will reſolue. This vapour conſiſting partly of moyſture, and partly of dryneſſe, if all the moyſture be ſpent, turnes to earth or ſalt, or concrete iuyces, which diſſolue in moyſture: if ſome moyſture remaine before congelation, then it turnes to ſtone: if this dry exhalation be vnctuous, and fat, and combuſtible, then Bitumen, and Sulphur, and Orpiment are bred of it: if it be dry and incombuſtible, then concrete iuyces, &c. But if moyſture doe abound in this vapour, then metals are generated which are fuſible and malleable. And for the perfecting of theſe generations, this exhalation is not ſufficient, but to giue them their due conſiſtence, there muſt be the helpe of cold from Rocks in the earth to congeale this exhalation. So that here muſt be two efficients, heat and cold. And for the better effecting of this, theſe exhalations doe inſinuate themſelues into ſtones, in the forme of dew or froſt, that is, in little graines; but differing from dew and froſt in this, that theſe are generated after that the vapour is conuerted to water; whereas Minerals are generated before this conuerſion into water. But there is doubt to be made of froſt, becauſe that is bred before the conuerſion of the exhalation into water, as may appeare, *Meteor.* 1. According to this aſſertion there muſt be two places for the generation of minerals: the one a

Eraſtus, Careri-us, Cæſalpinus, Martinus, Moreſinus, Foxius, Magy-rus, Libauius.

3 Meteor. c. vlt. Cæſalp. l. 3. c. 1.

Libau. de nat. metall c. 14. Carerius 178.

Septal. in Hipp. de aere, aqu. &c.

matrix,

matrix, where they receiue their essence by heat in forme of an exhalation, and from thence they are sent to a second place to receiue their congelation by the coldnesse of Rocks : and from this *matrix* come our minerall waters, aud not from the place of congelation.

This is the generation of minerals, according to *Aristotle*; but it is not so cleare, but that it leaues many scruples, both concerning the matter, and the efficients. For the matter, it seemes not probable, that water and earth should make any thing but mudde and dirt; for you can expect no more from any thing then is in it, the one is cold and dry, the other cold and moyst; and therefore as fit to be the matter of any other thing, as of particular mineralls. And water, whereof principally metals are made to consist, is very vnfit to make a malleable and extentible substance, especially being congeled by cold, as we may see in yce. But some doe adde a minerall quality to these materials, and that simple water is not the chiefe matter of metals, but such as hath imbibed some minerall quality, and so is altered from the nature of pure water. This assertion doth presuppose mineralls in the earth before they were bred: otherwise what should breed them at the first, when there was no minerall quality to be imparted to water? Againe, this minerall quality either giues the water or the vapour of it the essence of the minerall, and then it is not the effect of water, but of the minerall quality, or the potentiall faculty to breed it. If the essence, then this metallin water, or vapour, must haue the forme of the metall, and so be fusible and malleable. If it haue only the power and potentiall faculty, then the generation is not perfected, but must expect further concoction. This concoction is said to be partly by heat, and partly by

by cold; if by heat, it must be in the passages of the exhalation as it is carried in the bowels of the earth: for, afterwards when the exhalation is setled in the stones, the heat is gone. Now if the concoction bee perfected before the exhalation be insinuated into the Stones, as it must be, if it be like dew, then is it perfect metall, and neither is able to penetrate the Stones, nor hath any neede of the cold of them to perfect the generation. If by cold, it is strange that cold should be made the principall agent in the generation of metals, which generates nothing; neither can heate be the efficient of these generations. Simple qualities can haue but simple effects, as heate can but make hot, cold can but coole, &c. But they say cold doth congeale metals, because heate doth dissolue them; I answer, that the rule is true, if it bee rightly applied: as wee see yce which is congealed by cold, is readily dissolued by heate. But the fusion of metals cannot properly bee called a dissolution by heate, because it is neither reduced to water or vapour, as it was before the congelation by cold, nor is it permanent in that kinde of dissolution, although after fusion it should be kept in a greater heat then cold could be which congealed it. For the cold in the bowels of the earth cannot be so great, as it is vpon the superficies of the earth, seeing it was neuer obserued that there was any yce bred there. Wherefore this dissolution which is by fusion, tends not to the destruction of the metal (but doth rather make it more perfect) as it should doe according to the former rule rightly applied. And therefore this dissolution by fusion, doth not argue a congelation by cold: which being in the passiue elements, doth rather attend the matter then the efficient of generations: for it is apt to dull and hebetat all faculties and motions in nature, and so to hinder generations, rather then to further

Valesius sacra philosoph. c. 49.

further any. It is heate and moysture that further generations, as *Ouid* saith, *Quippe vbi temperiem sumpsere humorque calorque, Concipiunt.*

And thus much for *Aristotles* generation of minerals, where his vapours or exhalations doe rather serue for the collection or congregation of matter in the Mynes, then for the generation of them; as *Libauius* doth rightly iudge: *Agricola* makes the matter of minerals to be *Succus Lapidescens Metallificus, &c.* and with more reason, because they are found liquid in the earth: *Gilgill* would haue it Ashes; *Democritus* Lyme: but these two being artificiall matters, are no where found in the earth. The Alchymists make Sulphur and Mercurie the matter of metals: *Libauius*, Sulphur and Vitrioll. But I will not stand vpon discoursing of these materials, because it makes little to my purpose. It is enough for my purpose to shew the manner of these generations, which I take to be this.

Singularium lib. 1. part. 1

De nat. metal. cap. 10.

There is a Seminarie Spirit of all minerals in the bowels of the earth, which meeting with conuenient matter and adiuuant causes, is not idle, but doth proceed to produce minerals, according to the nature of it, and the matter which it meetes withall: which matter it workes vpon like a ferment, and by his motion procures an actuall heate, as an instrument to further his worke; which actuall heate is increased by the fermentation of the matter. The like we see in making of malt, where the graynes of Barley being moystened with water, the generatiue Spirit in them, is dilated, and put in action; and the superfluitie of water, being remoued, which might choake it, and the Barley laid vp in heapes; the Seedes gather heat, which is increased by the contiguitie of many graines lying one vpon another. In this worke natures intent is to produce moe indiuiduals,

according to the nature of the Seede, and therefore it ſhootes forth in ſpyres: but the Artiſt abuſes the intention of nature, and conuerts it to his end, that is, to increaſe the ſpirits of his Malt. The like we finde in minerall ſubſtances, where this ſpirit or ferment is reſident, as in Allum and Copperos mynes, which being broken, expoſed and moyſtened, will gather an actuall heate, and produce much more of thoſe minerals, then elſe the myne would yeeld: As *Agricola* and *Thurneiſer* doe affirme, and is proued by common experience. The like is generally obſerued in Mynes, as *Agricola*, *Eraſtus*, *Libauius*, *&c.* doe auouch out of the daily experience of minerall men, who affirme, that in moſt places, they finde their Mynes ſo hot, as they can hardly touch them: although it is likely that where they worke for perfect minerals, the heate which was in fermentation, whilſt they were yet breeding, is now much abated: the minerals being now growne to their perfection. And for this heate wee neede not call for the helpe of the Sunne, which a little cloude will take away from vs, much more the body of the earth, and Rocks; nor for ſubterraneall fire: this imbred heate is ſufficient, as may appeare alſo by the Mynes of Tinglaſſe, which being digged, and laid in the moyſt ayre, will become very hot. So Antimony and Sublimat being mixed together, will grow ſo hot as they are not to be touched: If this be ſo in little quantities, it is likely to bee much more in great quantities and huge rockes. Heate of it ſelfe differs not in kinde, but onely in degree, and therefore is inclined no more to one Species, then to another, but as it doth attend and ſerue a more worthy and ſuperiour faculty, ſuch as this generatiue ſpirit is. And this ſpirit doth conuert any apt matter it meetes withall to his owne Species, by the helpe of heate; and the earth is

Carerius p 217.

full

full of such matter which attends vpon the Species of things: and oftentimes for want of fit opportunitie and adiuuant causes, lyes idle, without producing any Species: but is apt to be transmuted by any mechanicall and generatiue spirit into them. And this matter is not the Elements themselues, but subterraneall Seeds placed in the Elements, which not being able to liue to themselues, doe liue vnto others. This seminarie Spirit is acknowledged by most of *Aristotles* interpreters, (and *Morisinus* cals it *Elphesteria*) not knowing how otherwise to attribute these generations to the Elements. And this is the cause why some places yeeld some one minerall species aboue another. *Quippe solo natura subest. Non omnis fert omnia tellus.* The seminary Spirit hath his proper wombs where it resides, and formes his Species according to his Nature, and to the aptnesse of his matter. But as *Severinus* affirmes of animall seedes, that they are in themselues *Hermaphroditicall*, and neither masculine nor feminine, but as they meete with superuenient causes, so it is in these minerall Seedes and Species, which in one wombe doe beget diuers sorts of minerals, either according to the aptnesse of the matter, or the vigour of the Spirits. Thus much for the generation of minerals, &c.

Foxius, Martinus, Moresinus, Magyrus, Libavius, Velcurio, Valesius, Carerius, Erastus, & Severinus.

Cap. 10.

Of the causes of actuall heat, and medicinable virtue in minerall waters. Diuers opinions of others, reiected.

NOw I come to shew how our minerall waters receiue both their actuall heat, and their virtues. I

ioyne them together, becauſe they depend vpon one and the ſame cauſe, vnleſſe they bee iuyces which will readily diſſolue in water, without the helpe of heat: other minerals will not, or very hardly.

This actuall heat of waters haue troubled all thoſe that haue written of them, and many opinions haue beene held of the cauſes of them.

Some attribute it to wind, or ayre, or exhalations included in the bowels of the earth, which either by their owne nature, or by their violent motion, and agitation, and attrition vpon rocks and narrow paſſages, doe gather heat, and impart it to our waters. Of their owne nature theſe exhalations cannot bee ſo hot, as to make our water hot, eſpecially ſeeing in their paſſage among cold rocks, it would bee much allaied, hauing no ſupply of heat to maintaine it. Moreouer, where water hath paſſage to get forth to the ſuperficies of the earth, there theſe exhalations and winds will eaſily paſſe, and ſo their heat gone withall, and ſo our waters left to their naturall coldneſſe: whereas wee ſee they doe continue in the ſame degree and tenor, many generations together. If by their agitation and violent motion they get this heat, becauſe no violent thing is perpetuall or conſtant: this cannot be the cauſe of the perpetuall and conſtant heat of water. Beſides, this would rather cauſe earthquakes and ſtormes, and noyſes in the earth, then heat our ſprings. Moreouer, wee dayly obſerue that water is neuer heated by winds, or agitation; as in the Cataracts of the Rhein by Splug; the agitation and fall of water vpon rocks is moſt violent, and makes a hydeous noyſe; yet it heats not the water, though it be very deepe in the earth. Neither can any attrition heat either ayre, or water, or any ſoft, and liquid thing, but rather make it more cold.

Valeſius contro. lib. 4. cap. 3. Solinand. li. 1. c. 4.

Others

Others attribute this actuall heat of Baths vnto the Sunne, whose beames peircing through the pores of the earth, doe heat our waters. The Sunne by his light and beames, no doubt, doth warme these inferiour parts, especially where they haue free passage, and reflection withall, and it is to be iudged, that the heat not being essentially in the Sunne, is an effect of the light by whose beames it is imparted to vs. So as where light is excluded, heat is also excluded. And if wee can exclude the heat of the Sunne by the interposition of a mud wall, or by making a Cellar six foot vnder the ground; how is it likely that these beames can peirce so deepe into the earth, as to heat the water there? as *Lucretius* saith.

Qui queat hic subter tam crasso corpore terram *Lib. 6.*
Percoquere humorem, & calido sociare vapori?
Præsertim cum vix possit per septa domorum
Insinuare suum radijs ardentibus æstum.

And if the Sunne be not able to heat a standing Poole in the middest of Summer, how should it heat a subterraneall water, which is alwayes in motion, especially in the winter time? Againe, if this heat come from the Sunne, then in the Summer, when the Sun is hottest, the waters should be so also, and in winter cold, because of the absence of the Sunne; but we finde them alwayes alike. Neither can any Antiperistasis be equiualent to the Sunnes presence to continue their heat. It should rather diminish it by the opposite quality of cold: for, adde cold to any heat, and the cold by working vpon the heat, doth bring it to a temper, and makes the heat lesse; otherwise how should a temperament arise from the mixture of the Elements, if there were not a reacti- *Valesc. cont. c. 5. Magirus l. 3. c. 3*

on, and a reſiſtence, which reduceth the mixture to his temperament. Wherefore this Antiperiſtaſis is an idle inuention to maintaine this purpoſe.

Others attribute this actuall heat to quick Lyme, which we ſee doth readily heat any water caſt vpon it, and alſo kindle any combuſtible ſubſtance put into it; this is *Democritus* his opinion. To this I anſwer, that Lyme is an artificiall thing, not naturall, and is neuer found in the bowels of the earth. Beſides, if it were found, one infuſion of water extinguiſheth the heat of it, and then it lyeth like a dead earth, and will yeeld no more heat. So as this cannot procure a perpetuall heat to Baths: neither can the Lymeſtones without calcination, yeeld any heat to water, nor will breake and crackle vpon the affuſion of water, as Lyme doth. Wherefore this opinion is altogether improbable.

Others attribute this actuall heat to a ſubterraneall fire kindled in the bowels of the earth vpon Sulphur and Bitumen. Now we are come to hell, which *Pithagoras* cals *Materiam Vatum, falſique pericula mundi*; The dreame of Poets, and a forged feare. The largeſt deſcription of it is in *Virgill*: from whence both Diuines and Philoſophers deriue much matter: and *Baccius* doth beleeue that there is ſuch a thing in the center of the earth. But if we obſerue *Virgill* well, we ſhall finde that he propounds it but as a dreame: for in the end of that booke he ſaith

Metamorph. 15.

Enead. 6.

Sunt geminæ ſomni portæ; quarum altera fertur
Cornea, qua veris facilis datur exitus umbris:
Altera candenti perfecta nitens Elephanto,
Sed falſa ad Cœlum mittunt inſomnia manes.

Dreames

Dreames haue two gates, the one is said to be
Of Horne, through which all true conceits do flee:
The other framed all of Iuory rare,
But lets out none, but such as forged are.

Now saith he, when *Anchyses* had led *Æneas* and *Sibilla* through Hell, hee lets them forth at the Iuory gate (*Portaque emittit Eburna:*) As if he should say; all that I haue related of hell, is but a fiction; and thus *Ludouicus Viues* interprets it, in his comment vpon this place.

I hope none will thinke that I deny a Hell, but I approue not of the assignement of it to the center of the earth, or that that fire should serue, as *Baccius* would haue it, to further all generations in the earth: and as others, to be the cause of Fountaines, Windes, Earth-quakes, Vulcanoes Stormes, Saltnesse of the Sea, &c. nor of the actuall heate of our Bathes, although it be the most common receiued opinion.

First for the place, it is not likely that the center of the earth, whither all heauie things doe tend, should be hollow, but rather more compact then any other part of the earth, as likewise *Valesius* thinkes: but if there bee any concauities, they are betweene the Center and the Superficies; and these concauities being receptacles of water from the Sea, cannot also receiue fire. These two will not agree together in one place, but the one will expell the other: for whereas some hold that Bitumen will burne in water, and is nourished by it, it is absolutely false, as experience shewes; and I haue touched it among the Bitumina. *Agricola. Baccius lib. 1. cap. 19.*

Moreouer, if the heate which warmes our Bathes did proceede from hence, there must be huge vessels aboue the fire to containe water, whereby the fire might heate it,

it, and not be quenched by it. Alſo the vapours ariſing from hence, muſt bee hotter then water can endure, or be capable of: for as they aſcend towards the Superficies of the earth, they muſt needes bee cooled as they paſſe by rockes, or elſe they could not be congealed into water againe: and after this congelation, the water hath loſt moſt of his heate, as we finde in our ordinary diſtillations of Roſe water, &c. where we ſee our water to deſcend into the receiuer, almoſt cold; ſo that they cannot deriue our hot Bathes from hence.

Secondly, for the fire it ſelfe, although water and ayre may be receiued into the bowels of the earth, yet there is great difficulty for fire. For the other two neede no nouriſhment to ſupport them, as fire doth. If there bee not competencie of ayre to nouriſh the fire, howſoeuer there be fewell enough, it is ſuddenly quenched, and ſuch huge fire as this muſt be, will require more ayre, then can there be yeelded: a great part thereof paſſing away through the ſecret creekes of rocks, and little or none entring through the Sea. And therefore daily experience ſhewes, that our minerall men are faine to ſinke new Shafts (as they call them) to admit ayre to their works, otherwiſe their lights would goe out. Although one would thinke that where many men may haue roome enough to worke, there would be ſpace enough for ayre to maintaine a few lights. The like we ſee in Cupping-glaſſes, where the light goes out as ſoone as they are applied. Alſo there are no fires perpetuall, as hot Bathes are, but are either extinct, or keepe not the ſame tenor. Wherefore fire cannot bee the cauſe of this conſtant heate of Bathes. Alſo where fire is, there will be ſmoake, for as it breedes exhalations, ſo it ſends them forth. But in moſt of our hot Bathes wee finde none of theſe dry exhalations. Moreouer fire is more hardly pend in then ayre;

ayre, yet we ſee that ayre doth breake forth: wherefore fire ſhould alſo make his way, hauing fewell enough to maintaine it. So they ſay it doth in our Vulcanoes at Hecla in Iſeland, Ætna in Sicily: Veſuuio in Campania: in Enaria, Æolia, Lipara, &c. But it is yet vnproued that theſe eruptions of fire, doe proceede from any deepe cauſe, but onely are kindled vpon or neere the ſuperficies of the earth, where there is ayre enough to feede it, and meanes enough to kindle it by lightnings, or other caſuall meanes. Whereas in the bowels of the earth, there is neither ayre to nouriſh it, nor any meanes to kindle it: ſeeing neither the beames of the Sunne, nor Winde, or other exhalations, nor Lyme, nor Lightnings, can doe it. For the ſame reaſons that exclude the beames of the Sunne and exhalations, will likewiſe exclude Lightnings.

Thirdly, for the fewell, there are onely two ſubſtances in the bowels of the earth, which are apt fewels for fire, Bitumen and Sulpher.

Sulpher is in ſuch requeſt with all men, as they think there can be no hot Bath without it: nay many hold, that if water doe but paſſe through a myne of Brimſtone, although it be not kindled, but actually cold, yet it will contract from thence, not onely a potentiall, but an actuall heate. But we doe manifeſtly finde, that neither all hot waters are ſulphurous, nor all ſulphurous waters hot (as is ſaid before in Sulpher.)

Donatius de aquis lucenſibus lib. 1. cap. 8.

The Bathes of Caldanella and Auinian, *in agro Senenſi, De Grotta in viterbio, De equis in piſano, Diui Iohannis in agro Lucenſi, Balneum Geberſuilleri in Halſatia, &c.* are all hot, and yet giue no ſigne of ſulphur, either by ſmell or taſte, or qualitie, or effect. Contrariwiſe that all ſulphurous waters are not hot, may appeare by the Bathes of Zurich in Heluetia, of Buda in Pannonia, at

Cure in Rhetia, Celenſes in Germany. In Campania, betweene Naples and Buteolum, are many cold ſulphurous Springs. At *Brandula in agro Carpenſi, &c.* All which Bathes ſhew much Sulphur to be in them, and yet are cold. And no meruaile, for if we infuſe any ſimple, be it neuer ſo hot potentially, yet it will not make the liquor actually hot. Wherefore this Sulphur muſt burne before it can giue any actuall heate to our Bathes; and then it muſt needes be ſubiect to the former difficulties, and alſo muſt bee continually repaired by new generations of matter, which actuall fire cannot further, but rather hinder. The fire generates nothing, but conſumes all things.

Lib.1.c ult. The like we may iudge of Bitumen, that vnleſſe it be kindled, it can yeeld no heate to our Bathes: as *Solinander* reports of a Bituminous Myne in Weſtfalia *in agro Tremonenſi*, where going downe into the groue, hee found much water, hauing the ſmell, taſte, and colour of Bitumen, and yet cold. *Agricola* imputes the chiefe cauſe of the heating of Bathes, vnto the fewell of Bitumen, *Baccius* on the other ſide to Sulphur. But in mine opinion, they need not contend about it. For as I haue ſhewed before in the examples of minerall waters, there are many hot Springs, from other minerals, where neither Sulphur nor Bitumen haue beene obſerued to be. *Iohn de Dondis*, and *Iulius Alexandrinus*, were much vnſatisfied in theſe opinions, and did rather acknowledge their ignorance, then that they would ſubſcribe vnto them. I neede not diſpute whether this fire be *in Alueis*, or *in Canalibus*, or *in Vicinis partibus, &c.* becauſe I thinke it is in neither of them.

CAP.

Cap. 13.

The Authors opinion concerning the cause of actuall heat, and medicinable virtue in minerall waters.

WHerefore finding all the former opinions to bee doubtfull and weakely grounded, concerning the causes of the actuall heat of Baths: let me presume to propound another, which I perswade my selfe to bee more true and certaine. But because it hath not beene mentioned by any Author that I know, I haue no mans steps to follow in it.

Avia Doctorum peragro loca, nullius ante
Trita solo.

I trauell where no path is to be seene
Of any learned foot that here hath beene.

Which makes me fearfull in the deliuery of it. But if I doe erre in it, I hope I shall not be blamed; seeing I doe it in disquisition of the truth.

I haue in the former Chapter set downe mine opinion concerning the generation of minerals; that they haue their seminaries in the earth repleniſhed with spirits, and faculties attending them: which meeting with conuenient matter and adiuuant causes, doe proceede to the generation of seuerall species, according to the nature of the efficient and aptnesse of the matter. In this worke of generation, as there is *generatio unius*, so there must be *corruptio alterius*. And this cannot bee done without a superiour power, which by moysture, dilating it selfe, worketh vpon the matter, like a ferment to bring it to his owne purpose. This motion betweene

the agent ſpirit, and the patient matter, produceth an actuall heat *(ex motu fit calor)* which ſerues as an inſtrument to further this worke. For as cold duls, and benumbes all faculties, ſo heat doth quicken them. This I ſhewed in the example of Malt. It is likewiſe true in euery particular grayne of Corne, ſowen in the ground, although by reaſon they lye ſingle, their actuall heat is not diſcernable by touch; yet wee finde that externall heat and moyſture doe further their ſpiring, as adiuuant cauſes: where the chiefe agent is the generatiue ſpirit in the ſeed. So I take it to bee in minerals, with thoſe diſtinctions before mentioned. And in this all generations agree, that an actuall heat, together with moyſture, is requiſite: otherwiſe there can neither be the corruption of the one, nor the generation of the other. This actuall heat is leſſe ſenſible in ſmall ſeeds and tender bodyes, then it is in the great and plentifull generations, and in hard and compact matter: for hard bodies are not ſo eaſily reduced to a new forme, as tender bodies are; but require both more ſpirit, and longer time to be wrought vpon. And therefore whereas vegetable generations are brought to perfection in a few moneths, theſe minerall generations doe require many yeares, as hath beene obſerued by minerall men. Moreouer, theſe generations are not terminated with one production, but as the ſeed gathereth ſtrength by enlarging it ſelfe; ſo it continually proceeds to ſubdue more matter vnder his gouernment: ſo as, where once any generation is begun, it continues many ages, and ſeldome giues ouer. As we ſee in the Iron mynes of Ilma, the Tinne mynes in Cornwall, the Lead mynes at Mendip, and the Peake, &c. which doe not only ſtretch further in extent of ground, then haue beene obſerued heretofore; but alſo are renewed in the ſame groues

which

which haue beene formerly wrought, as our Tinners in Cornewall doe acknowledge; and the examples of *Ilma* and *Saga* before mentioned doe confirme. This is a sufficient meanes for the perpetuitie of our hot Springs: that if the actuall heate proceede from hence, there needs be no doubt of the continuance of them, nor of their equall Tenor or degree of heate. *cap.11.*

Now for the nature of this heate, it is not a destructiue heate, as that of fire is, but a generatiue heate ioyned with moysture. It needes no ayre for euentilation, as the other doth. It is in degree hot enough for the hottest Bathes that are, if it bee not too remote from the place where the water issueth forth. It is a meanes to impart the qualities of minerals to our waters, as well as heate, by reason the minerals are then *in solutis principijs*, in their liquid formes, and not consolidated into hard bodies. For when they are consolidated, there are few of them that will yeeld any quality to water, vnlesse they be the concrete iuyces, or any actuall heate, because that is procured by the contiguity of bodies, when one part lyeth vpon another, and not when they are growne *In corpus continuum*. As we see in Malt, where by turning and changing the contiguitie, the heate is increased, but by suffering it to vnite, is quenched: But before consolidation, any of them may yeeld either Spirit, or Iuyce, or Tincture to the waters, which by reason of their tenuitie (as is said before) are apt to imbybe them. Now if actuall fire kindled in the earth, should meete with these minerals, whilst they are in generation, it would dissipate the Spirits, and destroy the Minerals. If it meete with them after consolidation, it will neuer be able to attenuate them so, as to make them yeeld their qualities to water. For wee neuer finde any Metals or Minerals melted in the earth, which must be, if the heate of actuall fire were such as is imagined: neither doe wee euer finde

Thurneiser Alchimiæ magnæ lib.4.cap.8.

finde any floores of metall ſublimed in the earth. This naturall heat is daily found by our Minerall men in the Mines, ſo as oftentimes they are not able to touch them, as *Agricola* teſtifieth; although by opening their groues and admiſſion of ayre, it ſhould be wel qualified. Whereas on the other ſide, it was neuer obſerued, that any actuall kindled fire was euer ſeene by workmen in the earth, which were likely to be, if theſe fires were ſo frequent.

Wherefore ſeeing we ſee that Minerall waters do participate with all ſorts of Minerals, as well metals, as other, as hath beene ſhewed in the particular examples of all of them: ſeeing alſo that few of them, vnleſſe Minerall iuyces, are able to impart their quality to water, as they are conſolidated, but only as they are *in ſolutis principijs*, and whilſt they are in generation, as is agreed vpon by all Authors: ſeeing alſo this naturall heat of fermentation muſt neceſſarily be preſent for the perfecting of their generations, and is ſufficient, in regard of the degree of heat to make our Baths as hot as they are: ſeeing alſo that the other aduentitious fire, would rather deſtroy theſe Minerals, then further them: ſeeing alſo we cannot imagine it either likely, or poſſible, without manifold difficulties, and abſurdities: I doe conclude that both the actuall heat of Baths, and the Minerall qualities which they haue, are deriued vnto them by meanes of this fermenting heat.

Examples might be brought from all kinde of generations, and from ſome artificiall works, of this fermenting heat proceeding from the ſeeds of naturall things. Theſe ſeeds containing the ſpecies, and kinds of naturall bodies, are not from the Elements, but are placed in the Elements, where they propagate their ſpecies, and indiuiduals, according to their nature; and

Martin. de prima generatione.

and haue their due times and ſeaſons of appearing vpon the Stage of the World. Animals haue their ſet times when their ſpermatick ſpirits are in turgeſcence, ſome once, ſome twice a yeare, and ſome oftner: eſpecially in the ſpring: *vere magis, quia vere calor redit oſſibus*; as *Virgill* ſpeakes of Mares: only man in regard of his excellency aboue other creatures, is not ſo confinde.

Vegetables haue likewiſe their ſeaſons of ſetting and planting, as they may haue the earth and the ſeaſon moſt conuenient: yet at any time, if their ſeeds get moyſture and heat to dilate them, they will ferment and attempt the production of moe indiuiduals: but oftentimes the Artiſt doth abuſe this intention of nature, and conuerts it to his ends: and oftentimes nature being ſet in action to proceede *à potentia in actum*, doth want conuenient meanes to maintaine her worke: as when we ſee a Ryck of Hay or Corne which hath receiued moyſture, burnt to aſhes. So in the making of Malt, or Woad, or Bread, or Beere, or Wine, &c. wee make vſe of this generatiue ſpirit for our ends: that we may ſtirre vp, and quicken it. Otherwiſe our Bread would not be ſo ſauory, our Beere would be but Wort, our Wine would bee but Muſt, or Plumpottage, and want thoſe ſpirits which we deſire; and which lie dead and benumbed in the ſeeds, vntill they come to fermentation. And in all theſe there is an actuall heat, although it appeare not in liquid things, ſo well as in dry: becauſe it is there quenched, by the abundance of moyſture: yet we may obſerue actiue Spirits in it, by the bubling and hiſſing, and working of it. So in minerals, which as they haue this generatiue Spirit, for the propagation of their Species, as hath beene ſhewed before, ſo they haue this meanes of fermentation, to bring them from

from a potentiall qualitie, to an actuall existence: And as their matter is more plentifull, and in consistence more hard and compact; so these Spirits must bee more vigorous and powerfull to subdue it: and consequently the heate of their fermentation must bee in a higher degree, then it is in other generations. And this is in briefe (though rudely deliuered) mine opinion concerning the actuall heate of our Bathes, and of the minerall qualities which we finde in them: which I referre to the censures of those that be learned.

There are two other motions which resemble this fermentation. The one is *Motus Dilatationis*, the other *Antipatheticus*. *Motus Dilatationis* is euident in Lyme, in Allum, in Coperos, and other concrete iuyces, where by the effusion of water, the Salt in the Lyme, or the concrete iuyces being suddenly dissolued, there is by this motion, an actuall heate procured for a time, able to kindle any combustible matter put to it.

The like we obserue in those Stone Coales, called metall Coales, which are mixed with a Marchesit containing some minerall iuyce, which receiuing moysture, doth dilate it selfe, and growes so hot, as oftentimes great heapes of those Coales are kindled thereby, and burnt before their time; as hath beene seene at Puddle Wharfe in London, and at Newcastle. But this is much different from our fermentation.

Another *Motus* resembling this fermentation, is that which is attributed to Antipathie, when disagreeing substances being put together, doe fight, and make a manifest actuall heate; as Antimony and Sublimat, oyle of Vitrioll, and oyle of Tartar, Allum Liquor and Vrine, Lees, Chalke, &c. But the reason of this disagreement is in their Salts, whereof one is astringent, the other relaxing; the one of easie dissolution in water, the

other of hard dissolution, &c. and not by reason of any antipathie: for it is not likely that nature would produce two contrarie substances mixed like atomes in one subiect, but that in their very generations, the one would be an impediment to the other. Moreouer if wee examine aright what this Sympathie and Antipathie is, we shall finde it to be nothing but a refuge of ignorance, when not being able to conceiue the true reasons of such actions, and passions in naturall things, wee flye sometimes to indefinite generalities, and sometimes to this inexplicable Sympathie and Antipathie: attributing voluntaries, and sensitiue actions and passions to insensible substances. This *motus* also is much different from fermentation, as may easily appeare by the former description. And thus much for this point of fermentation, which I hope will giue better satisfaction then any of the former opinions.

Cap. 14.

By what meanes it may be discouered what minerals any water containeth.

THe nature of minerals and their generations being handled, and from thence the reasons drawne, both of the actuall heate of Bathes, and of their qualities: Now it is fit we should seeke out some meanes, how to discouer what minerals are in any Bath, that thereby we may the better know their qualities, and what vse to make of them for our benefit. Many haue attempted this discouery, but by such weake meanes, and vpon such poore grounds, as it is no meruaile if they haue failed of their purpose: for they haue contented themselues with a bare distillation or euaporation of the water, and

obseruing the sediment, haue thereby iudged of the minerals, vnlesse perhaps they finde some manifest taste, or smell, or colour in the water, or some vnctuous matter swimming aboue it. Some desire no other argument of Sulphur and Bitumen, but the actuall heate: as though no other minerals could yeeld an actuall heate, but those two. But this point requires better consideration; and I haue beene so large in describing the natures and generations of minerals, because without it, wee cannot discerne what minerals we haue in our waters, nor iudge of the qualities and vse of them.

Our Minerals therefore, are either confused or mixed with the water. If they bee confused they are easily discerned: for they make the water thick and pudly, and will either swim aboue, as Bitumen will doe, or sinck to the bottome, as earth, Sulphur, and some terrestriall iuyces; for no confused water will remaine long vnseparated. If they are perfectly mixed with the water, then their mixture is either corporall, where the very body of the Minerall is imbibed in the water, or spirituall, where either some exhalation, or spirit, or tincture is imparted to the water.

Corporally there are no mineralls mixed with water, but iuyces, either liquid, as *succus lapidescens metallificus*, &c. before they are perfectly congeled into their naturall consistence, or concrete, as Salt, Niter, Vitriol, and Allum. And these concrete iuyces doe not only dissolue themselues in water, but oftentimes bring with them some tincture or spirit from other Minerals. For as water is apt to receiue iuyces, and tinctures, and spirits from animals, and vegetables; so are concrete iuyces, being dissolued, apt to extract tinctures and Spirits from minerals, and to communicate them with water. And there are no Mynes, but haue some of

these

these concrete iuyces in them, to dissolue the materials of them, for their better vnion and mixture: and there are few minerals or metals, but haue some of them incorporated with them: as we see in Iron, and Copper, and Tinne, and Leade, &c. And this is the reason that water being long kept in Vessels, of any of these metals, it will receiue a taste and smell from them, especially if it be attenuated, either by heate, or by addition of some soure iuyce; and yet more, if the metals be fyled into powder, as we see in making Chalibeat wine, or Sugar of Leade, or Puttie from Tinne, or Verdegrease from Copper. There may be also a mixture of Spirituall substance from minerals, whilst they are in generation, and *in Solutis principijs:* the water passing through them, and the rather if it be actually hot, for then it is more apt to imbybe it, and will containe more in it, being attenuated by heate, then being cold; as we see in Vrines, which though they bee full of humours, yet make no great shew of them so long as they are warme, but being cold, doe settle then to the bottome.

These spirituall substances are hardly discerned in our Baths, but by the effects; for they leaue no residence after euaporation; and are commonly as volutill in sublimation as the water it selfe: neither doe they encrease the weight of the water, nor much alter the taste or smell of them, vnlesse they be very plentifull. Wherefore we haue no certaine way to discouer them, but by the effects. We may coniecture somwhat of them by the Mynes which are found neare vnto the Baths, and by the mud which is brought with the water. But that may deceiue, as comming from the passages through which the water is conueyed, or, perhaps, from the sweat and strigments of mens bodyes which bathe in them. The corporall substances are found, either by

Sublimation or by precipitation. By Sublimation, when being brought to the ſtate of congelation, and ſtickes of Wood put into it, within a few dayes, the concrete iuyces will ſhoote vpon the wood; in Needles, if it bee Niter; in Squares, if it be Salt; and in Clods and Lumps, if it be Allum or Coperoſe; and the other minerall ſubſtance which the waters haue receiued, will either incorporate a tincture with them, or if it be more terreſtriall, will ſettle and ſeparate from it, and by drying it at a gentle fire, will ſhew from what houſe it comes, either by colour, taſte, ſmell, or vertue: There is an other way by precipitation, whereby thoſe minerall ſubſtances are ſtricken downe from their concrete iuyces which held them, by addition of ſome oppoſite ſubſtance. And this is of two ſorts: either Salts, as Tartar, Soape, Aſhes, Kelps, Vrine, &c. Or ſowre iuyces, as Vinegar, Lymons, Oyle of Vitrioll, Sulphur, &c. In which I haue obſerued that the Salts are proper to blew colours, and the other to red: for example, take a piece of Scarlet cloath, and wet it in Oyle of Tartar (the ſtrongeſt of that kinde) and it preſently becomes blew: dip it againe in Oyle of Vitriol, and it becomes red againe.

Theſe are the chiefe grounds of diſcouering minerall waters, according to which any man may make tryall of what waters he pleaſeth. I haue beene deſirous heretofore to haue attempted ſome diſcouerie of our Bathes, according to theſe principals: but being thought (by ſome) either not conuenient, or not vſefull, I was willing to ſaue my labour, which perhaps might haue ſeemed not to be worth thankes: and in theſe reſpects am willing now alſo to make but a bare mention of them.

CAP.

Cap. 9.

Of the vse of Minerall waters, inwardly, outwardly. In this Chapter is shewed the inward vse of them, first in generall; then particularly of the hot waters of Bathe.

THe nature and generations of Minerals being handled, and how our Minerall waters receiue their impressions, and actuall heat from thence; and by what meanes they are to be tried, what Minerals are in each of them. Now we are to shew the vses of them; which must bee drawne from the qualities of the Minerals whereof they consist: which are seldome one or two, but commonly moe. These qualities are either the first, as hot, cold, moyst, & dry; or the second, as penetrating, astringent, opening, resoluing, attracting, clensing, mollifying, &c. For the first qualities, it is certaine and agreed vpon by all Authors; That all Minerall waters doe dry exceedingly, as proceeding from earth: but some of those doe coole withall, and some doe heat.

Cooling waters are good for hot distemperatures of the liuer, stomach, kidneyes, bladder, wombe, &c. Also for salt distillations, sharp humors, light obstructions of the Mesaraicks, &c.

Heating waters are good for cold affects of the stomach, bowels, wombe, seminary vessels, cold distillations, Palsyes, &c.

For the second qualities, clensing waters are good in all vlcers, especially of the guts.

Mollifying waters, for all hard and schirrous tumors.

Astringent waters, for all fluxes, &c. and so of the rest.

Now theſe waters are vſed either inwardly or outwardly.

Inwardly, either by mouth, or by iniection.

By mouth, either in potion, or in broaths, iuleps, &c.

6 de tuenda ſanit. cap. 9. *Galen* neuer vſed them inwardly, becauſe hee iudged their qualities to be diſcouered by experience, rather then by reaſon. And ſeeing we finde many of them to be venomous, and deadly, as proceeding from Arſenick, Sandaracha, Cadmia, &c. we had need bee very wary in the inward vſe of them.

Neptunes Well in Tarracina was found to be ſo deadly, as it was therefore ſtopped vp. By Monpellier at Perant is a Well which kils all the fowles that drinke of it; the lake Auernus kils the fowles that fly ouer it; ſo doth the vapour ariſing from Charons den betweene Naples and Puteolum. So there are diuers waters in Sauoy and Rhetia, which breede ſwellings in the throat. Others proceeding from Gipſum doe ſtrangle, &c. But where we finde waters to proceede from wholſome Minerals, and ſuch as are conuenient, and proper for our intents, there we may be bold to vſe them as well inwardly as outwardly: yet ſo as we doe not imagine them to bee ſuch abſolute remedies, as that they are of themſelues able to cure diſeaſes without either rules for the vſe of them, or without other helps adioyned to them. For as it is not enough for a man to get a good Damaſco or Bilbo blade to defend himſelfe withall, vnleſſe he learne the right vſe of it, from a Fencer; ſo it is not enough to get a medicine and remedy for any diſeaſe, vnleſſe it be rightly vſed, and this right vſe muſt come from the Phyſitian, who knowes how to apply it, and how to prepare the body for it, what to adde and ioyne with it, how to gouerne and order the vſe of it, how to preuent ſuch inconueniences as may happen by it, &c.

Wherefore,

Wherefore, where we ſpeake of any Minerall water, or of any other medicine that is proper for ſuch & ſuch a griefe, we muſt be ſo vnderſtood, that the medicine is wiſe enogh to cure the diſeaſe of it ſelfe, no more then a ſword is able of it ſelfe to defend a man, or to offend his enemy, but according to the right and skilfull vſe of it. And as it is not poſſible for a Fencer to ſet down abſolute rules in writing for his Art, whereby a man may be able in reading of them to defend himſelfe ; no more is the Phyſitian poſſibly able to direct the particular vſes of his remedy, whereby a patient may cure himſelfe without demonſtration and the paticular direction of the Phyſitian. It is true, that we haue generall rules to guide vs in the cure of diſeaſes, which are very true and certaine ; yet when we come to apply them to particular perſons, and ſeuerall conſtitutions, theſe general rules are not ſufficient to make a cure, but is iuſtly varied according to circumſtances. Hereupon we daily finde, that thoſe patients which thinke to cure themſelues, out of a little reading of ſome rules or remedies, are oftentimes dangerouſly deceiued. And this is enough to intimate generally concerning the vſes of our Minerall waters.

Inwardly we finde great and profitable vſe of ſuch waters as proceed from Niter, Allum, Vitriol, Sulphur, Bitumen, Iron, Copper, &c. Examples whereof I haue ſet downe before in the ſeuerall Minerals, referring the particular vſes of each to ſuch Authors as haue purpoſely deſcribed them.

My intent is chiefely to apply my ſelfe to thoſe Baths of Bath in Summerſetſhire ; which conſiſting, as I iudge, principally of Bitumen, with Niter, and ſome Sulphur, I hold to be of great vſe both inwardly and outwardly. And I am ſorry that I dare not commend the

the inward vse of them as they deserue, in regard I can hardly be perswaded that we haue the water pure, as the springs yeeld them, but doe feare, lest where wee take them, they may bee mixt with the water of the Bath. If this doubt were cleared, I should not doubt to commend them inwardly, to heat, dry, mollifie, discusse, glutinate, dissolue, open obstructions, cleanse the kidneyes, and bladder, ease cholicks, comfort the matrix, mitigate fits of the mother, helpe barrennesse proceeding from cold humors, &c. as *Tabernemontanus* affirmes of other Bitumious Baths. Also in regard of the Niter, they cut and dissolue grosse humors, and cleanse by vrine. In regard of the Sulphur, they dry and resolue, and mollifie, and attract, and are especially good for vterine effects proceeding from cold and windy humors. Our Bath Guides do usually commend the drinking of this water with salt to purge the body, perswading the people, that the Bath water hath a purging quality in it, when as the same proportion of spring water, with the like quantity of salt will doe the like. Our Baths haue true virtues enough to commend them, so as we need not seeke to get credit or grace vnto them by false suggestions. The Bitumen and Niter which is in them, although it serues well for an alteratiue remedy, yet it is not sufficient for an euacuatiue: and therefore we must attribute this purgatiue quality, either to the great quantity of water which they drink (and so it works) *ratione ponderis)* or vnto the stimulation of salt which is dissolued in it, or vnto both together. I should like much better to dissolue in it some appropriate sirrup or other, purgatiue, for this purpose, as Manna, Tartar, Elaterium, sirrups of Roses, of Cicory, with Rhewbarb, Augustunus: or to moue vrine, *Syr. de 5. rad, Bizantinus de Limonibus, Sambucinus de Althea, &c.*

&c. And this course is vsuall in Italy, according as the Physitian sees most conuenient, but with this caution, that when they take it in potion, they must not vse the Bath, because of contrary motions.

Inwardly also Bath waters are vsed, for Brothes, Beere, Iuleps, &c. although some doe mislike it, because they will not mixe medicaments with aliments : wresting a text in *Hippocr.* to that purpose. But if wee may mixe Diureticks, Deoppilatiues, Purgatiues, &c. with aliments, as vsually we doe. I see no reason but we may as well vse minerall waters, where we desire to make our aliments more alteratiue by a medicinall qualitie: alwaies prouided that there be no malignitie in them, nor any ill qualitie which may offend any principall part. And thus much for the vse of them by mouth.

By iniection they are vsed also into the Wombe, to warme and dry, and cleanse those parts; into the passages of vrine, to drie and heale excoriations there: into the fundament for the like causes, as also for resolutions of the Sphincter, and bearing downe of the fundament, &c. And thus they are vsed either alone, or mixed with other medicines, according as the Physitian thinks most fit, and we daily finde very good successe thereby in vterin effects, depending vpon cold causes. Thus much for the inward vse of our Bath waters.

Cap. 16.

Of the outward vse of the hot waters of Bathe; first, the generall vse of them to the whole body, in bathing: secondly, the particular vse of them, by pumping, bucketing, or applying the mud.

OVtwardly our Bath waters are principally vsed, because they are most properly for such effects, as are in the habit of the body, and out of the veines: As Palsies, Contractions, Rheumes, cold tumours, affects of the skin, aches, &c. And in these cases we vse not onely the water, but also the mudde, and in some places the vapour.

The water is vsed both for his actuall and potentiall heate, as also for the second qualities of mollifying, discussing, clensing, resoluing, &c. which the minerals giue vnto it. The vse hereof is either generall to the whole body, as in bathing, or particular, to some one part, as in bucketting or pumping, which anciently was called *Stillicidium*. The Italians call it *Duccia*. The generall vse in Bathing, is most ancient: for our Bathes were first discouered thereby to be wholesome and soueraigne in many diseases.

Nechams verses concerning the vse of these Bathes, are foure hundred yeares old:

Bathonia Thermas vix praefero Virgilianas
Confecto prosunt Balnea nostra seni:
Presunt attritis, collisis inualidisque
Et quorum morbis frigida causa subest.

Which I will English out of Master Doctor *Hackwels* learned worke, of the perpetuitie of the world.

Our

Our Baynes at Bathe with *Virgils* to compare;
For their effects, I dare almoſt be bold,
For feeble folke, and crazie good they are,
For bruis'd, conſum'd, farre ſpent, and very old,
For thoſe likewiſe whoſe ſickneſſe comes of cold.

We haue antient traditions (*fama eſt obſcurior annis*) That King *Bladud* who is ſaid to haue lined in the time of *Elias*, did firſt diſcouer theſe Bathes, and made tryall of them vpon his owne ſonne, and thereupon built this Citie, and diſtinguiſhed the Bathes, &c. But we haue no certaine record hereof. It is enough that wee can ſhew the vſe of them for 4000. yeares, and that at this day they are as powerfull as euer they were: *Camden* giues them a more ancient date from *Ptolomy* and *Antonin*, and the Saxons: and ſaith they were called *Aqua Solis*, and by the Saxons *Akmancheſter*, that is, the towne of ſicke people, and dedicated to *Minerua*, as *Solinus* ſaith. The opinion that the Bathes were made by Art, is too ſimple for any wiſe man to beleeue, or for me to confute: And *Necham* in his verſes which follow after thoſe I haue mentioned, doth hold it a figment: you may ſee them in *Camden*. We haue them for their vſe in bathing, diſtinguiſhed into foure ſeuerall Bathes, whereof three haue beene anciently: namely the Kings Bath, the hot Bath, and the Croſſe Bath. The Queenes Bath was taken from the Springs of the Kings Bath, that being farther off, from the hot Springs, it might ſerue for ſuch as could not endure the heate of the other. We haue likewiſe an appendix to the hot Bath, called the Leapers Bath, for vncleane perſons. We finde little difference in the nature of theſe Bathes, but in the degree of heate, proceeding no doubt, from one and the ſame Myne. Yet as the Myne may be hotter in one part then in an

other, or the passages more direct from it, so the heate of them may vary. Some little difference also we finde among them, that one is more cleansing then another, by reason (as I take it) of more Niter. For in the crosse Bath wee finde that our fingers ends will shrinke and shriuell, as if we had washed in Soape water, more then in the other Bathes. The Kings Bath, as it is the hotteſt of all the Bathes, so it is the fitteſt for very cold diseases, and cold and plegmaticke constitutions: And we haue daily experience of the good effects it worketh vpon Palsies, Aches, Sciaticaes, cold tumours, &c. both by euacuation, by Sweate, and by warming the parts affected, attenuating, discussing, and resoluing the humors: Also in Epilepsies and Vterin affects in the Scorbut, and in that kinde of dropsie which wee call Anasarca. The hot Bath is little inferiour vnto it, as next in degree of heate, and vsefull in the same cases. The Queenes Bath, and Crosse Bath are more temperate in their heate, and therefore fitteſt for tender bodies, which are apt to bee inflamed by the other, and where there is more neede of mollifying and gentle warming, then of violent heate and much euacuation by sweate. And in these Bathes they may indure longer without dissipation of Spirits, then in the other: the Queenes Bath is the hotter of the two, but temperate enough for most bodies. The Crosse Bath is the coldest of all, as hauing but few Springs to feede it: yet we obserue it to supple, and mollifie more then the rest, both because they are able to stay longer in it, and because (as I said before) it seemes to participate more with Niter, then the rest, which doth cleanse better, and giues more penetration to the other Minerals. Wherefore in contractions, Epilepsies, Vterin affects, Conuulsions, Cramps, &c. This Bath is very vsefull, as also in cutaneall diseases, as Morphewes,

Itch,

Itch, &c. Thus much for the nature and difference of our Bathes, and the generall vſe of them in bathing.

They are vſed alſo to particular parts by pumping or bucketting, or applying the mud.

Pumping or bucketting are not vſed in that faſhion, as we vſe them, in any other Baths that I can learne, but only the Duccia or Stillicidium: But I hold our faſhion as good as that. The water comes more plentifully vpon the part, and may be directed as the patient hath occaſion. Our bucketting hath beene longeſt in vſe: but finding that it did not heat ſome ſufficiently, being taken from the ſurface of the Bath. We haue of late erected Pumpes, which draw the water from the ſprings or neare vnto them, ſo as wee haue it much hotter from thence, then wee can haue it by bucketting. A worthy Merchant and Citizen of London, M. *Humphrey Browne*, was perſwaded by me to beſtow two of theſe Pumps vpon the Kings and Queenes Bath, whereby he hath done much good to many, and deſerues a thankfull remembrance. The like alſo I procured to be done at the other Baths, although that of the Croſſe Bath is not ſo vſefull, by reaſon it wants heat, vnleſſe for yong children. Alſo we haue a Pumpe out of the hot Bath, which wee call the dry Pumpe, where one may ſit in a chayre in his clothes, and haue his head, or foot, or knee pumped without heating the reſt of the body in the Bath; and deuiſed chiefely for ſuch as haue hot kidneys, or ſome other infirmities which the Bath might hurt. This we finde very vſefull in rheumes and cold Braines, and in aches or tumors in the feet. For theſe Pumps we are beholding vnto the late Lord Archbiſhop of Yorke, and to M. *Hugh May*, who vpon my perſwaſions were contented to bee at the charge of them. It were to be wiſhed that ſome well diſpoſed

to the publique good, would erect the like at the Kings Bath, where, perhaps, it might be more vsefull for many, in regard of the greater heat which those springs haue.

The lute of Baths, is in much vse in some places, where it may be had pure, both to mollifie, and to resolue, and to strengthen weake parts. But we make little vse of it in our Baths, because we cannot haue it pure, but mixed with strigments. In diuers other places either the springs arise a good distance from the bathing places, or else there be other eruptions from whence it may bee taken. But our springs arising in the Baths themselues, it cannot well be saued pure. Besides, we haue not those meanes of the heat of the Sunne, to keepe it warme to the parts where it is applyed: so as growing cold, it rather does hurt, then good. Wherefore it were better for vs, to vse artificall lutes, as the Ancients did, of clay, Sulphur, Bitumen, Niter, Salt, &c. or vnguents of the same nature, as that which they call Ceroma. But the best way is to referre the election of these remedies, to the present Physitian, who will fit them according to the nature of the griefe.

Cap. 17.

In what particular infirmities of body, bathing in the hot waters of Bath is profitable.

TO come more particularly to the vse of bathing, we must vnderstand, that there are many Minerall waters fit for bathing, which are not fit to drinke: as those which participate with Lead, Quicksiluer, Gypsum, Cadmia, Arsenick, &c. Also those that containe liquid Bitumen, are thought to relaxe too much: but those

those that proceede from dry Bitumen, are permitted, and prescribed in potion, by *Paulus Ægineta*, and *Trallian*: Sulphur also is questioned, whether it bee fit to be taken inwardly by potion, because it relaxeth the stomach, and therefore *Aetius* forbids it: yet *Trallian* allowes it, and so doe others, if the Sulphur be not predominant. But for outward bathing there is no question to be made of these Minerals, nor of any other which are not in themselues venomous. And whereas *Oribasius*, *Ægineta*, *Actuarius*, &c. are suspicious of Sulphur and Bitumen for the head; they must bee vnderstood of hot distempers there, and not of cold rheumatick braines; where by daily experience wee finde the profitable vse of them, both by euacuation in bucketting, and by warming and comforting the cold part. And *Oribasius* doth ingenuously confesse, that the nature of these Baths was not then perfectly discouered: and therefore they were all held to bee, not only dry, but very hot: although we finde them not all so: for, Iron waters doe coole, and so doe those of Campher, and Alluminous, and Nitrous waters also. But for our Bitumious and Sulphurous waters, which *Galen* forbids in hot braines, there is no reason to suspect them in cold effects of the braine and nerues, in which cases we make especiall choyce all things, which either in taste or smell doe resemble Bitumen: as Rue, Castorum, *Valeriana*, *herba paralyseos*, *trifolium*, *asphalitis*, *&c*; which both by his warming quality, and by his suppling and mollifying substance, is most proper and conuenient for those parts. The like I may say of Sulphur, in which nothing can bee excepted against, but his sharp spirit, which is made by burning: and wee haue none of that in our waters, nor, I hope, any fire to make it withall. The other parts of Sulphur are hot and

1 *Tretrab. serm. 3. cap. 167. Trallian l. 10. c. 1*

Orib. l. 10. c. 3: Ægin. l. 1. c. 52: Actuar. l. 3. c. 10

cap. 53

Hippoc. de aere, aquis, & locis.

de sanit. tuenda lib. 6. cap. 9.

and dry, and very vnctuous. As for Niter, it clenseth, purgeth both by stoole and vrine, and helpeth the incorporation of the other Minerals with the water, and qualifies the heat of them, and giues them better penetration into our bodies. In regard of these Minerals, together wi h the actuall heat, we finde that the bathing in our Baths doth warme the whole habit of the body, attenuate humors, open the pores, procure sweat, moue vrine, cleanse the matrix, prouoke womens euacuations, dry vp vnnaturall humors, strengthen parts weakned, comfort the nerues, and all neruous parts, cleanse the skin, and suck out all salt humors from thence, open obstructions if they be not too much impacted, ease paines of the ioynts, and nerues, and muscles, mollifie and discusse hard tumors, &c. Whereby this bathing is profitable for all palsies, apoplexies, caros, epylepsies, stupiditie, defluctions, gouts, sciaticaes, contractions, cramps, aches, tumors, itches, scabs, leprosies, collicks, windines, whites in women, stopping of their courses, barrennesse, abortions, scorbuts, anasurcas, and generally all cold and phlegmatick diseases, which are needlesse to reckon vp. In all which cures our Bathes haue a great hand, being skillfully directed by the Physitian, with preparation of the body before, and addition of such other helps as are needfull. And whereas without the helpe of such Baths these diseases could not be cured without tormenting the body, either by fire, or launcing, or causticks, or long dyets, or bitter and vngratefull medicines, &c. In this course of bathing all is pleasant and comfortable, and more effectuall then the other courses, and therefore it is commonly the last refuge in these cases, when all other meanes faile. I will not vndertake to reckon vp all the benefits which our Baths doe promise; but if wee had a register kept of the manifold

manifold cares which haue beene done by the vſe of our Bathes principally, it would appeare of what great vſe they are. But as there is a defect in not keeping a Catalogue of rare Cures, ſo many perſons of the better ſort would be offended if a Phyſitian ſhould make any mention of their cures or griefes: wherefore I muſt ſpeake but generally.

Cap. 18.

The manner of bathing, chiefly referred to the inſpection and ordering of a Phyſician. Yet ſome particulars touched, concerning the gouernement of the Patient in and after bathing: the time of day, of ſtaying in the Bathe, of continuing the vſe of it. The time of the yeare. Of couering the Baths.

NOw for the manner of Bathing, I will not ſet downe what the Phyſitian is to doe, but leaue that to his iudgement and diſcretion: but what is fit for the Patient to know: for there are many cautions and obſeruations in the vſe of bathing, drawne from the particular conſtitutions of bodies; from the complication of diſeaſes, and from many other circumſtances which cannot be comprehended in generall rules, nor applied to all bodies alike: But many times vpon the ſucceſſe, and the appearing of accidents, the Phyſitian muſt *ex re nata capere conſilium*, and perhaps alter his intended courſe, and perhaps change the Bath either to a hotter or cooler, &c. In which reſpect, thoſe Patients are ill aduiſed which will aduenture without their Phyſitian vpon any particular Bath, or to direct themſelues in the vſe of it. And this is a great cauſe that many goe away from hence without benefit, and then they are apt to

complaine of our Bathes, and blaſpheme this great bleſſing of God beſtowed vpon vs.

It is fit for the Patient when he goeth into the Bath, to defend thoſe parts which are apt to be offended by the Bath: as to haue his Head well couered from the ayre and winde, and from the vapours ariſing from the Bath: alſo his kidneyes (if they be ſubiect to the Stone) anoynted with ſome cooling vnguents; as *Roſatum comitiſſæ infrigidans Galeni ſantolinum, &c.* Alſo to begin gently with the Bath, till his body be inured to it, and to be quiet from ſwimming, or much motion, which may offend the Head by ſending vp vapours thither: at his comming forth, to haue his body well dryed, and to reſt in his Bed an houre, and ſweate, &c.

A morning houre is fitteſt for Bathing, after the ſunne hath bin vp an houre or two; and if it be thought fit to vſe it againe in the afternoone, it is beſt foure or fiue houres after a light dinner. For the time of ſtaying in the Bath, it muſt bee according to the qualitie of the Bath, and the tolleration of the Patient. In a hot Bath, an houre or leſſe may be ſufficient: in a temperate Bath, two houres. For the time of continuing the Bath, there can be no certaine time ſet downe, but it muſt be according as the Patient findes amendment, ſometimes twenty dayes, ſometimes thirty, and in difficult caſes much longer. And therefore they reckon without their Hoſt, which aſſigne themſelues, a certaine time, as perhaps their occaſions of buſineſſe will beſt afford. For the time of the yeare, our Italian and Spaniſh Authors preferre the Spring and Fall; and ſo they may well doe in their hot Countries; but with vs conſidering our clymat is colder, and our Bathes are for cold diſeaſes; I hold the warmeſt moneths in the yeare to be beſt; as May, Iune, Iuly, and Auguſt; and I haue perſwaded many hereun-

to

to who haue found the benefit of it; for both in our Springs, and after September, our weather is commonly variable, and apt to offend weake persons; who finding it temperate at noone, doe not suspect the coolenesse of the mornings and euenings. Likewise in the Bath it selfe, although the Springs arise as hot as at other times, yet the winde and ayre beating vpon them, doth doe them much harme, and also make the surface of the water much cooler then the bottome: and therefore *Claudinus* wisheth all Bathes to be couered, and *Fallopius* findes great fault with the Lords of Venice, that they doe not couer their Bath at Apono. Wee see also that most of the Bathes in Europe, are couered, whereby they retaine the same temperature at all times. And it were to be wished that our Queenes Bath, and Crosse Bath, being small Bathes, were couered, and their Slips made close and warme. By this meanes our Bathes would be vsefull all the yeare, when neither winde and cold ayre in winter, nor the Sunne in summer, should hinder our bathing. Moreouer for want of this benefit, many who haue indifferently wel recouered in the Fall, doe fall backe againe in the winter before the Cure bee perfectly finished: and as this would be a great benefit to many weake persons, so it would be no harme to this Citie, if it may be a meanes of procuring more respect hither in the Winter time, or more early in the Spring, or more late at the Fall. The Right Honourable, the Earle of *Marleborow*, hath of his owne accord and noble disposition to doe any Bathes good, vndertaken the couering of the Crosse Bath vpon his sole charge. If some other out of the like affection would doe the like for the Queenes Bath, they should doe much good to many, and gaine a thankefull remembrance to their names for euer.

I desire not noueltie, or to bring in innouations, but I propound these things vpon good grounds and examples of the best Bathes in Europe, and so I desire to haue them considered of; referring both this point, and whatsoeuer else I haue said in this discourse, to the censure of those who are able to iudge.

I doe purposely omit many things about the vertues and vses of our Bathes, which belong properly to the Physitian, and cannot well be intimated to the Patient without dangerous mistaking. For as *Galen* saith, our Art of Physicke goes vpon two legges, Reason and Experience, and if either of these be defectiue, our Physicke must needs be lame. Reason without Experience, makes a meere contemplatiue and theoricall Physitian: Experience without Reason, makes a meere Empericke, no better then a Nurse or an attendant vpon sicke persons, who is not able out of all the experience he hath, to gather rules for the cure of others. Wherefore they must be both ioyned together: and therefore I referre Physitians workes, vnto Physitians themselues.

De compos. med. locos lib. 8. c. 7.

FINIS.

Errata.

PAge 2. line 29. for 4000. reade 4000c. page 83. line 13. for 4000. reade 400.