

The natural and experimental history of winds, &c.; / Written in Latine by the Right Honourable Francis Lord Verulam, Viscount St. Alban. Translated into English by R.G. Gent.

Contributors

Bacon, Francis, 1561-1626.
Gentili, Robert, 1590-1654?

Publication/Creation

London : Printed for Anne Moseley, and Tho. Basset, 1671.

Persistent URL

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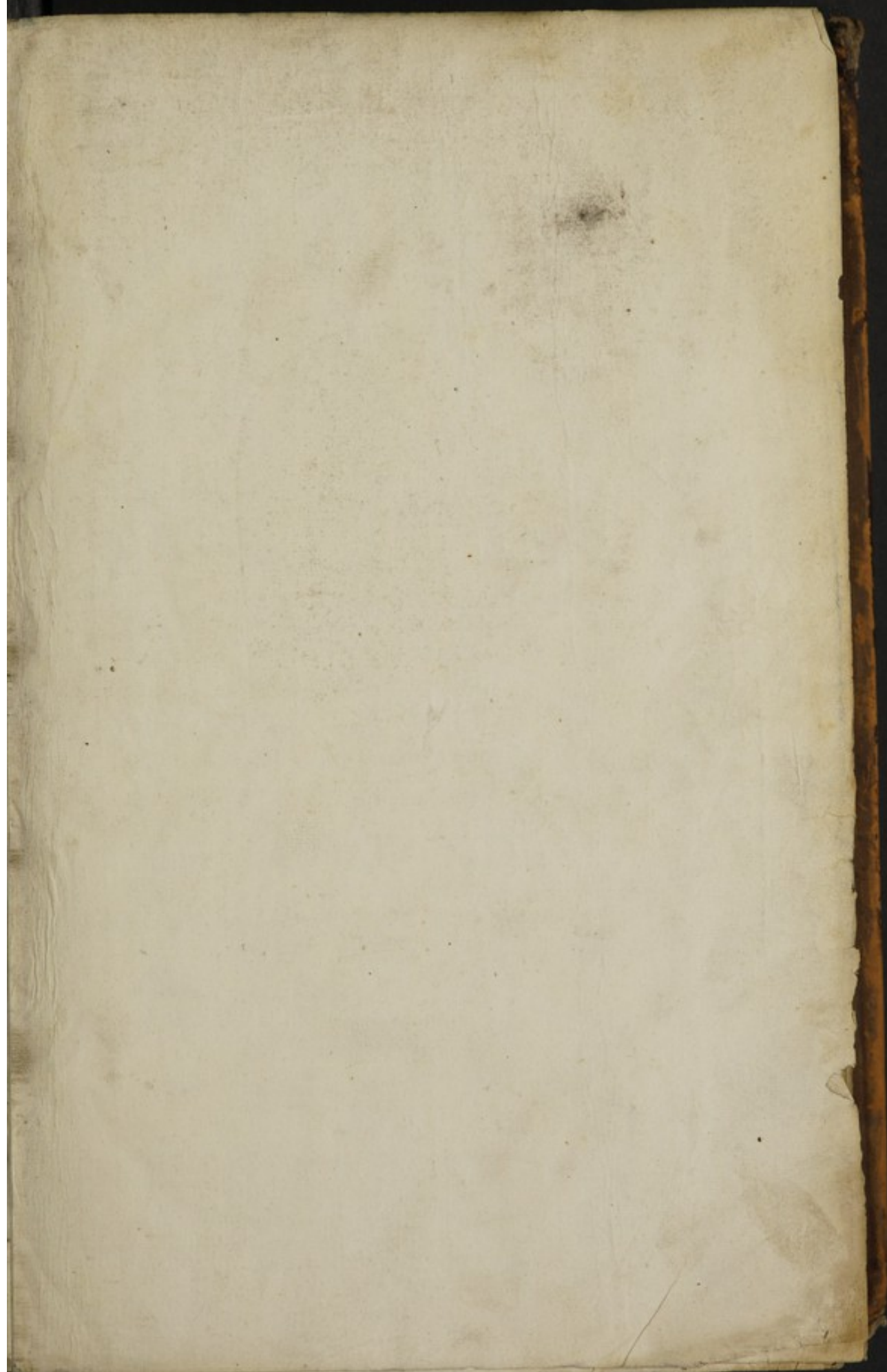
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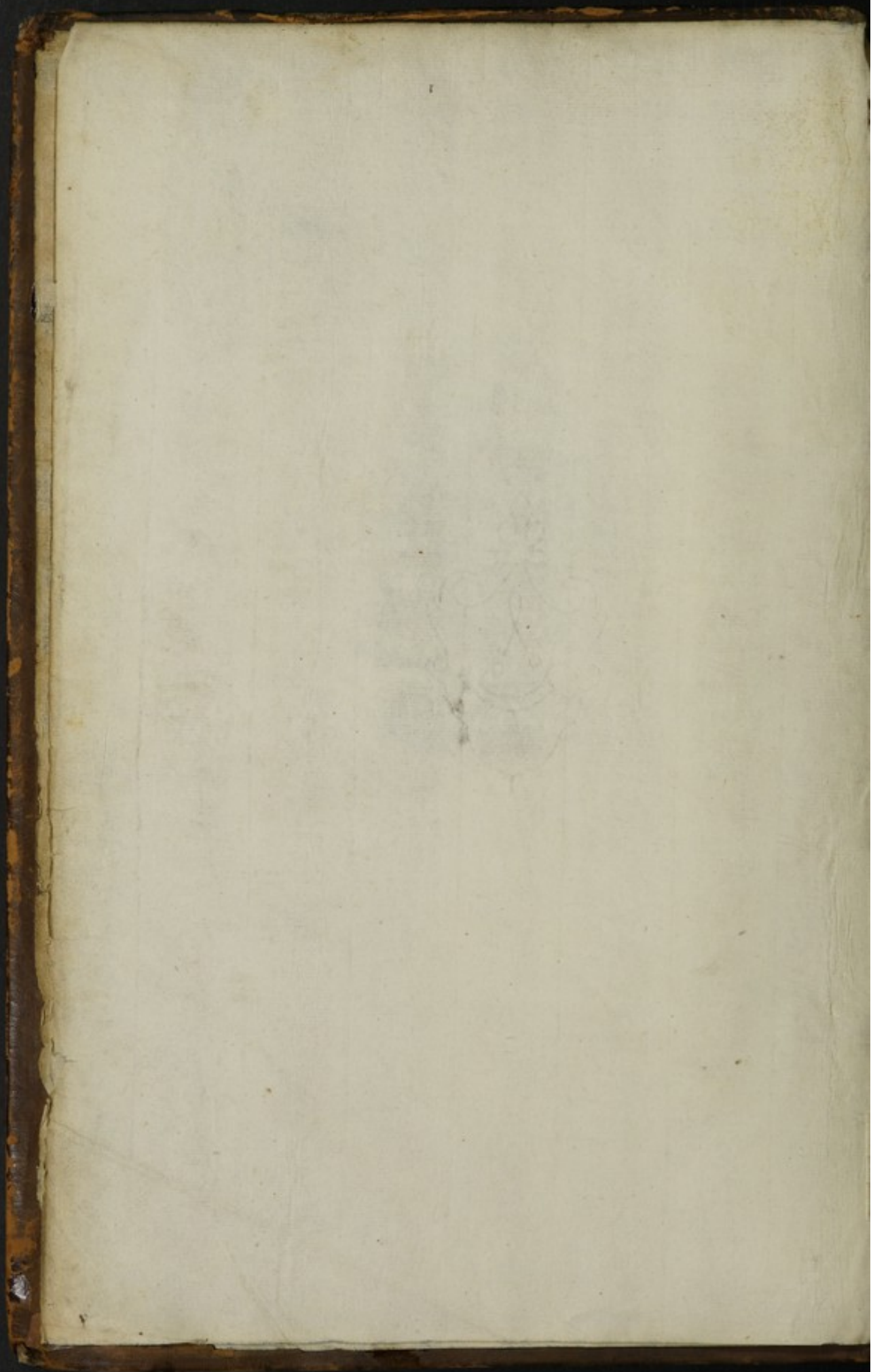
BACON, F

Bound in at end is J Selden's Brief
this course touching the office of Lord
Chancellor. 1671.



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THE
LIFE OF
FRANCIS
BACON

By
JAMES SPENCER
OF LINCOLN'S INN

In Two Parts

Part I.
Containing his Birth, Education,
and early Life.

Part II.
Containing his Manners, Character,
and Death.

in a Still. He was the first Heir of the *White*, and the *Red Rose*; So that there was no discontented Party now left in the *Kingdom*, but all Mens Hearts turned towards him. And not only their Hearts, but their Eyes also. For he was the only Son of the *Kingdom*. He had no *Brother*, which though it be a comfortable thing, for *Kings* to have, yet it draweth the Subjects Eyes a little aside. And yet being a married Man in those young years, it promised hope of speedy Issue, to succeed in the *Crown*. Neither was there any *Queen Mother*, who might share any way in the Government, or clash with his *Counsellours* for Authority, while the *King* intended his pleasure. No such thing, as any Great and Mighty *Subject*, who might any way eclipse, or overshadow the *Imperial Power*. And for the people, and *State* in general, they were in such lowness of obedience, as Subjects were like to yield, who had lived almost four and twenty years, under so politique a *King*, as his *Father*; Being also one who came partly in by the *Sword*; And had so high a Courage in all points of Regalitie; And was ever victorious in Rebellions, and Seditions of the *People*. The *Crown* extreamly rich, and full of Treasure, and the *Kingdom* like to be so in short time. For there was no War, no Dearth, no Stop of Trade, or Commerce, it was only the *Crown*, which had sucked too hard, and now being full, and upon the head of a young *King*, was like to draw less. Lastly, he was Inheritor of his *Fathers* Reputation, which was great throughout the World. He had streight Alliance, with the two Neighbour States, an ancient Enemy in former times, and an ancient Friend, *Scotland*, and *Burgundy*. He had Peace and Amity with *France*, under the Assurance, not only of Treaty and League, but of Necessity and Inhability in the *French* to do him hurt, in respect that the *French Kings* Designs were wholly bent upon *Italy*. So that it may be truly said; there had scarcely been seen, or known, in many Ages, such a rare Concurrence of Signs, and Promises of a happy, and flourishing Reign to ensue, as were now met in this young *King*, called, after his *Fathers* name, *HENRY* the Eighth, &c.

FINIS.

THE
NATURAL
AND
EXPERIMENTAL
HISTORY
OF
WINDS, &c.

Written in Latine by the Right Honourable
FRANCIS Lord *Verulam*, Viscount *S'Alban*.

Translated into English by R. G. Gent.



LONDON,
Printed for *Anne Moseley*, and *Tho. Basset* at the George
in *Fleet-street*, 1671.

THE
NATURAL
AND
EXPERIMENTAL
HISTORY
OF
WINDS, &c.

Written in Latin by the Right Honourable
FRANCIS WINDHAM, Viscount Windham.

Translated into English by R. G. G.



LONDON,
Printed for James Bohn, and J. Bohn at the George
in Fleet Street, 1871.



TO THE
Most Illustrious,
AND
EXCELLENT PRINCE,
CHARLES,
Son and Heir to the High and Mighty
KING *JAMES.*



*Humbly present unto your Highness
the first fruits of our Natural
History; A thing exceeding lit-
tle in quantity, like a grain of
Mustard-seed, but yet a pledg of
those things which God willing
shall ensue. For we have bound
ourselves, as by a vow, every Month that God shall
of his goodness please (whose glory it sets forth as it
were in a new Canticle or Song) to prolong our life,
to set out one or more parts of it, according as their
length and difficulty shall prove more or less. Others
may peradventure (moved by our example) be moved
to the like industry; especially when they shall clearly
perceive what is in hand. For in a Natural History*

which is good and well set out, are the Keys both of
Sciences and works. God preserve your Highness long
in safety,

Your Highness humble and devoted

Servant

FRAN. ST ALBAN.

THE

THE
NATURAL and EXPERIMENTAL HISTORY
for the making up of Philosophy: Or Experiments
of the Universe: Which is the third part of
the *INSTAURATIO MAGNA*.

MEN are to be intreated, advised and adjured even by their Fortunes, to submit their minds, and seek for Knowledge in the greater World; and likewise to cast away so much as the thought of Philosophy, or at least to hope but for slender and small fruits thereof, until a diligent and approved Natural and Experimental History be acquired and made up: For what would these shallow brains of men, and these potent trifles have? There were among the Ancient numerous Opinions of Philosophers, as of *Pythagoras*, *Philolaus*, *Xenophanes*, *Heraclitus*, *Empedocles*, *Parmenides*, *Anaxagoras*, *Leucippus*, *Democritus*, *Plato*, *Aristotle*, *Theophrastus*, *Zeno*, and others. All these made up Arguments of Worlds, as of Fables, according to their own Fancies, and recited and published those Fables; whereof some indeed were more handsome and probable, and some again most harsh. But in our Ages, by means of Colledges and Schools Disciplines, wits are somewhat more restrained; yet have they not quite ceased: *Patricius*, *Telesius*, *Brunus*, *Severine* the Dane, *Gilbertus* an Englishman, and *Campanella* did set foot upon the Stage, and acted new Fables, neither much applauded, nor of any Elegant Argument or Subject. But do we wonder at these things? as though such Sects and Opinions, might not in an infinite number arise in all ages? For neither is there, nor ever will be any end or limit for these things. One snatches at one thing, another is pleased with another; there is no dry nor clear sight of any thing, every one plays the Philosopher out of the small Treasures of his own Fancy, as it were out of *Plato's* Cave; the more sublime wits more acutely, and with better success: the duller with less success but equal obstinacy: and not long since by the discipline of some learned (and as things go now excellent) men, Sciences are bounded within the limits of some certain Authors which they have set down, imposing them upon old men, and instilling them into young. So that now (as *Tullie* cavilled upon *Cæsars* Consulship) the star *Lyra* or *Harpe* riseth by an Edict, and Authority is taken for truth, not truth for Authority. Which kind of order, and discipline is very convenient for our present use; but banisheth those which are better. For we both suffer for, and emulate our first Parents sin. They desired to be like unto God, and their posterity much more: for we create new worlds, go before nature and command it. We must have

have all things to be so as may agree with our folly, not to Divine wisdom, nor as they are found to be in themselves: neither can I say which we rest most, our wits, or the things themselves: but certainly we set the stamps and seals of our own Images upon Gods Creatures, and works, and never carefully look upon and acknowledg the Creators stamps. Therefore we do not without cause again strive for the domination over the Creatures. For whereas even after the fall of man, he had some kind of domination left him over reluctant Creatures, that he might tame and subdue them by true and solid arts; we have for the most part lost that also through our own insolencie, because we will be like unto God, and follow the dictates of our own reason. Wherefore if there be any humility towards the Creator, any reverence, and magnifying of his works, any charity in men, or care to release them out of their necessities and miseries, if there be any love of truth in natural things, hatred of darkness, and a desire of purifying the understanding, men are to be again and again desired, that casting off, or at least laying aside for a while, these flying and preposterous Philosophies, which have set the *Theses* before the *Hypotheses*, or suppositions before solid grounds, have captivated experience, and triumphed over the works of God, they would humbly and with a certain reverence draw near and turn over the great Volume of the Creatures, stop and meditate upon it: and being cleansed and free from opinions, handle them choicely and entirely. This is the speech and language that went out into all the ends of the World, and suffered not in the confusion of *Babel*. Let men learn this, and becomming children again and Infants, not scorn to take A. B. C. thereof in hand, and in finding and searching out the interpretation of it, let them spare no labour, but let them persist and go on, and even die in the quest of it. Seeing therefore that in our Instauration we have placed the Natural History (such as it is in order to our ends) in the third part of the work: we have thought fit to prevent this thing, and fall upon it immediately. For although in our Organon, there are many things of especial consequence to be finished, yet we think it fitting rather to promote or set forward the general work of Instauration in many things, then to perfect it in a few, always desiring with extream fervency (such as we are confident God puts in the minds of men) to have that which was never yet attempted, not to be now attempted in vain. Likewise there came this thought into my mind, namely, that there are questionless in *Europe* many capable, free, sublimed, subtile, solid, constant wits; and what if any one endued with such a wit, do betake himself to the use and manner of our Organon, and approve of it? yet hath he nothing to do nor knows not how to address himself to, or fit himself for Philosophy. If it were a thing which might be effected by reading of Philosophy books, disputation, or meditation; that man (whosoever it be) might sufficiently, and abundantly perform it: But if we remit him (as indeed we do) to Natural History, and experiments of arts, he is gravelled or sticks in the mire; it is not his intention, he hath no time, nor will not be at the charge: yet we must not desire to have men cast off old things, before they have gotten new. But after a copious, and faithful History of Nature and Arts is gathered and digested, and as it were set, and laid open before mens eyes, there is no small hope that such great wits as we have before spoken of (such as have been in ancient Philosophers, and are at this day frequent enough) having been heretofore of such efficacy, that they could out of corke or a little shell (namely by thin and frivolous experience)

ence) build certain little boats for Philosophy, gallant enough for Art and structure; how much more gallant and solid structures will they make, when they have found a whole wood, and stuff enough: and that, though they had rather go on in the old way, then make use of our Organons way which (in our opinion) is either the only, or the best way. So that the case stands thus: our *Organon* (though perfect) could not profit much without the Natural History; but our Natural History without the *Organon* might much advance Instauration, or renewing of Sciences. Wherefore we have thought it best and most advisedly to fall upon this before any thing else. God the Maker, Preserver, and Renewer of the Universe, guide and protect this Work, both in its ascent to his own glory, and in its descent to the good of man, through his good-will towards man, by his only begotten Son God with us.

The

The Rule of this present History.

THough we have set down towards the end of that part of our *Organon*, which is come forth, Precepts concerning the Natural and experimental History: yet we have thought good to set down more exactly and briefly, the form and rule of this History which we now take in hand. To the Titles comprehended in the Catalogue, which belong to the Concretes, we have added the Titles of the Abstract Natures; of which, as of a reserved History, we made mention in the same place. These are the various Figurations of the matter, or forms of the first Classis, simple Motions, sums of Motions, measures of Motions, and some other things: of these we have made a new Alphabet, and placed it at the end of this Volume. We have taken Titles (being no way able to take them all) not according to order, but by choice: those namely, the Inquisition of which either for use was most of weight, or for abundance of Experiments most convenient, or for the obscurity of the thing most difficult and noble, or by reason of the discrepancy of Titles among themselves, most open to examples. In each Title, after a kind of an entrance or Preface, we presently propound certain particular Topicks or Articles of Inquisition, as well to give light to the present Inquisition, as to encourage a future. For we are Masters of Questions, but not of things; yet we do not in the History precisely observe the order of Questions, least that which is for an aid and assistance should prove a hinderance.

The Histories and Experiments always hold the first place; and if they set forth any enumeration, and Series of particular things, they are made up in Tables, or if other wise, they are taken up severally.

Seeing that Histories and Experiments do oftentimes fail us, especially those which give light, and Instances of the Cross, by which the understanding may be informed of the true causes of things, we give Precepts of new Experiments, as far as we can see them fitting in our mind, for that as is to be enquired: and these Precepts are designed like Histories. For what other means is left to us, who are the first that come into this way? We unfold and make plain the manner of some Experiments that are more quaint and subtile, that there may be no error, and that we may stir up others to find out better and more exact ways. We enterweave Monitions and Cautions of the Fallacies of things, and of such Errors, and Scruples, as may be found in the Inquiry, that all Fancies, and as it were Apparitions may be frightened away, as by an Exorcisme or spell.

We joyn thereunto our Observations upon History and experiments, that the Interpretation of the Nature may be the readier.

We Interpose some Comments, or as it were Rudiments of the Interpretations of Causes, sparingly, and rather supposing what may be, than positively defining what is.

We prescribe and set down Rules, but moveable ones, and as it were inchoated Axiomes which offer themselves unto us as we enquire, not as we decisively pronounce, for they are profitable, though not altogether true.

Never forgetting the profit of man-kind (though the light be more worthy than those things which be shewen by it) we offer to mans attention and practise certain Essays or Practise, knowing that mens stupidity is such, and so unhappy, that sometimes they see not, and pass over things which lye just in their way.

We set down works and things impossible, or at least which are not yet found out, as they fall under each Title: and withal those which are already found out, and are in mens power; and we adde to those impossible, and not yet found out things, such as are next to them, and have most affinity with them, that we may stir up, and withall encourage humane industry.

It appears by the foresaid things, that this present History doth not only supply the place of the third part of the Institution, but also is a not despicable preparation to the fourth, by reason of the Titles out of the Alphabet and Topicks, and to the sixth, by reason of the larger Observations, Commentations, and Rules.

The

PARTICULAR TOPICKS:

OR,

Articles of Inquisition Concerning the Winds.

The Names of Winds.



Describe or set down the Winds according to the Sea-mans industry; and give them Names either new or old, so that you keep your self constant to them.

Winds are either general or precise, either peculiar, or free. I call them general which always blow; precise, those which blow at certain times: Attendants or Peculiar, those which blow most commonly: Free Winds, those which blow indifferently, or at any time.

General Winds.

2. Whether there be any General Winds, which are the very self motion of the Air; and if there be any such, in order to what motion, and in what places they blow?

Precise, or fixed Winds.

3. What Winds are Aniversary or yearly winds, returning by turns; and in what Countrys? Whether there be any Wind so precisely fixed, that it returns regularly at certain days and hours, like unto the flowing of the Sea?

Attending or Peculiar Winds.

4. What Winds are peculiar, and ordinary in Countrys, which observe a certain time in the same Countrys; which are Spring winds, and which are Summer winds; which Autumnal, which Brumal, which Equinoctial, which Solstitial; which are belonging to the Morning, which to Noon, which to the Evening, and which to the Night.

5. What winds are Sea winds, and what winds blow from the Continent? and mark and set down the differences of the Sea and Land winds carefully, as well of those which blow at Land and Sea, as of those which blow from Land and Sea.

Free Winds.

6. Whether winds do not blow from all parts of Heaven?

Winds do not vary much more in the parts of Heaven from which they

they blow, than in their own qualities. Some are vehement, some mild, some constant, some mutable; some hot, some cold; some moistning and dissolving; some drying and astringent; some gather clouds and are rainy, and peradventure Stormy: some disperse the clouds, and are clear.

Divers qualities of Winds.

7. Enquire and give accompt, which are the winds of all the fore-named sorts or kinds, and how they vary according to the regions and places.

There are three local beginnings of Winds, either they are thrown and cast down from above, or they spring out of the Earth, or they are made up of the very body of the Air.

Local beginnings of Winds.

8. According to these three beginnings enquire concerning winds: Namely, which are thrown down, out of that which they call the middle Region of the Air; which breath out of the concavities of the earth, whether they break out together; or whether they breath out of the Earth imperceivably, and scattering, and afterwards gather together, like rivolets into a River. Finally, which are scatteringly engendred from the swellings and dilatations of the neighbouring Air.

Neither are the generations of the winds, original only, for some there are also accidental, namely by the compressions or restraints of the Air, and by the percussions and repercussions of it.

Accidental Generations, and Production of Winds.

9. Enquire concerning these accidental Generations of winds: They are not properly generations of winds; for they rather increase and strengthen winds, than produce and excite them.

Hitherto of the community of winds. There are also certain rare and prodigious winds, such as are called tempests, whirl-winds, and storms: These are above ground. There are likewise some that are subterranean and under ground, whereof some vaporious and Mercurial, they are perceivable in Mines: Some are sulphurous, they are sent out, getting an issue by Earthquakes, or do flame out of fiery Mountains.

Extraordinary Winds, and sudden Blasts.

10. Enquire concerning such rare and prodigious winds, and of all miraculous and wonderful things done by winds.

From the several sorts of winds let the Inquisition pass to those things which contribute towards the winds, (for we will so express it, because the word Efficient signifies more, and the word concomitant less than we mean) and to those things which seem to raise, or to appease the winds.

Things

Things contributing, or making for the Winds, and raising, and appeasing them.

11. Enquire sparingly concerning Astrological considerations of winds, neither care thou for the over-curious Schemes of the heaven, only do not neglect the more manifest Observations of winds rising, about the rising of some stars, or about the Eclipses of the Luminaries, or Conjunctions of Planets; nor much less on those which depend on the courses of the Sun and Moon.

12. What Meteors of several sorts do contribute or make for winds, what the earth-quakes, what rain, what the skirmishing of winds one with another? for these things are linked together, and one draws on the other.

13. What the diversity of Vapours and exhalations contributes towards the winds? and which of them do most engender winds; and how far the Nature of winds doth follow these its materials.

14. What those things which are here upon the earth, or are there done do contribute towards the winds; what the hills and the dissolutions of Snow upon them; what those masses of Ice which swim upon the Sea, and are carried to some place; what the differences of soil and land (so it be of some large extent;) what Ponds, Sands, Woods, and Champion ground; what those things which we men do here, as burning of Heath, and the like, doth contribute to the manuring of Land, the firing of Towns in time of War, the drying up of Ponds and Lakes; the continual shooting off of Guns, the ringing of many Bells together in great Cities, and the like? These things and Acts of ours are but as small straws, yet something they may do.

15. Enquire concerning all manner of raisings, or allayings of winds, but besparing in fabulous and superstitious causes.

From those things which make for the winds, let the Inquisition proceed to enquire of the bounds of the winds, of their Height, Extention, and Continuance.

The bounds of Winds.

16. Enquire carefully of the Height, or elevation of winds, and whether there be any tops of mountains to which the winds do not reach; or whether Clouds may be seen sometimes to stand still, and not move, when the winds at the same time blow strongly upon the earth.

17. Enquire diligently of the spaces or rooms which the winds take up at once, and within what bounds they blew? As for example, if the south wind blew in such a place, whether it be known certainly, that at the same time the North wind blew ten miles off? And contrariwise into how narrow and straight bounds the winds may be reduced, so that winds may pass as it were through Channels; which seems to be done in some whirlwinds.

18. Enquire for how long time, very much, ordinary, or little time winds use to continue, and then slack, and as it were expire and die. Likewise how the rising and beginning of winds useth to be; what their languishing or cessation is, whether suddenly, or by degrees, or how?

From the bounds of the winds let your Inquisition pass over to the successions of winds, either amongst themselves, or in respect of rain and shows; for when they lead their rings it were pretty to know the order of their dancing.

Successions of Winds.

19. Whether there be any more certain rule or observation concerning the successions of winds one to another, or whether it have any relation to the motion of the Sun, or otherwise: if it have any, what manner of one it is?

20. Enquire concerning the succession and the alteration, or taking turns of the winds, and rain, seeing it is ordinarily, and often seen, that rain lays the wind, and the wind doth disperse the rain.

21. Whether after a certain term and period of years, the succession of winds begin anew; and if it be so, what that period is, and how long?

From the succession of the winds, let the Inquisition pass to their motions: and the motions of winds are comprehended in seven Inquisitions; whereof three are contained in the former Articles, four remain as yet untouched. For we have enquired of the motion of winds divided into the several Regions of the Heaven; also of the Motion upon three lines, upward, downward, and laterally: Likewise of the accidental motion of compressions or Restraints. There remain the fourth of Progressions or going forward: the fifth of Undulation, or waving: the sixth of conflict or skirmish: the seventh in humane Instruments and Engines.

Divers Motions of the Winds.

22. Seeing Progression is always from some certain place or bound; enquire diligently, or as well as thou canst concerning the place of the first beginning, and as it were the spring of any wind. For winds seem to be like unto Fame, for though they make a noise and run up and down, yet they hide their heads amongst the Clouds: so is their Progress; as for example, if the vehement Northern wind which blew at *Tork* such a day, do blow at *London* two days after.

23. Omit not the Inquisition of Undulation of winds. We call Undulation of winds that motion by which the wind in or for a little space of time rises and abates, as the waves of the water; which Turns may easily be apprehended by the hearing of them in houses: and you must so much the rather mark the differences of Undulation, or of Furrowing between the water and the air, because in the air and winds, there wants the Motion of gravity or weight, which is a great part of the cause of the waves rising in the water.

24. Enquire carefully concerning the Conflict, and meeting of winds, which blow at one and the same time: First, whether at the same time there blow several Original winds? (for we do not speak of reverberated winds) which if it comes to pass, what Windings they engender and bring forth in their motion, and also what Condensations, and Alterations they produce in the body of the Air?

25. Whether one wind blow above at the same time, as another blows here below with us? For it hath been observed by some, that sometimes

sometimes the Clouds are carried one way, when the Weather-cock upon a Steeple stands another. Also that the Clouds have been driven by a strong gale, when we here below have had a great calm.

26. Make an exact particular description of the motion of the winds, in driving on Ships with their Sails.

27. Let there be a Description made of the motion of the winds in the sails of Ships, and the sails of Wind-mills, in the flight of Hawks and Birds; also in things that are ordinary, and for sport, as of displayed Colours, flying Dragons, Duels with winds, &c.

From the motions of winds, let the Inquisition pass to the force and power of them.

Of the power of Winds.

28. What winds do, or can do concerning Currents or Tides of waters, in their keepings back, puttings forth, or inlets and overflowings.

29. What they do concerning Plants and Insects, bringing in of Locusts, Blasting, and Mill-dews.

30. What they effect concerning Purging or Clearing, and infecting of the air, in Plagues, Sickneses, and Diseases of Beasts.

31. What they effect concerning the conveying to us things (which we call) spiritual, as sounds, rayes, and the like.

From the powers of winds let the Inquisition pass to the Prognosticks of winds, not only for the use of Predictions, but because they lead us on to the causes: For Prognosticks do either shew us the preparations of things, before they be brought into action; or the beginnings before they appear to the sense.

Prognosticks of Winds.

32. Let all manner of good Prognosticks of winds be carefully gathered together (besides Astrological ones, of which we set down formerly, how far they are to be enquired after) and let them either be taken out of Meteors, or Waters, or instincts of Beasts, or any other way.

Lastly, close up the Inquisition, with enquiring after the imitations of winds, either in Natural or Artificial things.

Imitations of Winds.

33. Enquire of the Imitations of winds in Natural things; such as breaths inclosed within the bodies of living Creatures, and breaths within the receptacles of distilling Vessels.

Enquire concerning made Gales, and Artificial winds, as Bellows, Refrigeratories, or coolers in Parlours, or Dining rooms, &c.

Let the Heads or Articles be such: Neither is it unknown to me that it will be impossible to answer to some of these according to the small quantity of experience that we have: But as in civil causes, a good Lawyer knows what Interrogatories the Cause requires to have witnesses examined upon; but what the witnesses can answer he knows not. The same thing is incident to us in Natural History. Let those who come after us endeavour for the rest.

THE HISTORY.

The Names of Winds.

To the first Article.

WE give Names to Winds, rather as they are numbred in their order and degrees, than by their own Antiquity, this we do for memories and perspicuities sake. But we adde the old words also, because of the assenting voices or opinions of old Authors, of which having taken (though with somewhat a doubtful judgment) many things, they will hardly be known, but under such names as themselves have used. Let the general division be this: Let Cardinal winds be those which blow from Corners or Angles of the World: Semicardinal, those which blow in the half-wards of those; and Median Winds those which blow between these half-wards: Likewise of those which blow betwixt these half-wards, let those be called Major Medians, which blow in a Quadrant or fourth part of these divisions: the lesser Medians are all the rest. Now the particular division is that which follows.

Cardinal. North.	Cardinal. South.
North and by East.	South & by West.
Med.Maj. North, North-East, or Aquilo.	Med.Maj. South South West, or Libonotus.
North East and by North, or Meser.	South West and by South.
Semi-Card. North East.	Semi Card. South West, or Libs.
North East and by East.	South West and by West.
Med.Maj. East North East, or Cæcias.	Med. Maj. West South West, or Africus.
East and by North.	West and by South.
<hr/>	
Cardinal. East, or Subsolanus.	Cardinal. West, or Favonius.
East by South.	West and by North.
Med.Maj. East South East, or Vulturinus.	Med.Maj. West North West, or Corus.
South East & by East.	North West and by West.
Semi-Card. South East.	Semi Card. North West.
South East and by South.	North West and by North, or Thrascias.
Med. Maj. South South East, or Phœnicias.	Med. Maj. North North West, or Circius.
South and by East.	North and by West.

There

There are also other Names of winds. *Apeliotes* the East wind, *Argesies*, the South West, *Olympias*, the North West, *Scyron*, the South East, *Hellespontius*, the East North East, for these we care not. Let it suffice, that we have given constant and fixed names of winds, according to the order and disposition of the regions of the Heavens: we do not set much by the Comments of Authors; since the Authors themselves have little in them.

Free Winds.

To the sixth Article.

1. **T**HERE is not a Region of the Heaven from whence the wind doth not blow. Yea, if you divide the Heaven into as many Regions as there be degrees in the Horizon, you shall find winds sometimes blowing from every one of them.

2. There are some whole Countries, where it never rains, or at least very seldom; but there is no Country where the wind doth not blow, and that frequently.

General Winds.

To the second Article.

1. **C**ONCERNING general winds Experiments are plain, and it is no marvel, seeing that (especially within the Tropicks) we may find places condemned among the Ancients.

It is certain, that to those who sail between the Tropicks, in a free and open sea, there blows a constant and settled wind (which the seamen call a Breeze) from East to West. This wind is not of so little force, but that partly by its own blowing, and partly by its guiding the current of the Sea, it hindreth Sea-men from coming back again the same way they went to *Pern*.

2. In our Seas in *Europe*, when it is fair dry weather, and no particular winds stirring, there blows a soft kind of gale from the East, which followeth the Sun.

3. Our common Observations do admit that the higher Clouds are for the most part carried from East to West; and that it's so likewise when here below upon the earth either there is a great calm, or a contrary wind; and if they do not so always, it is because sometimes particular winds blow aloft, which overwhelm this general wind.

A Caution. If there be any such general wind, in order to the motion of the Heaven, it is not so firm nor strong, but that it gives way to particular winds. But it appears most plainly amongst the Tropicks, by reason of the larger circles which it makes: And likewise it is so when it blows on high, for the same cause, and by reason of its free course. Wherefore if you will take it without the Tropicks, and near the earth, (where it blows most gently and slowly) make trial of it in an open and free air, in an extream calm, and in high places, and in a body which is very moveable, and in the after-noon; for at that time the particular Eastern wind blows more sparingly.

Injunction.

Injunction. Observe diligently the Vains and Weather-cocks upon the tops and Towers of Churches, whether in extream calms they stand continually towards the West or not.

An Indirect Experiment.

4. It is certain, that here with us in *Europe*, the Eastern wind is drying and sharp: the West wind contrariwise moist and nourishing. May not this be by reason that (it being granted, that the Air moves from East to West) it must of necessity be that the East wind, whose blast goeth the same way, must needs disperse and attenuate the Air, whereby the Air is made biting and dry; but the western wind which blows the contrary way, turns the Airs back upon it self, and thickens it, whereby it becomes more dull, and at length moist.

An Indirect Experiment.

5. Consider the Inquisition of the motion, and flowing of waters, whether they move from East to West; for if the two extreams Heaven and Waters delight in this Motion, the Air which is in the midst will go near to participate of the same.

Caution. We call the two last Experiments indirect, because they do directly shew the thing which we aim at, but by consequence, which we also gladly admit of when we want direct Experiments.

Injunction. That the Breeze blows plentifully between the Tropicks, is most certain; the cause is very ambiguous. The cause may be, because the Air moves according to the Heaven: But without the Tropicks almost unperceivably, by reason of the smaller Circles which it makes within the Tropicks manifestly, because it makes bigger Circles. Another cause may be, because all kind of heat dilates and extends the Air, and doth not suffer it to be contained in its former place; and by the dilation of the Air, there must needs be an impulsion of the contiguous Air, which produceth this Breeze, as the Sun goes forward: and that is more evident within the Tropicks, where the Sun is more scorching, without it is hardly perceived: And this seems to be an instance of the Cross, or a decisory instance. To clear this doubt you may enquire, whether the Breeze blow in the night or no; for the wheeling of the Air continues also in the night, but the heat of the Sun does not.

6. But it is most certain that the Breeze doth not blow in the night, but in the morning, and when the morning is pretty well spent; yet that instance doth not determine the Question: whether the nightly condensation of the Air, (especially in those Countrys where the days and nights are not more equal in their length than they are differing in their heat and cold) may dull and confound that Natural Motion of the Air, which is but weak.

If the air participates of the motion of the Heaven, it does not only follow, that the East wind concurs with the motion of the Air, and the West wind strives against it; but also that the North wind blows as it were from above, and the South wind as from below here in our Hemisphere, where the Antartick Pole is under ground, and the Artick Pole is elevated; which hath likewise been observed by the Ancients, though staggeringly and obscurely: But it agrees very well with our modern Experience; because the Breeze (which may be a motion of the air) is not a full East, but a North-East wind.

Stayed

Stayed or certain Winds.

To the third Article.

Connexion.

AS in the Inquisition of General winds, men have suffered and been in darkness, so they have been troubled with a *Vertigo* or giddiness concerning staid and certain Winds. Of the former they say nothing, of the latter, they talk up and down and at random: This is the more pardonable, the thing being various: for these stayed winds do change and alter according to the places where they be: the same do not blow in *Egypt*, *Greece*, and *Italy*.

1. That there are stayed winds in some places, the very name that is given them doth declare it, as the other name of *Etesiaes* means Anniversary or yearly winds.

2. The Ancients attributed the cause of the over-flowing of *Nilus* to the blowing of the *Etesian* (that is to say Northern) winds at that time of the year which did hinder the River's running into the Sea, and turned the stream of it back.

3. There are Currents in the Sea, which can neither be attributed to the natural motion of the Ocean, nor to the running down from higher places, nor the straightness of the opposite shoars, or to Promontories running out into the Sea, but are meerly guided and governed by these stayed winds.

4. Those who will not have *Columbus* to have conceived such a strong opinion concerning the West-Indies by the relation of a *Spanish* Pilot, and much less believe that he might gather it out of some obscure foot-steps of the Ancients have this refuge; that he might conjecture there was some Continent in the West by the certain and stayed winds which blew from them towards the shoars of *Lusitania*, or *Portugal*. A doubtful, and not very probable thing; seeing that the voyage of winds will hardly reach so large a distance. In the mean time there is great honour due to this Inquisition, if the finding of this new world be due to one of those Axioms or Observations, whereof it comprehends many.

5. Wheresoever are high and snowy Mountains, from thence blow stayed winds, until that time as the snow be melted away.

6. I believe also that from great Pools which are full of water in the Winter, there blows stayed winds in those seasons, when as they begin to dry up with the heat of the Sun. But of this I have no certainty.

7. Wheresoever Vapours are engendred in abundance, and that at certain times, be sure that stayed winds will blow there at the same times.

8. If stayed and certain winds blow any where, and the cause cannot be found near at hand, assure your self that those certain winds are strangers, and come from far.

9. It hath been observed, that stayed winds do not blow in the night time, but do rise about three hours after Sun-rising. Surely such winds are tired as it were with a long journey, that they can scarcely break through the thicknes of the night Air, but being stirred up again by the rising of the Sun, they go forward by little and little.

10. All stayed winds (unless they blow from some neighbouring places) are weak, and yield unto sudden winds.

11. There are many stayed winds which are not perceivable, and which we do not observe, by reason of their weakness, whereby they are overthrown by the freewinds. Wherefore in the winter they are hardly taken notice of, when the free winds wander most: but are more observable in the Summer, when those wandering winds grow weak.

12. In *Europe* these are the chief stayed winds, Northwinds from the Solstice, and they are both fore-runners and followers of the Dog-star. West-winds from the Equinoctial in Autumn, Eastwinds from the Spring Equinoctial; as for the winter Solstice, there is little heed to be taken of it, by reason of the varieties.

13. The winds called *Ornithii* or Bird winds, had that name given them, because they bring Birds out of cold Regions beyond the Sea, into warm Climates; and they belong not to stayed winds, because they for the most part keep no punctual time: and the Birds they for the convenience of them, whether they come sooner or later: and many times when they have begun to blow a little; and turn, the birds being forsaken by it, are drowned in the sea, and sometimes fall into ships.

14. The returns of these certain or stayed winds are not so precise at a day or an hour, as the flowing of the Sea is. Some Authors do set down a day, but it is rather by conjecture than any constant observation.

Customary or Attending Winds.

Of the fourth and fifth Articles.

Connexion.

THe word of attending winds is ours, and we thought good to give it, that the Observation concerning them be not lost; nor confounded. The meaning is this, Divide the year if you please (in what Country soever you be) into three, four, or five parts, and if any one certain wind blow, then two, three, or four of those parts, and a contrary wind but one; we call that wind which blows most frequently, The customary, or Attending wind of that Country, and likewise of the times.

1. The South and Northwinds are attendants of the world, for they with those which are within their Sections or Divisions, blow oftner over all the world, than either the East or the West.

2. All free winds (not the customary) are more attendant in the winter than in the summer; but most of all in the Autumn and Spring.

3. All free winds are attendants rather in the Countries without the Tropicks, and about the Polar Circles, than within: for in frozen and in torrid Countrys, for the most part they blow more sparingly, in the middle Regions they are more frequent.

4. Also all free winds, especially the strongest and most forcible of them, do blow oftner and more strongly, morning and evening, than at noon and night.

5. Free winds blow frequently in hollow places, and where there be Caves, than in solid and firm ground.

Injunction.

Injunction. Humane diligence hath almost ceased and stood still in the observation of attending winds in particular places, which notwithstanding should not have been, that Observation being profitable for many things. I remember I asked a certain Merchant, (a wise and discreet man) who had made a Plantation in *Greenland*, and had wintred there, why that Country was so extream cold, seeing it stood in a reasonable temperate Climate. He said, it was not so great as it was reported; but that the cause was twofold: One was, that the masses and heaps of Ice, which came out of the *Scythian* sea were carried thither. The other, (which he also thought to be the better reason) was, because the West wind there blows many parts of the year, more than the East wind; as also, (said he) it doth with us; but there it blows from the Continent, and cold, but with us from the Sea and warmth. And (said he) if the East wind should blow here in *England* so often & constantly as the West wind does there, we should have far colder weather, even equal to that as is there.

6. The West-winds are attendants of the *Pomeridian*, or afternoon hours: for towards the declining of the Sun, the winds blow oftner from the East, then from the West.

7. The South-wind is attendant on the night; for it rises and blows more strongly in the night, and the North-wind in the day time.

8. But there are many and great differences between winds which are attendant on the sea, and those which are attendant upon the land. That is one of the chief which gave *Columbus* occasion to find out the new world; namely, that Sea-winds are not stayed, but land winds are: for the Sea abounding in Vapors, which are indifferently every where winds are also engendred indifferently every where, and with great inconstancy are carryed here and there, having no certain beginnings nor sources. But the earth is much unlike for the begetting of winds: some places are more efficacious to engender and increase winds, some less: wherefore they stand most from that part where they have their nourishment, and take their rise from thence.

9. *Acofta* is unconstant in his own Position. He saith that at *Pern*, and the Sea coasts of the South Sea, South winds do blow almost the whole year: and he saith in another place, that upon those Coasts sea winds do blow chiefly. But the South wind to them is a land wind, as likewise the North and East wind also, and the West-wind is their only sea wind. We must take that which he sets down more certainly; namely, that the South-wind is an attending and familiar wind of those Countries; unless peradventure in the name of the South Sea he hath corrupted his meaning, or his speech, meaning the West by the South, which blows from the South-sea. But the Sea which they call the South-sea, is not properly the South-Sea; but as a second western Ocean, being stretched out in the like situation as the *Atlantick* sea is.

10. Sea winds are questionless more moist than land winds, but yet they are more pure, and will easilier, and with more equality be incorporated with the pure Air. For terrestrial winds are ill composed, and smoaky. Neither let any one object, that they ought to be grosser by reason of the saltness of the Sea. For the nature of terrestrial salt doth not rise in vapours.

Sea winds are luke-warm or cold, by reason of the two foresaid qualities, humidity and pureness. For by humidity they mitigate the colds (for driness increaseth both heat and cold) and with their pureness they

cool. Therefore without the Tropicks they are luke-warm, within the Tropicks they are cold.

12. I believe that sea winds are every where attendant upon particular Countries, especially such as stand upon the Sea coasts: That is to say, winds blow more frequently from that side where the sea is, by reason of the greater plenty of matter which winds have in the sea, than in the land; unless there be some firm wind blowing from the land, for some peculiar reason. But let no man confound firm or stayed winds, with attendant winds: the attendants being always more frequent; but the staid ones for the most part blowing more seldom: But that is common to them both, namely, to blow from that place from which they receive their nourishment.

13. Sea winds are commonly more vehement than land winds: yet when they cease, the sea is calmer from the shoars than near unto them; insomuch, that Mariners to avoid calms, will sometimes coast along the shoar, rather than lanch into the deep.

14. Winds which are called *Tropes*, that is to say, Retorted, namely, such as when they have blown a little way, suddenly turn again, such winds I say blow from the Sea towards the shoar: but retorted winds, and whirlwinds are most commonly in gulfs of Seas.

15. Some small Gales blow for the most part about all great waters, and they are most felt in a morning; but more about Rivers than at Sea, because of the difference which is between a land-gale, and a water-gale.

16. In places which are near the sea trees bow and bend, as shunning the Sea Air: but that comes not through any averfeness in them: but sea winds by reason of their humidity and thicknes, are as it were more heavy and ponderous.

The Qualities and Powers of Winds.

To the 7, 28, 29, 30, 31 Articles.

Connexion:

Concerning the Qualities and Powers of winds men have made careles and various Observations: we will cull out the most certain, and the rest, as too light, we will leave to the winds themselves.

1. With us the south wind is rainy, and the northern wind clear and fair, the one gathers together and nourishes the Clouds; the other scatters and casts them off. Wherefore the Poets when they speak of the Deluge, feign the Northern wind at that time to be shut up in prison, and the south wind to be sent out with very large commission.

2. The West wind hath with us been held to be the wind which blew in the golden age, the companion of a perpetual Spring, and a cherisher of Flowers.

3. *Paracelsus* his Schollars, when they sought for a place for their three Principles in *Juno's Temple* also, which is the Air, placed three, but found no place for the East-wind.

*They Mercury ascribe to the South-winds,
To the rich Western blasts the Sulphure Mines,
And rugged Boreas blasts the sad salt fims.*

But

4. But with us in *England* the East wind is thought to be mischievous, so that it goes for a Proverb, That when the wind is in the East, 'tis neither good for man nor beast.

5. The south wind blows from the presence of the Sun, the North from the absence in our Hemisphere. The East wind in order to the motion of the air: the West wind from the Sea, the East wind from the Continent most commonly in *Europe* and the western parts of *Asia*. These are the most radical and essential differences of winds; from which truly and really depend most of the Qualities and Powers of the winds.

6. The south wind is not so Anniversary, or yearly, nor so stayed as the Northern wind is, but more wandring and free: and when it is stayed, it is so soft and mild that it can scarcely be perceived.

7. The south wind is lower, and more lateral and blowing of one side; the Northern wind is higher and blows from above: we do not mean the Polar elevation and depression of which we have spoken formerly; but because the North wind for the most part hath its beginnings higher, and the south wind for the most part nearer to us.

8. The south wind to us is rain (as we said before) but in *Africk* it causes clear weather, but bringing great heat along with it, and not cold, as some have affirmed. In *Africk* it is pretty healthful, but to us, if the south wind last long with fair weather, and without rain, it is very Pestilential.

9. The south winds and west winds do not engender vapours, but they blow from those coasts where there is great store of them, by reason of the encrease of the Sun's heat, which draws forth the vapours, and therefore they are rainy. But if they blow from dry places, which have no Vapours in them, they are fair. But notwithstanding sometimes they are pure, and sometimes turbulent.

10. The south and west wind here with us, seem to be confederate, and are warm and moist, and on the other side the North and East winds, have some affinity between them, being cold and dry.

11. The North and South winds (whereof we have also spoken before) do blow oftner than the East and West winds, because there is a great inequality of vapours in those parts, by reason of the absence and presence of the Sun, but to the East and to the West the Sun is as it were indifferent.

12. The south wind is very healthful, when it comes from the Sea, but when it blows from the Continent it is more unhealthful; and so contrariwise the North wind is suspicious, blowing from the Sea, from the Continent it is healthful. Likewise the south sea wind is very agreeable with Plants and Fruits, killing their Cankers, or rusts and other hurtful annoyances.

13. A gentle south wind doth assemble and gather together Clouds much, especially if it continue but a short while: but if it blow too boisterously, or long, it clouds the skie, and brings in rain. But especially when it ceases or grows remis, more than in its beginning, and when it is in its chiefest vigor.

14. When the south wind either begins to blow, or ceases for the most there are changes of weather, from fair to cloudy, and from hot to cold, and contrariwise. The North wind many times rises and ceases, the former weather remaining and continuing.

15. After

15. After hoary frosts and long continued snow, there scarcely blows any other wind than a south wind, there being as it were a concoction, or digestion made of cold, which then at last dissolves: neither doth rain also follow; but this likewise happens in changes, or intervals of fair weather.

16. The south wind rises oftner, and blows stronger in the night than in the day, especially in winter nights. But the North wind if it rise in the night (which is contrary to its custom) it doth usually last above three days.

17. When the south wind blows the waves swell higher than when the north wind blows, though it blow with an equal or lesser force.

18. The south wind blowing, the sea becomes blew, and more bright than when the North wind blows, which causes it to look darker and blacker.

19. When the air becomes warmer on a sudden, it sometimes betokens rain: and again at other times, when on a sudden it grows colder, it likewise betokens rain. But this happens according to the Nature of the winds: for if the air grow warm, whilst the south or east wind blows, there is rain at hand; and likewise when it grows cold during the Northern or Western blasts.

20. The south wind blows for the most part entire, and alone. But the north wind blowing, especially the East North-East, or the North-West often times contrary and various, or divers winds blow together, whereby they are broken and disturbed.

21. Beware a Northern wind when you sow seed, neither would I wish any one to inoculate or graft in a southern wind.

22. Leaves fall from trees soonest on the south side, but Vine sprouts or stalks bud forth, and grow most that way.

23. In large Pasture shepherds must take care (as *Pliny* saith) to bring their Flocks to the North side, that they may feed against the South. For if they feed towards the North, they grow lame and blecreyed, and distempered in their bellies. The Northern wind also doth so weaken their coupling, that if they couple looking that way, they will for the most part bring forth Ewe-Lambs. But *Pliny* doth not stand very stiffly to this Opinion, having as it were but taken it up upon trust, and borrowed it.

24. Winds are hurtful to Wheat and all manner of grain at three times: namely, at the opening and at the falling of the flower, and when the grain it self is ripe, for then they blow the Corn out of the Ear, and at the other two times either they blast the flower, or blow it off.

25. While the south wind blows mens breath grow ranker, all creatures appetites decay, pestilent diseases reign, men wax more slow and dull. But when the wind is Northwardly, men are more lively, healthful, and greedy after food. Yet the Northern wind is hurtful for them that are troubled with the Phthisick, Cough, Gout, or any other sharp deflexions.

26. An East wind is dry, piercing, and mortifying. The West wind moist, meek and nourishing.

27. If the East wind blow when the Spring is any thing forward, it is hurtful to fruits, bringing in of Worms and Caterpillars, so that the leaves are hardly spared: neither is it very good to grain. Contrariwise, the West wind is very propitious and friendly to Herbs, Flowers, and all man-

ner of vegetables. And so is the East wind too about the Autumnal Equinoctial.

28. Western winds are more vehement than Eastern winds, and bow and bend Trees more.

29. Rainy weather which begins when the East wind blows, doth last longer than that which begins when a West wind blows, and may peradventure hold out for a whole day.

30. The East and North wind, when they once begin to blow, blow more constantly; the South and West wind are more mutable.

31. In an Eastern wind all visible things do appear bigger; But in a Western wind all audible things are heard further, as sounds of Bells, and the like.

32. The East, North-East wind draws Clouds to it. It is a Proverb amongst the Greeks to compare it to Usurers, who by laying out money do swallow it up: It is a vehement and large wind, which cannot remove Clouds so fast, as they will turn back and press upon it. Which is likewise seen in great fires, which grow stronger against the wind.

33. Cardinal or Semi-Cardinal winds are not so stormy as the Median.

34. Median winds from North to North-East are more fair, from North-East to East more stormy. Likewise from East to South-East more fair, from South-East to South more stormy. Likewise from South to South-West more fair, from South-West to West more stormy. Likewise from West to North-west more fair; from North-west to North more stormy. So that proceeding according to the order of the heavens, the Median winds of the first half-ward are always disposed to fair weather; those of the latter half-ward to storms and tempests.

35. Thunders and Lightnings, and storms, with falling of broken Clouds are, when cold winds as participate of the North do blow, as the North-west, North, North-west, North North-east, North-east, and East North-east. Wherefore those thunders likely are accompanied with Hail.

36. Likewise snowy winds come from the North, but it is from those Median winds which are not stormy, as the North-west, and North-east and by North.

37. Winds gain their Natures and Properties five wayes onely: Either by the absence or presence of the Sun; or by agreeing or disagreeing with the natural Motion of the Air; or by the diversity of the matter which feedeth them, by which they are engendred; as Sea, Snow, Marishes, or the like: Or by the tincture of the Countrys through which they pass: Or by their original local beginnings: on high, under ground, in the middle; all which things the ensuing Articles will better declare and explain.

38. All winds have a power to dry, yea more than the Sun it self, because the Sun draws out the vapours; but if it be not very fervent, it doth not disperse them: but the wind both draws them out, and carries them away. But the south wind doth this least of any; and both timber and stones sweat more when the South wind blows a little, than when it is calm and lies still.

39. March winds are far more drying than summer winds: insomuch that such as make Musical Instruments will stay for March winds to dry their stuff they make their Instruments of, to make it more porous, and better sounding.

40. All

40. All manner of winds purge the air, and cleanse it from all putrefaction, so that such years as are most windy, are most healthful.

41. The Sun is like to Princes, who sometimes having appointed Deputies in some remote Countries, the subjects there are more obsequious to those Deputies, and yield them more respect than to the Prince himself. And so the winds which have their power and origine from the Sun, do govern the temperatures of the Countries, and the disposition of the air as much or more than the Sun it self. Insomuch that *Peru* (which by reason of the nearness of the Ocean, the vastness of Rivers, and exceeding great and high hills, hath abundance of winds and blais blowing there) may contend with *Europe* for a temperate and sweet air.

42. It is no wonder if the force and power of winds be so great, as it is found to be; Vehement winds being as Inundations, Torrents, and Flowings of the spacious air, Neither (if we attentively heed it) is their power any great matter. They can throw down trees, which with their tops, like unto spread sails, give them advantage to do it, and are a burden to themselves: Likewise they can blow down weak buildings; strong and firm ones they cannot without Earthquakes join with them. Sometimes they will blow all the snow off the tops of hills, burying the Valley that is below them with it; as it befel *Soliman* in the *Sultanian* fields. They will also sometimes drive in waters, and cause great Inundations.

43. Sometimes winds will dry up Rivers, and leave the Channels bare. For if after a great drought a strong wind blows with the Current for many days, so that it as it were sweeps away the water of the River into the sea, and keeps the Sea water from coming in, the River will dry up in many places where it doth uot use to be so.

Monition. Turn the Poles, and withal turn the Observations as concerning the North and South. For the presence and absence of the Sun being the cause, it must vary according to the Poles. But this may be a constant thing, that there is more sea towards the south, and more land towards the North, which doth not a little help the winds.

Monition. Winds are made, or engendred a thousand ways, as by the subsequent Inquisition it will appear; so to fix that Observations in a thing so various is not very easie. Yet those things which we have set down, are for the most part, most certain.

Local beginnings of Winds.

To the eighth Article.

Connexion.

TO know the local beginnings of winds, is a thing which requires a deep search and Inquisition, seeing that the *Whence* and *Whither* of winds, are things noted even in Scripture to be abstruse and hidden. Neither do we now speak of the Fountains or beginnings of particular winds, (of which more shall be said hereafter) but of the matrixes of winds in general. Some fetch them from above, some search for them in the deep: but in the middle (where they are for the most part engendred) no body hardly looks for them: such is the custom of men to enquire after things which are obscure, and omit those things which lie, as it were, in

in their way. This is certain that winds are either in-bred, or strangers. For winds are as it were Merchants of vapors, which being by them gathered into Clouds, they carry out, and bring in again into Countreys, from whence winds are again returned as it were by exchange. But let us now enquire concerning Native winds, for those which coming from another place are strangers, are in another place Natives. There are three local beginnings of them; They either breath or spring out of the ground, or are cast down from above, or are here made up in the body of the Air. Those which are cast down from above, are of a double generation: for they are either cast down before they be formed into Clouds, or afterwards composed of rarified and dispersed Clouds. Let us now see what is the History of these things.

1. The Poets feigned *Eolus* his Kingdom to be placed under ground in Dens and Caves, where the winds prison was, out of which they were at times let forth.

2. Some Philosophical Divines moved by those words of Scripture, *He brings forth the winds out of his Treasures*, think that the winds come out of some Treasures; namely, places under ground amongst the Mines of Minerals. But this is nothing: for the Scripture speaketh likewise of the Treasures of Snow and Hail, which doubtless are engendred above.

3. Questionless in subterranean places there is great store of Air, which it is very likely sometimes breaths out by little and little, and sometimes again upon urgent causes, must needs come rushing forth together.

An Indirect Experiment.

In great droughts, and in the middle of Summer, when the ground is cleft and chopped, there breaks out water many times in dry and sandy places. Which if waters (being a gross body) do, though it be but seldom, it is probable that the air (which is a subtile and tenuous body) may often do it.

4. If the Air breaths out of the earth by little and little, and scatteringly, it is little perceived at the first; but when many of those small emanations or comings out are come together, there is a wind produced, as a River out of several Springs. And this seems to be so, because it hath been observed by the Ancients, that many winds in those places where they begin, do at first blow but softly, which afterward grow stronger and increase in their progress like unto Rivers.

5. There are some places in the Sea, and some Lakes also which swell extremely when there is no wind stirring; which apparently proceeds from some subterranean wind.

6. There is great quantity of subterranean spirit required to shake or cleave the earth; less will serve turn for the raising of water. Wherefore earthquakes come but seldom, risings and swellings of waters are more frequent.

7. Likewise it is every where taken notice of that waters do somewhat swell and rise before Tempests.

8. The weak subterranean spirit which is breathed out scatteringly; is not perceived upon the earth, until it be gathered into wind, by reason the earth is full of pores; but when it issues from under the water, it is

presently perceived (by reason of the waters continuity) by some manner swelling.

9. We resolved before that in Cavernous and Denny places there were attendant winds; insomuch that those winds seem to have their local beginnings out of the earth.

10. In great and rocky Hills winds are found to breath sooner, (namely before they be perceived in the Valleys) and more frequently, (namely when it is calm weather in the valleys,) But all mountains and rocks are cavernous and hollow.

11. In *Wales*, in the County of *Denbigh*, a mountainous and rocky Country, out of certain Caves (as *Gilbertus* relateth) are such vehement eruptions of wind, that cloaths or linnen laid out there upon any occasion, are blown up, and carried a great way up into the air.

12. In *Aber Barry* near *Severn* in *Wales* in a rocky cliff, are certain holes, to which if you lay your ear, you shall hear divers sounds and murmurs of winds under ground.

An Indirect Experiment.

Acofta hath observed that the Towns of *Plata* and *Potosa*, in *Pern* are not far distant one from the other, and both situated upon a high and hilly ground, so that they differ not in that. And yet *Potosa* hath a cold and winter-like air; and *Plata* hath a mild and spring-like temperature; which difference it seems may be attributed to the silver Mines which are near *Potosa*: Which sheweth that there are breathing places of the earth, as in relation to hot and cold.

13. If the earth be the first cold thing, according to *Parmenides*, (whose opinion is not contemptible, seeing cold and density are knit together by a strict knot) it is no less probable that there are hotter breaths sent out from the Central cold of the earth, than are cast down from the cold of the higher air.

14. There are certain Wells in *Dalmatia*, and the Country of *Cyrene* (as some of the Ancients record) into which if you cast a stone, there will presently arise tempests, as if the stone had broken some covering of a place, in which the force of the winds was inclosed.

An Indirect Experiment.

Aetna, and divers other Mountains cast out fire: therefore it is likely that air may likewise break forth, especially being dilatated and set into motion, by heat in subterranean places.

15. It hath been noted, that both before and after Earth-quakes, there hath blown certain noxious and forraign winds: as there are certain little smothers usually before and after great firings and burnings.

Monition. The Air shut up in the earth is forced to break out for several causes, sometimes a mass of earth, ill joined together, falls into a hollow place of the earth; sometimes waters do ingulf themselves; sometimes the Air is extended by subterranean heats, and seeks for more room: sometimes the earth which before was solid and vaulted, being by fires turned into ashes, no longer able to bear it self up, falls. And many such like causes.

And

And so these Inquisitions have been made concerning the first local beginning of winds. Now followeth the second origine, or beginning from above, namely from that which they call the middle Region of the air.

Monition. But let no man understand what hath been spoken, so far amiss, as if we should deny the rest of the winds also are brought forth of the earth by vapours. But this first kind was of winds which come forth of the earth, being already perfectly framed winds.

16. It hath been observed, that there is a murmuring of woods before we do plainly perceive the winds, whereby it is conjectured, that the wind descends from a higher place: which is likewise observed in Hills, (as we said before) but the cause is more ambiguous, by reason of the concavity and hollowness of the hills.

17. Wind follows darted, or (as we call them) shooting stars, and it come that way as the star hath shot; whereby it appears, that the air hath been moved above, before the motion comes to us.

18. The opening of the Firmament, and dispersion of Clouds, are Prognosticks of winds, before they blow here on earth, which also shews that the winds begin above.

19. Small stars are not seen before the rising of winds, though the night be clear and fair. Because (it should seem) the Air grows thick, and is less transparent, by reason of that matter which afterward is turned into wind.

20. There appears Circles about the body of the Moon, the Sun looks sometimes blood red at its setting, the Moon rises red at her fourth rising; and there are many more Prognosticks of winds on high (whereof we will speak in its proper place) which shews that the matter of the winds is there begun and prepared.

21. In these Experiments you must note, that difference we spake of; namely of the two-fold generation of winds on high: that is to say, before the gathering together of vapours into a Cloud, and after. For the Prognosticks of Circles about, and colours of the Sun and Moon, have something of the Cloud: but that darting, and occultation of the lesser stars, is in fair and clear weather.

22. When the wind comes out of a Cloud ready formed, either the Cloud is totally dispersed, and turned into wind; or it is torn and rent in sunder, and the wind breaks out, as in a storm.

23. There are many Indirect Experiments in the world, concerning the repercussion by cold. So that it being certain, that there are most extreme colds in the middle region of the Air: it is likewise plain, that vapours for the most part cannot break through that place without being joined and gathered together, or darted according to the opinion of the Ancients, which in this particular is true and sound.

The third local beginning of winds, is of those which are ingendred here in the lower part of the air, which we also call swellings or overburthenings of the Air. A thing very familiar and frequent, yet passed over with silence.

A Commentation. The generation of those winds which are made up in this lower part of the Air, is a thing no more obscure than this: namely, that the Air newly composed and made up of water, and attenuated and resolved vapours, joined with the first Air, cannot be contained within the same bounds as it was before, but groweth out and is turned, and takes up further room. Yet there are in this two things to be granted.

First, that one drop of water turned into air (whatsoever they fabulously speak of the tenth proportion of the Elements) requires, at least a hundred times more room than it had before. Secondly, that a little new air, and moved, added to the old air, shaketh the whole, and sets it into motion: as we may perceive by a little wind that comes forth of a pair of Bellows, or in at a little crevice of a window or wall; that will set all the air which is in a room in motion, as appears by the blazing of the lights which are in the same room.

24. As Dews and Mists are engendred here in the lower air, never coming to be Clouds, nor penetrating to the middle region of the Air: in the like manner are also many winds.

25. A continual gale blows about the sea, and other waters, which is nothing but a small wind newly made up.

26. The Rain-bow, which is as it were the lowest of Meteors, and nearest to us, when it doth not appear whole, but curtailed, and as it were only some pieces of the horns of it, is dissolved into winds, as often, or rather oftner than into rain.

27. It hath been observed, that there are some winds in Countrys which are divided and separated by hills, which ordinarily blow on the one side of the hills, and do not reach to the other. Whereby it manifestly appears that they are engendred below the height of the said hills.

28. There are an infinite sort of winds that blow in fair and clear days; and also in Countrys where it never rains; which are engendred where they blow, and never were Clouds, nor did ever ascend into the middle region of the air.

Indirect Experiments.

Whosoever shall know how easily a Vapour is dissolved into air, and how great a quantity of vapours there are; and how much room a drop of water turned into air takes up more than it did before (as we said already) and how little the air will endure to be thrust up together, will questionless affirm, that of necessity winds must be every where engendred, from the very superficies of the earth, even to the highest parts of the air. For it cannot be, that a great abundance of vapours, when they begin to be dilatated and expanded, can be lifted up to the middle region of the air, without an over-burthening of the air, and making a noise by the way.

Accidental generations of Winds.

To the Ninth Article.

Connexion.

WE call those Accidental generations of winds, which do not make or beget the impulsive motion of winds, but with compression do sharpen it, by repercussion turn it, by sinuation or winding do agitate and tumble it: which is done by extrinsecal causes, and the posture of the adjoining bodies.

1. In places where there are hills which are not very high, bordering upon Valleys, and beyond them again higher hills, there is a greater agitation of the air, and sense of winds, than there is in mountainous, or plain places.

2. In Cities, if there be any place somewhat broader than ordinary and narrow goings out, as Portals, or Porches, and Cross streets, winds and fresh Gales are there to be perceived.

3. In houses cool rooms are made by winds, or happen to be so, where the Air bloweth thorow, and comes in on the one side, and goeth out at the other: But much more if the Air comes in several ways and meets in the corners, and hath one common passage from thence: the vaulting likewise and roundness doth contribute much to coolness, because the air being moved, is beaten back in every line, Also the winding of Porches is better than if they were built straight out. For a direct blast, though it be not shut up, but hath a free egress, doth not make the air so unequal, and voluminous, and waving, as the meeting at Angles, and hollow places, and windings round, and the like.

4. After great tempests at Sea, an Accidental wind continues for a time, after the original is laid; which wind is made by the collision and percussion of the air, through the curling of the waves.

5. In gardens commonly there is a repercussion of wind, from the walls, and banks, so that one would imagine the wind to come the contrary way from that whence it really comes.

6. If Hills enclose a Country on the one side, and the wind blows for some space of time from the plain against the Hill, by the very repercussion of the Hill, either the wind is turned into rain, if it be a moist wind, or into a contrary wind, which will last but a little while.

7. In the turnings of Promontory, Mariners do often find changes and alterations of winds.

Extraordinary Winds, and sudden Blasts.

To the tenth Article.

Connexion.

SOME men discourse of extraordinary winds, and derive the causes of them; of Clouds breaking, or storms, *Vortice*, *Typhone*, *Prestere*; Or in English, Whirl-winds. But they do not relate the thing it self, which must be taken out of Chronicles and several Histories.

1. Sudden blasts never come in clear weather, but always when the sky is cloudy, and the weather rainy. That it may justly be thought that there is a certain eruption made; The blast driven out, and the waters shaken.

2. Storms which come with a Mist and a Fog, and are called *Bellue*, and bear up themselves like a Column, are very vehement, and dreadful to those who are at sea.

3. The greater *Typhones*, who will take up at some large distance, and sup them, as it were upward, do happen but seldom, but small whirlwinds come often.

4. All storms and *Typhones*, and great Whirlwinds, have a manifest precipitous motion, or darting downwards, more than other winds; so

as they seem to fall like Torrents, and run as it were in Channels, and be afterward reverberated by the earth.

5. In Meadows, Haycocks, are sometimes carryed on high, and spread abroad there like Canopies: Likewise in Fields, Cocks of Pease, reaped Wheat, and cloaths laid out to drying, are carried up by Whirl-winds as high as tops of Trees and Houses, and these things are done without any extraordinary force, or great vehemency of wind.

6. Also sometimes there are very small whirl-winds, and within a narrow compass, which happen also in fair clear weather; so that one that rides may see the dust, or straws taken up, and turned close by him, yet he himself not feel the wind much; which things are done questionless near unto us, by contrary blasts driving one another back, and causing a circulation of the air by concussion.

7. It is certain, that some winds do leave manifest signs of burning and scorching in Plants. But *Presterem*, which is a kind of dark Lightning, and hot air without any flame, we will put off to the Inquisition of Lightning.

Helps to Winds; namely, to Original Winds: for of accidental ones we have enquired before.

To the 11, 12, 13, 14, 15 Articles.

Connexion.

Those things which have been spoken by the Ancients, concerning Winds and their causes, are meerly confused and uncertain, and for the most part untrue: and it is no marvel, if they see not clear that look not near. They speak as if wind were somewhat else, or a thing severall from moved air; and as if exhalations did generate and make up the whole body of the winds; and as if the matter of winds were only a dry and hot exhalation; and as if the beginning of the motion of winds were but only a casting down and percussion by the cold of the middle Region, all fantastical and arbitrary opinions: yet out of such threds they weave long pieces, namely, Cobwebs. But all impulsion of the Air is wind; and Exhalations mixed with the air contribute more to the motion than to the matter: and moist vapours, by a proportionate heat, are easilier dissolved into wind than dry Exhalations, and many winds are engendred in the lowest Region of the Air, and breath out of the earth, besides those which are thrown down and beaten back.

1. The Natural wheeling of the air (as we said in the *Article of General Winds*) without any other external cause bringeth forth winds preceptible within the Tropicks, where the Conversion is ingreater Circles.

2. Next to the Natural Motion of the Air, before we enquire of the Sun (who is the chief begetter of winds) let us see whether any thing ought to be attributed to the Moon, and other Asters by clear experience.

3. There arise many great and strong winds some hours before the Eclipse of the Moon; so that if the Moon be Eclipsed in the middle of the night, the winds blow the precedent evening: if the Moon be Eclipsed towards the morning, then the winds blow in the middle of the precedent night.

In

4. In *Peru*, which is a very windy Country, *Acosta* observes that winds blow most when the Moon is at the full.

Injunction. It were certainly a thing worthy to be observed, what power the Ages and Motions of the Moon have upon the winds, seeing they have some power over the waters. As for example, whether the winds be not in a greater commotion in full and new Moons, than in her first and last Quarters, as we find it to be in the flowings of waters: For though some do conveniently feign the command of the Moon to be over the waters, as the Sun and Planets over the air, yet it is certain, that the water and the air are very Homogeneous bodies, and that the Moon next to the Sun hath most power over all things here below.

5. It hath been observed by men, that about the Conjunctions of Planets greater winds do blow.

6. At the rising of *Orion* there rise commonly divers winds and storms. But we must advise whether this be not because *Orion* rises in such a season of the year as is most effectual for the generation of winds; so that it is rather a concomitant than causing thing. Which may also very well be questioned concerning rain at the rising of the *Hyades* and the *Pleiades*, and concerning storms at the rising of *Arcturus*. And so much concerning the Moon and Stars.

7. The Sun is questionless the primary efficient of many winds, working by its heat on a twofold matter, namely, the body of the air, and likewise vapours and exhalations.

8. When the Sun is most powerful, dilatates and extends the air, though it be pure and without any commixion one third part, which is no small matter; so that by meer dilatation there must needs arise some small wind in the Sun's ways; and that rather two or three hours after its rising, than at his first rise.

9. In *Europe* the nights are hotter, in *Peru* three hours in the morning, and all for one cause, namely, by reason of winds and gales ceasing and lying still at those hours.

10. In a *Vitro Calendari*, dilatated or extended air beats down the water as it were with a breath: but in a *Vitro Pileato*, which is filled only with air, the dilatated air swells the Bladder, as a manifest and apparent wind.

11. We have made trial of such a kind of wind in a round Tower, every way closed up. For we have placed a hearth or fire-place in the midst of it, laying a fire of Charcoal thoroughly kindled upon it, that there might be the less smoak, and on the side of the hearth, at a small distance, hath been a thread hung up with a cross of Feathers, to the end that it might easily be moved. So after a little stay the heat increasing, and the Air dilatating, the thread and the Feather cross which hung upon it waved up and down in a various motion: and having made a hole in the window of the Tower, there came out a hot breath, which was not continual, but with intermission and waving.

12. Also the reception of Air by cold, after dilatation begets such a wind, but weaker, by reason of the lesser force of cold. So that in *Peru* under every little shadow we find not only more coolness than here with us (by Antiperistasis) but a manifest kind of gale through the reception of air when it comes into the shade. And so much concerning wind occasioned by meer dilatation or reception of Air.

13. Winds proceeding from the meer motion of the air without any commixion of vapours, are but gentle and soft. Let us see what may be said concerning Vaporary winds, (we mean such as are engendred by vapours) which may be so much more vehement than the other, as a dilatation of a drop of water turned into air, exceeds any dilatation of Air already made: which it doth by many degrees, as we shewed before.

14. The efficient cause of vapourary winds, (which are they that commonly blow) is the Sun, and its proportionate heat: the matter is Vapors and Exhalations which are turned and resolved into Air. I say Air (and not any thing but Air) yet at the first not very pure.

15. A small heat of the Sun doth not raise Vapours, and consequently causes no wind.

16. A mean, or middle heat of the Sun raiseth and excites vapours, but doth not presently dissipate them. Therefore if there be any great store of them, they gather together into rain, either simply of it self, or joined with wind: if there be but small store of them, they turn only to wind.

17. The Suns heat in its increase, inclines more to the generation of winds, in its decrease of rains.

18. The great and continued heat of the Sun, attenuates and disperses vapours and sublimes them, and withal equally mixes and incorporates them with the Air, whereby the Air becomes calm and serene.

19. The more equal and continue heat of the Sun is less apt for the generation of winds: that which is more unequal and intermitted, is more apt. Wherefore in sailing into *Russia* they are less troubled with winds than in the Brittish Sea, because of the length of the days: but in *Peru* under the Equinoctial are frequent winds, by reason of the great inequality of heat, taking turns night and day.

20. In Vapours is to be considered both the quantity and quality. A small quantity engenders weak winds, a mean or middle store stronger; great store engenders rain, either calm, or accompanied with wind.

21. Vapours out of the Sea and Rivers, and over-flown Marishes, engender far greater quantity of winds than the exhalations of the earth. But those winds which are engendred on the land, and dry places are more obstinate and last longer, and are for the most part such as are cast down from above. So that the opinion of the Ancients in this is not altogether unprofitable: but only that it pleased them, as in a manner dividing the inheritance, to assign rain to Vapours, and to winds, exhalations only, which things sound handsomly, but are vain in effect and substance.

22. Winds brought forth out of the resolutions of Snow lying upon Hills, are of a mean condition between Water and Land winds; but they incline more to water; yet they are more sharp and moveable.

23. The dissolution of Snow on Snowy Hills, (as we observed before) always brings constant winds from that part.

24. Also yearly Northern winds about the rising of the Dog-star, are held to come from the frozen Ocean, and those parts about the Arctick Circle, where the Dissolutions of Snow and Ice come late when the Summer is far spent.

25. Those masses or mountains of Ice which are carried towards *Canada* and *Greenland*, do rather breed cold Gales, than moveable winds.

26. Winds which arise from chalky and sandy grounds are few and dry, and in hotter Countrys they are foultry, smoaky, and scorching.

27. Winds made of Sea vapours, do easilier turn back into rain, the water re-demanding and claiming its right: and if this be not granted them, they presently mix with Air, and so are quier. But terrestrial, smoaky and unctuous vapours, are both hardlier dissolved, and ascend higher, and are more provoked in their motion, and oftentimes penetrate the middle Region of the Air, and some of them are matter of fiery Meteors.

28. It is reported here in *England*, that in those days that *Gascoine* was under our jurisdiction, there was a Petition offered to the King by his subjects of *Burdeaux*, and the Confiners thereof, desiring him to forbid the burning of heath in the Counties of *Sussex* and *Southampton*, which bred a wind towards the end of *April* which killed their Vines.

29. The meeting of winds, if they be strong, bring forth vehement and whirling winds: if they be soft and moist, they produce rain, and lay the wind.

30. Winds are allayed and restrained five ways. When the Air overburthened, and troubled, is freed by the vapours contracting themselves into rain: Or when vapours are dispersed, and subtilized, whereby they are mixed with the air, and agree fairly with it, and they live quietly: Or when vapours or Fogs are exalted and carried upon high, so that they cause no disturbance, until they be thrown down from the middle Region of the Air, or do penetrate it. Or when vapours gathered into Clouds, are carried away into other Countrys, by other winds blowing on high; so that for them there is peace in those Countrys which they flie beyond: Or lastly, when the winds blowing from their nurseries, languish through a long voyage, finding no new matter to feed on, and so their vehemency forsakes them, and they do as it were expire and dye.

31. Rain for the most part allayeth winds, especially those which are stormy: as winds contrariwise oftentimes keep off rain.

32. Winds do contract themselves into rain, (which is the first of the five, and the chiefeft means of allaying them) either being burthened by the burthen it self, when the vapours are copious, or by the contrary motions of winds, so they be calm and mild; or by the opposition of mountains and Promontories which stop the violence of the winds, and by little and little turn them against themselves; or by extream colds, whereby they are condensed and thickned.

33. Smaller and lighter winds do commonly rise in the morning, and go down with the Sun, the condensation of the night Air being sufficient to receive them: for Air will endure some kind of compression without stirring or tumult.

34. It is thought that the sound of Bells will disperse Lightning and Thunder: in winds it hath not been observed.

Monition. Take advice from the place in Prognosticks of winds; for there is some connexion of causes and signs.

35. *Pliny* relates, that the vehemence of a Whirl-wind may be allayed by sprinkling of Vinegar in the encounter of it.

The Bounds of VVinds.

To the 16, 17, 18. Articles.

1. **I**T is reported of Mount *Atbos*, & likewise of *Olimpus*, that the Priests would write in the ashes of the Sacrifices which lay upon the Altars, built on the tops of those hills, and when they returned the year following, (for the Offerings were Annual) they found the same letters undisturbed, and uncanceled; though those Altars stood not in any Temple, but in the open Air. Whereby it was manifest, that in such a height there had neither fallen rain, nor wind blown.

2. They say that on the top of the Peak of *Teneriff*, and on the *Audes*, betwixt *Pern*, and *Chile*, snow lyeth upon the borders, and sides of the hills; but that on the tops of them there is nothing but a quiet and still Air, hardly breathable by reason of its tenuity, which also with a kind of Acrimony pricks the eyes and orifice of the stomach, begetting in some a desire to vomit, and in others a flushing and redness.

3. Vaporary winds seem not in any great height, though it be probable that some of them ascend higher than most clouds. Hitherto of the height, now we must consider of the Latitude.

4. It is certain, that those spaces which winds take up, are very various, sometimes they are very large, sometimes little and narrow: winds have been known to have taken up an hundred miles space with a few hours difference.

5. Spacious winds (if they be of the free kind) are for the most part vehement and not soft, and more lasting; for they will last almost four and twenty hours. They are likewise not so much inclined to rain. Straight or narrow winds contrariwise, are either soft or stormy, and always short.

6. Fixed and stayed winds are itinerary or travelling, and take up very large spaces.

7. Stormy winds do not extend themselves into any large spaces, though they always go beyond the bounds of the storm it self.

8. Sea winds always blow within narrower spaces than earth winds, as may sometimes be seen at sea, namely, a pretty fresh gale in some part of the water (which may be easily perceived by the crisping of it) when there is a calm, as smooth as Glass, every where else.

9. Small whirlwinds (as we said before) will sometimes play before men as they are riding, almost like wind out of a pair of bellows. So much of the Latitude; now we must see concerning the lastingness.

10. The vehement winds will last longer at Sea, by reason of the sufficient quantity of vapours: at land they will hardly last above a day and an half.

11. Very soft winds will not blow constantly, neither at sea, nor upon the land above three days.

12. The south wind is not only more lasting than the west, (which we set down in another place) but likewise what wind soever it be that begins to blow in the morning, useth to be more durable and lasting than that which begins to blow at night.

13. It is certain that winds do rise, and increase by degrees, (unless they be meer storms) but they allay sooner, sometimes as it were in an instant.

Succes-

Successions of Winds.

To the 19, 20, 21 Articles.

1. IF the Wind doth change according to the motion of the Sun, that is from East to South, from South to West, from West to North, from the North to the East, it doth not return often, or if it doth, it doth it but for a short time. But if it go contrary to the motion of the Sun, that is from the East to the North, from the North to the West, from the West to the South, and from the South to the East, for the most part it is restored to its first quarter, at least before it hath gone round its whole compass and circuit.

2. If rain begin first, and the wind begins to blow afterwards, that wind will outlast the rain: but if the wind blow first, and then is allayed by the rain, the wind for the most part will not rise again; and if it does, there ensues a new rain.

3. If winds do blow variously for a few hours, and as it were to make a trial, and afterward begin to blow constantly, that wind shall continue for many days.

4. If the South wind begin to blow two or three days, sometimes the North wind will blow presently after it. But if the North wind blows as many days, the South wind will not blow, until the wind have blown a little from the East.

5. When the year is declining, and Winter begins after Autumn is past, if the Southwind blows in the beginning of winter, and after it comes the North-wind, it will be a frosty winter: But if the North-wind blow in the beginning of winter, and the South-wind come after, it will be a mild and warm winter.

6. *Pliny* quotes *Endoxus*, to shew that the order of winds returns after every four years, which seems not to be true, for revolutions are not so quick. This indeed hath been by some mens diligence observed, that greatest and most notable seasons (for heat, snow, frost, warm winters, and cold summers) for the most part return after the revolution of five and thirty years.

The Motion of the Winds.

To the 22, 23, 24, 25, 26, 27 Articles.

Connexion.

MEN talk as if the wind were some body of it self, and by its own force did drive and agitate the air. Also when the wind changes its place, they talk as if it did transport it self into another place. This is the vulgars opinion; yet the Philosophers themselves apply no remedy thereunto, but they likewise stammer at it, and do not any way contradict and oppose these errors.

1. We must therefore enquire concerning the raising of the motion of the winds, and of the Direction of it, having already enquired of the local beginnings. And of those winds which have their beginning of motion in their first impulsion, as in those which are cast down from above, or blow out of the earth, the raising of their motion is manifest: others descend below their own beginnings; others ascend, and being resisted by

the Air, become voluminous, especially near the Angles of their violence. But of those which are engendred every where in this inferiour Air, (which are the frequentest of all the winds) the Inquisition seems to be somewhat obscure, although it be a vulgar thing, as we have set down in the Commentation under the eighth Article.

2. We found likewise an image or representation of this in that close Tower which we spake of before. For we varied that trial three ways. The first was that which we spake of before; namely, a fire of clear burning coals. The second was a Kettle of seething water, the fire being set away, and then the motion of the cross of Feathers was more slow and dull. The third was with both fire and Kettle; and then the agitation of the Cross of Feathers was very vehement, so that sometimes it would whirl up and down, as if it had been in a petty whirlwind, the water yielding store of vapours, and the fire which stood by it dissipating and dispersing them.

3. So that the chief cause of exciting motion in the winds is the overcharging of the air, by a new addition of air engendred by vapours. Now we must see concerning the direction of the motion, and of the whirling, which is a change of the direction.

4. The Nurseries and food of the winds doth govern their progressive motion: which nurseries and feedings are like unto the springs of rivers; namely, the places where there are great store of vapours, for there is the native Country of the winds. Then when they have found a Current, where the air makes no resistance, (as water when it finds a falling way) then whatsoever semblable matter they find by the way, they take into their fellowship, and mix it with their Currents even as Rivers do. So that the winds blow always from that side where their Nurseries are which feed them.

5. Where there are no notable Nurseries in any certain place, the winds stray very much, and do easily change their Current, as in the middle of the sea, and large spacious fields.

6. Where there are great nurseries of the winds in one place, but in the way of its progress it hath but small additions, there the winds blow strongly in their beginnings, and by little and little they allay. And contrariwise, where they find good store of matter to feed on by the way, they are weak in the beginning, but gather strength by the way.

7. There are moveable nurseries for the winds, namely, in the Clouds, which many times are carried far away from the Nurseries of vapours, of which those Clouds were made, by winds blowing high: then the Nursery of the wind begins to be in that place where the Clouds do begin to be dissolved into wind.

8. But the whirling of winds does not happen, because the wind which blows at first transports it self; but because either that is allayed and spent, or brought into order by another wind: And all this business depends on the various placings of the Nurseries of winds, and variety of times, when vapours issuing out of these Nurseries are dissolved.

9. If there be Nurseries of winds on contrary parts, as one Nursery on the South, another on the North-side, the strongest wind will prevail; neither will there be contrary winds, but the stronger wind will blow continually, though it be somewhat dulled and tamed by the weaker wind: as it is in Rivers, when the flowing of the sea comes in; for the Sea's motion prevails, and is the only one, but it is somewhat curbed by the

the motion of the river. And if it so happen, that one of those contrary winds, namely, that which was the strongest be allayed, then presently the contrary will blow, from that side where it blew before, but lay hidden under the force and power of the greater.

10. As for example, if the Nursery be at the North-East, the North-East wind will blow. But if there be two Nurseries of winds, namely, another in the North, those winds for some tract of way will blow severally; but after the angle of confluence where they come together, they will blow to the North-East, or with some inclination, according as the other Nursery shall prove stronger.

11. If there be a Nursery of wind on the North-side, which may be distant from some Country twenty miles, and is the stronger; another on the East-side, which is distant some ten miles, and is weaker: Yet the East-wind shall blow for some hours, and a while after (namely, when its journey is ended) the North wind.

12. If the Northern wind blow, and some Hill stands in the way of it on the West side, a little while after the North-East wind will blow, compounded by the original, and that which is beaten back again.

13. If there be a Nursery of winds in the earth on the Northern side, and the breath thereof be carried directly upward, and it find a cold Cloud on the West side which turns it off the contrary way, there will blow a North-East wind.

14. *Monition.* Nurseries of winds in Sea and Land are constant, so that the spring and beginning of them may be the better perceived: But the Nurseries of winds in the Clouds are moveable, so that in one place there is matter furnished for the winds, and they are formed in another: which makes the direction of motion in winds, to be more confused and uncertain.

Those things we have produced for examples sake, the like are after the like manner: And hitherto of the direction of the motion of winds: Now we must see concerning the Longitude, and as it were the Itinerary or journey of the winds, though it may seem we have already enquired of this under the notion of the Latitude of winds: For Latitude may by unlearned men also be taken for Longitude, if winds take up more space Laterally than they go forward in Longitude.

14. If it be true that *Columbus* could upon the Coasts of *Portugal*, judge of the Continent of *America* by the constant winds from the West, truly the winds can travel a long journey.

15. If it be true that the dissolution of Snows about the frozen seas and *Scandia*, do excite and raise Northerly winds in *Italy*, and *Greece*, &c. in the Dog days; surely these are long journeys.

16. It hath not yet been observed how much sooner a storm does arrive, according to the way it comes, (as for example, if it be an Eastern wind) how much sooner it comes from the East, and how much later from the West. And so much concerning the motion of winds in their progression or going forward: now we must see concerning the Undulation or swelling of winds.

17. The Undulation or swelling of winds is done in a few moments: So that a wind will (though it be strong) rise and fall by turns, at the least a hundred times in an hour. Whereby it appears that the violence of winds is unequal; for neither Rivers, though swift, nor Currents in the Sea, though strong, do rise in waves, unless the blowing of wind be joined

ed thereunto: Neither hath the swelling of winds any equality in itself. For like unto the pulse of ones hand, sometimes it beats, and sometimes it intermits.

The Undulation or swelling of the air, differs from the swelling of waters into waves in this, that in waters after the waves are risen on high, they of themselves, and their own accord, do again fall to the place of them; whence it comes that (whatsoever Poets say when they aggravate tempests, namely, that the waves are raised up to heaven, and again sink down to hell) the descent of the waves do not precipitate much below the plane and superficies of the water. But in the swelling of the air, where the motion of gravity or weight is wanting, the air is thrust down and raised almost in an equal manner. And thus much of Undulation; Now we must enquire of the motion of Conflict or Striving.

19. The Conflicts of winds, and compounded Conflicts we have partly enquired already. It is plain that winds are Ubiquitary, especially the mildest of them. Which is likewise manifest by this, that there are few days and hours wherein some gales do not blow in free places, and that incessantly and variously enough. For winds which do not proceed from greater Nurseries are vagabond and voluble, as it were playing one with the other; sometimes driving forward, and sometimes flying back.

20. It hath been seen sometimes at Sea, that winds have come from contrary parts together, which was plainly to be perceived by the perturbation of the water on both sides, and the calmness in the middle between them: but after those contrary winds have met, either there hath followed a general calm of the water every where, namely, when the winds have broken and quelled one another equally; or the perturbation of the water hath continued, namely, when the stronger Wind hath prevailed.

21. It is certain, that in the mountains of Peru it hath often chanced that the winds at one time have blown on the tops of the Hills one way, and in the Valleys the clean contrary way.

22. It is likewise certain here with us, that the Clouds are carried one way, when the wind near us hath blown the contrary way.

23. That is likewise certain, that sometimes the higher Clouds will out-flie the lower Clouds, so that they will go diverse, yea, and contrary ways, as it were in contrary Currents.

24. It is likewise certain, that sometimes in the higher part of the air winds have been neither distracted, nor moved forward; when here below they have been driven forward with a mad kind of violence, for the space of half a mile.

25. And it is likewise certain, that contrariwise, that here below the air hath been very still, when above the Clouds have been carried with a fresh and merry gale: But that happens more seldom.

An Indirect Experiment.

Likewise in waves sometimes the upper water is swifter, sometimes the lower; and sometimes there are (but that is seldom) several Currents of water, of that which is uppermost, and that which lyeth beneath.

26. Nor are Virgils testimonies altogether to be rejected, he being not utterly unskilful in Natural Philosophy.

Together

*Together rush the East and South-East wind,
Nor doth wave calling South-West stay behind.*

*And again,
I all the winds have seen their battels join.*

We have considered of the Motions of winds, in the nature of things : we must now consider their Motions in humane Engines ; and first of all in the Sails of Ships.

The Motion of Winds in the Sails of Ships.

1. **I**N our greatest *Brittain* Ships (for we have chosen those for our pattern) there are four Masts, and sometimes five, set up one behind the other, in a direct line drawn through the middle of the ship. Which Masts we will name thus :
 2. The main Mast, which stands in the middle of the ship : the fore-Mast, the Mizon-Mast, (which is sometimes double) and the Sprit Mast.
 3. Each Mast consists of several pieces, which may be lifted up, and fashioned with several knots and joints, or taken away ; some have three of them, some only two.
 4. The Sprit-sail Mast from the lower joint lies bending over the Sea, from that it stands upright ; all the other Masts stand upright.
 5. Upon these Masts hang ten Sails, and when there be two Mizon-Masts twelve : the Main-Mast and fore-Mast have three tires of sails, which we will call the Main-sail, the top sail, and the Main top sail : The rest have but two, wanting the main top sail.
 6. The sails are stretched out a cross, near the top of every joint of the Mast, by certain beams which we call Yards, to which the upper parts of the sails are fastened, the lower parts are fastened with Ropes at each corner ; the main sails to the sides of the ship, top and main top sails to the Yards which are next below them.
 7. The Yard of every Mast hangs a cross, only the Yards of the Mizon-Masts hang sloping, one end up and the other down, in the rest they hang straight a-cross the Masts like unto the Letter T.
 8. The Main sails of the main-Mast, fore-Mast, and boar-Sprit, are of a Quadrangular Parallelogram form ; the top, and main top sails somewhat sharp, and growing narrow at the top ; but the top Mizon sails are sharp, the lower or main sails triangular.
 9. In a ship of eleven hundred Tun, and was one hundred and twelve foot long in the Keel, and forty in breadth in the Hold : the main sail of the main Mast was two and forty foot deep, and eighty seven foot broad.
 10. The top sail of the same Mast was fifty foot deep, and eighty four foot broad at the bottom, and forty two at the top.
 11. The main top sail was seven and twenty foot deep, and two and forty broad at the bottom, and one and twenty at the top.
 12. The fore-Mast main sail was forty foot and a half deep, and seventy two foot broad.
 13. The top sail was six and forty foot and a half deep, and sixty nine foot broad at the bottom, and six and thirty at the top.
 14. The

14. The main top sail was four and twenty foot deep, six and thirty foot broad at the bottom, and eighteen foot at the top.

15. The Mizon main sail was on the upper part of the Yard one and fifty foot broad, in that part which was joined to the Yard seventy two foot, the rest ending in a sharp point.

16. The top sail was thirty foot deep, fifty seven foot broad at the bottom, and thirty foot at the top.

17. If there be two Mizon-Masts, the hindermost sails are less than the formost about the fifth part.

18. The main sail of the Boar Spirit was eight and twenty foot deep and a half, and sixty foot broad.

19. The top sail five and twenty foot and a half deep, and sixty foot broad at the bottom, and thirty at the top.

20. The proportions of Masts and sails do vary; not only according to the bigness of Ships, but also according to the several uses for which they are built: Some for fighting, some for Merchandize, some for swiftness, &c. But the proportion of the dimension of sails is no way proportioned to the number of Tuns whereof the Ships consist, seeing a Ship of five hundred Tuns or thereabout, may bear almost as large a sail as the other we spake of, which was almost as big again. Whence it proceeds that lesser ships are far swifter and speedier than great ones, not onely by reason of their lightness, but also by reason of the largeness of their sails, in respect of the body of the ship: for to continue that proportion in bigger ships would be too vast, and impossible a thing.

21. Each sail being stretched out at the top, and only tyed by the corners at the bottom, the wind must needs cause it to swell, especially about the bottome where it is slacker.

22. The swelling is far greater in the lower sails than in the upper, because they are not only Parrallelograms, and the other more pointed at the top, but also because the extent of the Yard doth so far exceed the breadth of the ship sides to which they are fastned, that of necessity, because of the looseness, there must be a great receipt for the wind; so that in the great which we proposed for an example, the swelling of the sail in a direct wind may be nine or ten foot inward.

23. By the same reason it also happens, that all sails which are swelled by the wind, do gather themselves into a kind of Arch or bow, so that of necessity much wind must slip thorow: insomuch, that in such a ship as we made mention of, that Arch may be as high as a man.

24. But in the triangular sail of the Mizon Mast, there must of necessity be a lesser swelling than in the quadrangular; as well because that figure is less capable, as also because that in the quadrangular three sides are slack and loose, but in the triangular only two, so that the wind is more sparingly received.

25. The motion of the wind in sails, the nearer it comes to the Beak of the ship, the stronger it is, and sets the ship more forward; partly because it is in a place, where because of the sharpness of the Beak head the waves are easilier cut in sunder; but chiefly, because the motion at the Beak draws on the ship, the motion from the Stern and back part of the ship doth but drive it.

26. The motion of the winds in the Sails of the upper tire, advances more than that in the lower tire, because a violent motion is most violent when it is farthest removed from resistance, as in the Wings and Sails of Windmills;

Windmills; but there is danger of drowning or over-turning the ship: wherefore those Sails are made narrower at the top, that they should not take in too much wind, and are chiefly made use of when there is not much wind.

27. Sails being placed in a direct line, one behind the other, of necessity those sails which stand behind must steal the wind from the foremost, when the wind blows fore-right; wherefore if they be all spread out at once, the force of the wind hath scarce any power but in the main Mast sails, with little help of the lower sails of the Boar Sprit.

28. The best and most convenient ordering of sails in a direct wind, is, to have the two lower sails of the fore-Mast hoisted up: for there (as we said before) the motion is most effectual, let also the top sail of the main Mast be hoisted up: for there will be so much room left under it, that there may be wind sufficient for the fore sails, without any notable stealing of the wind from them.

29. By reason of the hinder sails stealing of the wind away from the fore sails, we sail swifter with a side wind than with a fore wind. For with a side wind all the sails may be made use of, for they turn their sides to one another, and so hinder nor rob not one another.

30. Likewise when a side wind blows, the sails are stiffer stretched out against the wind, which somewhat restrains the wind, and sends it that way as it should blow, whereby it gains some strength. But that wind is most advantagious which blows cornerly between a fore wind, and a side wind.

31. The lower Boar Sprit sail can hardly ever be unuseful, for it cannot be robbed from gathering the wind which way soever it doth blow, either about the ship sides, or under the rest of the sails.

32. There is considerable in the motion of winds in ships, both the impulsion and direction of them: For that direction which is made by the Helm doth not much belong to the present Inquisition but only as it hath a Connexion, with the motion of the winds in the sails.

Connexion. As the motion of Impulsion or driving forward is in force at the Beak, so is the motion of Direction in the Poop; therefore for that the lower Mizon-Mast sail is of greatest concernment, for it is as it were an assistant to the Helm.

33. Seeing the Compass is divided into two and thirty Points, so that the Semicircles of it are sixteen points, there may be a progressive sailing (without any casting aboard, which is used when the wind is clean contrary) though of the sixteen parts there be but six favourable, and the other ten contrary. But that kind of sailing depends much upon the lower sail, of the Mizon-Mast. For whilst the adverse parts of the wind being more powerful and not to be opposed by the Helm alone, would turn the other sails, and the ship it self against its intended course, that sail being stiffly stretched, favouring the Helm, and strengthening its motion, turns the Beak into the way of its course.

34. All manner of wind in the sails doth somewhat burden and depress the ship, and so much the more, when it blows most from above. So that in greatest storms, first they lower their yards, and take away the upper sails, and if need be all the rest, cut down the Masts, cast their goods into the Sea, and their Ordinance, &c. to lighten the ship and make it swim, and give way to the waves.

35. By this motion of the winds in the sails of ships, (if it be a merry and prosperous gale) a Merchants ship may sail sixscore *Italian* miles in four and twenty hours; for there are certain Packet Boats which are built a purpose for swiftness, (that are called *Caravels*) which will go further. But when the wind is clean contrary, they lie to this last refuge, and a very weak one, to go on their course; namely to proceed side-way, as the wind will suffer them, out of their course, then turn their way again towards their course, and so proceed in an Angular way. By which progression (which is less than creeping, for Serpents creep on by crooked turnings, but they make angles) they may in four and twenty hours go fifteen miles journey.

Greater Observations.

1. **T**His Motion of winds in sails of ships hath three chief Heads and Fountains of its Impulsion or driving forward, from whence it flows and derives; whence also Precepts may be taken to increase and strengthen it.

2. The first spring comes from the quantity of the wind which is received: For questionless more wind helps more than less: wherefore the quantity of wind must be carefully procured; which will be done, if like wise house-holders, we be good husbands, and take care nothing be stoln from us. Wherefore we must be very careful that no wind may be lost.

3. The wind blows either above the ships, or below them, to the very superficies and surface of the Sea: And as provident men use to look most after the least things, (for the greater no man can chuse but look after) so we will first look after these lower winds, which questionless cannot perform so much as the higher.

4. As concerning the winds which blow chiefly about the sides of the ships, and under their sails, it is the office of the main Boar sprit sail, which lies low and sloping, to gather them into it, that there may be no waste nor loss of wind: and this of it self does good, and hinders not the wind which fills the other sails: And about this I do not see what can be done more by the industry of man, unless they should perchance fix such low sails out of the middle of the ship, like wings, or feathers, two on each side when the wind blows right.

5. But concerning the bewaring of being robbed, which happens when the hinder sails (in a fore-right wind) steal the wind away from the fore-sails, (for in a side-wind all the sails are set a work) I know not what can be added to the care man hath already taken to prevent it, unless when there is a fore-wind, there may be made a kind of stairs or scale of sails, that the hindermost sails of the Mizon-Mast may be the lowest, the middle ones at the main-Mast a little higher, the fore-mast, at the fore-Mast, highest of all, that one sail may not hinder, but rather help the other, delivering and passing over the wind from one to another. And let so much be observed of the first Fountain of Impulsion.

6. The second Fountain of Impulsion consists in the manner of striking the sail with the wind, which if through the contraction of the wind it be acute and swift, will move more, if obtuse and languishing, less.

7. As concerning this, it is of great moment, and much to the purpose, to let the sails have a reasonable extension and swelling: for if they be stretched

stretched out stiff, they will like a wall beat back the wind; if they be too loose, there will be a weak Impulsion.

8. Touching this, humane Industry hath behaved it self well in some things, though it was more by chance than out of any good judgment. For in a side wind, they gather up that part of the sail as much as they can which is opposite against the wind: and by that means they set in the wind into that part where it should blow. And this they do and intend. But in the mean season this follows, (which peradventure they do not perceive) that the wind is more contracted, and strikes more sharply.

9. What may be added to humane industry in this, I cannot perceive, unless the figure of the sails be changed, and some sails be made which shall not swell round; but like a Spur or a Triangle, with a mast or piece of timber in that corner of the top, that they may contract the wind more sharply, and cut the outward air more powerfully. And that angle (as we suppose) must not be altogether sharp, but like a short obtuse triangle, that it may have some breadth. Neither do we know what good it would do, if there were as it were a sail made in a sail; if there were in the middle of a greater sail, there were a kind of a Purse, not altogether loose, of Canvas, but with ribs of wood, which should take up the wind in the middle of the sail, and bring it into a sharpness.

10. The third Fountain or Original of Impulsion, is in the place where the wind hits; and that is two-fold: for from the fore-side of the ship, the Impulsion is easier and stronger than on the hinder part; and from the upper part of the Mast, and sail, than from the lower part.

11. Neither seems the Industry of man to have been ignorant of this, when in a fore-wind their greatest hopes have been in their fore-Masts, and in calms, they have not been careless in hoisting up of their top sails. Neither for the present do we find what may be added to humane Industry in this point; unless concerning the first, we should set up two or three fore-Masts (the first upright, and the rest sloping) whose sails shall hang downward: and as for the second, that the fore-sails should be enlarged at the top, and made less sharp than they usually are: But in both we must take heed of the inconvenience of danger, in sinking the ship too much.

The Motion of Winds in other Engines of Mans Invention.

THE Motion of wind-mills hath no subtilty at all in it: and yet usually it is not well explained nor demonstrated. The sails are set right and direct opposite against the wind which bloweth. One side of the sail lies to the wind, the other side by little and little bends it self, and gets it self away from the wind. But the turning and continuance of the Motion is always caused by the lower part, namely, that which is farthest from the wind. But the wind over-casting it self against the Engine, is contracted and restrained by the four sails, and is constrained to take its way in four spaces. The wind doth not well endure that compression; wherefore of necessity it must as it were with its elbow hit the sides of the sails, and so turn them, even as little Whirligigs that Children play withal are turned with the fingers.

2. If the sails were extended even and equally, it would be doubtful which way the inclination would be, as in the fall of a staff; but when the nearer side which meets with the wind, casts the violence of it upon the lower

lower side, and from thence into distances, so that when the lower side receives the wind, like the palm of the hand, or the sail of a ships Boat, presently there is a turning on that side. But this is to be observed, that the beginning of the motion proceeds not from the first Impulsion, which is direct, and a breast; but from the lateral Impulsion, which is after the compression or straightning of the wind.

3. We made some proofs and trials about this, for the increasing of this motion, as well to be assured we had found the cause, as also for use; feigning an imitation of this Motion, with Paper Sails, and the wind of a pair of Bellows. We therefore added to the side of the lower sail, a fold turned in from the wind, that the wind being become a side wind, might have somewhat more to beat upon; which did no good, that fold not so much assisting the percussive of the wind, as in consequence hindring the cutting of the air. We placed behind the sails at some distance, certain obstacles, as broad as the Diameter of all the sails, that the wind being more compressed, might hit the stronger: but this did rather hurt than good, the repercussion dulling the primary motion. Then we made the sails of a double breadth, that the wind might be the more restrained, and there might be a stronger lateral percussive; which at last proved very well: so that the Conversion was caused by a far milder gale, and did turn a great deal more swiftly.

Mandate. Peradventure this increase of motion might more conveniently be made by eight sails, than by four, doubling the breadth, unless too much weight did over-burthen the motion: Which must have trial made of it.

Mandate. Likewise the length of sails doth much conduce to the Motion. For in wheelings, a slight violence about the circumference, is equivalent to a far greater about the Center. But then this inconvenience follows, that the longer the sails are, the more distant they are at the top, and the wind is so much the less straightned. Peradventure the business would go well, if the sails were a little longer and broader towards the top, like the outermost end of an Oar. But this we are not sure of.

Monition. If these Experiments be made trial of in Wind-mills; care must be taken of the Wind-mill posts, and the foundations of it: for the more the wind is restrained, the more it shakes (though it swiftens the motion of the sails) the whole frame of the Mill.

4. It is reported, that in some Countreys there are Coaches and Waggon which move with the wind; but this must be more diligently looked after.

Mandate. Chariots moving by vertue of the wind, can be of no use, unless it be in open places and plains: Besides, what will be done if the wind allays. It had been better to have thought of easing the Motion of Waggon and Coaches by sails, which might be set up and taken down, to ease the Oxen or Horses which draw them, rather than to make a Motion by wind alone.

Prognosticks

Prognosticks of Winds.

To the two and thirtieth Article.

Connexion.

THe more Divination useth to be polluted by vanity and superstition, so much more is the purer part of it to be received and honoured. But Natural Divination is sometimes more certain, sometimes more slippery and deceitful, according to the subject with which it hath to do; for if it be of a constant and regular nature, it causeth a certain prediction. If it be of a variable and irregular nature, it may make a casual and deceitful one: Yet in a various subject the Prediction will hold true if it be diligently regulated, peradventure it may not hint upon the very moments, but in the thing it self it will not erre much. Likewise for the times of the event and complement, some Predictions will hit right enough, namely, those which are not gathered from the causes, but from the thing it self already inchoated, but sooner appearing, in an apt and fitly disposed matter than in another, as we said before in the Topicks concerning this two and thirtieth Article. We will now therefore set forth the Prognosticks of winds, of necessity intermixing some of rain, and fair weather, which could not conveniently be separated, remitting the full enquiry of them to their proper titles.

1. If the Sun appears hollow at its rising, it will the very same day yield wind or rain; if it appears as it were a little hollow, it signifies wind; if deeply hollow, rain.

2. If the Sun rises pale, or (as we call it) waterish, it betokens rain, if it set so, it betokens wind.

3. If the body of the Sun it self appears at its setting of the colour of blood, it foretokens great winds, for many days.

4. If at Sun rising its beams appear rather red than yellow, it signifies wind rather than rain, and the like if they appear so at its setting.

5. If at Sun rising or setting, its rays appear contracted or shortened, and do not shine out bright, though the weather be not cloudy, it signifies rain rather than wind.

6. If before Sun rising there appear some rays as fore-runners, it signifies both wind and rain.

7. If the Sun at its rising diffuses its rays through the Clouds, the middle of the Sun remaining still under Clouds, it shall signify rain, especially if those beams break out downwards, that the Sun appears as it were with a Beard. But if the rays break forth out of the middle, or dispersed, and its exterior body, or the out-parts of it be covered with clouds, it fore-shewes great tempests both of wind and rain.

8. If the Sun, when it rises, be encompassed with a Circle, let wind be expected from that side on which the Circle opens. But if the Circle fall off all at one time, it will be fair weather.

9. If at the setting of the Sun there appears a white Circle about it, it signifies some small storm the same night: if black or darkness, much wind the day following.

10. If the Clouds look red at Sun-rising, they are Prognosticks of wind: if at Sun-setting, of a fair ensuing day.

11. If about the rising of the Sun, Clouds do gather themselves about it, they foreshew rough storms that day; but if they be driven back from the rising towards the setting of the Sun, they signify fair weather.

12. If at Sun-rising the Clouds be dispersed from the sides of the Sun, some South-ward, and some North-ward, though the sky be clear about the Sun, it foreshews wind.

13. If the Sun goes down in a Cloud, it foreshews rain the next day; but if it rains at Sun-setting, it is a token of wind rather. But if the Clouds seem to be as it were drawn towards the Sun, it signifies both wind and storms.

14. If Clouds at the rising of the Sun seem not to encompass it, but to lie over it, as if they were about to Eclipse it, they foreshew the rising of winds, on that side as the Clouds incline. And if they do this about noon, they signify both wind and rain.

15. If the Clouds have encompassed the Sun, the less light they leave it, and the lesser the Orb of the Sun appears, so much the more raging shall the tempest be; but if there appear a double or treble Orb, as though there were two or three Suns, the Tempest will be so much the more violent for many days.

16. New Moons presage the dispositions of the Air: but especially the fourth rising of it, as if it were a confirmed New Moon. The full Moons likewise do presage more than the days which come after.

17. By long observation, the fifth day of the Moon, is feared by Mariners for stormy.

18. If the New Moon do not appear before the fourth day, it foreshews a troubled air for the whole Month.

19. If the New Moon at her first appearance, or within a few days after, have its lower horn obscure, or dusky, or any way blemished, it signifies stormy and tempestuous days before the Full Moon; if it be ill coloured in the middle, Tempests will come about the Full of the Moon; if it be so about the upper part of the horn, they will be about the decreasing of the Moon.

20. If at the fourth rising the Moon appear bright, with sharp horns, not lying flat, nor standing upright, but in a middle kind of posture between both, it promises fair weather for the most part, until the next New Moon.

21. If at the same rising it be red, it portends winds; if dusky or black, rains but howsoever it signifies nothing beyond the Full Moon.

22. An upright Moon is almost always threatening, and hurtful, but it chiefly portends winds: But if it have blunt horns, and as it were cut off short, it rather signifies rain.

23. If one horn of the Moon be sharp, and the other blunt, it signifies wind; if both be blunt, rain.

24. If a Circle, or Halo appear about the Moon, it signifies rain rather than wind, unless the Moon stands directly within that Circle, for then it signifies both.

25. Circles about the Moon always foreshew winds on that side where they break; also a notable shining in some part of the Circle, signifies winds from that part where the shining is.

26. If the Circles about the Moon be double or treble, they foreshew horrible and rough Tempests, and especially if those Circles be not whole, but spotted and divided.

27. Full

27. Full Moons, as concerning the Colours and Circles, do in a manner foreflew the same things, as the fourth rising, but more present, and not so long delayed.

28. Full Moons use to be more clear than the other ages of the Moon, and in winter use to be far colder.

29. The Moon appearing larger at the going down of the Sun, if it be splendent and not dusky, betokens fair weather for many days.

30. Winds almost continually follow the Eclipses of the Moon; and fair weather the Eclipses of the Sun; rain comes after neither.

31. From the Conjunctions of any of the Planets, but only the Sun, you may expect winds both before and after, from their conjunctions with the Sun, fair weather.

32. At the rising of the *Pleiades*, and *Hyades*, come showres of rain, but calm ones; after the rising of *Arcturus* and *Orion*, tempests.

33. Returning and shooting stars (as we call them) signifie winds to come from that place whence they run, or are shot; but if they flye from severall, or contrary parts, it is a sign of great approaching storms of wind and rain.

34. When such little stars as those which are called *Afelli*, are not seen generally all over the sky, it foreshews great tempests and rain within some few days. But if they be seen in some places, and not in other some, it foreshews winds only, and that suddenly.

35. The sky when it is all over bright, in a New-Moon, or at the fourth rising of it, portends fair weather for many days; if it be all over dark, it foreshews rain, if partly dark, and partly fair, it portends wind of that side where the darkness is seen. But if it grow dark on a sudden, without either Cloud or Mist to dim the brightness of the Stars, there are great and rough tempests a breeding.

36. If an entire Circle incloseth a Planet, or any of the greater stars, it foreshews wind; if it be a broken Circle, wind from those parts where the Circle is deficient.

37. When the Thunder is more than the Lightnings, there will be great winds; but if the Lightnings be thick amidst the thundering, it foreshews thick showres, with great drops.

38. Morning Thunders signifie wind, mid-day Thunders rain.

39. Bellowing Thunders which do as it were pass along, presage winds, and those which make a sharp and unequal noise, presage storms both of wind and rain.

40. When it lightens in a clear sky, winds are at hand, and rain from that part where it lightens: But if it lightens in diverse parts, there will follow cruel and horrid tempests.

41. If it lightens in the cold quarters of the Heavens, namely, the East and North, Hail will follow; if in the warmer; namely, South and West, we shall have rain and a warm sky.

42. Great heats after the Summer Solstice, and commonly with Thunder and Lightning, and if those come not, there will be wind and rain for many days.

43. The Globe of Flame, which the Ancient called *Castor*, which is seen by Mariners, and Seafaring men at Sea, if there be but one, presages a cruel tempest, (*Castor* is the dead brother) and much more if it stick not close to the Malt, but dances up and down. But if they be twins, (and *Pollux* the living brother be present) and that when the tempest is high, it is a good

good presage: But if there be three (namely, if *Helen*, the Plague of all things come in) it will be a more cruel tempest: so that one seems to shew the indigested matter of the storm, Two a digested and ripe matter; Three or more an abundance that will hardly be dispersed.

44. If we see the Clouds drive very fast when it is a clear sky, we must look for winds from that way from which the Clouds are driven: But if they wheel and tumble up together, when the Sun drawes near to that part in which they are tumbled up together, they will begin to scatter and sever; and if they part most towards the North, it betokens wind, if towards the South, rain.

45. If at Sun-setting there arise black and dark Clouds, they presage rain: If against the Sun, namely, in the East, the same night, if near the Sun in the West the next day, with winds.

46. The clearing of a Cloudy sky, if it begins against the wind which then blows, signifies clear fair weather; with the wind it betokens nothing, but the thing remains uncertain.

47. There are sometimes seen several as it were Chambers or joined Stories of Clouds one above the other, (so as *Gilbertus* affirms, he hath seen five of them together) and always the blackest are lowermost, though sometimes it appears otherwise, because the whitest do more allure the sight. A double Conjunction of stories, if it be thick, shews approaching rain (especially if the lower Cloud seem as it were big with Child) more Conjunctions presage continuance of rain.

48. If Clouds spread abroad like Fleeces of wool here and there, they foreshew Tempests: but if they lie one a top of another, like skales or tiles, they presage drought and clear weather.

49. Feathered Clouds, like to the boughs of a Palm tree, or the flowers of a Rainbow, are Prognosticks of present rain, or immediately to follow.

50. When Hills and Hillocks looks as though they wore Caps by reason of the Clouds lying upon them, and encompassing them, it presages imminent Tempests.

51. Amber, or Gold Colour Clouds before Sun-setting, that have as it were gilded Helms or borders, after the Sun begins to be quite down, foreshew fair clear weather.

52. Grayish, and as it were Clay-coloured Clouds, shew that rain with wind are drawing on.

53. Some petty Cloud shewing it self suddenly, having not been seen before, and all the skie clear about it, especially if it be in the West, and about Noon, shews there is a storm comming.

54. Clouds and Mists ascending, and going upward, presage rain, and that this be done suddenly, so that they be as it were sucked up, they presage rain: but if they fall and reside in the Valleys, they presage fair weather.

55. A big Cloud growing white, which the Ancients called a white Tempest, in Summer is a fore-runner of small hail, like Comfits, in Winter snow.

56. A fair and clear Autumn presages a windy winter; a windy winter, a rainy spring; a rainy spring a clear summer; a clear summer a windy Autumn. So that the year (as the Proverb goes) is seldom its own debtor, and the same order of seasons will scarce happen two years together.

57. Fires

Fires upon the Hearth when they look paler than they are accustomed, and make a murmuring noise within themselves, do preface tempests. And if the flame rises bending and turning, it signifies wind chiefly: and when the snuffs of Lamps and Candles grow like Mushrooms with broad heads, it is a sign of rainy weather.

58. Coals shining bright, and sparkling over-much, signifie wind

59. When the superficies of the Sea is calm and smooth in the Harbour, and yet murmures within it self, though it doth not swell, signifies wind.

60. The shoars resounding in a calm, and the sound of the Sea it self, with a clear noise, and a certain Eccho, heard plainer and further than ordinary, prefaces winds.

61. If in a calm and smooth sea, we espie froth here and there, or white Circles or Bubbles of water, they are Prognosticks of winds; and if these Prefages be very apparent, they foreshew rough tempests.

62. If in a rough sea there appear a shining froth (which they call sea-lungs) it foreshews a lasting tempest for many days.

63. If the sea swell silently, and rises higher than ordinary within the Harbour, or the Tide come in sooner than it uses to do, it foretels wind.

64. Sound from the Hills, and the murmure of woods growing lowder, and a noise in open Champion fields, portends wind. Also a prodigious murmuring of the Element, without Thunder; for the most part prefaces winds.

65. Leaves and straws playing on the ground, without any breath of wind that can be felt, and the Down of Plants flying about, Feathers swimming and playing upon the water, signifie that wind is near at hand.

66. Water Fowls flying at one another, and flying together in flocks, especially sea-Mews and Gulls, flying from the sea and lakes, and hasting to the banks and shoars, especially if they make a noise and play upon dry land, they are Prognosticks of winds, especially if they do so in the morning.

67. But contrariwise, sea fowls going to the water, and beating with their wings, chattering and bathing themselves, especially the Crow, are all prefages of storms.

68. Duckers and Ducks cleanse their feathers with their Bills against wind: but Geese with their importunate crying call for rain.

69. A Hern flying high, so that it sometimes flies over a low Cloud, signifies wind: But Kites when they flye high, foreshew fairweather.

70. Crows as it were barking after a sobbing manner, if they continue in it, do preface winds, but if they catchingly swallow up their voice again, or croak a long time together, it signifies that we shall have some showers.

71. A chattering Owl was thought by the Ancients to fore-tel change of weather; if it were fair, rain; if Cloudy, fair weather: But with us the Owl making a clear and free noise, for the most part signifies fair weather, especial in winter.

72. Birds pearching in trees, if they flie to their nests, and give over feeding betimes, it prefaces tempest: But the Hearn standing as it were sad and melancholy upon the sand; or a Crow walking up and down, do preface wind onely.

73. Dolphins playing in a calm sea, are thought to presage wind from that way they come: and if they play and throw up water when the Sea is rough, they presage fair weather. And most kinds of fishes swimming on the top of the water, and sometimes leaping, do prognosticate wind.

74. Upon the approach of wind, Swine will be so terrified and disturbed, and use such strange actions, that Country people say that Creature onely can see the wind, and perceive the horridness of it.

75. A little before the wind spiders work and spin carefully, as if they prudently forestall'd the time, knowing that in windy weather they cannot work.

76. Before rain, the sound of Bells is heard further off; but before wind it is heard more unequally, drawing near and going further off, as it doth when the wind blows really.

77. *Pliny* affirms for a certain, that three leaved grass creeps together, and raises its leaves against a storm.

78. He sayes likewise, that vessels which food is put into, will leave a kind of sweat in Cupboards, which presage cruel storms.

Monition. Seeing rain and wind, have almost a common matter, and seeing alwayes before rain, there is a certain condensation of the air, caused by the new air received into the old, as it appears by the sounding of the shoars, and the high flight of Hearn, and other things; and seeing the wind likewise thickens, (but afterward in rain the air is more drawn together, and in winds contrariwise it is enlarged) of necessity winds must have many Prognosticks common with the rain. Whereof advise with the Prognosticks of rain, under their own title.

Imitations of Winds.

To the three and thirtieth Article.

Connexion.

IF men could be perswaded not to fix their contemplations over-much upon a propounded subject, and reject others as it were by the byes; and that they would not subtilize about that subject in *insinuation*, and for the most part unprofitably, they would not be seized with such a stupor as they are; but transferring their thoughts, and discoursing, would find many things at a distance, which near at hand are hidden. So that as in the Civil Law, so we must likewise in the Law of Nature, we must carefully proceed to semblable things, and such as have a conformity between them.

1. Bellows with men are *Æolus* his Bags, out of which one may take as much as he needeth. And likewise spaces between, and openings of Hills, and crooks of buildings, are but as it were large bellows. Bellows are most useful either to kindle fire, or for Musical Organs: The manner of the working of Bellows is by sucking in of the air, to shun vacuity, (as they say) and to send it out by compression.

2. We also use Hand Fans to make a wind, and to cool, only by driving forward of the air softly.

3. The cooling of Summer rooms, we spake of in Answer to the ninth Article. There may other more curious means be found, especially if the air be drawn in somewhere after the manner of bellows, and let out

at another place; But those which are now in use have relation only to meer compression.

4. The breath in mans *Microcosmos*, and in other Animals, do very well agree with the winds in the greater world: For they are engendred by humours, and alter with moisture as wind and rain doth, and are dispersed and blow freer by a greater heat. And from them that observation is to be transferred to the winds, namely, that breaths are engendred of matter that yields a tenacious vapour, not easie to be dissolved; as Beans, Pulse, and Fruits; which is so likewise in greater winds.

5. In the distilling of Vitriol and other Minerals which are most windy, they must have great and large receptacles, otherwise they will break.

6. Wind composed of Niter and Gun-powder, breaking out and swelling, the flame doth not only imitate, but also exceed winds, which blow abroad in the world, unless they be such as are made by thunder.

7. But the forces of it are pressed in, as in humane Engines, as Guns, Mines, and Powder-houses set on fire. But it hath not yet been tried whether in open air, a great heap of Gun-powder set on fire would raise a wind for certain hours, by the commotion of the air.

8. There lies hidden a flatuous and expansive spirit in Quick-silver, so that it doth, (in some mens opinions) imitate Gun-powder, and a little of it mixed with Gun-powder, will make the Powder stronger. Likewise the Chymists speak the same of gold that being prepared some way, it will break out dangerously, like to Thunder; but these things I never tried.

A greater Observation.

THe Motion of winds is for most things, seen as it were in a Looking-glass, in the motion of waters.

Great winds are Inundations of the air, as we see Inundations of waters, both through the augmentation of the quantity. As waters either descend from above, or spring out of the earth, so some winds are cast down, and some rise up. As sometimes in Rivers there are contrary motions, one of the flowing of the Sea, the other of the Current of the River, yet both become one motion, by the prevailing of the flood; so when contrary winds blow, the greater subdues the lesser. As in the Currents of the sea, and of some rivers, it sometimes falls out, that the waves above go contrary to the waves below: So in the air, when contrary winds blow together, one flies over the other. As there are Cataracts of Rain within a narrow space, so there are Whirlwinds. As waters, however they go forward, yet if they be troubled, swell up into waves, sometimes ascending, grow up into heaps, sometimes descending, are as it were furrowed: so the winds do the same, but only want the Motion of Gravity. There are also other similitudes which may be observed and gathered out of those things which have already been enquired about.

Moveable Rules concerning Winds.

Connexion.

Rules are either particular or general, both with us are moveable; for as yet we have not affirmed any thing positively. Particular Rules may be taken and gathered almost out of every Article. We will cull out some general ones, and those but a few, and adde thereunto.

1. Wind is no other thing but moved air; but the air it self moved either by a simple impulsion, or by commixion of vapors.

2. Winds by a simple Impulsion are caused four ways, either by the natural Motion of the air, or by expansion of the air, in the Suns ways; or by reception of air thorow a sudden cold; or by the compression of the air by external bodies.

There may be also a fifth way, by the agitation and concussion of the air by stars. But let these things be a while silent, or be given ear unto with a sparing belief.

3. Of winds which are made by immixion of vapours, the chief cause is the over-burthening of the air, by air newly made out of vapours, whereby the mass of the air grows bigger, and seeks new room.

4. A small quantity of air added, causeth a great tumor of the air round about it: so that new air out of the resolution of vapours doth confer more to motion than to matter. But the great body of wind consists in the former air, neither doth the new air drive the old air before it, as if they were several bodies; but being both commixt, they desire larger room.

5. When any other beginning of Motion concurs, besides the over-burthening of the air, it is an accessory which strengthneth and encreaseth that Principal, which is the reason that great and violent winds do seldom rise, by the simple over-burthening of the air.

6. Four things are accessory to the over-burthening of the air: The breathing out of subterranean places; the casting down out of (as it is called) the middle region of the air, Dissipation made out of a Cloud, and the Mobility and Acrimony of the Exhalation it self.

7. The Motion of the wind is for the most part lateral: But that which is made by meer over-burthening, is so from the beginning, that which is made by the expiration of the earth, or repercussion from above, a little while after, unless the Eruption, or Precipitation, or Reverberation be exceeding violent.

8. Air will endure some compression, before it be over-burthened, and begins to thrust away the adjoining air, by reason whereof all winds are a little thicker than quiet and calm air.

9. Winds are allayed five ways, either by the conjunction of vapours, or by their sublimation, or by transporting them, or by their being spent.

10. Vapors are conjoynd, and so the Air it self becomes water, four ways, either by abundance aggravating, or by colds condensing, or by contrary winds compelling, or by obstacles reverberating.

11. Both Vapours and Exhalations, but wind very frequently from vapours. But there is this difference, that winds which are made of Vapours, do more easily incorporate themselves into pure air, are sooner allayed, and are not so obstinate as those winds which are engendred of Exhalations.

12. The

12. The manner and several conditions of heat have no less power in the generation of winds, than the abundance or conditions of the matter.

13. The heat of the Sun ought to be so proportioned in the generation of winds, that it may raise them, but not in such abundance as that they gather into rain, nor in so small a quantity, that they may be quite shaken off and dispersed.

14. Winds blow from their Nurseries, and the Nurseries being disposed several ways, divers winds for the most part blow together, but the strongest either quite overthrows, or turns into its current the weakest.

15. Winds are engendred every where, from the very Superficies of the earth, up into the middle Region of the air, the more frequent below, but the stronger above.

16. The Countries which have retaining or trade-winds, if they be warm, have them warmer that according to the measure of their Climate: if they be cold, they have them colder.

A Humane Map, or Optatives, with such things as are next to them concerning Winds.

Optatives.

1. **T**O frame and dispose sails of ships in such a manner, that with less wind they might go a greater journey; a thing very useful to shorten journeys by sea, and save charges.

Next. The next invention precisely in practice I have not as yet found; yet concerning that, look upon our greater observations upon the six and twentieth Article.

2. *Optative.* That we could make Wind-mills, and their sails in such manner that they may grind more with less wind. A thing very useful for gain.

Next. Look concerning this upon our Experiments in the answer to the seven and twentieth Article, where the thing seems to be as it were done.

Optative. To foreknow when winds will rise and allay: A thing useful for Navigation and for Husbandry, especially for the chusing of times for Sea-fights.

Next. To this belong many of those things which are observed in the Inquisition, and especially in the Answer to the two and thirtieth Article. But a more careful observation hereafter (if any shall apply their mind to it) will give far more exact Prognosticks, the cause of the winds being already laid open.

4. *Optative.* To give judgment, and make Prognosticks by winds, of other things, as first, whether they be Continents or Islands in the Sea in any place: or rather a free open sea; a thing very useful for new and unknown voyages.

Next. The next is the observation concerning constant and trade-winds: that which *Columbus* seemed to make use of.

5. *Optative.* Likewise of the plenty or scarcity of corn every year. A thing useful for gain, and buying before-hand, and fore-stalling, as it is reported of *Thales*, concerning a Monopoly of Olives.

Next.

Next. To this belong some things specified in the Inquisition of winds, whether hurtful, or shaking winds, and the times when they do hurt; to the nine and twentieth Article.

6. *Optative.* Likewise concerning Diseases and Plagues every year. A thing useful for the credit of Physicians, if they can fore-tel them also for the causes and cures of Diseases, and some other civil considerations.

Next. To this likewise belong some things set down in the Inquisition to the thirtieth Article.

Monition. Of Predictions by wind concerning corn, fruits, and diseases, look upon Histories of Husbandry and Physick.

Optative. 7. How to raise winds and to allay them.

Next. Concerning these things there are some superstitious opinions, which do not seem worthy to be inserted into a serious and severe Natural History: Nor can I think of any thing that is near in this kind. The design may be this, to look thoroughly into, and enquire about the Nature of the air; whether any thing may be found, whereof a small quantity put into air, may raise and multiply the motion to dilatation, or contraction in the body of the air. For out of this (if it might be done) would follow the raisings and allayings of winds. Such as that Experiment of *Pliny* is concerning Vinegar thrown against the Whirlwinds, if it were true. Another design might be, by letting forth of winds out of subterranean places; if so be they should gather together any where in great abundance, as it is a common and approved opinion of the Well in *Dalmatia*: but to know such places of prisons, is very hard and difficult.

8. *Optative.* To work many fine, pleasant, and wonderful conceits by the motion of winds.

Next. We have not leisure to enter into consideration touching these things: Next to it is that common report of the Duels of winds. Questionless many such pleasant things might very well be found out, both for Motions and Sounds of Winds.

An



An Entrance to the Titles appointed for the next five Months.

The History of Density and Rarity.

The Entrance.

IT is no marvail if nature be indebted to Philosophy and the Sciences, seeing it was never yet called upon to give an account, for there never was any diligent and dispensatory Inquisition made of the quantity of the matter, and how that had been distributed into bodies (in some copiously, in others sparingly) according to the true, or at least truest accounts that hath been truly received and approved of, that nothing is taken away and lost, or added unto the universal summe. Likewise that place hath been treated upon by some, namely how it can be loosened or contracted without intermixture or vacuity, according to more or less: But the Natures of Density and Rarity, some have referred to the abundance or scarcity of the matter, another hath laughed at the same; the greatest part following their Author, do discuss and compose the whole matter by that cold and weak distinction of act, and power. Those also who attribute them to the reasons of matter (which is the true opinion) do neither quite deprive the *Materia prima*, or primary matter of its *Quantum*, or quantity, though for other forms they will have it equal, but here do terminate and end the matter, and seek no further, nor do not perceive what followeth thereby; and either do not touch at all, or at least do not urge home that which hath a regard to infinites, and is as it were the Basis and ground of Natural Philosophy.

First therefore that which is rightly set down must not be moved nor altered; namely, that there is no transmutation made in any transmutation of bodies, either from nothing, or to nothing: but that they are works of the same omnipotence, to create out of nothing, and to reduce unto nothing, and that by course of Nature this can never be done. Therefore the summe of the total matter stands still whole, nothing is added, nothing is diminished: yet that this sum is divided by portions amongst the bodies, is unquestionable, for there can no man be so much beside himself through any subtile abstractions as to think that there is as much matter in one vessel of water as in ten vessels of water, nor likewise in one vessel of air, as much as in ten vessels of air. But in the same body there is no question but that the abundance of matter is multiplied according to the measure of the body, in divers bodies it is questionable. And if it be demonstrated that one vessel of water turned into air, will yield ten vessels of air, (for we take this computation for a received opinion,

opinion, though that of a hundred fold be the truer) it is well; for now they are no more divers bodies, water and air, but the same body of air in ten vessels: But one vessel of air (as it was but now granted) is but onely the tenth part of ten vessels. Therefore it cannot be contradicted, but that in one vessel of Water, there is ten times more matter than in one vessel of air: Therefore if one should affirm, that one whole vessel of water could be converted into one vessel of air, it were as much as if one should affirme that something could be reduced to nothing: for as much as one tenth part of water would suffice to do it, and the other nine parts must of necessity be reduced to nothing: And contrariwise, if one should affirm that one vessel of air could be turned into a vessel of water, it would be as much as if he should say, that something could be created out of nothing: for one vessel of air can attain and reach but unto the tenth part of a Vessel of water, and the other nine parts must needs proceed from nothing. In the mean time we will plainly acknowledge and confess, that to understand the true means of the reasons and calculations, of the how much part of the *Quantum*, or how much of the matter which is in divers bodies, and by what industry and sagacity one may be truly informed thereof, is a high matter to be enquired; but such as the great and largely extended profit which will accrue thereby will largely recompence. For to know the Densities and Rarities of the body, and much more how to procure, and effect the Condensations and Rarefactions, is of great importance and moment both to contemplative, and to the Practick. Seeing then it is a thing (if any there be at all) meerly fundamental and universal; we must go carefully, and prepared about it, seeing that all Philosophy without it is loose and disjointed.

The History of Heavy and Light.

The Entrance.

THE Motion of Gravity and Lightness, the Ancients did illustrate with the name of Natural Motion: For they saw no external efficient, nor no apparent resistance; yea the motion seemed swifter in its progress. This contemplation, or rather speech, they seasoned with that Mathematical Phantasie of the staying or stopping of heavy things at the center of the earth (although the earth should be bored quite thorow) and that Scholastical Invention of the motion of bodies to their several places. Having laid or set down these things, supposing they had done their parts, they looked no further, but onely that which some of them more carefully enquired after, namely, of the Center of Gravity in divers figures, and of such things as are carried by water. Neither did any of the Modern Authors do any thing worth speaking of concerning this, onely by adding some few Mechanical things which they had also wrested with their Demonstrations: But laying many words aside, it is most certain, that a body cannot suffer but by a body: Neither can there be any Local Motion made, unless it be solicited or set forward, either by the parts of the body it self which is moved, or by the adjacent bodies, which either touch it, or are near unto it, or are at least within the Orb of its Activity. So that *Gilbertus* did not unknowingly introduce Magnetick powers, he also becoming a Loadstone, namely, drawing more things

things by those powers than he should have done, and building a Ship as it were of a round piece of wood.

The History of the Sympathy and Antipathy of things.

The Entrance.

STrife and amity in Nature are the egggers on of motions, and the Keys of works. Hence proceeds the union and dissention of bodies; hence the mixion and separation of bodies; hence the high and intimate impressions of vertues, and that which they call joyning of actives with passives: finally they are the great and wonderful works of nature. But this part of Philosophy, namely of the Sympathy and Antipathy of things is most impure, which also they call Natural Magick: and (which always likely comes to pass) where diligence and care hath wanted, there hath hope remained: But the operation thereof in men is meerly like unto certain Soporiferous Medicines which cast one asleep, and do moreover send and infuse into him merry and pleasant Dreams. For first it casts mans understanding into a sleep, representing unto him specifical Properties, and hidden Vertues, whereby men awake no more, nor look after the finding and searching out of true causes; but acquiesce and lie still in these idle ways. Then it insinuates an innumerable company of fictions like unto Dreams; And vain men hope to know the Nature by the outward shape and shew, and by extrinsecal similitudes to discover inward Properties. Their Practise also is very like unto their Enquiry: For the Precepts of Natural Magick are such, as if men should be confident that they could subdue the earth, and eat their bread without the sweat of their Brow, and to have power over things by idle and easie applications of bodies; and still they have in their mouths, and like undertakers or Sureties, they call upon the Loadstone, and the consent which is between Gold and Quicksilver; and some few things of this kind they alledge, for to prove other things, which are not bound by any such like contract. But God hath appointed the best of things to be enquired out and be wrought by labours and endeavours. We will be a little more carefull in searching out the law of Nature, and the mutual Contracts of things, neither favouring Miracles, nor making too lowly and straightned an Inquisition.

The History of Su'phur, Mercury, and Salt.

The Entrance.

THis triple of Principles hath been introduced by the Chymists, and as concerning Speculatives is of them which they bring the best Invention. The most subtile and acute of these, and those who are most Philosophical, will have the Elements to be Earth, Water, Air, and the skie. And those they will not have to be the Matter of things, but the Matrixes in which the Specifical seeds of things do engender in the nature of a Matrix. But for the *Materia prima*, or primary matter, (which Scholars do lay down as it were naked, and indifferent) they

substitute those three, Sulphur Mercury and Salt; out of which all bodies are gathered together and mixed. We do accept of their words, but their opinions are not very sound. Yet that doth not ill agree with their opinion, namely, that we hold two of them, to wit, Sulphur and Mercury (taken according to our sence) to be very first and prime natures, and most inward figurations of matter, and almost chief amongst the forms of the first Classis. But we may vary the words of Sulphur and Mercury, and name them otherwise Oyl, Waterish, Fat, Crude, Inflamable, not Inflamable, or the like. For these seem to be two very great things of the three, and which possess and penetrate the Universe; for amongst subterranean things, they are Sulphur and Mercury, as they are called; in the Vegetable and Animal kind, they are Oyl and Water; in the inferior spiritual things, they are Air and Flame; in the heavenly, the body of a Star, and the pure skie; but of this last Duality we yet say nothing, though it seem to be a probable decyphering: For if they mean by Salt, the fixed part of the body, which is not resolved either into flame or smoak, this belongeth to the Inquisition of fluid, and determinate things. But if we take Salt according to the Letter without any Parabolical meaning, Salt is no third thing from Sulphur and Mercury, but mixed of both, connexed into one, by an acrimonious and sharp spirit. For all manner of Salt hath inflamable parts; and other parts also, which not only will not take fire, but do also abhor it and flie from it: Yet the Inquisition of Salt, being somewhat allyed to the Inquisition of the other two, and exceeding useful, as being a tie and band of both Natures, Sulphurous and Salt, and the very Rudiment of life it self, we have thought fitting to comprehend it also within this History and Inquisition. But in the mean time we give you notice, that those spiritual things, Air, Water, Stars, and Skie, we do (as they very well deserve it) reserve them for proper and peculiar Inquisitions, and here in this place to set down the History only, of tangible, that is to say, Mineral or Vegetable Sulphur and Mercury.

The History of Life and Death.

The Entrance.

THERE is an old complaint of the shortness of life, and tediousness of Art. Therefore it seems very fitting to us, who strive to the uttermost of our powers to make Arts perfect, to take care also of prolonging the Life of man, the Author of Life and Truth assisting us therein. For although mens lives be nothing else, but an increase and accumulation of sins and miseries; and that life is but of small advantage to those who aspire to Eternity: Yet we who are Christians should not contemn or despise a continuation of works of Charity. And the beloved Disciple lived longer than any of the rest; and many of the Fathers, especially the holy Monks, and Hermites, were long lived. And there was less taken away from this blessing, (so often made mention of in the old Law) than from any other earthly blessing, after the coming of our Savior. But it is plain & manifest enough, that this is held for a great good: but how to attain thereunto, is a high and mysterious question; and

and so much the more, because it hath been abused both by false opinions and false *Præconiums*. For those things which are commonly spoken of by the Rabble of Physicians, concerning the Radical Humour, and Natural Heat, are deceitful. And the immoderate praises of Chymical Medicines, first swell men up with hopes, and then forsake them, and leave them in the mire. Neither is our Inquisition now of that death which proceeds from suffocation, putrification, and divers other Diseases; for that belongs to a Physical or Medicinal Historie; but of that Death only which comes by the Resolution and consumption of old age. Yet to enquire of the last passage or step to death, and the very extinction or putting out of life, which may be done by many, both internal and external ways (which notwithstanding have as it were one and the self same place of habitation, before we come unto the very pangs of death.) I believe hath some affinity with our present Inquisition, but we will set that in the last place. That which may be repaired by degrees and without destruction, the primary entire thing, that in *potentia* is eternal as the Vestal fire. Wherefore when the Philosophers and Physicians saw, that creatures were nourished, and that their bodies were repaired and made up again; yet that it could not last long, but that a while after they grew old, and dyed, they sought for death in some thing, which properly could not be repaired, thinking that some Radical and first engendred Humor is not totally repaired, but that there is even from the infancy some degenerate addition, and not a precise, solid and just reparation, which by degrees is depraved with age, and at last brings that which is depraved to nothing. These unskilful and erroneous opinions they hold. For all things in youth and young age are fully and wholly repaired, and for a time increase in quantity, and are bettered in quality: so that the matter of Reparation might in a manner be eternal, if the means of Reparation did not fall away. But indeed in a declining age, there is but a very unequal Reparation made. In some parts Reparation proceeds happily, and other parts grow worse and worse; and from that time men begin to endure that torment which *Alexandria* did use to inflict, namely to kill living men with the embraces of dead ones; and those things, which might easily be repaired do fail by being joyned to those things which can hardly be repaired. For even after that men do begin to decline through age, their Spirit, Bloud, flesh and Fat may easily be repaired; but those parts which are more Porous, all Membranes and Tunicles, Nerves, Arteries, Veins, Bones, Cartilages, most part of the Inwards, and finally almost all the Organical parts, are difficultly, and with great losse repaired. And those parts being to assist the reparation of those Reparable parts which are actually to be repaired, losing their activity and strength, can no longer performe their function. And from thence a while after proceeds the falling to ruin of all together; and those very same parts, which in their own Nature are very Reparable, the Organs of Reparations failing, cannot be well repaired, but decrease, and at last totally fail. And the cause of the Period, is because the spirit preying alwayes like a still and gentle Flame, the external air (which also sucks and dries up the bodies) conspiring with it, at the last ruins the frame of the body and its Organs, and makes them unable to performe the act of Reparation: And these are the true ways of Natural Death, which are carefully to be revolved in mans mind. For he that knows not the ways of Nature, how can he obviate and turn them? Therefore there ought

to be a double Inquisition: one of the Consumption, or Depredation of the body of man; and the other of the Reparation or Refection of the same. And with this *proviso* or Caveat that the one may be inhibited and restrained, and the other promoted and comforted as much as may be: and the first of these belongs chiefly to the spirits and external air, by which the Depredation and waste is made; the second to the whole process of alimentation, which causeth the Restitution. And as for the first part of the Inquisition, which is of the Consumption, that is for a great part common to inanimate bodies: For those things which the inbred spirit (which is in all Tangible things be they living or dead) and the encompassing Air do operate upon inanimate things, the same they do also attempt upon those things which are animate: though the Vital which is added unto them, partly breaks and quells those operations, and partly doth most powerfully increase and augment them. For it is most manifest, that many inanimate things can last a long time without any Reparation; whereas animate things do presently fall and are extinguished without Aliment or Reparation, as the fire also. Therefore there ought to be a double Inquisition: First, Contemplating mans body, as Inanimate, and without Aliment: Then as it is Animate and Alimeted. And having spoken thus much by way of Preface, let us now proceed to the Topics of the Inquisition; concerning which you must read the History of Life and Death.

FINIS.



THE
NATURAL
AND
EXPERIMENTAL
HISTORY
OF
THE FORM of HOT THINGS.

The Inquisition of Forms proceeds thus.

The first Aphorism.

UPON the proposed Nature, first there must be an apparance made before the understanding of all the known Instances which agree in the same Nature, though the matters be very unlike: And this Collection is to be made Historically, without any over-hasty Contemplation, or any transcendent subtilty: as for example in the Form of Hot Things.

Convenient Instances in the Nature of Hot Things.

1. The Beams of the Sun, especially in Summer, and at Noon time.
2. The Sun beams reflected, and kept up close and drawn together, as among Hills, or by Wals, and especially in Burning-glasses.
3. Fiery Meteors.
4. Burning Lightnings.
5. The breaking out of fire, out of the hollow parts of Hills, &c.
6. All manner of Flame.
7. Solid things set on fire.
8. Natural hot Baths.
9. Liquid things boyling or heated.
10. Hot smoaks and vapours, and the Air it self, which takes a strong and fierce heat if it be shut in, especially in Reverberatories.
11. Certain foultry hot times by the meer Constitution of the air, without any regard of the season, or time of the year.
12. A

12. A subterranean Air, enclosed in certain Caves, especially in winter time.

13. All woolly or hairy things, as Beasts Skins, or Hides, and Feathers, have a kind of warmth in them.

14. All manner of bodies, as well solid as liquid, as well thick as thin (such as the air it self is) being for a time brought near the fire.

15. Sparkles out of a Flint-stone, or out of Iron or Steel, caused by hand-striking.

16. Any kind of body strongly rubbed together, as stone, wood, cloth, &c. so that sometimes Axel-trees, and Naves of Wheels are set on fire: and the way of kindling of fire amongst the West Indians is by Attrition.

17. Green and moist herbs packt and thrust up together, as Roses, and Pease-cods, and Hay being laid up moist will many times take fire.

18. Unslackt quick Lime having water thrown upon it.

19. Fire when it is first dissolved by strong waters, or *Aqua Fortis* in a Glass, without setting any fire to it; and so likewise Pewter, &c. but not in such a high degree.

20. Living creatures, especially (and that continually) their Entrails; though in the Insects the heat be not so palpably perceived by the sense of feeling, by reason of the smallness of their bodies.

21. Horse-dung, and the like Excrements of beasts being newly made.

22. Strong oyl of Sulphur and Vitriol, shew the effects of heat in burning of linnen.

23. Oyl of *Origanum* and the like, shew their effects of heat also in burning of the teeth.

24. A strong spirit of Wine rightly made up, will shew the effects of its heat in such manner, that if you put the white of an egge into it, it will grow together and be white, almost like that of a boiled egge, and a piece of bread being thrown into it, will heat and be like unto a piece of toasted bread.

25. Spices and hot herbs, as Dragon, and old Cresses, &c. though they be not hot in the handling (neither whole nor yet the powder of them) yet being a little chewed, they are hot, and in a manner burning upon the tongue and the Palate of the mouth.

26. Strong Vinegar, and all sharp four things laid upon any part where there is no upper skin, as in the eye, or upon the tongue, or any other part when it is wounded or galled, do cause a kind of smart, like unto that which is produced by heat.

27. Also sharp and violent cold produceth a kind of tingling, like unto burning.

The Northern winds sharp penetrating cold burneth, &c.

28. Other things also which I omit for brevity.

This we use to call the Table of Essence and presence.

The second Aphorism.

SEcondly, there is manifestation to be made to the understanding of instances which are deprived of their nature which was first given them. For the Forme (as we said before) ought as well to be absent where the primary Nature is absent, as be present where it is present: But this would be infinite in all things. Wherefore Negatives are to be added

added to the Affirmatives, and Privations are onely to be looked upon in those subjects, which are nearly allyed to those others in which the Primary Nature is, and appears. And this we use to call the Table of Declination or Absence *in proximo*, or the next degree.

The nearest Instances which are deprived of the Nature of Heat.

A Negative, or Subjunctive Instance to the first Affirmative Instance.

The Moon and the stars and the Comets Beams are not found hot by the sense of feeling, yea one may observe extreame cold seasons at full Moons. But the greater fixed Stars when the Sun comes under them, or nigh unto them, are thought to increase and exasperate the heat of the Sun, as it is when the Sun is in *Leo*, and in the Dog-days.

Six Negatives to the second Instance.

1. The Sun-beams give not any heat in that which they call the middle Region of the air; for which is commonly given a tolerable reason. For that Region or part of the air is neither near unto the body of the Sun, from which issue the beams, nor yet unto the earth, by which the said beams are reflected. And this appears by the tops of those Hills which are of a great height, where the Snow lyeth continually. But on the contrary, it hath been noted by some, that on the top of the Peak of *Tenariff*, and also of some Hills of *Peru*, the tops of the hills have no snow upon them, the snow lying lower upon the ascent of the Hill: and besides, the air is not cold upon the tops of those Hills, but very piercing and sharp; so that upon those hills of *Peru*, it pricks and hurts the eyes with its too much acrimony, and pricks the Orifice of the Ventricle, and causeth vomiting. And it was noted by the Ancients, that on the top of *Olympus* there was such a tenuity of air, that they who ascended thither were fain to carry with them sponges steeped in Water and Vinegar, and hold them to their mouths and nostrils, lest the tenuity or subtilness of the Air should hinder their breathing. Upon the top of which mountain it was also said the air was so clear and free from Winds and Rain, that if the Priests had written upon the Ashes which remained upon *Jupiters* Altar after the Sacrifices had been there offered unto him, the Letters would remain there and not be blown away or blotted out, until the next year. And to this hour those which ascend to the top of *Tenariff*, which they do by night, and not by day, are called upon and haltned to descend presently after Sun-rising. For fear (as it should seem) lest the tenuity of the air should dissolve their spirits, and suffocate them.

2. The reflexion of the Sun-beams in those Countries which are nigh unto the Polar Circles, is very weak and ineffectual in its heat: so that the *Dutch* who wintred in *Nova Zembla*, when they expected their ship should be freed from the great heaps and mountains of Ice which were grown about it in the beginning of the Month of *July*, were frustrated of their hopes, and forced to come away in their ship boat: So that the Beams of the Sun seem to be of small strength when they are direct, even upon

upon plain ground: nor yet when they are reflected, unless they be multiplied and united, which happeneth when the Sun grows to be more perpendicular; for the incidence of the beams makes more acute Angles, so that the lines of the beams are more near; whereas contrariwise in great obliquities of the Sun, the Angles are very obtuse, and consequently, the lines of the beams more distant. But in the mean time we must note that there may be many operations of the Sun-beams, and in the nature of heat, which are not proportioned to our touch, or feelings; so that in respect of us they do not operate so far as calefaction or heating, but in respect of some other bodies, they may execute the Operations and Functions of heat.

3. Let us try such an experiment as this. Let there be a Glas made and framed of a contrary quality to a burning-Glas, and let this glas be held between the Sun and our hand, and let us observe whether that will diminish the heat of the Sun as a burning-Glas doth increase it. For it is manifest in the Optick beams, that as the Glas is of an unequal thickness in the middle and on the sides, so the things which are seen thorow them, are either more diffused, or more contracted. So the same should be in the matter of heat.

4. Let it be carefully tried, whether the strongest and best made Burning-Glasses can gather up the beams of the Moon in such sort as the least degree of warmth or tepidity may proceed from them. And if that degree of tepidity should be too weak and subtile to be perceived by the sense of feeling, let recourse be had to those kinds of Weather-Glasses that shew the Constitution of the air, whether it be hot or cold, and let the Moon-beams fall thorow a burning-Glas into the Orifice of this Weather-Glas, and observe whether the tepidity do cause any fall or abatement of the water that is in the said Weather-Glas.

5. Let the Burning-Glas be used over some hot thing that is not radiant, or luminous; as a hot Iron or stone, which is not red or fire hot, or boyling water, or the like: and let it be observed whether there be any increase or augmentation of heat, as there is in the Sun-beams.

6. Let a Burning-Glas also be tried with a common flame.

One Negative to the third Affirmative Instance.

There is no manifest or constant effect found in Comets, (if so be they also may be reckoned amongst Meteors) for the increasing the heat of the Weather according to the season of the year; though drought have commonly been observed to follow. Also bright beams and columns, openings of the Element, and the like, are more commonly seen in Winter than in Summer, especially in extream cold weather, so it be joynd with Drought. But Thunders and flashes of Lightning do seldome happen in Winter, but onely in time of great heat. But those (which we call) falling or shooting stars, are commonly thought to consist rather of some bright visions or slimie matter, set on fire, than of any stronger fiery Nature. But of this we will enquire further.

To the fourth one.

There are some Coruscations which yield light, but do not burn: And those are always without Thunder.

To the fifth one.

Eruptions, and breakings out of flames happen in cold Countries as well as in hot, in *Iceland* and *Greenland*: as also trees growing in cold Countries are sometimes more apt to take fire, and have more Pitch and Rozen in them than those which grow in hot Countries, as Fir and Pinetrees, and the like. But in what situation and nature of soil such breakings out use to be, that we might adde a Negative to the Affirmative, is not yet sufficiently enquired.

To the sixth one.

All manner of flame is perpetually hot, either more or less, neither can there any Negative be added. And yet it is reported, that which they call *Ignis Fatuus*, which also sometimes hits against a wall, hath not much heat in it; peradventure like the flame of spirit of Wine, or Aqua-vitæ, which is not fierce or scorching. Yet that seems to be yet a milder flame which we read of in some grave and credible Histories, that hath been seen to appear about the heads and hair of young boys, and maidens, which fire no way burned their hair, but softly seemed to flame and play about it. And it is certain, that in a night horses have been seen, when they swet with travail, to have a certain kind of lightning flashes upon them, without any manifest scorching heat. And not many years since was seen, and held for a kind of Miracle, a child's Apron, which being a little stirred and rubbed, flashed out with fire, and sparkles flew out of it, which might happen peradventure, by reason of the Salt or Allom where-with the Apron was Dyed, which might stick upon the Apron in Scales, which with violent rubbing might be broken. And it is most certain that all manner of Sugar, either Candid or otherwise (so it be hard) broken or scraped in the dark will shine and sparkle. Likewise sea-water violently stirred up with Oars, will give a light, and seem to burn, which kind of burning or light the Spaniards call the Sea-lungs. But what kind of heat that fire or flame yields which sea-men in ancient times were wont to call *Castor* and *Pollux*, and now in our days is called *St. Anthony's* fire, is not yet certainly found out.

To the seventh one.

Whatsoever is fiery, and turned into red heat, though it be without flame, yet it is perpetually hot; neither can there be any negative added to this affirmative. Yet there are some things which seem to be somewhat near thereunto: as rotten wood which shines in the night, and yet doth not feel hot: and the scales of rotten fish, which also glister in the dark, yet seem not hot, if you feel them; neither can there be any heat perceived in handling a Glow-worm which shineth so bright in the dark.

To the eighth one.

It is not yet thoroughly enquired concerning hot Baths, in what situation and kind of Soil they spring out; therefore there is no Negative added.

To the ninth one.

To liquid boiling or hot things is added a Negative of the liquid thing it self in its own Nature. For there is not any tangible liquid thing, which in its own nature is, and constantly endures and remains hot : but heat is only caused in it, as an additional, and acquired nature; and those things which in power and operation are very hot, as the spirits of Wine, Chymical Aromatick Oils, Oils of Vitriol and Sulphur, and the like; which after a little continuance will burn, yet at the first touching they are cold. The Water of hot Natural Baths taken up in Vessels and severed from its springs will grow cold as well as water heated at the fire. Oily bodies indeed are not altogether so cold to be touched as watry bodies are, and silk is not so cold as linnen. But these things belong to the Table of Degrees of cold.

To the Tenth one.

1. To a hot or fervent vapour, is added the Negative of the Nature of the Vapour it self, such as we find it. For Exhalations out of Oily things though they be easily inflamed, yet they are not found to be hot, unless they be newly exhaled from a hot body.

2. Likewise to a hot fervent Air is added a Negative of the Nature of the Air it self. For we do not find any air to be hot, unless it be shut up, or chafed, or palpably heated by the Sun, or by fire, or some other hot body.

To the eleventh one.

There is a Negative added of weather, which is colder than it should be at that season of the year, which happeneth upon a South-East or North-East winds blowing; as also contrary weathers happen, when a South or West South-West wind bloweth. There is likewise an inclination to rain (especially in Winter) when it is mild weather, and to frost in sharp cold weather.

To the Twelfth one.

There is a Negative added concerning Air inclosed in Caves in the summer time; But there must be a more diligent Inquisition made of inclosed Air. For first it is a Question (and that not without cause) what the Nature of the Air is of it self, concerng in heat and cold. For the Air doth manifestly receive heat from Celestial Impressions, and cold, peradventure, by the expiration of the earth; and again, in that which is called the middle Region of the Air, from cold vapours and snow: so that no judgement can be given of the Nature of the Air, by that air which lies open and abroad; but a truer judgment may be given by that which is inclosed and shut up. And again, that air should be inclosed and shut up in such a vessel or substance, which may not of it self qualifie the air, either with heat or cold; nor easily admit the force of the air which is without it. Let trial therefore be made with an earthen Pitcher, covered all over with double Leather to safeguard it from the outward air; keeping in the included air in such a vessel well closed for the space of three or four dayes; and

and the trial thereof after the opening of the vessel may be made, either by the feeling it with the hand, or by a Glass of Degrees, called a Weather-glass, well and orderly applied.

To the thirteenth one.

It is likewise a Question, whether tepidity, or lukewarmness in wool, skins, feathers, and the like, be by reason of some small inherent heat, because they are taken off from living creatures; or by reason of a certain fatness, and oiliness, which is of a Nature agreeing with tepidity; or meerly by reason of the conclusion and fraction of the Air, as was spoken in the precedent Article; for all Air which is cut off from the continuation of the outward air, seems to have some tepidity or luke-warmness in it. Let therefore trial of this be made in thready Stuffs which are made of Linnen, and not of Feathers, Wool or Silk, which are taken from living Creatures. It is also to be noted, that all manner of Dusts, or Pulverized things (in which Air is manifestly included) are less cold than the bodies of them: as we also hold all manner of scum or froth, (by reason that it contains air) to be less cold than the liquor it self.

To the fourteenth one.

To this there is no Negative added: For there is not any thing either Tangible or Spiritual, but will heat if it be set to the fire: Yet there is this difference, that some things will heat sooner, as Air, Oil, and Water; and some will be longer a heating, as Stone and Metals. But this belongs to the table of Degrees.

To the fifteenth one.

To this Instance there is no other Negative added, but that it is carefully to be observed, that no sparkles can be drawn out of a Flint, or out of Steel, or any other hard substance; but there are some parcels of the substance it self beaten off, either of the stone or Metall; and that the attrition of the aire it self can never produce or engender any sparkles, as it is commonly believed. And those very sparkles, by reason of the weight of the fired body, do tend downward rather than upward, and at their going out do turn to a kind of bodily foot.

To the sixteenth one.

We hold there can be no Negative added to this instance: For there is not any Tangible body to be found that will not manifestly heat with attrition or violent rubbing. So that the Ancients did dream that there was no other heating power or vertue in heavenly things, but by reason of the attrition or chafing of the air through a violent wheeling about. But concerning this, or in this kind, we must enquire further, whether such bodies or substances as are shot out of Engines (as Bullets out of Guns) do not receive some degree of heat from the percussio or blow it self, so that we find them somewhat hot after they fall. But the air being mov'd rather cools than heats: as we find in winds, and in a pair of Bellows, and the breath of a mans mouth drawn up together. But

this motion is not so violent as to excite heat: and it must be done without intermission and not by parcels, so that it is no marvail, if it does not cause any heat.

To the seventeenth one.

There must be a more diligent Inquiry made about this Instance; for green and moist Herbs and Vegetables seem to have some occult or hidden heat within them. But that heat is so small and weak, that it cannot be felt in each several one; but being laid and shut up together, so that their spirit cannot breath out into air, but feedeth and nourisheth each others; then there ariseth a manifest heat, and sometimes a flame, when the matter is fitting for it.

To the eighteenth one.

Also concerning this Instance there must be a more diligent Enquiry made. For quick or unslackt Lime seems to take heat by having water thrown upon it, either by the union of the heat which before was distracted, (as we said before of Herbs laid up close together) or by the irritation and exasperation of the fiery spirit by the Water, there being some conflict and antiperistasis between them. Now which of those two things may be the cause will more easily appear, if there be Oil thrown on instead of water: For the Oil will serve as well for the uniting of the inclosed spirit, though not for the irritation or provoking of it. Also there must be a larger experiment or trial made as well in ashes and lines of divers bodies, as by the putting in of divers sorts of liquors.

To the nineteenth one.

To this Instance is added the Negative of other Metals, which are more soft and fluid: For thin leaves of gold dissolved into liquor with the Royal water, yield no palpable heat in their dissolving; nor Lead in Aqua-fortis; nor yet Quick-silver, (as far as I can remember) but silver doth excite a little heat, and Copper, as I remember, but Pewter doth it more manifestly, and most Iron and Steel, which in their dissolution cause not only a strong heat, but also a violent kind of boyling: So that the heat seems to be caused by the conflict when the strong waters do pierce and rent in sunder the parts of the body. But where there is less resistance in the bodies, and that they easilier yield, there is hardly any heat excited.

To the twentieth one.

There is no Negative to be added to the heat of creatures, unless it be of Insects, by reason of the smallness of their bodies: For in Fishes compared with earthly Creatures, there is rather to be noted a degree of heat, than a privation. In Vegetables and Plants there is no degree of heat to be perceived in the feeling of them, nor in their gums, nor in their very Marrows being opened. But in Animal Creatures there is a great diversity of heat to be found, as well in their parts, (for one is the heat about the heart, another in the brain, another about the external parts) as in their accidents, as in their vehement exercitation, and Feavers.

To the one and twentieth one.

To this Instance there is scarce any Negative to be added: For the Excrements of Beasts, even after they are old and long ejected, manifestly have some potential heat in them, as may be perceived by their fattening of the ground.

To the two and twentieth one.

All manner of liquors which have a great and strong acrimony in them (be they either Waters or Oils) do execute the operations of heat in the rending in sunder or divulsion of bodies, and the adustion or burning of them after some continuance; yet at the first touching of them there can be no heat perceived. And they operate according to the analogie and pores of the body to which they are applyed. *Aqua Regis* dissolves Gold, but not Silver: And contrariwise *Aqua fortis* dissolves Silver, but not Gold, and neither of both these waters will dissolve Glasse: and so of others.

To the four and twentieth one.

Let there be a trial of the spirit of Wine, made in wood, or Butter, Wax, or Pitch, and see if it will any way melt any of them with its heat. For the four and twentieth Instance sheweth an imitative power of heat in it in incrustations or hardnings. So let there trial be made also in Liqefactions or Meltings. Let there also be a trial made, or Experience tried by a Glasse of Degrees, or a Weather-glasse, and let it have an outward hollow place at the top, and put spirit of Wine well rectified into that outward hollow place, and let the hollow place be covered, that it may the better contain the heat; and let it be observed whether by its heat it will cause the water to descend.

To the five and twentieth one.

Drugs and Herbs which are sharp and biting upon the Palate, much more being taken inward, are perceived to be hot: Let us therefore see upon what other Materials they do execute the works and operations of heat. Sea-men do report, that when heaps and great masses of Drugs or Spices which have been long shut and heaped up together, are opened on a suddain; they who turn them or take them out first, are in great danger of Feavers and Inflammations of their spirits. Likewise there may be trial made, whether the Powders of such Drugs or Herbs will dry Lard, or other flesh hanged over them, as the smoak of fire will.

To the six and twentieth one.

Acrimony or Penetration is as well in cold things, as Vinegar, and Oil of Vitriol, as in hot things, as Oil of Origanum, or the like. And so likewise in Animate things they cause pain and smart, and in inanimate things they pull in sunder the parts and consume them: neither is there any Negative added to this Instance: And in animate or living things, there is never any pain, but is accompanied with some kind of heat.

To the seven and twentieth one.

Many are the actions and operations which are common both to heat and cold, though in a diverse way. For Snow seems a while after the handling of it, to burn childrens hands: and cold keeps flesh from putrefaction as well as fire; and heat contracts bodies and makes them less, and so doth cold. But it is better to leave these and the like things till we come to enquire of cold.

The third Aphorism.

THirdly, there is apparence to be made before understanding of Instances, in which Nature (of which Inquiry is made) is according to more or less, either making comparison of the increase and decrease in the same subject, or making comparison the one with the other in divers subjects. For the form of a thing, being the very thing it self, and the thing not differing from the form otherwise than Apperancy and Existency, or Outward, and Inward do differ, as well in order to man, as to the Universe; It therefore necessarily followeth, that no Nature must be taken for a true form, unless it continually decrease when Nature it self decreaseth: and likewise continually increaseth when Nature it self is increased. And this Table we commonly call the Table of Degrees or Table of Comparative.

The Table of Degrees or Comparatives in Heat.

WE will first speak of those things in which there is no Degree at all of Heat, but seem only to have a kind of a Potential heat, or a disposition or preparation to heat. Then we will descend to those things which are indeed actually and palpably hot to the touch, and of their strength and degrees.

1. In solid and tangible bodies there is not any thing that of its own Nature is originally hot: For there is no stone, no metal, no sulphur, nothing that may be digged up; no wood, no water, no carcase of a beast that is hot. And the hot waters of Baths seem to gain their heat by some chance or accident, either by some fire or flame within the earth, such as we see is cast out of Mount *Aetna*, and other hills; or by the conflict and strife of bodies; as we see a certain heat excited in the dissolving of Iron, and Pewter, so that there is no degree at all of heat in things inanimate which can be felt by man: yet they differ in degrees of coldness, for wood is not so cold as Metal. But this belongs to the Table of degrees in coldness.

2. Yet many inanimate things are very much disposed to Potential heats, and preparations to flame, as Sulphur, Marle, and Salt Peter.

3. Those things which before were hot, as Horse-dung or Lime, or peradventure Ashes, or Soot, do retain certain hidden Relicks of their first heat, so that certain distillations and separations may be caused in some things by burying them in Horse-dungs; and heat is excited in Lime by casting water upon it, as we said before.

4. Amongst Vegetables there is not any Plant, or part thereof (as the Gum or Marrow) that seems hot being touched; But (as we said before) green Herbs laid up close together do heat. And so the inward feeling,

as that of the Palate, and Stomack; yea, and to the outward feeling also after they have been applyed for a while (as in Plaisters and ointments) some Vegetables are hot, and some cold.

5. There is no part of any Beast after it is dead, or severed from the rest of the body, wherein man can feel any heat: For horse-dung it self retains no heat in it, unless it be close laid up or buried. Yet all manner of dung seems to have a Potential kind of heat, as appears by its fattening and enriching of soil. And likewise the carkasses of living things have such a kind of hidden and Potential heat: So that in Church-yards, where people are buried dayly, the earth gathers a kind of occulted and hidden heat, which will sooner consume a body that is laid in it, than another pure earth. And amongst the Indians (as it is reported) they have a certain kind of thin and soft web made of Birds Feathers, which hath a kind of in-bred force, by which it will dissolve and melt Butter that is wrapped up in it.

6. All things that are of force to fatten and enrich soil, as Dung of all sorts, Chalk, Sea-sand, Salt, and the like, have a kind of disposition to heat.

7. Every Putrefaction hath in it self the beginnings or grounds of some small heat, though it cannot be perceived by the sense of feeling: For even those things which putrified turn to Maggots, as Flesh and Cheese, seem not hot when you touch them; neither doth that rotten wood which shineth and glistereth in the dark, feel hot. But there is a kind of heat in putrified things, which sometime betrays it self by the smell.

8. Therefore the first degree of heat, which by the sense of feeling is perceived to be hot, seems to be the heat of living things, which hath a great extent of degrees: for the lowest degree which is in Insects, is scarce to be felt, and the highest degree will hardly reach to that degree of heat which is in the Sun-beams, in hottest Countries and seasons: neither is it so sharp and vehement, but that you may endure your hand on it. And yet it is reported of *Constantius*, and some others, who were of an exceeding dry constitution of body, that being taken with a burning Feaver, they were so hot that you could not endure to hold your hand upon them.

9. Living Creatures have their heat increased in them, by Motion and exercise, by Wine and high food, venery, burning Feavers, and pain.

10. Living Creatures in Feavers which have intermission, in the beginning of their fits are taken with a chilliness and cold; and a while after they grow extream hot, which they likewise do in burning Agues and Pestilent Feavers.

11. Let further Enquiry be made of the Comparative heat in divers Creatures, as Fishes, four-footed Beasts, Serpents, Birds, and likewise according to their severall and special kinds, as in a Lion, a Kite, a Man. For according to the common opinion, the Inwards of Fishes are not very hot, but the Entrails of Birds are extream hot, as Pigeons, Hawks, and Estridges.

12. Let there also further enquiry be made of the Comparative heat in the same Creature, according to the diversity of its parts and members. For Milk, Bloud, Seed, Eggs, are found in a mean degree lukewarm, and less hot than the outward flesh of a Creature, when it moves or is driven. But what degree of Heat is in the brain, stomach, heart, and the rest, hath not likewise been enquired of.

13. All

13. All manner of Creatures, in winter, and cold weather are outwardly cold, but their inward parts are thought to be the hotter thereby.

14. The Heat of the Heaven of Element, in the hottest Countries and seasons is not so in high a degree as to burn dry wood, or straw, or light tinder which is made of Linnen, unless it be corroborated by the help of a burning-glass; and yet it may draw up vapours out of moist things.

15. According to the relation of Astronomers, there are some stars hotter than other some. And amongst the Planets, next to *Sol*, *Mars* is the hottest, then *Jupiter*, and then *Venus*. *Luna* is cold, and *Saturn* coldest of all. Amongst the fixed stars, the hottest is that called *Sirius*, then the Lions heart, or *Regulus*, then the Dog-star, &c.

16. The Sun casts most heat when it groweth nearest its perpendicular or Zenith; which is likewise so in other Planets, according to their portion of heat. As for example, *Jupiter* heats us more when he is in *Cancer*, or *Leo*, than when he is in *Capricornius* or *Aquarius*.

17. The Sun and the rest of the Planets do heat more when they are in their *Perigeons*, by reason of their nearness to the earth, than in their *Apogeons*. And if it happen at any time the Sun to be in his *Perigeon*, and withal near his Perpendicularity, it must needs heat more than when it is in its *Perigeon*, but more in obliquity. So that the Comparison of the Exaltation of the Planets ought to be noted whether it participate more of Obliquity or Perpendicularity, according to the variety of Regions.

18. *Sol*, and likewise the rest of the Planets, are thought to yield a greater heat when they are nearest to the greatest fixed stars: as when *Sol* is in *Leo*, it is nearer *Cor Leonis*, *Cauda Leonis*, and *Spica Virginis*, and *Sirius*, and *Canicula*, than when it is in *Cancer*, where notwithstanding it is nearest its Perpendicularity. And it is credible that the parts of the Heavens do infuse the greater heat, (though it be not perceptible to the feeling) the more they are adorned with stars, especially of the biggest kind.

19. The Heat of the Heavens is therefore increased three ways. By the Perpendicularity, the Propinquity or *Perigeon*, and by the Conjunction or Consorting of Stars.

20. Howsoever there is a great difference between the heat of living Creatures, of Celestial beams (as they come to us) and flame, though it be never so weak, and all things heated with fire, and liquid things, or the air it self being much heated by fire. For the flame of spirit of Wine, especially if it be rarified, and not thrust up together; yet is of force to burn straw, or linnen, or paper, which the heat of a Creature can never do, nor yet the heat of the Sun, without the help of a burning-Glass.

21. Besides, in flames, and fired things there are many degrees in the violence or weakness of heat. But of these there hath been no diligent Inquisition: so that we must of necessity lightly run them over. Of flames therefore that of the spirit of wine seems to be the softest, unless that which they call *Ignis fatuus*, and those flashes which are caused by the sweat of beasts be softer. Next is the flame of porous Vegetables; as straw, rushes, drie leaves, from which the flame of hair, or feathers doth not much differ. Next unto this is the flame of wood, especially such wood as hath not much rozen or pitch in it, and the flame of small wood (such as commonly is made up in Faggots) is softer than that of great logs.

logs, and timber, and roots of trees : a trial whereof may be made in Iron Furnaces, in which Faggots made of boughs of trees, are no way useful : Next to this (as we conceive) is the flame of Oil, Tallow and Wax, and such Oily and fat things which have not much acrimony in them ; but the strongest heat is in Pitch and Rozen ; and more fervent in Sulphur and Camphire, and Marle, and Salt-Peter, and Salts, (after the crude or raw matter is broken out) and in the compounds of these, as Gunpowder and Greek-fire, (which is commonly called Wild-fire) and several kinds of it, which have such an obstinate heat, that water will hardly put it out.

22. We also hold the flame which proceeds out of some imperfect Metals to be very strong and sharp : But of all these things we must enquire further.

23. But the flame of fierce and strong Lightnings seems to exceed all these : For it hath sometimes melted perfect Iron into drops, which none of those other flames could do.

24. In fired things also there are divers degrees of heat, of which also there hath been no diligent Inquisition made. We hold a most weak heat to be in burned Linnen, such as we use to kindle fire with, and likewise that of spungy wood, or dried Match, such as is used to fire Guns withal. Next unto these comes a burning wood-coal, or Charcoal, and fiery hot bricks, and the like. But of all fired things we hold fiery Metals to be the most vehement hot, as Iron and Copper, &c. But of these there must be further Inquisition made.

25. There are some fired things far better than some flames. For fired or red hot Iron is far hotter and more burning than the flame of the spirit of wine.

26. There are also some things which are not fired, but only heated with fire and air shut up in Reverberatories. Some do much exceed in heat doth flames and fired things.

27. Motion increaseth heat, as we may find by experience in bellows and blowing : so that some of the hardest kind of Metals will not dissolve or melt with a dead fire, without it be blown up.

28. Let trial be made by burning-glasses, with which, as I remember, this may be done. As for example, if the Glas be set at the distance of a span from the combustible object, it will not light nor burn so well as if it be set (as for example) at the distance of half a span length, and so softly and by degrees be drawn to the distance of a whole span length : yet the Angles and union of the beams is the same, but the Motion it self increaseth the operation of the heat.

29. It is that those burnings which happen when it is a strong wind do proceed further when they are against the wind than with the wind, namely, because the flame beats back with a quicker motion when the wind sends it back, than when the wind drives it forward.

30. Flame doth not break out, or engender, unless there be some Concavity in which the flame may move and play, unless it be in flatuous and windy flames of Gun-powder and the like, where the compression and imprisoning of the flame increaseth the fury of it.

31. An Anvil is much heated by the hammer ; so that if the Anvil were of a thin plate, we believe it might be heated by strong and continual blows of the Hammer, so far as to be red hot, as if it had been put in the fire. But this may be made trial of.

32. But in such fired things which are porous, and give space and way for the exercising of the Motion of the fire, if that Motion be hindered by a strong compression; the fire is presently put out, as when tinder, or a burning snuff of a Candle or Lamp is pressed or trodden out, presently the operations of the fire do cease.

33. The approaching or setting near of a thing to a hot body, increaseth the heat, according to the degree of approaching; and the same effect is in light. For the nearer the object is set to the light, the more visible it is.

34. The union of divers heats increaseth the heat. For a great fire and a little fire in the same place, do somewhat one with the other increase the heat: But lukewarm water put into boyling water cools it.

35. The remaining or long staying in a place of a hot body increaseth the heat. For the heat continually proceeding and issuing out, is mixed with the heat which was there before; so that it multiplyeth the heat. For a fire will not heat a Chamber so much in half an hour as it will do in a whole hour. But it is not so in light; for a Lamp or a Candle set in a place, will give no more light after a long stay, than it did at the very first.

36. An irritation or exasperation by the coldness which is round about, increaseth the heat, as we find by fire in frosty weather: which we believe to be done, not only by the keeping in, and contracting of the heat, which is a kind of uniting it; but also by exasperation: as when Air, or a stick is violently drawn together, it doth not flie out again punctually into its proper place, but goes further the contrary way. So let there be a diligent trial made, by a stick, or some such thing thrust into the flame, whether it doth not burn sooner thrust on the one side of the flame, than if it be thrust into the middle of it.

37. The degrees of taking in, or receiving of heat are many. And first of all you must note how small and little a heat will alter, and in some measure heat even such things as are least fit to take heat. For a Bullet of Lead, or any other metal will be somewhat heated by holding it for some time in a mans hands so easily is heat excited, and transmitted into any thing, the body being no way apparently changed.

38. Of all bodies air doth most easily take, and send back heat, which may be easiest perceived in the Weatherglasses. They are made in this kind: Take a glass with a hollow belly, and a long and small neck; let this glass be turned topsie turvie, the mouth downward, and the belly upward, and so let it be put into another glasse where there is water, touching the bottome of the receiving-glasse, with the mouth of the glass which is put in. And let the neck of the glass which is put, lean a little upon the mouth of the receiving-glass, which that it may the better do, let a little wax be laid about the mouth of the lower glass; but the Mouth must not be quite stopped, for fear lest for want of succeeding Air, the Motion which we shall presently speak, be hindered, which is very delicate and easie. But the glass which is put in must first have the top of it, which is the belly, warmed. Then after the glass is placed, as we have said, the Air will retreat and draw it self up together, (which before was dilated, and spread abroad by heating) after a sufficient pause, to quench that acquired heat to such an extent and dimension as the air at that time shall be when the glass is put in, and the water shall be drawn up to such a measure: And there must be a long and narrow paper hanged about

about it, and marked out with as many degrees as you shall think fitting. And you shall see as the time of the day grows hot or cold, that the Air will contract it self into the lesse compass by reason of cold, and extend and dilate it self by reason of heat, which shall be perceived by the water ascending when the Air closes up together; and descending when the air dilates or spreads it self abroad. And the sence of the air concerning heat and cold is so subtile and exquisite, that it goes far beyond the faculty of mans feeling: so that a Sun beam, or the heat of ones breath, and much more the heat of ones hand, it being laid a top of the glass will manifestly cause the water to descend. But we believe that the spirit of Beasts hath yet a more exquisite feeling of heat and cold, if it were not hindered and dulled by the mass of the body.

39. Next to the Air we believe those bodies to be most sensible of heat, which are most immediately changed and altered, from cold, as snow and Ice; for they begin to melt and be dissolved with the least heat and luke-warmness. Next to them peradventure is Quick silver. Next unto it are your fat bodies, or substances, as Oil, Butter, and the like; then Wood, then Water, and last of all Stons and Metals, which do not easily grow hot, especially inwardly. But these being once hot, do retain their heat for a long time; so that a Brick or a stone, or a hot Iron being put into a tub of water for a quarter of an hours space, more or less, will hold and keep their heat, so that you shall hardly be able to touch them.

40. The lesser the mass of the body is, the sooner it heats, a hot body being laid near to it; which sheweth that all manner of heat with us, is in some manner adverse and contrary to any tangible body.

41. Heat, as concerning the humane sence of feeling, is a various and respective thing: so that if we put our hand when it is cold into luke-warm water, the water will seem hot; if our hand be hot, the same water will seem cold.

The fourth Aphorism.

HOW poor we are in History every one may easily perceive, by that in the precedent Tables: We have been forced not onely to insert Traditions and relations instead of History, making some question and doubt of the Truth and Authority of them; but we have also oftentimes been constrained to make use of these or the like words: Let trial be made; or, let it be further enquired.

The fifth Aphorism.

AND we use to call the work and office of these three Tables, the appearance of the Instances to the understanding: and the appearance being made, the Induction it self is to be set a work. For upon the appearances of all and every Instance, such a Nature as may always be present or absent, may increase or decrease with the Nature which is proposed; and shall be, as we said before, a limitation of common Nature. This if the mind do at first and from the beginning attempt to do affirmatively (which being left to it self it always useth to do) we shall find ill determined notionals, phantasms, and imaginary things, and Axioms daily to be amended; unless we will (according to the custome of the Schools) fight for falsehoods. And yet they will questionless be either

better or worse according to the faculty and strength of the understanding which operates. To God (who is the giver and Maker of forms) or peradventure to Angels, and Understandings it may belong to know Forms immediately by way of affirmation, and in the beginning of Contemplation: But it is a thing indeed beyond mans capacity, who can at first proceed onely by Negatives, and at the last end with Affirmatives, after all manner of exclusion.

The sixth Aphorism.

THere must therefore a solution and separation of Nature be made; not by Fire, but by the Mind, as by a divine fire. Therefore the first work of a true Induction is (as concerning finding out of Forms) a Rejection or Exclusion of all, and singular such Natures which are not found in any Instance where the supposed Nature is present; or that are found in any Instance where the supposed Nature is absent; or that are found to increase in any Instance when the supposed Nature decreaseth, or to decrease when the supposed Nature increaseth. And then after the Rejection and Exclusion is rightly and duly made, in the second place (as in the bottom) will remain (all volatile opinions flying up into smoak) the solid, true, and well terminated Affirmative Form. And this is brief and easie to be spoken; but we must attain to it by many windings and circumstances: And peradventure we shall not omit any thing that shall make to this purpose.

The seventh Aphorism.

But we must continually take heed and beware, lest while we seem to attribute so many parts to Forms, the things we speak be wrested to those Forms to which mens thoughts and contemplations have hitherto been accustomed. For in the first place we do not now speak of copulated Forms, which are (as we said before) the marriages or conjunctions of simple Natures by the common course of the Universe, as of the Lion, Eagle, Rose, Gold, and the like. For it will be time to treat of them when we shall come to the hidden Progressions, and hidden Figurations, and the finding out of them, as they are to be found in substances (as they call them) or concrete Natures. And again, those things which we speak must not be understood, (also as concerning simple Natures) of abstracted Forms and Ideas, either not dermined or ill determined in the matter. For when we speak of Forms, we mean nothing else but those Laws and determinations of a pure act which do order and constitute some simple Nature, as heat, light, weight in any susceptible matter and subject: So that the Form of Heat, or the Form of Light, is the same thing as the Law of heat, or the Law of Light: neither do we ever withdraw our selves, or recede from the things themselves, and the operative part. Therefore when we say (as for example) in the Inquisition of the Form of heat; Reject tenuity, or tenuity is not of the Form of Heat, it is as much as if we said, a man may bring in heat upon a condensed or solid body; or contrariwise, a man may take, or put away heat from a thin and tenuous body. And if to any one it seems that our Forms also have something of the Abstract because they mix and joyn together Heterogeneous,

als; (for the heat of heavenly things and fire seem to be very Heterogeneous; the redness which is fixed in the rose or the like, and that redness which is the Rain-bow, or the luster of an Opall, or a Diamond; Death by drowning, Burning, by a prick of a Sword, by an Apoplexy, and by Consumption, and these do agree in the Nature of Heat, Redness, Death,) let him know that he hath an understanding captivated and kept in by custome, integrality of things, and by opinions. For it is most certain, that these things, though they be Heterogeneous and Alien, yet they agree in the Form, or Law, which ordains Heat, Redness, or Death. And that humane power cannot be emancipated and freed from the common course of Nature, and be enlarged and exalted to new Efficients, and new ways and means of operating, but onely by revealing and inventing of such Forms. And yet after this union of Nature, which is the most principal thing, we will afterward, in its proper place, speak of the divisions and veins of Nature, as well ordinary, as those which are internal, and most true.

The eighth Aphorism.

NOW we must propose an Example of the Exclusion or Rejection of Natures, which by the Tables of Appearance are found to be not of the Form of Heat: Giving you in the mean time to understand, that not onely each Table is sufficient for the Rejection of any Nature, but also each severall Instance contained in them. For it appears plainly by what hath been said, that every contradictory Instance doth destroy what may be thought of the Form: yet notwithstanding, for perspicuities sake, and to demonstrate the use of the Tables more plainly, we double or repeat the Exclusive.

An Example of the Exclusive, or Rejection of natures from the Form of Heat.

1. **B**Y the Beams of the Sun, Reject the Elementary Nature.
2. By common fire, especially fires under ground (which are most remote and secluded from the Celestial beams) Reject the Celestial Nature.
3. By all manner of Calefactions of bodys, (namely Minerals, Vegetables, exterior parts of Animals, or living Creatures, Water, Oil, Air, and the like) only by putting them near to the fire, or any other hot body, Reject all manner of Variety, or more subtile texture or composure of bodies.
4. By Iron and other metals made red hot, which heat other bodys, and yet are no ways diminished in their weight or substance; Reject the infusion or mixture of the substance of another hot thing.
5. By hot Water, and Air, and also by Metals and other solid things heated, but not to that degree to be fiery, or red hot; Reject Light.
6. By the Rays of the Moon and other Stars, (the Sun only excepted,) Reject also Light.
7. By the Comparison of Red hot Iron, and the flame of the Spirit of Wine (of which the Red hot Iron hath more heat, and less light, and the Spirit of Wine more light and less heat) Reject Light also.
8. By Gold and other Red hot Metals, which are generally of a most thick body; Reject Tenuity or Thinness.
9. By air, which for the most part is cold, and yet remains tenuous and thin. Reject also thinness or tenuity.
10. By

10. By Red hot Iron, which doth not swell in the mass, but remains still within the same visible dimension; Reject Local or Expansive Motion in general.

11. By the dilatation of air in Weather-glasses, and the like, which moveth manifestly, locally, and expansively, and yet receives no manifest increase of heat; Reject also Local and Expansive Motion in general.

12. By the easie Tepefaction or making Luke-warm of all manner of bodys without any destruction, or notable alteration; Reject the destructive Nature, or violent infusion of any new Nature.

13. By the consent and conformity of like operations done by Heat and Cold: Reject both Expansive, and Contractive cold in general.

14. By the kindling of heat by Attrition or violent rubbing together of bodys; Reject the Principal Nature. We call that Principal Nature which is found positive in Nature, and is not caused by precedent Nature: There are also other Natures, for we do not make up perfect Tables, but only set down Examples. All and singular the former Natures are not of the Form of heat. And man is free of all the foresaid Natures, in his operation upon heat.

The Ninth Aphorism.

IN the Exclusive are laid the grounds and foundations of the true Induction, which notwithstanding is not perfected until it be settled in the Affirmative. Neither is the Exclusive any way perfect, nor cannot be so in the beginnings. For the Exclusive is (as it plainly appears) a Rejection of simple Natures: and if we yet have not good and true notions of simple natures, how can the Exclusive be rectified? But some of those which we have spoken of (as the notion of the Elementary nature, the notion of the Celestial nature, the notion of Tenuity) are wandering notions, that are not well terminated. We therefore who both know and remember what a great work we undertake (namely to make the understanding of Man equal to things, and to nature) will no way give over with that which we have already spoken; but will carry the matter on further, and are framing and distributing stronger helps for the use of the understanding, which we will now adde. And truly for the interpreting of nature, the mind is to be so prepared and framed, that it may hold it self up in the true degrees of Certitude; and yet think (especially in the beginnings) that those things which are present, do much depend upon them which after.

The tenth Aphorism.

YET because truth is sooner gotten out of error than out of confusion, we think it were fitting to suffer the the understanding after it hath studied and pondered upon the three Tables of the first Appearance (such as we have laid them down) to prepare it self and attempt the work of the Interpretation of nature in the Affirmative, as well out of the Instances of the Table, as of those things which shall otherwise present themselves unto him. Which kind of Trial we use to call a Permission of the understanding; or a begun Interpretation, or first.

The first Vindemiation of the Form of Heat.

WE must note, that the Form of the thing is (as it plainly appears by what we have spoken before) in all and each of those Instances, in which the thing it self is, otherwise it would not be a Form: So that there can be no contradictorie Instance given. Yet the Form is found far more conspicuous and evident in some Instances then in others: namely, in such where the nature of Form is lesse restrained, hindered and reduced into order by other Natures: And such Instances are called Enlightnings, or Ostensive Instances. We must therefore proceed to the first Vindemiation of the Form of Heat. In all and singular Instances Nature whose limitation is heat, seems to be a motion, which is most plainly shewn in Flame, which always moveth, and in boiling or seething Liquors, which do continually move. And it likewise appears, in the hastning and increase of heat made by Motion, as in Bellows and Winds, whereof see Instance 29. Table 3. And likewise in other kinds of Motion, whereof see Instance 28. and 31. Table 3. Again it is shewn in the extinction of fire and heat by a strong compression, which stays and causeth Motion to cease: whereof see Instance 30. and 32. Table 3. It is also made manifest in this, that any kind of body is destroyed, or at least notably altered by any kind of fire, and strong and vehement heat. Whereby it plainly appears, that Heat doth cause a tumult and perturbation, and a sharp Motion in the inward parts of the body, which by little and little inclines to a dissolution. Let that which we have said of Motion, (namely that it is in place of a Genus to heat) not that heat ingenders Motion, or that Motion ingenders heat (though these be true in some thing) but that the very self-heat, or the quiddity it self of heat is Motion and nothing else, but limited by differences, which we will presently adde, after we have set down some Cautions to avoid the Equivocation. A thing hot to the sense is a respective thing, and in order to man, and not to the universal, and it is rightly laid as an effect of heat onely in the Animal spirit. And in it self also it is a different thing, seeing the same bodie (according as the sense is predisposed) brings in the perceivance both of heat and cold, as appears by the Instance 41. Table 3. Neither must the communication of heat or its Transitive Nature, by which one body laid to another body that is hot, doth also grow hot, be confounded with the form of heat. For heat is one thing, and Calefactive or causing of heat is another. For by the Motion of Attrition heat is brought in, without any preceding heat: whereby the Calefactive or causer of heat is excluded from the Form of heat. And likewise when heat is made by the approximation or drawing near of heat, this is not done out of the Form of heat, but wholly depends upon a higher and more common Nature, namely the Nature of Assimilation or Multiplication of it self; whereof must be a several Inquisition made. But the notion of fire is vulgar, and nothing worth; for it is composed of the concurrence or meeting of heat and brightness in some one body, as in ordinary flame, and bodies heated to the height of being red hot.

Laying therefore all Equivocals aside, we must at last come to the true Differences, which limit the Motion, and bring it into the Form of Heat.

The

THe first Difference therefore is, that Heat is an Expansive Motion, by which the body strives to dilate and spread abroad it self, to grow into a greater sphere or dimension than it held at first. And this Difference shews it self most manifestly in the flame where the smoak or fat breath doth manifestly open and dilate it self into flame.

It appears also in all boyling liquor, which manifestly swells, rises, and bubbles, and forces a way of extending it self, till it turns into a body of greater extent, and more dilatated than the liquor it self: namely, into vapour, or smoak, or Air.

It shews it self also in all manner of wood, or combustible things; wherein sometimes there is a sweating, and always an evaporation.

It shews it self also in the melting of Metals, which (being of a most compacted body) do not easily swell nor dilatate themselves, and yet their spirit after it is dilatated within it self, and consequently desires a greater dilatation, it thrusts and plainly drives the thicker parts into the liquid. And if the Heat be encreased, and made more violent, it resolves and turns much of it into volatile.

It shews it self also in Iron or Stones, which though they do not melt and run, yet they grow soft: which appears also in wooden rods or sticks, which being heated in hot Embers, become flexible.

But this Motion is best discerned in the Air, which by a little heat presently and manifestly dilatates it self, as by Instance 38. Table 3:

It shews it self also in the contrary Nature, namely of cold. For cold doth contract and shrink up all bodies; so that in extream cold weather nails will fall out of walls, Brass will crack, and Glass also being heated and presently laid in the cold will crack and break. The Air also with every slight cold will contract it self, as Instance 38. Table 3. But of these things we will speak more at large in the Inquisition of cold.

Neither is it to be wondred at, though heat and cold do work many common effects, (whereof see Instance 32. Table 2.) seeing there are two of the following Differences (which we will presently speak of) which belong unto both Natures: though in this Difference (whereof we now speak) the actions be diametrically opposite. For heat gives an Expansive and Dilatating Motion; And cold gives a Contracting and Shrinking Motion.

THe second Difference is a Modification of the first, namely this; That heat is an Expansive Motion, or a Motion towards the circumference, but with this limitation, that the body must withal be carried upwards. For questionless there are many mixt Motions: as for example, an Arrow or a Dart in going forward wheels about, and wheeling about it goes forward: So likewise the Motion of heat is both expansive and bearing upward.

This Difference plainly appears by putting of a fork or Iron Bar into the fire; for if it be put into the fire perpendicularly, and hold your hand upon it, it will quickly burn your hand, which it will not do so suddenly if it be put in side-way or lower.

It also appears by distillations in a Descending Still, such as are used for the tenderest kind of Flowers, the smell whereof easily vanisheth away: Wherein Industry hath invented this way to place the fire upon, and not under the Still, to the end that it may scorch less; for not onely flame, but all manner of heat naturally tends upward.

Let

Let a Trial or Experiment of this be made in the contrary nature of cold, namely, whether cold doth not contract the body descending downward, as heat doth dilate it ascending upward. Take two Iron rods, or two glass Trunks, both of one bigness and proportion, and let them be made somewhat hot, and lay a sponge dipped in cold water, or some snow under one, and upon the other; And we believe that will sooner be cold, all over which hath the snow above it, than that which hath the snow beneath it: Contrary to the effect which is wrought by heat.

The third Difference is, that heat is a motion not uniformly Expansive in all parts, but in some lesser parts of the body; and withal restrained, repelled, and reverberated, so that it turneth to an alternative, trying, and striving motion, chased by the repercussion, whence the raging of heat and fire takes it beginning.

And this difference is most of all perceived in flame and boiling liquors; which always quake, and swell up in small parcels, and then sink again.

It is shewn also in those bodies which are so hardly compacted together, that being heated or fired, they do not swell nor increase their bulk or mass; as red hot Iron, in which is a most sharp heat.

This appears also in that, that fire scorcherh most in cold weather.

Likewise it appears by this, that when Air is extended in a Weather-glass, without any let or repulsion, that is to say, uniformly and equally, the heat is not perceived. Likewise in winds which are inclosed and shut up, though they break out with a mighty force, yet there is no notable heat perceived; because the Motion is of the whole, and not alternative by parcels. And for this let trial be made, whether flame doth not burn more sharply toward the sides than in the middle.

It appears also in this, that all manner of burning is performed thorow small pores of the body which is burned; so that burning doth undermine, penetrate, dig, and prick, as if there were an infinite sort of needles. And thence it comes that all strong waters (if they be proportioned to the body upon which they operate) do work and operate like fire, thorow their corroding and piercing Nature.

And this Difference, whereof we now speak, is common to the Nature of cold, in which the contractive Motion is restrained by the retinency or opposition of expansion: As in heat the expansive motion is restrained by the retinency or hanging back of contraction.

So that whether the parts of the body do penetrate inwardly, or outwardly, the reason is alike; though the strength or force be very unequal and different; for we have not here with us upon the superficies of the earth any thing that is cold in an Extream degree. See Instance 27. Table 9.

The fourth Difference is a modification of the first; Namely this, that the motion of pricking or penetration, must be somewhat swift, and not slow and dull; and that it must be done by parcels, though small ones: yet not extream small, but of a mean bigness.

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This Difference appears in comparing of the operations done by fire with those which are performed by time or age. For age or time dries up, consumes, ruins, and turns to ashes as well as fire, or rather more subtilly. But because such a kind of motion is very slow, and is wrought upon very small parcels, the heat is not perceived.

It appears also in comparing the dissolvings of Iron and Gold; for Gold is dissolved without raising any heat, but Iron with a most vehement stirring up of heat, though for the time, it be almost in the same quantity. Because that in Gold the ingress or entrance of the water of separation is mild, and insinuates it self subtilly, and the parts of the Gold do yield easily: But in Iron the ingress is harsh, and with some conflict, and the parts of the Iron shew more obstinacy.

It appears also in some Gangrenes, and Mortifications of the flesh; which do not cause any great heat or pain, by reason of the subtilness of the Putrefaction.

And let this be the first Vindemiation or inchoated interpretation of the Form of heat, made by the permission of the understanding.

And by this first Vindemiation the Form or true Definition of heat, (namely of that heat which in respect of the Universal, not only relative to the sense) is in few words this. Heat is an Expansive Motion, cohibited, and striving by the lesser parts: and Expansion is modified, that expanding or spreading it self out in circuit, it must notwithstanding incline somewhat upward; and that striving by parts is likewise modified, that it ought not to be altogether slow, but somewhat swift, and with some violence.

And concerning what belongs to the Operative it is the same thing; for the Designation or Description is this: If in any natural body you can excite a Motion to dilate and spread out it self, and can stay back that motion, and so turn it against it self, that dilatation may not proceed equally, but partly proceed, and partly be beaten back, you will questionless engender a heat: not any way regarding whether it be an Elementary body, (as they call it) or imbrued by the Celestial; whether luminous or dark; whether thin or thick; whether locally spread abroad, or contained within the inclosures of the first dimension; whether tending to dissolution, or remaining in the same state, whether Animal or Vegetable; whether Mineral or Water; whether Oil or Air, or any other substance whatsoever, so it be susceptible of the foresaid motion. A hot thing to the sense is the same, but with such an Analogy as is fitting for the sense.

The Division of Heat.

It seems to be a customary and authentical division, that there are three kinds of heat; Namely, the heat of Celestial things, the heat of Animals, or living creatures, and the heat of fire; and that these heats, (especially one of them compared to the other two) are in their essence and kind, or their specific Nature, meerly different, and altogether heterogeneous. For the heat of heavenly and animal things ingenders and cherishes; whereas contrariwise the heat of the fire corrupts and destroys.

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There is therefore an Instance of contract, and that is a common trial when we take a branch of a Vine into a room where there is ordinarily a fire, by it Grapes will ripen sooner than they will abroad, by a month. So that the ripening of fruit even when it hangs upon the tree, may be effected by fire, which seems to be a proper work of the Sun. So that from this beginning the understanding easily raiseth it self, rejecting the essential Heterogeneity, to enquire what, or which are those differences which are really and truly found between the heat of the Sun, and that of the fire, from which it proceeds that their operations are so diverse and different, though they themselves participate in a common nature: which differences we shall find to be four. The first that the Heat of the Sun, in respect of the heat of the Fire, is in degree much softer and milder. Secondly, that it is (especially as it is conveyed to us thorow the Air) of a much more moist quality. Thirdly, (which is the very chiefest of the business) that it is extremely unequal, and drawing near and increased, and then receding or going back and diminished, which is of no small moment or improvement in the generation of bodies. For *Aristotle* did most truly affirm, that the principle cause of generations and corruptions which are here with us upon the superficies of the earth, is the oblique way of the Sun thorow the Zodiack: whereby the heat of the Sun, partly thorow the vicissitudes of day and night: partly by the successive seasons of winter and summer, proves wonderfully unequal: Neither doth this man end there, but presently spoils and makes bad that which he had rightly found out. For as an Arbitrator of Nature, (which is his common practice) he Magistrate-like assigns the cause of Generation to the approach of the Sun, and the cause of corruption to the receding and going away of it: When both (namely, the access, or recess of the Sun) not respectively, but in a manner indifferently, yield cause as well for Generation as Corruption: forasmuch as the inequality serves onely to the Generation and Corruption of things, and equality to the preservation of them. There is also a fourth Difference between the heat of the Sun, and the heat of the fire, which is of great moment: namely, that the Sun insinuates its Operations in long spaces of time: whereas the Operations of Fire (Mens impatience forcing it thereunto) do bring things to an issue in a shorter time. For if any man shall carefully attempt, to temper the heat of the Fire, and reduce it to a more moderate and mild Degree (which may be done many ways) and sprinkle it, and mix it with some moistness, especially if he imitate the heat of the Sun in its inequality; and lastly, tolerate or suffer delay patiently (not such a delay as shall be proportionable to the operations of the Sun, but more than that which men use to have in the operations of the Fire) he will quickly lay aside that Heterogeneity of heat; and either he will, or equal, or in some things even exceed the operations of the Sun, by the heat of the Fire. The same Instance of Covenant is, the reviving of Butter-flies stupified and as it were dead thorow Cold, with a little luke-warmness of fire: Whereby you may easily discern, that the Fire may as well vivifie living things, as ripen Vegetables.

Also that famous Invention of FRACASTORIUS, of a Frying-panne strongly heated, which Physicians hold about the Heads of those who are fallen into a desperate Apoplexie, which manifestly

dilates and extends the Animal Spirits contracted and pressed together, and almost extinguished by Humours and Obstructions of the Brain, and excites them to Motion even as Fire doth Water or Air, and consequently vivifieth. Likewise Eggs are sometimes hatched by the Heat of Fire, and many such like things are done; whereby no man can question, or make a doubt, but that the Heat of fire in many subjects may be Modified to the Image of Celestial and animal Heat.

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The Lord FRANCIS BACON of *Verulam*
of the several kinds of Motion.

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Of the active Vertue.

Of Divers Kinds of Motion.

LET the first Motion be of the Antitype of matter which is in each parcel and portion thereof, whereby it will not be quite annihilated and brought to nothing: so that no burning, no weight or depression, no weight nor no violence, nor any age or length of time can reduce any the smallest portion of matter to nothing; but it must still be something, and take up some place, and free it self, (into what necessity soever it be brought) either by changing form or place, or (if it can do no otherwise) subsist as it is. Neither doth it ever come to that pass, either to be nothing, or no where. Which Motion the Schools (which almost always name and define things rather by effects and discommodities, than by Internal causes) either points at by that Axiome, That two bodies cannot be in one place; or calls it a Motion, that there may be no penetration of dimensions. Neither is it fitting to propose any examples of this Motion; for it is in every manner of body.

Let the second Motion be the Motion which we call of Connexion by which bodies will not suffer themselves in any part to be severed from the touching of another body, as rejoycing in that mutual connexion and touching. Which Motion the Schools call the Motion of their being no vacuity; as when water is drawn up by sucking, or by Pipes; the flesh by Ventoses or Cupping-glasses; or when water stands still and remains in Pitchers with holes in them, unless the Pitcher be opened, and the Air let in; and many things of this kind.

Let the third Motion be that Motion which we call of Liberty, by which bodies seek to free themselves from a preternatural pressure or stretching, and restore themselves into a dimension fitting for their bodies. Of which Motion there are likewise innumerable examples, (as concerning the freeing from Pressure) of water in swimming, of air in flying, of the Water in rowing, of the Air in the waving of winds: Neither doth the Motion of the Air thrust up together, shew it self very absurdly in Guns, which Children play with, and are commonly called Pot-guns, which are made of a piece of Elder made hollow, into which they thrust a piece of some juycie root or the like at both the ends: then with a Scowrer they thrust this root up at one end towards the other

root

root which is at the other end, which flyeth out with a sound before the lowermost root or the scourer toucheth it. As, for the freeing from tenuity or stretching, this Motion shews it self in an Egg-shel after the Egge is sucked up, in Strings; and Leather, and Cloth, which will shrink up again after they are stretched, unless they have quite altered their dimensions by standing too long a time stretched, &c. And this Motion the Schools call the Motion out of the Form of the Element; and that ignorantly enough, seeing that this Motion belongs not only to air, water, and flame, but to every diversity of consistencies; as of Wood, Iron, Lead, Cloth, Parchment, &c. In which each severall bodies have a model or prefixed extent of their dimensions, and from thence are hardly drawn to any notable space. But this Motion of Liberty being most obvious and belonging to infinites, it will be advisedly done to distinguish it plainly and well; for many do most carelessly confound this Motion with the other two of Antitype and connexion. Namely, the Motion from Pressure, with the Motion of antitype, and that of extension with the Motion of connexion. Therefore if the compressed bodies did yield or extend themselves that there might not follow a Penetration of dimensions, the bodies extended would grow back and contract themselves that Vacuity might not follow: But if compressed air would recover and turn it self into the thickness or density of Water, or Wood into the density of a stone, penetration of dimensions would be needless; and yet there might be a far greater Compression than they can any way admit of. And in the same manner, if Water could dilatate it self into the rarity of air, or a Stone into the rarity of Wood, there would be no need of vacuity; and yet there might be a far greater extension of them, than they can any way suffer. Therefore the thing is not reduced to Penetration of dimensions, and vacuity; but only in latter ends of Condensation and Rarefaction; when notwithstanding, these Motions stay and stop a long way on this side of them, and nothing else but desires of the bodies to preserve themselves in their own Consistencies, (or if they had rather, in their own Forms) and not to recede from them suddenly, unless they be altered by mild means, and by consent. But it is far more necessary (because it draws many things after it) to have it intimated unto men, that a Violent Motion (which we call Mechanical; and *Democritus*, who in expediting of his first Motions may be accounted less than the meanest of Philosophers, calls the Motion of the Coast) is nothing else but the Motion of Liberty, namely from compression to Relaxation. For in every simple Protrusion and thrusting forward, or flying in the air, there is no summotion or local carriage, before the parts of the body do preternaturally, or beyond nature suffer, and be compressed by the driver; and then the Parts successively thrusting one another, the whole is carried, not only going forward, but withall wheeling: that by this means the Parts may free themselves, or suffer more than is just. And so much for this Motion.

Let the fourth Motion be that which we have termed Motion of *Hyles*; which Motion is in a manner contrary to that Motion which we have spoken of, namely, the Motion of Liberty. For in the Motion of Liberty, the bodies do utterly abhor, reject and shun a new Dimension, or new Sphere, or new Dilatation or Contraction, (for this variety of words express all one thing) and strive with all their might to recover, and return to their old Consistency. But contrariwise in this motion of *Hyles*, the bodies do

desire

desire a new Sphere or Dimension, and do willingly, and withall their might (as in Gun-powder) hasten towards it. But the most powerful, and most frequent, if not the onely instruments of this motion, are Heat and Cold. As for example, if air be dilatated by Tensure or stretching out, as by sucking of Glals-Eggs, it hath a longing desire to be restored: But if you apply Heat to it, it will contrariwise desire to be dilatated, and to be in a new Sphere, and passes into it willingly as into a new Forme, as they call it. Neither after it is dilatated doth it care for returning, unless it be invited to it by application of some cold thing, which is not properly a return, but a repeated Transmutation. And in the like manner, water, if it be restrained within narrower bounds by compressi- on, it spurns against it, and desires to be again what it was, namely, larger. But if there comes a strong and continued cold, it changeth willingly and of its own accord, and is condensed into Ice: and if the cold continue, and is not interrupted by warm weather, (as it is oftentimes in deep Caves and Grotts) it turns to Chrystal, or some such like matter, and is never restored to its primitive being.

Let the fifth motion be the motion of Continuation; we do not mean the simple and primary continuation with some other body or substance (for that is the motion of Connexion) but of Continuation of it self in a certain body. For it is most certain, that all bodies do abhor the dissolution of Continuity, some more, some less, but all in some measure. For as in hard bodies, (as steel or glass) the reluctancy against Discontinuation is very strong; so in Liquors, where this kind of motion seems to cease, or at the least languish, yet there is not an absolute pivation of it, but it plainly remains in them, as in the lowest degree, and shews it self in, and by many experiences, as in Bubbles, and the roundness of drops, in the smallest threads of running Gutters, and in the holding together, and drawing out as it were in threads of glutinous bodies, and the like. But this desire is most plainly apparant, if we attempt a discontinuation by lesser fractions. For in Mortars after Contusion is made to a certain degree the Pestel operates no more: Water will not get in at the smallest chinks or crevices: and Air it self notwithstanding the subtileness of its body, cannot suddenly pass thorow the pores of solid Vessels, but by a long insinuation.

Let the sixth Motion be the motion which we call a Motion to Lucre or Gain: Or the motion of Indigency or Want. Which is that by which bodies when they converse amongst others, which are meerly Heterogeneous, and as it were enemies; if they can but get a conveniency or means to avoid those Heterogeneals, and apply themselves to such as have more affinity with them, (though even they do not thorowly agree with them) they presently embrace them, and make choice of them, and seem to make some gain thereby; from whence we have taken the word, as being in want and Indigency of such bodies. As for example, Gold or any other metal beaten out to leaf, delights not in having Air about it; therefore if it can come at some thick and tangible body, (as a finger, paper, or the like) it sticks presently, and can hardly be gotten off. Likewise Paper, and Cloth, and the like, do not well agree with the air which is inserted and commixed in their Pores; wherefore they willingly drink in water, and drive out the Air. Likewise Sugar or a Spung put into Water or Wine, though part of them stand up, and be far above the Water or Wine, yet by little and little, and by degrees they draw the Water or Wine up-
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wards. From whence is taken an excellent rule for the opening and solution of bodies; for laying aside Corrosives, and strong waters, which open a way for themselves, if there might be found a proportionate and more agreeing and consenting solid body, than that wherewith it is (as it were through necessity) mixed, presently the body slacks, and opens it self, and receives the other within it, excluding and putting away the first. Neither doth this Motion to Lucre onely operate, or hath power upon the feeling: For the Operation of Amber, (of which *Gilbertus* and others since him have raised such Fables) is no other but the Appetite of the body raised and excited by some light frication or rubbing, which doth not very well tolerate the Air, but had rather have some other tangible thing, if so be there be any near unto it.

Let the seventh Motion be the Motion (which we call) of greater Congregation; by which bodies are carried to the masses of the Connatural, as ponderous things to the Globe of the earth, light things towards the circumference of the heavens. This the Schools upon slight contemplation have specified by the name of Natural Motion: Because there was nothing of *ab extra*, or externally to be seen which should cause that Motion, (therefore they thought in-bred and placed firmly in it:) Or peradventure because it doth not cease: Which is no marvel, for the heaven and the earth are always ready and at hand; whereas contrariwise, the causes and beginnings of most of the other Motions are sometimes absent sometimes present. Therefore because this doth intermit, but always meets the other when they intermit, they made this perpetual and proper, and the rest as it were but acquired. But this Motion is indeed weak and dull enough, as succumbing and yielding (unless there be a greater mass of body) to other Motions as long as they are in operation. And though this Motion hath so filled mens thoughts, that it hath almost hidden all other Motions, yet it is but little that men know of it, but are plunged in many errors about it.

Let the eight Motion be the Motion of the lesser Congregation, by which the Homogeneous parts in any body separate themselves from the Heterogeneous, and come together amongst themselves: by which also whole bodies, through similitude of substance, embrace and nourish one another, and sometimes are congregated and drawn together from some distance; as when the cream, after some pause of time, swims upon the top of the Milk, the Lees and Tartar settle at the bottom of the Wine. For these things are not done by the motion of Gravity and Levity, that some parts swim at the top, and others go to the bottom, but through the desire of the Homogeneous of coming together, and uniting themselves. And this motion differs from the motion of Indigency in two things. The first, that in the Motion of Indigency there is a greater provocation of the Malignant and contrary nature: but in this motion (if there be no obstacles or ties) the parts are united by friendship, though the Alien Nature be absent, which moveth strife. The second thing wherein they differ, is, that the union is more strict, and as it were with more delight: For in the other, so that the adverse body be shunned, those bodies which have no great affinity one with the other, notwithstanding concur: But in this substances come together, which are knit one to another as it were by a twin-like substance, and are in a manner made up into one. And this motion is in all compounded bodies, and would easily be seen in each one of them, if it were not tyed up
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and restrained by other appetites and necessities of bodies, which disturb this Coition and going together. And this motion is most commonly tyed and bound up three ways; By the numness of bodies; The curb of the predominant body; And the external motion. As for the numness of Bodies, it is most certain, that there is in all Tangible bodies a kind of sloth, either more or less, and a kind of aversion from local Motion, so that unless they be excited and stirred up thereunto, they had rather remain in that state wherein they are, than seek after a better. And this Numness, or Dulness, or Sloth, is to be shaken off by a threefold help: Either by heat, or by an eminent Vertue of some allyed body, or by a lively and powerful motion. And first as concerning the assistance of heat, from thence it proceeds that heat is defined to be that separates Heterogeneals, and brings Homogeneals together. Which definition of the *Peripateticks*, *Gilbertus* did most deservingly deride, saying that it is as if a man should define a man to be it which soweth Corn, and planteth Vineyards, which is but only a Definition by effects, and those also particular ones. And this Definition is yet further to be blamed: For those effects (whatsoever they be) proceed not from the propriety of heat, but only by meer accident (for cold will do the same, as we shall shew hereafter) namely, by the desire which Homogeneous parts have to come together: Heat onely helping to shake off the dulness, which before had bound up the desire. Secondly, as concerning the Assistance of the vertue of the allyed body that doth wonderfully appear in an armed Load-stone. For the Nature of an armed Load-stone is such, that at a certain distance it will not draw nor attract Iron stronger than a Load-stone which is not armed: but if the Iron be brought so near to it, that the armed Loadstone touch it, it will take up a greater quantity of Iron than a plain and unarmed Loadstone, by reason of the similitude of the substance of Iron to Iron. Thirdly, as concerning the assistance of Motion, it may be perceived in Arrows which are made all of wood, and are not headed with Iron, of which it is reported, that being shot out of a Peece of Ordnance will penetrate further into any wooden substance (as the sides of ships or the like) than those which are headed with Iron, by reason of the substances similitude wood to wood, though this vertue lay hidden in the wood, the numness of the wood being shaken off by the celerity of the Motion. But the binding of the Motion of the minor Congregation, which is by the curb of the Dominating or commanding body; it appears in the dissolving of blood and urine by means of cold: For as long as those bodies are replenished with an active spirit, which as Master of the whole orders, and keeps in each singular part, so long the Heterogeneous cannot come together, by reason of the curb: But when that spirit is once evaporated or suffocated by cold, then the parts freed from the curb come together according to their own natural desire. And thence it proceeds that all substances which contain a sharp spirit, (as Salt and the like) last and do not dissolve by reason of the lasting and permanent curb of the commanding and imperious spirit. The binding of the motion of the Minor Congregation, which is done by an external motion is especially perceived in the Agitations of Bodies, by which Putrefaction is hindered. For all manner of Putrefaction is grounded upon the Congregation or gathering together of Homogeneals, whereby by little and little is caused the Corruption (as they call it) of the first form, and the generation of another new one. For the dissoluti-

on of the old form goes before Putrefaction, which prepares the way to the Generation of the new form, which is the Coition it self to Homogenia, and that if it be not hindred becomes a simple solution; but if there come divers things in the way to hinder it, then Putrefactions follow, which are rudiments or beginnings of a new Generation. And if (which is the thing we have now in hand) there be a frequent agitation by an external motion, then this motion of Coition (which is delicate and tender, and desires rest outwardly) is disturbed and ceaseth, as we see in an innumerable company of things: As when a daily agitation or running water expels Putrefaction, Winds drive away the Pestilence of the Air, Corn in Garners of the Air, or Store-houses turned and tossed up and down continue pure, and finally all things that are agitated outwardly, do not easily putrifie inwardly. We must not at last omit that Coition or going together of Parts of the body, which chiefly causeth Induration, or Desiccation. For after the spirit, or some humidity turned into spirit is fled out of some porous body (as in Wood, a Bone, a Parchment, and the like) then the thickest parts are contracted and grow up together with greater vehemence, whereupon grows Exsiccation, or Induration, which we believe to be done, not so much by the motion of Connexion, that there may be no vacuity as by this motion of Amity and Union. As concerning the Coition at distance, that is very unfrequent and rare, and yet it is in more things than is observed. The representations of these are one bubble dissolving another. Medicaments draw humours out of the similitude of substance; one string moves another string in a several instrument to an Unison and the like. I conceive this kind of motion likewise to be in the spirits of living or animal things, but this is as yet unknown. But certainly it is eminent in the Load-stone and Iron raised up. Now when we speak of the motions of the Load-stone, they must be plainly distinguished: for there are four vertues or operations in the Load-stone which ought not to be confounded but separated, though the admiration and stupidity of men hath mixed them, the one is the Coition or coming together of the Load-stone with the Load-stone, or of Iron with the Load-stone, or of Iron with Iron touched therewith. The second is of its turning North and South, and also of its Declination: the third is of its penetrating through Gold, Glass, Stone, or any thing: The fourth is of the Communication of its vertue from the stone into Iron, and from Iron into Iron, without any communication of the substance: but in this place we speak only of its first vertue; namely, of its Coition or coming together. That is also a notable Coition of Quicksilver and Gold, so that Gold will attract Quicksilver, though it be made up in Unguents, and those who work amongst the vapours of Quick-silver, use to hold a piece of Gold in their mouths, to gather together the emissions of the Quick-silver, which would otherwise invade and penetrate their craniums and bones, and causeth the gold so held in their mouths to turn white. And thus much shall suffice to be spoken of the motion of the lesser Congregation.

Let the ninth Motion be the Magnetick Motion, which though it be of the same kind, as the Motion of the Lesser Congregation; yet if it operate at great distances, and upon great masses of things, it deserves a several Inquisition: especially if it do not begin with touching, nor doth not bring the action to the touch, as all Congregating Motions do; but only elevates the bodies, or causes them to swell, and no more. For if

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the Moon raiseth the waters, or causeth moist things to swell up; or the starry sky draws their Planets towards their Apogea; or the Sun binds together the stars of *Venus* and *Mercury*, that they can go no further from his body then to such a certain distance. These Motions seem cannot be well placed neither under the Major nor Minor Congregation, but are as it were middle or imperfect Congregatives, and must have a proper species or kind to themselves.

Let the tenth Motion be the Motion of Flight or Shunning: Namely, a Motion contrary to that of the Minor Congregation: by which bodies through Antipathy flie from such bodies as are enemies to them, separate themselves from them, and refuse to mix with them. For though in some things this Motion seem to be only an accidental Motion, or by consequence, in respect of the motion of the lesser Congregation, because Homogeneals cannot come together, but the Heterogeneals must be excluded and removed. Yet this motion must be placed by it self, and be made one several kind or species, because in many things the desire of Flight is less principal than the appetite or desire of Coition or coming together. And this Motion is most eminent in the Excrements of living Creatures, and likewise in the hateful objects of some senses, especially those of smelling and tasting. For a stinking smell is so hateful to the sense of smelling, that it brings the motion of expulsion into the Orifice of the stomach by consent: a bitter and horrid savour is so rejected by the Palate or the throat, that it causeth a shaking and horror of the head by consent. But this Motion doth likewise take place in other things, for it may be perceived in some Antiperistases; as in the middle Region of the Air, whose coldness seems to be the rejection of Natural coldness from the heavenly confines; as likewise those great heats and Inflammations which are found in subterranean places, are rejections of the hot Nature from the Bowels of the Earth: for heat and cold, if they be in a Minor or lesser quantity, do destroy each other; but if they be in greater Masses, and as it were in equal Armies, they thrust one another out of place. It is reported also, that Cinamon, and other fragrant and odoriferous Plants being set by Privies and stinking places, will retain their own fragrantcy the longer, as refusing to come forth and mix themselves with the stinking smells. And truly Quick-silver, which would otherwise reunite it self into an entire body, is hindered from it by mans spittle or Barrows-grease, or Turpentine, and the like, and cannot gather its parts together, by reason of their dissent with such bodies, from which being circumfused round about them, they withdraw themselves. So that their flight from these interjacent things is of more force than the desire of reuniting themselves with those parts which are of the same kind; and this is called mortifying or killing of Quick-silver. Also that Oyl will not mix with water, is not onely by reason of the difference of levity or lightness, but by reason of their evill agreement, for the spirit of Wine which is lighter than Oyl will mix with water. But this motion of Flight is most notable in Niter, and such like crude bodies which do abhor fire, as Gunne-powder, Quick-silver, Gold, and the like. But the Flight of Iron from the other Magnetick Pole is by *Gilbertus* very well observed to be not properly a Flight, but a Conformity and Coition to a more convenient situation.

Let the eleventh Motion be the Motion of Assembling, or Multiplying of its self, or of simple Generation. And we call simple Generation not of whole or Integral bodies, as in Plants and living things, but of simular or like bodies; That is to say, that by this Motion bodies which are alike do turn other bodies which have some affinity with them, or at least are well disposed or prepared, into their own substance or Nature: As flame which multiplies it self upon breaths and oylie things, and ingenders a new Flame: Air, which upon water and watery things multiplies it self and ingenders a new Air: The Vegetible spirit which multiplies it self in its nourishments upon the most subtile and thin parts, as well of watery as oylie things, and ingenders a new spirit, the solid parts of Plants, and living Creatures, as Leaves, Flowers, Flesh, Bone, and the like, each of which out of the juyces of nourishments do assimilate and ingender a successive substance and excretion. For we would not have any man dote with *Paracelsus*, who (blinded with his Distillations) would have Nutrition made by separation only; and that in bread or food there lyeth hidden the Eye, Nose, Brain, Liver, &c. in the moisture of the earth, the Root, the Leaf, the Flower. For as a Carver or Sculpter out of a rude Mass of wood or stone will bring forth a Leaf, a Flower, an Eye, a Nose, a Hand, a Foot, or the like, by separating and putting away what is superfluous: so that chief internal workman (saith he) will by separation and rejection out of food bring forth several members and parts. But laying such trifles and toys aside, it is most certain, that each several parts, as well Similar as Organical, in Vegetables and Animals, do first with some delight attract, then assimilate and turn into their own Nature, the juyces of their several foods almost common, or at least not much unlike. Neither is this assimilation or simple Generation in animate bodies only, but the Inanimate also participate thereof, as we have said of Flame and Air. And also the dead spirit which is contained in every tangible animate thing, doth always work, to digest and turn the thicker parts into spirit, which may afterwards go forth: whence comes the diminution of weight, and the drying up, as we said elsewhere: Neither is that accretion, or growing together, which they commonly reject in alimentation be rejected in assimilation, as when Mud grows together amongst small stones, and is turned into a stony substance: Scales about the Teeth turn into a substance as hard as the Teeth themselves, &c. For we are of that opinion that there is in all bodies a desire of assimilation or making alike, as great as that of Homogeneals to come together; but this vertue is bound up as well as the other, but not by the same means: But we must with our greatest care inquire out those means, and the way of getting loose from them; because they belong to the comforting of old age. Lastly, it is worthy to be noted, that in nine of those motions whereof we have spoken, bodies do only desire their own preservation, but in this eleventh they desire to have it propagated.

Let the twelfth Motion be the motion of Excitation, which motion seems to be of the same kind as assimilation, and sometimes it is so by us promiscuously called: For it is a Diffusive, Communicative, Transitive, and multiplicative motion, as well as the other; and they agree for the most part in their effects, though they differ in the manner and subject of effecting. For the motion of assimilation proceeds as it were with command and power; for it commands and constrains the assimilated thing

thing to turn and chang it self into the assimilated. But the motion of Excitation proceeds as it were with Art and Insinuation, and by stealth; for it doth only invite and dispose the thing excited to the nature of the exciting thing: also the motion of assimilation doth multiply and transform bodies and substances; as for example, there is more flame, more air, more spirit, more flesh made: But in the Motion of Excitation the vertues only are multiplyed and transported, and there is made more heat, more Magnetick power, more rottenness. And this Motion is most eminent in heat and cold: For heat doth not diffuse it self in heating, by the communication of the first heat, but only by Excitation of the parts of the body to that Motion, which is the form of heat, of which we spake in the first Vindication of heat; so that heat is far more slowly and difficulty excited in a stone or Metal, than it is in Air, by reason of the Inability and unreadiness of those bodies to that Motion: so that it is likely that there may be such matters within the Bowels of the earth, as do utterly refuse to be heated, by reason that through their greater condensation they are destitute of that spirit, from which this Motion of Excitation first begins. So the Load-stone doth endure Iron with a new disposition of parts, yet it loseth nothing of its vertue: so the Leaven of Bread, the Flower or Yeast of Drink, and the runnet which coagulates milk; and likewise some poisons do excite and invite Motion in a quantity of Meal, or Beer, or Cheese, successively and continuately, not so much by the power of the excitor, as by the predisposition and easie yeelding of the excited.

Let the thirteenth Motion be the Motion of Impression; which motion is likewise of the same kind as the motion of assimilation, and is the most subtile of all Diffusive motions. Yet we thought good to place it in a proper species, because of the notable difference which is between it and the former two: For the plain and simple Motion of assimilation doth transform the bodies themselves: so that if you take away the first mover, it nothing concerns those which follow; for the first kindling into Flame, or the first turning into air, doth nothing concern the flame or the air which succeeds in Generation. Likewise the Motion of Excitation remains for a very long time, the first mover being taken away; as in a heated body, the first heater being laid away: in Iron excited, the Load-stone being taken away; in the heap of Meal, the Leaven being laid aside. But the motion of Impression, though it be Diffusive and Transitive, yet it seems to depend upon the first movers so that it ever being taken away or ceasing, it presently fails or perishes; so that it is ended in a moment, or in a very little time. Wherefore we use to call those motions of Assimilation and Excitation, the motion of *Jupiters* Generation, because the Generation remains; and this motion of Impression the motion of the Generation of *Saturn*, because that as soon as it is born it is devoured and swallowed up. And this motion manifests it self in three things; in the beams or glimpses of light, in the stroak of sounds, and magnetick forces, as concerning communication. For the light being taken away, the colours presently perish, together with the other Images of it. The first stroak and shaking of the body caused thereby being ended, presently after the sound perisheth. For sounds are tossed up and down by Winds, as it were by Waters; yet you must more diligently observe, that the sound doth not last so long as there is a resounding: For the Bell being rung, the sound seems to continue for a long time; where-

by

by a man may easily fall into an error if he think or imagine that sound doth stick, or as it were swim in the air all that while, which is most false. For that resounding is not the same sound in Number, but is only renewed: and this is made manifest by the stopping or cohibition of the stricken or smitten body; for if the Bell be strongly stayed or withheld and kept immoveable, presently the sound perisheth, and it sounds no more, as in strings, if after the first stroak the string be touched with the finger, as in the Harp, or with the quill, as in Virginals, presently the resounding ceaseth. The Load-stone being taken away, the Iron presently falls: But the Moon cannot be removed from the Sea, nor the earth from any thing that is ponderous when it falls; therefore there can be no trial made of them, but howsoever the reason is alike.

Let the fourteenth Motion be the motion of Configuration, or Situation, by which bodies seem to desire not any Coition, nor separation, but a Situation, Collocation, and Configuration with others. But this is a most abstruse and hidden motion, neither hath it been well enquired about; and in some things it seems as it were to be incausable, though indeed (as we believe) it be not so. For if one should ask why the heaven turneth and wheeleth from East to West, rather than from West to East; or why it turns about those Poles which are set about the *Ursas* or Bears, rather than about *Orion*, or any other part of the Heaven: This Question seems to be as it were some Extasis, seeing that such things should rather through experience be received as positive: and there are indeed in Nature some ultimate and incausable things, but this is none of them. For we hold this to be done by a certain harmony and consent of the world, which is not yet come into observation: but if the Motion of the earth be admitted to be from West to East, the same Questions do remain; for it also moves upon some Poles, and why at last should these Poles be placed where they are rather than any where else. Also the verticity and direction, and Declination of the Loadstone are referred to this motion. Likewise there are found as well in Natural as Artificial bodies, especially those which are consistent, and not fluid; a certain collocation and posture of parts, and as it were wooll and threads, which must be diligently searched out and enquired after, as being such that without the finding of them, those bodies cannot be easily touched nor guided; but those Circulations in liquid things, by which, they while they are pressed before they can free themselves, do relieve each other, that they may bear that compression equally, we do more truly assign to the motion of Liberty.

Let the fifteenth Motion be the motion of Pertransition, or the motion according to the issues or holes by which the vertues of bodies are more or less hindred or forwarded by their mediums or means, according to the Nature of the operating bodies or vertues, and also of the means: For one medium or means is convenient for the light, another for the sound, another for heat and cold, another for magnetick Vertues, and for other things respectively.

Let the sixteenth motion be the Regal or Politick motion, for so we call it. By which the predominant and commanding parts do bridle, tame, subdue and order the rest of the parts, and force them to be gathered together, and separated, to stop, move, and be placed, not according to their own desires, but as it is in order, and expedient for the well being

being of that commanding part: so that it is as it were a kind of Government, and Policy which the ruling part exerciseth over the subjected parts. And this Motion is most eminent in the spirits of living things, which Motion doth temper together all the Motions of the rest of the parts, as long as it self is in vigor and force. It is likewise to be found in other bodies in a certain inferiour degree, as hath been said of blood and urines, which are not dissolved, till the spirit which restrained and mixed their parts was let forth, or suffocated. Neither is this Motion altogether proper to Spirits, though Spirits are predominant in most bodies, by reason of their quick and penetrating Motion. But in bodies which are more condensed, and are not filled with a lively and vigorous spirit, such as is in Quick-silver and Vitriol, the thicker parts are predominant; so that unless this curb and yoke be some way shaken off, we must not hope for any new transformation of such bodies.

Let the seventeenth Motion be the Spontaneal or Willing Motion of Rotation or wheeling: by which bodies that delight in Motion, and are well placed, do enjoy themselves, and follow one another, and not any thing else, seeking (as it were) their own embraces. For bodies seem either to move without any term, or to stand quite still, or to be carried to that term, where through their own Nature they must either wheel or stand still: And those things that are well placed, if they enjoy Motion, do move circularly, namely with an Eternal an Infinite motion. Those things which are well placed, and are averse from motion, do stand quite still: Those which are not well placed do move in a direct line, (as by the shortest path) to the company of their connaturals. And this motion of Rotation or wheeling, admits of seven differences: The first of its Center about which the bodies move: The second of their Poles upon which they move: The third of its circumference or compass, according as they are distant from the Center: The fourth of their Incitation, according as they move either more slowly, or more swiftly: The fifth of the consecution of their Motion, as from East to West, or from West to East: The sixth of the Declination from the perfect Circle by threads or lines nearer to, or further from the Center: The seventh of its declination from the perfect circle by the Lines nearer to, or further from their Poles: The eighth of the further or nearer distance of the Poles themselves, if they be moveable; the which doth not belong to Rotation or wheeling, unless it be done circularly; And this Motion by the common and inveterate opinion is held to be the proper Motion of the Heavens: Yet there is a great Question amongst some as well ancient as modern concerning that Motion, who have attributed this Rotation or wheeling to the earth. But it would be a far more just question or controversie (if the thing be not without question) namely, whether this Motion (granted that the Earth doth stand still) be contained within the bounds of the heaven, or rather descends and communicates it self to the Air and to the Waters. But the motion of Rotation in darted things, as in Arrows, Darts, Bullets for Guns, and the like, we remit altogether to the motion of Liberty.

Let the eighteenth motion be the motion of Trepidation, to which (as it is understood by Astronomers) we give no great credit. But to us who seriously seek out every where the Appetites and Desires of Natural bodies, this motion comes in our way, and seems it ought to be placed in

specie,

specie, as of a several kind. And this motion is as it were of a certain perpetual captivity or bondage: namely, in which bodies being not altogether well placed according to their Nature, nor yet finding themselves altogether ill, do trepidate or agitate continually, taking no rest, as not contented with the state they are in, nor yet daring to proceed any further. And such a motion is found in the heart and pulses of living Creatures, and must of necessity be in all bodies which are in an anxious and doubtful case between commodities and discommodities. that being distracted do trie to free themselves, and still receive a repulse, yet still go on trying.

Let the nineteenth and last motion be that to which the name of motion scarce belongeth, and yet is a meer motion. Which motion we may call the motion of lying down, or the motion of abhorring of motion. By this motion the earth stands in its own frame, the extrems of it moving themselves into the middle, not to the imaginative Center, but to Union. By this appetite also all things which are condensed or grown thick in a high degree do abhor motion, and all their appetite is, not to move: and though they be provoked infinitely to move, yet (as far as they can) they preserve their own Nature. And if they be forced to motion, yet they seem always to endeavour to recover their own estate and rest, to move no more. And indeed about this they are active enough, and do strive swiftly and speedily enough, as being impatient of any delay. But the Image of this appetite can but partly be discerned, because with us by the subagitation and concoction of the Celestials, every tangible thing is not only not condensed to the height, but is also mixed with some spirit. We have therefore now proposed the species, or simple Elements of Motions, Appetites, and Active Vertues which are most universal in Nature: neither is there a small part of Natural Knowledge shadowed under these. Yet we do not deny, but that other species may peradventure be added, and that these very Divisions may be transported according to the truer veins of things, and be reduced into a smaller number: Yet we do not mean this of any abstracted Divisions; As who should say, that bodies desire either the Preservation or Exaltation, or Propagation, or Fruition of their own Nature; or as if one should say, that the motions of things do tend to the Preservation and good either of the Universal, as Antitypie, or Connexion; or of great Universalities as the motion of the greater Congregation, or of Rotation and wheeling, or of the abhorring of motion, or of special Forms, as the rest of motions. For though these things be true, yet unless they be terminated in Matter and Fabrick, according to the true lines, they are speculative and less profitable. In the mean time they will be sufficient, and of good use to weigh the Predominances of Virtues, and enquire out the instances of strife. For of these motions whereof we have spoken, some are altogether invincible, some are stronger, and bind, curb and dispose them. Some do shoot out and dart further: some do prevent others in time and swiftness: some do nourish, strengthen, enlarge, and hasten the other.

The Motion of Antitypie is altogether Adamantine and Invincible. But whether the Motion of Connexion be so or no, we yet doubt of. For we will not for a certainty affirm whether there be a Vacuity, or Coacervation and heaping up, or a Permixon. But this we are sure of, that the reason which *Lucippus* and *Democritus* give to bring in a vacuity (namely because without it the same bodies could not fill up and containe

tain greater and lesser spaces) is false. For certainly it is the fold of the matter doubling and redoubling it self by spaces within certain bounds, without interposition of Vacuity. Neither is there in air two thousand times more (for so much it must be) of Vacuity than there is in Gold, which is sufficiently known to us by the most powerful vertues of Pneumatick or windy bodies, (which otherwise would swim in Vacuity like small dust) and many other Demonstrations. And the rest of the Motions do govern, and are governed one by another according to the Vigor, Quantity, Incitation, Ejaculation, and according to the helps and hindrances which do happen. As for example, some Load-stone armed will draw up and hold Iron which shall weigh threescore times as much as it self: so far the Motion of the lesser Congregation doth predominate above the Motion of the greater Congregation; And if there be any greater weight it yields. A Beam will bear some weight of timber: So far doth the Motion of Liberty predominate upon the motion of the greater Congregation: But if the weight be more it will yield. Leather stretched out to such an extent will not tear: So far the Motion of Continuation predominates upon the Motion of Extension; But if it be stretched any further, the Leather tears, and the Motion of Continuation doth yield. Water runs out at a crevise of such a bigness, so far the Motion of the greater Congregation predominates over the Motion of Continuation: and if the crevise be lesser it yields, and the Motion of Continuation overcomes. The powder of Sulphur alone put into a Gun with a Bullet and fired doth not drive out the Bullet; In that the Motion of the greater Congregation overcomes the motion of *Hyles*: but gunpowder being put in, it overcomes the motion of *Hyles* in the Brimstone, being helped by the Motions of *Hyles*, and of Flight in the Niter, and so of the rest. For the instances of strife (which shew the predominancy of vertues, and according to what means and degrees they predominate and yield) is to be sought out by a sharp and diligent Inquisition. Likewise the means and ways of the succumbency and yielding of Motions are carefully to be looked into: Namely, whether they cease altogether, or whether they only strive so to do, and are withheld. For in bodies here with us there is no true rest, neither in the whole, nor in the parts, but only in appearance and seemingness. And this seeming Quietness or rest, is caused either by the Counterpoise, or the predominancy of Motions: By counterpoise, as in Scales which stand even if the weights be equal; By predominancy, as in pitchers which have holes in them, where the water lyeth still, and is kept from falling by the predominancy of the motion of Connexion: Yet we must observe (as we said before) how far those yielding Motions do strive. For if any one through striving be kept down stretched out upon the earth, with his arms and legs bound, or otherwise held, and yet he with all his force strive to get up, his striving is nothing the less, though it doth not availe. But the condition of this thing, (namely, whether the yielding motion be as it were annihilated by the predominancy, or whether the strife continue, though it is not perceived) which lyeth hidden in Conflicts, will peradventure appear in concurrencies. Let the trial be made in Guns; whether a Gun will shoot a bullet furthest in a direct line, which we call point blank, or shooting upwards where the only force carries the Bullet, or downwards, where the Motion of Gravity concurs with the force of the blow. Also the Rules of Predominancies which come in the way are to

be gathered together: As the commoner the good is which is desired, the stronger it is: As the motion of Connexion, which looks upon the communion of the Universal, is stronger than the Motion of Gravity or weight, which looks only upon the communion of dense and solid things. Also that the desires of a private good, most commonly do not prevail against the desires which are for a more Publick good, but in some small quantities. Which would God we might obtain in Civil Affairs.

*The way how to find out the Causes of the Ebbing
and flowing of the Sea.*

THis motion must of necessity be brought to passe, either by the Progress, and Regresse of waters, like unto water tossed up and down in a Tub, which when it washeth one side of the Tub, forsaketh the other side: or by the rising and falling of the waters from the bottome, like unto water that boiles up and falls again. Now which of these two causes must be the cause of Ebbing and Flowing is the question. If the first assertion be admitted of, then of necessity when the flowing of the sea is one way, the sea must at the same time in one place or other be Ebbing: and this is the thing which we enquired. *Acosta* with some others (after diligent enquirie) have observed, that on the shoars of *Florida* and the opposite shoars of *Spain* and *Africk*, the Ebbings and Flowings of the Sea are at the same time, and not contrariwise, when it flows at the shoars of *Florida*, it ebbs on the shoars of *Spain* and *Africa*. But if one give more attention, and take better heed, the rising motion is not confirmed, nor the motion by Progress denied. For it may be that the motion of waters in Progress may be, and yet it may flow upon the opposite banks of the same Channel, at the same time; namely, if the waters be forced and driven in from another place, as it is in Rivers which ebb and flow on both their banks on each side at the same time, this motion notwithstanding being a meer motion in Progress, namely, of waters coming in at the mouths of the Rivers out of the Sea: so in the same manner waters coming in great abundance out of the Indian Eastern Ocean, may be driven and thrust into the Channel of the *Atlantick* Sea, and therefore may over-flow both banks at one time. Therefore we must enquire whether there be ever another Channel by which the waters may ebb, and so diminish at the same time: And behold here is the south sea at hand, which is no lesser than the *Atlantick* sea, but large and extended sufficiently for this purpose. So now at last we are come to the Instance of the Cross concerning this subject: which word is taken from Crosses, which are set up in cross ways, and point out the separations of them. And these we use to call Decisory and Judicial Instances, and in some cases Instance of Oracle and mandate: The manner of them is this; When in the Inquisition of some Nature, the understanding is suspended and uncertain, to which of the two or more natures the Cause of the enquired Nature ought to be attributed and assigned, by reason of the frequent and ordinary concurrence of divers Natures; the instances of the Cross do shew the faithful and indissoluble agreement (concerning the Nature which is enquired of) of one of the Natures, and the variable and separable agreement of the other, whereby the

the question is determined, and the former Nature is received for the cause, the other being rejected and laid aside: And that is such a one, if we find of a certainty, that when it flows on the opposite shoars as well of *Florida* and *Spain* in the *Atlantick* sea, it flows also upon the shoars of *Peru*, and the back-side of *China* in the south sea: then by this Decisorie Instance this Assertion must be confirmed, that the ebbing and flowing of the sea which we enquire after, must be done by a Progressive Motion: For there is no other sea or other place left where there can be a Regress or ebb made at the same time: And this may most easily be known, if one could enquire of the Inhabitants of *Panama* and *Lima* (where the Atlantick and Southern Ocean are severed only by a small *Isthmus*) whether the ebbing and flowing be at the same time on both sides of the *Isthmus* or no. But this Decision seems to be certain, if it be granted that the Earth stand immoveable. For if the Earth turns round, it may be that by unequal turning of it, (as touching the celerity & swiftness of it) and of the water of the sea, there may be a violent driving of waters up into a heap, which may be the flowing, and a Re-laxation of the same, (when they can be heaped up no more) which may be the ebbing: But of this there must be an Inquisition severally. But this being also supposed, that still remaineth stedfast, that there must be somewhere an ebbing of waters when there is a flowing in other places. Likewise let the latter motion of those two which we supposed, be the enquired Nature: namely, the motion of the Sea raising it self, and sinking down again; if it so happen that (after the matter is diligently examined) the other Progressive motion which we have spoken of, be rejected: Then there will be such a threefold way concerning this Nature; and of Necessity this motion by which waters in ebbings and flowings rise and fall again, without any addition of waters coming to them, must be one of these three ways: Either that this abundance of waters comes out of the Entrails of the earth, and returns again into them: Or that there be no greater mass of waters, but that the same waters, (without any increasing of Quantity) are extended, or rarified, so that they spread themselves into a larger dimension, and take up more room, and then restrain and contract themselves again: Or that there is neither more quantity, nor larger extension, but that the same waters (as they are both in Quantity or Rarity and Density) do raise themselves, and so fall again by and through some Magnetick power drawing them from above, and so by consent rise and fall again. So now (if you please) let the Inquisition be reduced (laying aside the two first Motions) to this last, and let us enquire whether there be any such sublation or raising made by consent, or Magnetick power. But in the first place it is manifest that all the whole waters as they are laid in the hollow or concave place of the Sea, cannot be raised altogether, for then there would want some thing to succeed and be in the bottome: so that if there were any such appetite or desire in the waters of raising themselves, yet that would be broken and inhibited by the connexion of things, or (as they commonly call it) by the Nonentity or not being of any vacuity. It remains therefore that the waters must rise on the one side, or part, and thereby diminish and fall on the other. For again, it will of necessity follow, that the Magnetick power, seeing it cannot operate upon the whole, must needs operate most strongly about the middle, so that raising the water in the middle, it must needs successively abandon and forsake the shoars. So thus at last this subject

subject is come to the Instance of the Crofs, which is this : That if it be found that in the ebbings of the sea, the superficies of the waters in the sea is more arched and round, namely, the waters rising in the middle of the sea, and failing about the sides, which are the shoars; and in the Floods or Flowings the same superficies is more plain and even, by reason of the waters returning to their first posture: Then truly by this Decifory Instance the raising by Magnetick power may be admitted of, otherwise it must be absolutely rejected. But this may easily be tried in Arms of the sea, by sea lines, namely, whether in ebbs towards the middle of the sea, the sea be not deeper than in floods. But we must note, that if this be so, waters do (contrary to what is commonly believed) rise in their ebbings, and fall only in flowings, whereby they fill and overflow the banks.

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FINIS.

The Titles of the Histories and Inquisitions
destined for the first six Months.

THe History of Winds.
The History of Density, and Rarity; *as likewise of Coition
and Expansion of matter by spaces.*
The History of Heavy and Light.
The History of the Sympathy, and Antipathy of things.
The History of Sulphur, Mercury, and Salt.
The History of Life and Death.

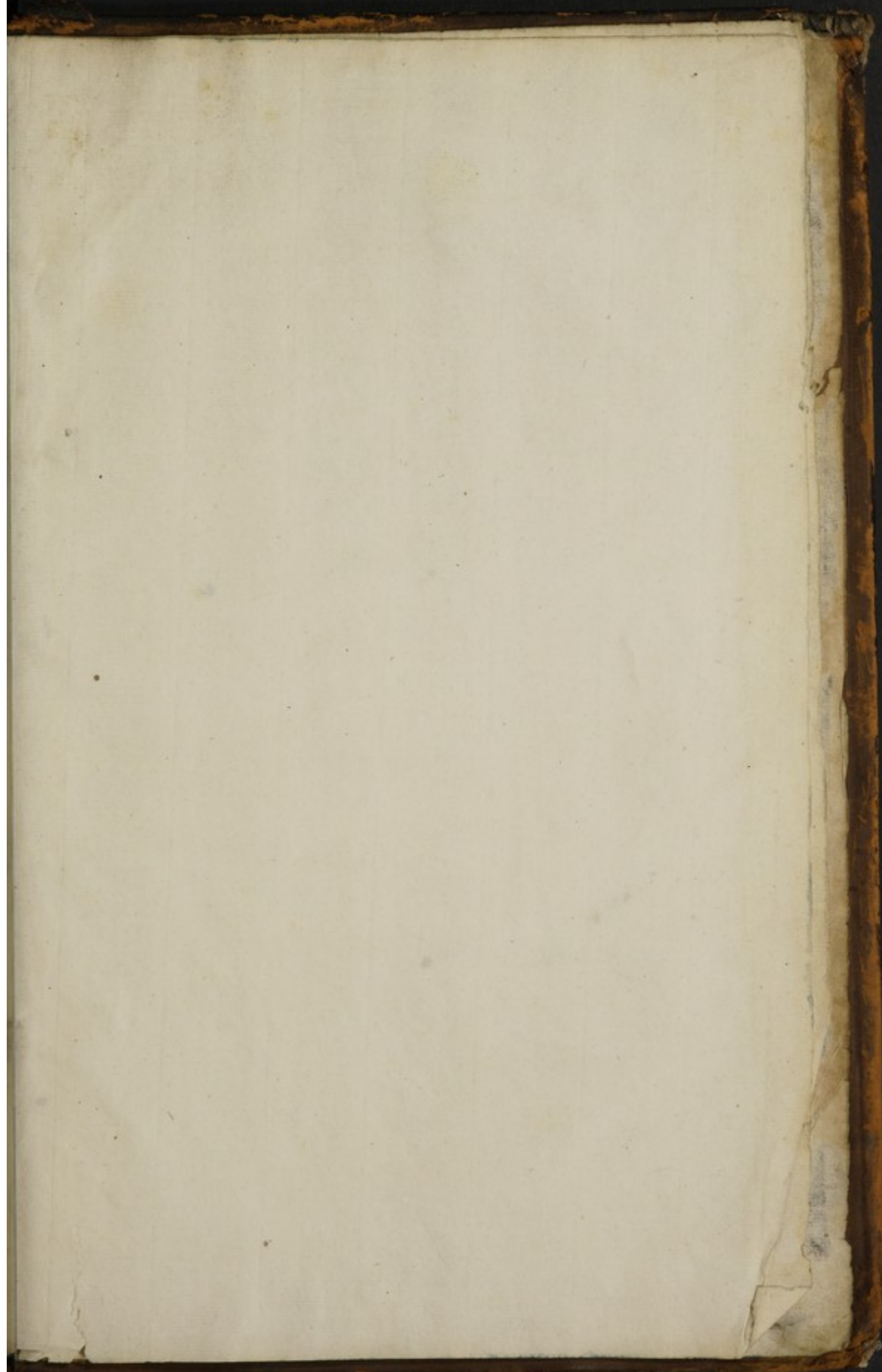
In this Book are contained;

THe Natural and Experimental History of Winds.
The Natural and Experimental History of the form of
Heat.
Of the several kinds of Motion, or of the Active vertue.
The way to find out the causes of the Ebbing and Flowing of
the Sea.

b

The Entry into the History of Winds.

THe Winds gave Wings to men; for by their assistance men are carried up through the Air and flye; not through the Air indeed, but upon the Sea; and a wide door is laid open to commerce, and the World is made precious. They are the besomes which sweep and make clean the earth, which is the seat and habitation of mankind; and they cleanse both it and the air: But they make the Sea hurtful, which otherwise is harmlesse, neither are they some other ways also, free from doing hurt: They are without help of man able to stir up great and vehement motions, and like Hirelings serve both to sail and grind, and would be useful for many other things, if humane care were not wanting, Their Natures are reckoned amongst secret and bidden things. Neither is that to be wondred at, seeing the Nature and Power of the Air is unknown, whom the Winds do serve and flatter, as Eolus doth Juno in the Poets. They are not primary Creatures, nor any of the six days works, no more than the rest of the Meteors actually, but after born, by the order of the Creation.



1667. Sir Edward Hyde, Knight, Chancellor of the
Exchequer to King Charles the First, had
the Great Seal of England committed to
his Custody 13 Jan.

And was made Lord Chancellor of England
in Britain in Flanders 27 Jan. following

1667. Sir Orlando Bridgman Knight and Baronet,
Lord Chief Justice of the Court of Com-
mon Pleas, had the Great Seal of En-
land committed to his Custody 30 Aug.

