

THE
General History
OF THE
AIR,

Designed and Begun

BY THE

Hon^{ble} ROBERT BOYLE Esq.

IMPRIMATUR.

June 29. 1692.

Robert Southwell,
P. R. S.

L O N D O N,

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R E A D E R.

THE Design of the following Papers the Author's own Preface will acquaint thee with. And though, as thou wilt there see, his Expectation of Assistance (in a Work too great for one single Man's Undertaking) from others fail'd him, yet I doubt not but his own Experiments and Collections would have made this Treatise much larger before it had been published, had his Health allowed him Opportunity: But that permitting him not so much as to review these Papers, or range them into that order, which would be most advantageous, thou art not to wonder, if thou findest some Defects, some Dislocations, and other Faults in this Publication, which the Author's last Hand would have prevented. The Negligence of Transcribers has let slip the Characters of Relators, and Names and Places of Author's from whom several of the Particulars in the following Papers were taken: Nor could it be hoped that the Authors own Memory (were he in a State of Health fit to be troubled with it) should after so long a time as this Collection has been making, and in that Variety of Men and Books he has had to do with, be able to retrieve them. But this will be no great Loss to the learned World, which is sufficiently acquainted with his great Caution, and will make no Difficulty confidently to rely upon his unaffected Candor and Sincerity. I know not how much some other Parts of his noble, and always busy Designs for the Advancement of Knowledge, and the Benefit of Mankind, may suffer by that

Tenderneſs of his Conſtitution, which the Importunity of his Friends can hardly prevail upon him to withdraw from Philoſophical Cares. But this he has ordered ſo, that imperfect as it is, one cannot call it deficient; ſince the Foundation being here laid, and the Draught made, every one may, if he pleaſe, add towards the compleating of the building, I will not ſay with Materials equal to what his Sagacity and Laboratory uſed to afford: For we muſt not expect to find in every Age a Man able and ready to lay out ſo much Coſt, Pains and Skill, frankly, for the Improvement of Natural Philoſophy, and the Information of the World, as he has done. The Scheme of Titles under which theſe Materials for a Hiſtory of the Air are ranged, is ſomewhat different from that printed by him ſeveral Tears ſince, and diſtributed amongſt his Friends. But this is without any Prejudice to the main Deſign, ſince whatſoever any one hath collected under thoſe Heads, will be eaſily reducible to theſe, which in a more natural Order are more comprehenſive. In that firſt Draught he followed my Lord Bacon's Advice, not to be over-curious or nice in making the firſt Set of Heads, but to take them as they occur. But now that thus much comes to be publiſhed, which perhaps may ſerve to ſome Men as a common Place for the Hiſtory of the Air, the Titles have been a little more increaſed or methodized, to which any one may add as he finds Occaſion: Only in theſe the Reader is deſired to obſerve,

I. *That under the Title of Mineral Subſtances, are comprehended Earth, and all other Fossiles to avoid multiplying of Articles.*

II. *That when any mixed Body is ranked under Animal, Vegetable, or Mineral Subſtances, it is put under that of the three which either it partakes moſt of, or to which moſt is owing in the preſent Experiment, or which in its own Nature it moſt reſembles.*

III. *That*

III. *That it is not by an Over-sight that Lightning is put under two different Titles ; for in one it is considered only in reference to the Sight ; in the other it is considered as the Product of sulphureous or inflamable Effluvioms taking fire, with the strange Effects it produces ; which may be an Example of putting the same thing with different Views, under different Heads.*

What is abovesaid was written whilst the Author was living, to which it is necessary now to add, That the Titles, as here printed, and the Orders of the Papers, as now ranged under them, were shewn to the Author, and approved by him as fitter for the General History of the Air, than those he had formerly printed. So that, Reader, thou hast these Papers as they were prepared and ordered to be published in his Life-time ; and they had then gone to the Press to be printed, just as thou now receivest them, had not the Publisher the last Winter been hastily called out of Town.

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T H E
P R E F A C E.

THE continual *Use* of the Air is so absolutely necessary to our *Life*; the good or bad *Temperature* of it is so important to our *Health*; and the scarce evitable *Presence* and powerful *Pressure* of it, has so great an Interest in many of the *Phenomena* we meet with here below, and even in divers where its Agency is not suspected; that among mere *Bodies* there are perhaps few Subjects that more deserve our Curiosity, whether as we are Animals, or as we are Naturalists. Upon which Account I can scarce think that any thing that conduces to the fuller Knowledge of a Body so diffused, so necessary, and so powerful, is fit to be *despised*, or is unworthy to be *preserved* in Writing.

And therefore, though I have formerly had occasion to treat, in distinct Tracts, of some of the *Qualities* or *Affections* of the *Air*, as its *Gravity*, *Springiness*, &c. yet I found my self inclined to contribute further to the Knowledge of that vast and useful Subject, by setting down some *Memorials*, partly out of my own Observations and Trials, and partly out of those I had from Persons of good Credit, concerning some Causes and Effects of the Changes of the Air, and consequently concerning several of its Qualities that were requisite to be taken into Consideration in a work of that Nature. And not content with this, though my own Studies

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and

and Affairs would not permit me to prosecute my self the Design I am going to mention, yet thinking it might be a very useful thing, in reference both to Philosophy and Physick, that a Natural History of the Air (though at first it should prove but a very imperfect one) were faithfully compiled, I propounded the Design to some *Virtuosi* that seem'd to relish it, and undertook to be Assistant in it.

And to facilitate their Work, I drew up a Set of Heads and Inquiries of that sort, which in another Paper I call *Titles of the first Classis or Order*; which, tho' purposely set down without any anxious Method, were comprehensive enough to have a good Number and Variety of Particulars conveniently referr'd to them. But afterwards finding the Persons to whom I had committed these Schemes, to have been for many Years very unmindful of their Promises; I did on this Discouragement lay aside, not only the Hopes of a *General History of the Air*, but what I had already written about the Changes of that Body.

And upon the same Accounts, those scattered Notes lay many Years in loose neglected Papers, till at length the Curiosity and Desires of some *Virtuosi*, that knew I had gathered some Remarks, though few and incoherent, touching some Qualities of the Air, obliged me to draw together those that without a troublesome Search I could retrieve, offering themselves to promote the Design that others had abandon'd. The Desire to gratify these Inquisitive Men, and the Conviction I am brought under, by such Reasons as are mentioned at the Beginning of this Paper, that scarce any Truth, whether Historical or Doctrinal, that relates to so important a Subject as the *Air*, is unfit to be preserv'd, prevail'd with me, rather to chuse a very disadvantageous

ous way of setting down what I have to deliver about it, than suffer the loose Observations I had occasion to make about some *Phanomena* and *Qualities*, and especially the *Changes* of the Air, to be lost. And therefore, though I have not the leisure to methodize my incoherent Notes, and much less to weave them into continued Discourses; yet rather than let them perish, and disappoint those that will have them such as they are, I am content to refer to some of the Titles prefixed to this Treatise, as to a kind of Common Places, what my Memory, or some old Notes about divers things relating to the Air, and especially to the *Causes and Effects of its Changes*, supply me with in reference to that Body.

And upon the like Account, I have not strictly confined my self to the mention of my loose Observations, and those that I have been furnished with by Answers to the Questions I put to divers Travellers and Navigators: but I have also cast in several pertinent Passages that chanced to occur to me in the reading of some Voyages, and other Books, especially such as either are *out of Print*, or are but *in few Hands*, or else are not extant in those that are called the *Learned Languages*. And that those *Virtuosi* that are willing to contribute their Industry to carry on the Design that was at first proposed, might have some Heads whereunto to refer what shall occur to them; I thought fit to premise to my Papers the above-mentioned Scheme, or rough Draught, of the *General History* (which after many Years I chanced to recover.) I have also thought fit, that under three or four Titles, my Collections of Particulars should be somewhat large and Methodical, to afford the same Persons some *Specimens* of what I should have thought requisite to do upon particular Subjects, if

I would have ventur'd upon such a Task, as to write a *Natural History of the Air*.

I am not ignorant that I expose my self to Censure, for suffering to pass out of my Hands, Memoirs so maimed and imperfect, that several of the Subjects mentioned in the Scheme of Titles are left altogether untouch'd; and those that are particularly mentioned, are for the most part touch'd upon but lightly. But the chief, though not perhaps the only Reasons that kept me from being silenc'd by these Considerations, though I confess them to be weighty, were these. *First*, That not pretending to write the *History of the Air*, but only some Memoirs for it; I might without Incongruity or Indecency contribute what had occur'd to me in reference to some of the Titles, though I left the others to those that had made Experiments or Observations about them. *Next*, That having through the Fraud or Negligence of some Persons, lost sundry loose Papers that I had provided for the *History of the Air*, my Unwillingness that the rest should undergo the same Fate, invited me to impart them to many, as the best Expedient to secure them. To which I, *Thirdly*, add an Inducement, which though last named, was the first in Efficacy, as that which made the other two significant; namely, that I had more than once observed, that when a Work of this Nature has been once begun and taken notice of, in such an inquisitive and active Age as this of ours, it seldom fails to excite the Curiosity and Industry of others, whom, if the Design be any thing well laid, the Utility that it promises will invite to carry it on.

T I T L E I.

What we understand by the AIR.

BY the *Air* I commonly understand that thin, fluid, diaphanous, compressible and dilatible Body in which we breath, and wherein we move, which envelops the Earth on all sides to a great height above the highest Mountains; but yet is so different from the *Æther* [or *Vacuum*] in the intermundane or interplanetary Spaces, that it refracts the Rays of the Moon and other remoter Luminaries.

B

T I.

T I T L E II.

*Of the constant and permanent Ingredients
of the Air.*

*A short Answer to a Question about the Nature of the
Air, given by Mr. Boyle to Mr. H. Oldenburg.*

AS to your Question, *What I think the Air to be* I shall in the first place take it for granted, that by the Air you mean not, either the pure Element of Air, which *some*, nor that *Ethereal* or *Celestial* Substance, that *others* (upon what Grounds I must not here examine) assert; but that, which I am wont to call the *Atmospherical* Air, which is that common Air we breath and move in.

But though I know you too well, to suspect that you design any Ambiguity in your Question; yet I shall not adventure to answer it, till I have premised a Distinction that is not usual: For, according to my Thoughts, the Air may be taken either for that which is *Temporary*, (if I may so call it;) or in a *Transient* State; or that which is *Lasting*, and in a *Permanent* State. This Distinction, which perhaps you look'd not for, I shall illustrate by this Example; That if you sufficiently heat an Eolipile furnished with Water, and stay a pretty while to afford time for the expulsion of the *Aerial* Particles by the *Aqueous* Vapours, you may afterwards observe,

serve, that these last named will be driven out in multitudes, and with a noise, and will emulate a Wind or Stream of Air, by blowing Coals, held at a convenient distance, like a pair of Bellows, and by producing a sharp and whistling Sound against the edge of a Knife, held in a convenient Posture almost upon the Orifice of the Pipe, whence they issue out. But this vapid Stream, though in these, and some other things it imitates true Air, whilst the vehement Agitation lasts, which the Vapours it consists of, received from the Fire; yet in a very short time, especially if the Weather, or the Vessels it enters into, be cold, loses the *temporary* Form it seemed to have of Air, and returns to Water, as it was at first.

This premised, I come to speak *directly*, but dare not do it *confidently*, to your Question; For though possibly I may have made as many Trials as another about the Nature of the Air; yet I freely confess to you, that I much suspect there lies yet something concealed in it, that needs a further Discovery, which may perhaps be made by further Trials. But in the mean time, (not wholly to baffle your Curiosity, since 'tis so modest, as to desire to know of me, not what the true Nature of the Air is, but what I guess concerning its chiefest Property or Attribute) I will acquaint you with some of the Thoughts I long ago had, and which I yet took upon my self, and desire to have them look'd upon by you but as Conjectures, entertain'd only till farther Discoveries confirm them, or suggest better in their room.

It seems then not improbable to me, that our *Atmospherical* Air may consist of *three* differing Kinds of Corpuscles. The *first* is made of that numberless Multitude and great Variety of Particles, which, under the form of Vapours or dry Exhalations, ascend from the

Earth, Water, Minerals, Vegetables and Animals, &c. and in a word, of whatever Substances are elevated by the Celestial or Subterranean Heats, and made to diffuse themselves into the Atmosphere. The *second* sort of Particles that make the Air, may be yet more subtile than the former, and consist of such exceeding minute Parts, as make up the *Magnetical* Steams of our Terrestrial Globe, and the innumerable Particles, that the Sun and other Stars, that seem to shine of themselves, do either emit out of their own Bodies, or by their Pressure thrust against our Eyes, and thereby produce what we call *Light*; which, whether we explicate it by the *Epicurean* or *Cartesian* Hypothesis, argues a great Plenty of a Celestial, or some other very subtile Matter, to be dispersed through, or harboured in the Intervals of the stabler or grosser Corpuscles of the Atmosphere.

But because you expect from me a distinguishing, and as it were, *Characteristick* Quality, which may put a difference between the Parts already named of the Atmosphere, and those to which most of the *Phenomena* of our Engine, and many other Pneumatical Experiments, seem to be due; I shall add a *third* sort of Atmospheric Particles, compared with which, I have not yet found any, whereto the Name of Air does so deservedly belong. And this sort of Particles are those, which are not only for a while, by manifest outward Agents, made *Elastical*, but are *permanently* so, and on that account may be stil'd *Perennial* Air.

Of the Structure of the *Elastical* Particles of the Air, divers Conceptions may be framed, according to the several Contrivances Men may devise to answer the *Phenomena*: For one may think them to be like the *Springs* of *Watches*, coil'd up, and still endeavouring to fly abroad.

broad. One may also fancy a Portion of Air to be like a Lock or Parcel of curled *Hairs* of *Wooll*; which being compressed by an external Force, or their own Weight, may have a continual endeavour to stretch themselves out, and thrust away the neighbouring Particles, and whatever other Bodies would hinder them to recover their former State, or attain their full Liberty. One may also fancy them like extremely *slender Wires*, such as those of Gold and Silver, that Tradesmen unwind from some Cylindrical Bodies of differing Sizes, on which they were rolled; which Pieces of Spiral or curled Wire may be, *as* of differing Substances and Consistences, *so* of very differing Lengths and Thicknesses, and have their Curls greater or lesser, nearer each other, or more distant, and be otherwise diversified; and yet all have Springiness in them, and (notwithstanding) be, by reason of their Shape, readily expansible on the score of their native Structure, as also by Heat, Girations, and other Motions; and compressible by an external Force into a very little room. I remember too, that I have among other Comparisons of this kind, represented the springy Particles of the Air, like the very *thin Shavings of Wood*, (that Carpenters and Joiners are wont to take off with their Planers;) for, besides that these may be made of differing Woods, as Oak, Ash, Firr, &c. and thereby be diversified as to their Substance, they are usually of very various Breadths, and Lengths, and Thicknesses. And perhaps you may the rather prefer this Comparison, because it may seem somewhat to illustrate the *Production* of the springy Particles of the Air: for to make these Shavings, there is no Art nor curious Instruments required; and their Curls are no ways uniform, but many ways differing, and seemingly casual; and, which is chiefly considerable, these
 Shavings

Shavings are producible out of Bodies, that did not appear, nor were suspected to be Elastical in their Bulk, as Beans and Blocks; almost any of which may afford springy Shavings, barely by having some of its Parts so taken off, as to be thin and flexible enough, and commodiously shap'd: Which may perhaps illustrate what I tried, that divers solid, and even mineral Bodies, not suspected of Elasticity, being put into corrosive Menstruums, devoid of that Quality, there will, upon the convenient Comminution of Parts, insuing the Action and Re-action, that passes between them in the Dissolution, result or emerge a pretty Quantity of permanently Elastical Fire. But possibly you will think that these are but extravagant Conjectures; and therefore without adding any thing in favour of them, I shall proceed, and willingly grant, that one may fancy several other Shapes (and perhaps fitter than these we have mentioned) for these springy Corpuscles; about whose Structure I shall not now particularly discourse, because of the variety of probable Conjectures that, I think, may be proposed concerning it. Only I shall here intimate, that though the Elastical Air seem to continue such, rather upon the score of its Structure, than any external Agitation; yet Heat, that is a kind of Motion, may make the agitated Particles strive to recede further and further from the Centers of their Motions, and to beat off those, that would hinder the freedom of their Gyration, and so very much add to the endeavour of such Air to expand it self. And I will allow you to suspect, that there may be sometimes mingled with the Particles that are springy, upon the newly mentioned Account, some others, that owe their Elasticity, not so much to their Structure, as their Motion, which, variously brandishing them and whirling them about, may make them

beat

beat off the neighbouring Particles, and thereby promote an expansive Endeavour in the Air, whereof they are Parts. And though some of these may, in very cold Climates and Seasons, prove to be of those, which I not long since referr'd to *temporary Air*; yet others of them may be so minute and agile, and so advantageously shap'd, that at least in our Climate, the Air will scarce be so cold, but that the Causes, which entertain the Agitation, and keep it fluid, may also give a competent Motion to Particles so well disposed to be kept in it.

And now, Sir, 'twill be time to endeavour to proceed to some Particulars, that may countenance the Conjectures I have hitherto been proposing.

Having not now the leisure to prosecute this Discourse uninterruptedly, till it be compleatly finish'd, I thought it not unfit, not only to set down, in this Paper, some of those occurring Thoughts and Observations of my own, upon this Subject, that were the likeliest, unless this way preserved, to vanish out of my Memory, and which may serve to recal. divers others into it; but also to annex some Passages referable to the same Purposes, borrowed from such Books, as probably I may not have at hand, when I shall resume this Treatise. These two sorts of Passages make up the following Notes, and are therefore to be look'd upon but as materially here laid together to be preserved, not so much for themselves; (though some of them perhaps deserve not to perish) as in Order to the finishing of the design'd Structure. And though, for that Reason, they may often appear very confusedly placed, yet they may seem more incoherent than they are, there being certain Transitions, and other things, by which some of them may be so connected, as to be fit to make discursive Parts and Paragraphs of the Treatise they belong to;

upon

upon which Account 'tis that they are put at divers Distances one from another, that if hereafter I have leisure, there may be room for the Transitions, &c. by which they are designed to be connected into coherent Discourses.

What is above said in reference to this Tract in general, is applicable to those particular Parts of it, whether Chapters or Sections, or other Divisions that follow a Line of Astericks, such as the ensuing * * * * *
* * * * * employed to separate the unfinish'd Part of the Division it belongs to, from the foregoing.



T I T L E

(9)

T I T L E III.

Of the Æther in the Atmosphere.

C

T I T L E IV.

*Of the Springy Particles of the Air, and
the Spring of the Air.*

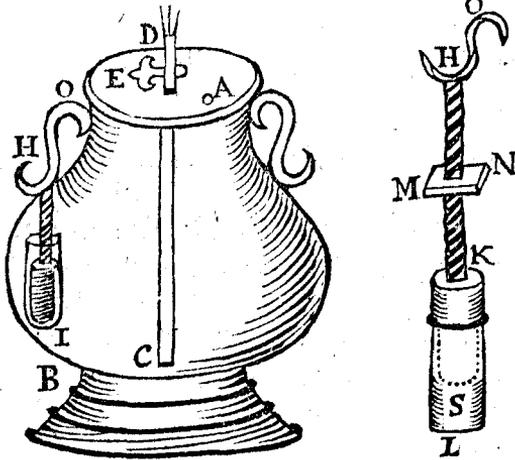
Aerem validè comprimere, aut dilatare.

Follibus luforiis aerem pyulco ingredientes majorem subinde atque majorem difficultatem percipiunt; que enim magis aer conclusus à naturali raritate recedere cogitur, etiam majore nisu resistit, neque solum magis densari renuit, sed & se latius explicare molitur. Hinc didicimus & pneumaticos fontes construere, qui spiritu interno urgente aquam in altum evibrant, & plumbeas glandes fistulis ejaculari, non pulvere nittrato ignem concipiente, sed aere per vim densato ad antiquas dimensiones recuperandas erumpente. Quoniam verò ingesta jam in conceptaculum non exigua aeris copia difficiliius comprimatur novâ aeris accessione, quam ut manus valeat trufillum rectâ impellere; idcirco trufilli hastulam deformatam in helicem, & suæ matrici insertam, adhibere operæ pretium erit: dum enim manubrio agitante contorquetur cochlea, sensim deprimitur embolus, aeremque ingerit. Ne autem morâ longiore opus sit perpetuâ versatione manubrii, ita cochleæ matrici externam vasis faciem contingat, ut illi adnecti, atque ab eo disjungi valeat: initio enim, quando adhuc levis est aeris modicè compressi resistentia, lamella illa suo foramine interius claviculatim striato coharens hastulæ emboli, si à vase disjuncta fuerit, unâ cum hastulâ movebitur: deinde vero, quando jam trufillis ægrè impellitur,

Casati Mecha-
nicorum, lib. 8.
cap. 5. P. 792,
793, &c.

pellitur, lamella illa cum vase connectatur, & non nisi versato manubrio adduci atque reduci embolus poterit, id quod satis lentè perficietur. Rem claritatis gratia in fonte pneumatico explicemus.

Sit vas A. B. ex materiâ metallicâ, in cujus superiore parte labrum, ex quo per foramen A. immittatur in vas



aqua, ita tamen, ut non impleatur; aqua enim in vas modicè inclinatum descendens, aerem expellet per tubulum C. D. ubi satis aquæ immissum fuerit, occludatur foramen A. diligentissimè cochleolâ congruente, & convo-

luto epistomio E. tubus D. C. sit aeri impervius ad vasis latus statuatur modiolus cum embolo congruente H. I. & emboli hastula sit connexa cum mobili vasi ansâ H. O.

Porrò hastula H. K. perforata sit, & continuo ductu usque ad emboli K. S. fundum pateat aeri ingredienti via H. S. sed foramini S. adjecta sit valvula, quæ aeri regressum obstruat. Similiter modiolii fundo in I. valvula exterius apposita aperiatur ingesto aeri transitum præbens; sed aeri intra vas compresso cum nusquam exitus pateat, valvula ipsa modiolii foramen I. occludit. Hastulæ verò H. K. exterior facies sit in helicem striata, & lamellæ M. N. tanquam matrici congruat, quæ
in

in M. & N. cochleolis adnecti queat exterius vasi, quasi esset ansæ fulcrum.

Ubi immissum fuerit quantum satis est aquæ, cochleolis M. & N. revolutis disjungatur matrix à vase: tum attractâ ansâ H. O. unâ cum lamellâ M. N. attrahitur embolus K. S. & per apertum ductum H. S. ingreditur aer, modiolum implens. Impulso deinde embolo, valvula ad S. clauditur, & aer ex modiolo per patentem valvulam I. ingeritur in vas; ex quo nequit exire, neque aquam propellere, clauso scilicet epistomio E. & foramine A. qua propter comprimitur, & densatur; ideoque attracto denuo embolo K. S. inclusus vasi aer se latius explicare connitens valvulam I. valide applicat foramini modioli, sibi que exitum obstruit. Toties adducitur atque reducitur embolus, & aer ingeritur, quoad magna premendi difficultas percipiatur; ubi eò ventum fuerit, tunc lamella M. N. iterum vasi adnectatur suis cochleolis; nec jam embolus rectâ adduci potest; sed areptum in O. manubrium versatur, & embolus intrâ modiolum circumactus sensim attollitur, qui deinde revolutus in contrarium manubrio deprimitur, & multâ vi aer in vase comprimitur. Laxato demum Epistomio E. compressus in vase aer, aquam exprimit per tubum C. D. primùm quidem vehementius, subinde remissius, prout aeris vis elastica sensim longuescit.

Hoc idem quod de aere intra vas comprimendo ad aquam evibrandam comminisci placuit, servatâ analogiâ, dicendum est de aere, tum conatu manûs rectâ trussillum impellentis, tum ope cochleæ similiter conformatæ, intrâ conceptaculum comprimendo, ut ex fistulâ deinde multâ vi emittatur plumbea glans, ubi reseratus aeri exitus illum subito dilatari permiserit. Quin & pneumatica hujusmodi tormenta citrà conceptaculum
aeris

aeris compressi construere non inutile accidat, si, quemadmodum nostrates pueri surculos sambuceos fungosâ medullâ exhauriunt, & utraque tubuli extremitate papyraceis globulis obstructâ, alterum globulum congruo cylindro propellunt, atque inclusum aerem densant, quoad aeris vim elasticam, & impellentis manus conatum non ferens extremus alter globulus edito scloppo expellatur; ita ferream fistulam longiorem paraveris, cujus alteri extremitati immittatur plumbea glâns obducta papyro, aut simili materiâ, ut exquisitè tubi osculum implens demum universam aeris vim excipiat, alteram extremitatem aliquot spiris ambiat cava cochlea, quam impleat cylindrus ferreus in congruentem cochleam deformatus; si enim hujusmodi cylindrus vix brevior fuerit, quàm fistula, & apto manubrio convolutus in fistulam sensim immittatur, totum aerem, quo fistula replebatur, ad exiguas spatii angustias adiget, ex quibus magnâ vi demum, quâ data porta, erumpens ejaculabitur plumbeum globulum.

T I T L E V.

Of the Magnetical Particles in the Air.

T I T L E VI.

Of the Destruction, Generation, Absorption and Extrication of the Air.

New Experiments about producing of Air. And examining the Bodies produced.

THAT the Air has a great Interest in the Production of many Phenomena of Nature, either not formerly known, or not formerly ascribed unto it, as the chief Agent, if as any at all, has been, I suppose sufficiently manifested by our own Experiments, as well as by those published by abler Writers.

That also the Air is necessary not only to the well-being, but to the very Being and Motions of the Generality of Animals, will be easily deduc'd from those Trials whereby we have made it appear, that Animals whose Blood is hot, may be killed in our Engine by the withdrawing of the Air in about one Minute of an Hour, and that even those minute Creatures, whose Blood or Analogous Juice is cold, will for the most part, without excepting Cheese-Mites themselves, presently lose all their visible Motions, upon the Recess of the Air, may appear from our Experiments about Respiration.

Wherefore the Air, being a Body so important in our Speculations of Nature, and so necessary to the

Continuance of our Lives, I could not but think it deserv'd, that we should solicitously inquire, whether it may or may not be produc'd by Art; for if it can be so by any, not very uneasily practicable ways, the Discovery may not only help us to explicate some difficult Phenomena of Nature, but may afford us, among several other Uses, that of enabling us to supply divers, if not also submarine Navigators with fresh Air produced under Water, and thereby lengthen their staying in Places, where the Continuance of it may be of great Use both speculative and practical.

Upon these and the like Motives, I resolv'd, notwithstanding the Difficulties I foresaw my Curiosity would meet with in so new an Attempt, to try what I could do. But before I relate the Success of this Attempt, I must premise a couple of necessary Advertisements.

And first, when I here speak of Production of Air, I desire to be understood in a familiar Sense, meaning by that Expression the obtaining a sensible Quantity of Air, from Bodies wherein it did not appear before they were handled after our way, that so much Air, if any at all, was pre-existent. This I say, because I would not in this Place needlessly ingage in the Controversy about the Ingenerability (as they speak) or the mutual Transmutation of the Bodies that are called Elementary: for though I am not sure, but that some of our Experiments may argue a new and real Production of Air, or a Generation of it in the stricter Sense, yet I shall now imply the words Generation and Production, in the large and popular Acception, and would signify by them, as I lately intimated, the obtaining of a sensible Quantity of Aerial Substances from Bodies, that did not appear to have it, whether this obtain'd Substance were due to an Extrication and Union of Aerial Particles la-

tent in the Pores of the Bodies that afforded it, or to a real Production or Generation of Air, no where existent antecedently to our Experiments. And this is the first of my two Advertisements.

The second is this, That among the Difficulties, I fore-saw, in making Experiments suited to my Design, I look'd upon it as one of the greatest, though the least obvious, that to satisfy such a Disposition as mine, that is naturally prone enough to question things, it would be requisite for me to consider, and, if I could, to determine by appropriated Trials, whether the fluid Substances my Experiments might afford me, deserv'd the Name of Air or not. Wherefore I saw my self oblig'd to increase my Task, and so direct my Inquiries, that in the first Place they may afford me sensible Portions of such a Substance, as in a popular Sense may be stiled Air, whether these obtain'd Substances ought to be look'd upon as true Air or no. So that my intended Disquisition would naturally consist of two Parts, whereof the former was to contain the ways of producing, that which seems Air; and the other to propound those of examining, how far the produc'd Substance is indow'd with the Qualities, that are judg'd to belong to Air as such.

But in regard that I thought it most convenient so to contrive my Experiments, as to make such of them as I could to serve me, both to produce Air, and to examine it, I shall be more than once obliged to mingle the two Parts of my Disquisition, and reserve for the latter of them, only those few Trials, that concern purely the Examen of the produced Air.

And upon this Score it will be seasonable to take notice in this Place, that forasmuch as there are divers Qualities ascribed to Air, which to me seem but acci-

dental, and not universally to belong to Air as such, I have not observed any one Attribute that I think to be so much the Property of Air, and so fit to distinguish its true Particles from aqueous Vapours, earthy Exhalations, and the *Effluvia* of other Bodies, as a durable Elasticity or Springiness. And therefore I shall henceforth employ that, as the chief Criterion, whereby to constitute a Portion of Matter Aerial, and discriminate it from other flying and fluid Substances, and consequently to allow or deny it the Title of Air.

Now among the several Ways I thought of, whereby to produce Air, those I judg'd fittest to put in practice were these. 1. By Fermentation. 2. By Corrosions and Dissolutions of Bodies. 3. By boiling of Water and other Liquors. 4. By the mutual Actions of some, especially saline Bodies, upon one another. 5. By the Analyses and Resolutions of certain Substances.

Experiment
I.

On *January 17*, we conveyed into a long and large Tube some Filings of Steel, and as much Water as was thought convenient to dilute the Oil of *Vitriol*, which we also conveyed in a peculiarly shap'd Glass, seal'd at both Ends, but with a Hole opened near one of them; the external Tube, and the Water in them being exhausted, and the *Mercury* in the Gage, which we had also included, being so far impelled up into the open Leg, that there was scarce any at all left in the seal'd one; this, I say, being done, the external Tube was by our way exactly clos'd: and then the Oil of *Vitriol* being by little and little, and at good Intervals of Time, poured out of the internal Tube, to actuate the Water, there were produced exceeding large Bubbles by the Action of the Solvent upon the Metal, which also produc'd a sensible Heat, though not a great one. When this
Conflict.

Conflict had lasted a while, we observed, in compliance with the chief Scope of this Experiment, whether there would be any springy Air produced by all those Bubbles; and we perceiv'd that there seem'd to be so much of it generated, that at length the *Mercury* in the Gage was impell'd to the very bottom of the open Leg, and the Air included in the other seem'd to be more compress'd than it had been when it was put in by the Weight of the Atmosphere: But to try whether this Spring (wherein the Warmth, formerly mentioned, might be suspected to have for that time some Interest) would continue, I removed the Tube into another Room where was no Chimny; and coming to look on it the next Day, did not take notice of any sensible Alteration in the Gage; and with the like Success I visited it for three or four Days: But then coming one Day to look upon it, I found the *Mercury* in the Gage to have ascend'd about one Inch and an half, and about that quantity of Water to have got into the sealed Leg; which inclin'd me so much the more to suspect, that this Change in the Gage might have been accidental, a Boy having unknown to me removed the Tube from its wonted Station, to place somewhat else there, without doing it heedfully enough. And this Conjecture seems the more likely, because I have not seen any notable Change to have happened in the Gage from that time to this, (which is the 25th of *January* at Night) the *Mercury* in the open Leg being about one Inch and an half.

March 8. A Glass Vial holding about a Pint (by guess) was filled with Wheat Flower, and as much Water as was sufficient to drench it well. Afterwards the Orifice was exactly and strongly clos'd with a Cork, and an excellent Cement: the Glass was set in a warm Place of the Labo- Experiment:
11.

Laboratory, because of the Coldness of the Season; and having stood there a Fortnight baring one Day, it this Morning broke by the mere Dilatation of the included Matter, whose visible Part was last Night observ'd to leave a considerable Part unfill'd beneath the Cork. Notice was taken by the Laborant of the Event of this Trial, by a Noise which yet was no louder than one made upon the bursting of the Glass into several Pieces: To my Taste the included Matter was but a little sourish, but another afterwards judged it to be manifestly acid.

Experiment
III.

March 9. Having on the 23^d of *February* put into a pretty large Bolt-head a convenient Quantity of bruised Raisons, with as much Water as I thought necessary to make them ferment; and having caused the Air to be carefully pump'd out, and taken sufficient Order to keep any from forcing or stealing into the Glass, I set it in the Laboratory, that the Warmth of the Air might facilitate the Fermentation. At the end of four or five Days, it did not appear by a Mercurial Gage, (which had been purposely inclosed together with the Raisons) that there was generated any springy Substance. But being hindred by several Occasions from looking after this Glass from time to time, it seems the contained Liquor fermented more violently than the time of the Year would have made one expect: for about four of the Clock in the Afternoon, no body being in the Laboratory, the Glass flew in pieces with a loud Noise like the Report of a Pistol; which alarming a Domestick of mine, that was in a Chamber not far off, made him hasten to the Laboratory, where he found the Raisons thrown all about, and the middle part of the Bolt-head (for the Bottom and the Pipe were intire enough) scattered

scattered into such little Pieces, that they seem'd almost to be vanished.

On the 22^d of *February*, I fill'd a Glass that had a somewhat wide Mouth, and might hold by Estimation three Pints (or Pounds) of Water; to which that Liquor, and a convenient Quantity of bruised Raisins upon the Orifice of the Glass, were tied the Neck of a pretty large Bladder, out of which the Air having been diligently express'd, it was strongly fastned to our Glass with one of our close Cements; so that by squeezing the Bladder, we could not perceive that any Air could get in or out. Then, this done, we left the Glass in a convenient Place in the Laboratory, till the 8th or 9th of *March*; and then finding the Bladder to be pump'd up, we would have tied up the contained Air, but could not do it by reason of an imperceiv'd Hole, perchance made with the Point of a Pin, by some one of them that handled it. Wherefore taking off this Bladder, we caus'd another that was very limber, to be put on after the manner newly described; and yesterday Morning we found it, though by Estimation it might hold about two Pounds of Water, to be so full of Air, that we could not without difficulty, and losing a pretty deal of the contain'd Air, tie the Bladder very close near the Neck of it.

And to try whether this same Mixture would continue to produce Air, (whether fermented or not, I must not here dispute) I caus'd another Bladder to be fastned to the same Glass as before, and found it this Morning *March 11.* as full as if it were distended with a Pair of Bellows.

April 28. Into the bottom of a wide-mouth'd Vial we put some good Spirit of Salt, and Filings of Steel, and
whelm'd.

Experiment
IV.

Experiment
V

whelm'd over it a R^r. fitted with an Eel-skin and a Wire; to the latter of which was tied a thin Glass-Vessel, hermetically seal'd at the bottom, tho'twas but slender, and furnished with a competent Quantity of Filings of Copper, then we exhausted the R^r. well with our Engine, and afterwards by thrusting the Glass that held the Filings against the bottom of the Vial, we broke it off, upon which the Filings fell into the Menstruum, which acting upon them, there ensued good store of Bubbles that made a Froth much deeper than was the Liquor, and the successive Generation of these Bubbles continued a good while, and appear'd some of them large enough, though in the free Air they would scarce have been visible, or at least would not have been taken notice of, the Vial having been kept in our *Vacuum* for a Quarter of an Hour longer, and no Greenness to be seen in the Liquor, the R^r. was taken off, and the Vial left open to the Air.

Experiment
VI.

A Bubble of Air, whose Diameter was near in length to that of a middle siz'd Pea, was left at the top of a round Vial with a long narrow Neck, whose Cavity was fill'd with fine Oil of Turpentine, and then being inverted into a Vial fill'd with the same Liquor, was set aside in a quiet Place, and left there for a competent time. Another Vial shap'd like the former, but a pretty deal less, was fill'd Neck and all with Alcohol of Wine, save a Bubble of Air about the same Bigness with the former: This Vial being inverted into another furnish'd with the same Liquor, was set aside in the same Window with it, and at the same time: The Event was, that about the End of the 6th Day, the Bubble disappear'd in the Glass that contain'd the Oil of Turpentine. And the like Absorption, if I may so call it, I observ'd to have been made of the Air by the
con-

contiguous Spirit of Wine, the next Day after:

May the 23^d. We open'd another exhausted Receiver, wherein was an unstop'd Vial more than half full of an opacous and blackish Liquor, which we guefs'd (for we found no Inscription belonging to it) to have been Frogs Spawn, and were sure to have been included at least three Years: By the Mercurial Gage that was put up with it, it appear'd to have afforded some Air, but not very much. Its Smell was stinking, much like that of the Pump of a Ship, but yet it had produc'd no Insects, nor had any Appearance of Mouldiness. *Experiment VII.*

A Gentleman of my Acquaintance, an industrious Digger for Mines, and Owner of a good one, informs me, that when the Miners meet with running Water under Ground, they are thereby supplied with Air enough for free Respiration: And when I ask'd whether he thought that Air was produced or extricated by the Motion of the Water, or else were only concomitant to the Stream? He answered, that it seem'd to him more like to proceed from the Water it self: and further answered me, that standing Waters did not afford Air to the Diggers; and that running Waters did it even at considerable Depths, amounting to many Fathoms. *Experiment VIII.*

Experiments about the Production of Air, and the examining thereof propos'd.

Sect I. **T**O produce Air by Fermentation in exactly closed Receivers.

To produce Air by Fermentation in seal'd Glasses.

E

To

To separate Air from Liquors by boiling.

To separate Air from Liquors by the Engine.

To produce Air by Corrosion, especially with *Sp. Aceti.*

To separate Air by Animal and sulphureous *Solvents.*

To obtain Air in the exhausted Receiver by burning
Glasses, and red hot Irons.

To produce Air out of Gun-powder, and other ni-
trous Bodies.

Sect. 2. Examine the produc'd Aerial Substance by
its preserving or reviving: *1st.* Animals. *2dly.*
Flame. *3dly.* Fire. *4thly.* The Light of rotten
Wood, Fish.

To examine it by its Elasticity, and the Duration
thereof.

As also by its Weight.

And by its lifting up the Smoak of Liquors.

T I T L E

T I T L E VII.

*Of the Accidental or less constant
Ingredients of the Air.*

T I T L E VIII.

Of Aqueous Particles in the Air, and of the Moisture and Driness of the Air.

I Shall not here determine whether in all the Instances that are referr'd to this Title, the Phenomena be produced by the meer Moisture of the Air as such, or by some other Agents, whose Corpuscles are accompanied and assisted by the moist Air as a Vehicle and a concurrent Cause. But without nicely distinguishing the Grounds of particular Operations, we shall refer the Phenomena in general to the Moisture of the Air, (or moist Air) that Quality being the most obvious to be observ'd in these Phenomena; in the Production of some of which it seems either the only, or the main Cause, in others an assistant Cause, and in all a not useless Concomitant.

The Account upon which a Body is dry, being usually but this, that the Pores intercepted between its more stable Parts, are not fill'd with any visible Liquor, it is not to be expected that a Quality so near of kin to a Privation, should furnish much to our present historical Notes: But yet Driness may sometimes have a not-inconsiderable Interest in the Changes of a Body, and that upon differing Scores, whereof I take these two to be the chief. 1st. As the Body by Exsiccation is deprived of those liquid and exhaleable Parts that were before harbour'd in its Pores, and were perhaps the Principle of divers Operations ascribed to it. And, 2^{dly}. As these
these

these Evaporable Parts by their Recess may occasion a Change of Texture in the Body, especially in regard of the Pores, whose Bigness, Figure, and perhaps Position, being alter'd, the Body by this Change of Texture acquires a Disposition to act, and be acted on, in several Cases, otherwise than formerly.

*A Transcript of
an Observation
made at Stan-
ton.*

Sometimes when the Weather began to be overcast, the Hygroscope did not sensibly appear to grow heavier, and sometimes it would preponderate when I took notice of no Vapours to make it do so: and though these things happen'd but seldom, in respect of the ordinary Changes of the Hygroscope according to those of the Weather; yet they made me suspect that sometimes the Clouds may consist of other Streams than Aqueous, or that there may be some Exhalations that may have a peculiar Congruity with the Pores of the Hygroscope, and whose Nature may be such as to the Power of drying the Hygroscope, that upon these or some other, yet unheeded Accounts, the Streams that are sometimes diffused in the Air, may controul the usual and regular Causes of increasing or lessening the Gravity of the Hygroscope. And this Suspicion was the stronger, because having made Hygrosopes with Powder and Salt, and also with the Saw-dust of Wainscot, hung at nice Scales in very thin open Glasses, purposely blown for Lightness sake at the Flame of a Lamp, though they usually acquired and lost Weight, as the Weather grew moister or drier, yet sometimes they did not.

Experiment

I.

At half of an Hour after nine a Clock at Night, I look'd upon the Half Hundred Weight that hung at the bottom of the Rope, the Weather being then fair, and a Mark being put at that part of the erected Board where the bottom of the Weight touch'd, I perceiv'd the sky a while after to grow cloudy and overcast, but without Rain;

Rain; wherefore going to visit the Weight again, I found it to be risen $\frac{1}{4}$ of an Inch or more; and looking on my Watch, perceiv'd there had pass'd an Hour and a Quarter since the Mark was made.

This Morning I came again to look upon the Weight between eight and nine of the Clock, and found it rais'd above the newly mentioned Mark, made last Night about one Inch, (for 'twas about $\frac{1}{2}$ of an Inch.) This Day the Weather being fair and windy, the Weight was fallen by ten at Night about six Inches beneath its Station, at which I found it when I look'd on it in the Morning.

Being not well yester-night, the Weight was observ'd at Bed-time, by two of my Servants, and it then rested at the 11th of the erected Bound. This Morning about eight of the Clock, I visited it my self, and found it to be risen about $\frac{1}{4}$ of an Inch above the eighth Inch, the Morning being cloudy, though the Morning very dry and dusty. The Weather growing more overcast, within somewhat less than an Hour after, I visited the Weight again, some scatter'd Drops of Rain then beginning to fall, and found it to be risen about half an Inch above the newly mention'd eighth Mark.

I look'd when I was ready to go to Bed upon the suspended Weight of 56 Pound, and mark'd how low it reach'd upon the divided Board; and a great part of the Night having been rainy, I look'd again when I was dress'd in the Morning, which was about half an Hour after eight a Clock, and I found the Cord so shrunk, that the Weight was rais'd above five Inches higher than I left it the Night before; but the Day recovering dry and windy, and sometimes warm, the Rope was so stretch'd, that at Night the Weight sunk a good way beneath all the Marks. N. B. The Rope near the Weight
was

was in Diameter $\frac{1}{4}$ of an Inch, and four decimal Parts of a tenth.

Experiment
II.

We took a Rope of near three Foot and an half in length from the Point of Appension, and somewhat less than $\frac{1}{4}$ (Inch) in Diameter; this we suffer'd to be stretch'd for some Days by a Weight of Lead with an Iron Ring or Anfula, weighing a Quarter of an Hundred, according to the great Hundred, which is five score and twelve: and then placing a flat Board under it so, that the Weight just rested upon it, we had the Rope well wetted over them with a Sponge dip'd in Water, and so often applied to it, that the Liquor might be thoroughly soak'd into the Pores of the Rope, which at first seem'd thereby a little stretch'd, rather than shorten'd; but after an Hour or two it began to shrink, so that we could make the Weight swing like a Pendulum over the Piece of Board it lean'd upon before. But afterwards the same Day the Weight stretch'd out the Rope again as much as formerly.

'Tis observable, that though *Morocco* be an Inland-Town, and the Soil of those Parts be usually dry, if not parched; yet Doctor *D.* who was lately there, inform'd me, that about *Morocco*, notwithstanding the violent Heats he felt in the Day-time, he observed the Nocturnal Air to be very damp, so as to make the Clothes he put off at Night exceeding moist, and unfit to be worn without airing the next Morning. He added, That though the Air was very piercing, and manifested it self to be so by many other Signs, yet it would not make his Knife rust in his Pocket, or his Sword in the Scabbard, though it would quickly produce a Rust in Instruments of that Metal exposed naked to it.

Air too moist cannot be wholesome. The Air in our Parts, *viz.* about *Oakly* in *Buckingham-shire*, though a high

high Country, is, as I said before, between *Michaelmas* and *Alhallontide* very moist, especially in rainy Weather, and upon a Thaw, infomuch that Wainscots, Stair-cases and Pictures will stand all of a Water, and after-run down in great Drops; and at *Brill*, upon that high Hill, 'tis in divers Houses worse than in the Valley, infomuch that the Stair-cases, especially if laid in Oil, will run down with Water: the North and North-East side of our Houses are observed to be moister, infomuch that the Furniture will rot, if Fires be not made sometimes in the Rooms, and the things aired: This is observ'd to be the most aguish Season of the Year. Mr. J. T.

As in another Experiment we tried, whether or no the Removal of the Air out of the Receiver would much alter the Temperature of the included Medium or Space, as to Heat and Cold: so we endeavour'd to discover, whether the Alteration would be notable, as to Driness and Moisture. To this purpose we did indeed wish for such a Hygroscope (or Instrument wherewith to measure the Moisture and Driness of the Air) as we used many Years ago, and since found well described by the industrious *Kircher*, in a Place of his *Ars magnetica*, to which I therefore refer your Lordship. But in regard that to this Instrument there is requisite the Beard of a wild Oat seasonably gather'd, which we could not then procure; we recall'd to Mind another Hygroscope, which, though it discover not such small Mutations as the former, we thought might be usefully enough substituted instead of it.

Of this Hygroscope, having particularly described it in another Paper, we shall now only say in a word, that 'tis made by fastning to the upper End of a Piece of Gut-string, or great Lutestring, a very light Index, and strongly fastning the lower end of the same String

to the bottom of a Box, or other convenient Frame, the Circumference of whose upper Part may be at pleasure divided into Degrees or other Partitions, upon which the Index may move to and fro. For the Instrument being thus made, when the Air grows moister, the Vapours insinuating themselves into the Pores of the Filaments that compose the String, do somewhat shorten it; and thereby those Filaments being altered in point of Contortion, the Index that is fastned to them turns one way: and upon the recess of those Vapours, or of others of like nature, the String comes to be wreath'd, and consequently the Index to be moved another way. So that in a String of about three Inches long, the Point of the Index will be oftentimes made to change its Place very notably, by such a mutation of the Air, as to Driness and Moisture, as was to be met with in the Morning and at Noon of the same Day, tho' such a Change did not always need either Rain, Clouds or Mists, or the absence of them, to make it notable.

Experiment
III.

We took then one of these Hygrosopes, and conveyed it into a small Receiver, that the removal of the Air being sudden, the Change of Temperature (if any should happen) in the exhausted Cavity, might be the more sudden and conspicuous. But we found not that the emptying of the Receiver made the Index sensibly change place. And though this Experiment were carefully made, yet for the greater Security we repeated it once more; and neither then perceiving the Index to remove, we kept the Receiver exhausted for a pretty while, lest there should be some more time requisite to the Operation of the Medium upon the Instrument. But neither did this Trial produce any sensible Alteration of the Index; but after the Key was turned, and Access was thereby given to the excluded Air, tho'
the

the Cover were still kept on, we found that then within some Hours, the Index was considerably removed. So that as far as these Experiments informed us, the Ether or subtile Matter that succeeds in the place deserted by the Air, if that Place be not left void; and consequently the thinner and more fluid part of the Atmosphere (in which the Corpuscles, that may be more properly called Aerial, swim) seems in its own nature to be very sensibly, neither cold, or hot, or dry, or moist. I said, as far as these Experiments, I mean those we made in this Engine with the Thermoscope and Hygroscope, inform us: because this Conjecture (for I dare yet call it no more) may be examined divers other ways, whose Events may either confirm, or oppose, or limit it. In the mean time I could wish, that if your Lordship had one of *Kircher's* Hygrosopes at hand, you would frequently and carefully try the last-recited Experiment with it; because I have found, that if such a Hygroscope be very well made, 'tis admirable, as well as pleasant, to see how small a Mutation of the neighbouring Air it will take notice of. But I thought fit to desire to have it frequently tried, because Care must be taken that such Motions of the Index be not mistaken for the Effects of the altered Temper of the Medium in the Receiver, which may in some Cases proceed from those Steams of the Oil and Water, which we elsewhere mention, that we now and then, tho' but seldom, observed to get out of the Cylinder into the Receiver, and play up and down there.

T I T L E IX.

Of Clouds, Mists and Fogs.

HEaring that an excellent Astronomer of my Acquaintance, had often measured the Height of Clouds, I enquired of him what Height he observ'd them to have? and was answered, That though he had measured eighteen or twenty even of white Clouds in fair Weather, yet he observed scarce any one to be higher than three quarters of a Mile, and few of them he found to exceed half a Mile.

A Mist coming, driving upon the Sea towards the Shoar, though without any sensible Wind, will raise a greater Swell of a Sea, than a brisk Wind will do. *N.*

I have observed in a Ground near my House, which is somewhat moist in Winter, as also in other Places, especially after a warm Day, and against fair Weather in *Autumn*, a moist blewish Mist to ascend about twenty or thirty Foot high, and then to subside again in Dew.
Mr. J. T.

T I T L E

T I T L E X.

Of Terrestrial Steams in the Air.

INquiring of an ingenious Acquaintance of mine, who, in an inclosed Scope of Ground, has several Veins of differing Metals and Minerals, whether he did not see, and sometimes smell Steams ascending out of this or that Spot of his Ground, in Circumstances where their Ascension could not be imputed to the Action of the Sun? He and his Son, who was also a *Virtuoso*, told me, that they had divers times seen as 'twere Pillars of Fumes ascending like Smoak, whereof some would be inodorous, some ill-scented, and some, though but seldom, well-scented. And you may have observed, as well as I, that Fogs, some of which I have known to be very lasting, and to have a large Spread, did require no tender Nostrils to perceive them to stink.

I have frequently observed the smoaking Steams that arose out of the Shafts of Mines not wrought in: And it is certain, the Charcoal made in *Cornwal* (especially of that Wood that grows in the Mineral Part thereof) doth afford a manifest Arsenical and Sulphureous Smell beyond other Charcoal. *N.*

Tel est par exemple ce nuage horrible d'une fumée épaisse qui s'éleva de la mer de Crete au Commencement de l'Esté de l'an 721. et qui s'étant repandu dans l'air.

Journal des
Scavans
1685.

Tair le fit paroître tout en feu. La mer n'en fut pas
meſme exempte ; car les groſſes maſſes de pierres en-
flammées qu'on en vit fortir, et qui ſe joignirent a
l'Iſle qu'on nomme Hiera, échaufferent ſi fort les eaux
qu'elles en bruloient les mains.

T I T L E

T I T L E XI.

Of Salts in the Air.

THIS sufficiently known that the Peripatetick Schools teach the Air to be an Element warm and moist; and if it be an Element, it ought, according to their Principles, and those of the greatest part of other Naturalists, to be a simple and Homogeneous Body. But because such an elementary or uniform Purity is much easier to be found in the Writings of Schoolmen, than amongst the Works of Nature, many of the modern Philosophers have justly forsaken this Doctrine of the elementary Simplicity of the Air in some measure; but perhaps very few of them, if any, have asserted the Air to be so exceedingly compounded a Body, as in my Opinion it really is. For divers of them grant indeed, that the Atmosphere is not absolutely pure, but yet think, that it differs but gradually from true and simple Air, as Water a little moved and troubled does from clear and settled Water. But for my part, I confess I acquiesce not in either of those Notions of the Air. For, as I have elsewhere more fully declared in a short Discourse, purposely treating of the Substance of the Air, although I will not deny that there is an Ethereal Matter more subtile than the common Air, which Ether I take to be diffused through all the Interstellar Part of the Universe known to us, reaching to and surrounding all its great Globes; yet speaking of the Air which we Men live and breath in, I take our
Atmo-

Atmosphere to consist not only of the purer Ether, but in great part of a vast multitude of *Effluvia* emitted by the Terraqueous Globe, and the various Bodies it is made up of, and perhaps in some part also of substantial Emanations from the Celestial Bodies; and that that whereby the Atmosphere differs from such pure Air, as the Schools tell us of, is not a bare and indeterminate Feculency, but a confused Aggregate of several distinct and perhaps disagreeing kinds of *Effluvia*. And amongst those, one of the principal sorts I take to be the *Saline ones*, which rove up and down amongst others in that vast Ocean of Effluxions, we call the Atmosphere: wherein yet I do not think there are to be met with, either all sorts of them every where, or perhaps any sort in like Plenty, in all Places, and at all Seasons.

To shew that the Air is not unfurnished with Parts of a saline Nature, I might alledg some Considerations that seem to make it probable *à priori*, as they speak, that there are always some such Corpuscles emitted into the Air. But instead of insisting on such Particulars, because they may seem too little of an Historical Nature, to be fit for this Paper, I shall content my self to take notice in the general, that almost (if not more than almost) all the Arguments I have employed, to prove the copious Ascension of subterranean Steams into the Air, may be applied to our present Purpose, since amongst the *effluviating* Substances of the Terraqueous Globe, there are, as I have declared in another Paper, huge quantities of common or Marine Salt, besides Nitrous, Aluminous, Vitriolate, and perhaps other kinds of Salts. To which I shall add, that the emission of Subterranean Aporrheas or Effluxes, is not the only Means whereby the Air may be impregnated with saline Particles; since the Exhalations and Vapours produced by the Action of the Sun-beams upon
the

the more superficial Parts of the Earth and Sea, may supply the Air with Swarms of Corpuscles, as well of saline, as of any other Nature. Not to mention that the Number of these may, in divers Places, be much increased, by those Vulcans, that have open Vents to discharge their Fumes into the Air; by those numerous Fires which burning in our Chimnies, produce much saline Smoak; and by other ways, which I shall here forbear to discourse of, for the Reason lately given for my declining Arguments drawn *a priori*: though some things applicable to this purpose, will in likelihood occur amongst the Instances I am about to add, to make it seem probable *a posteriori*, or by some Effects and Phenomena, that the Air is impregnated with saline Corpuscles, that are none of its least active Parts, and may have great Interest in divers of its Operations.

From what has been hitherto delivered, to make it probable that there is a saline Substance in the Air, I thought fit to proceed to other Inquiries. The first; Whether the Aerial Salts be of differing kind? and if so, which they are? And the second; How it comes by its saline Substance? But about such differing Points I durst promise *my self* but little Satisfaction, and therefore shall not pretend to give *you* much.

And yet, to say something to the first of the two Inquiries, I am prone to think, that the saline Particles of the Atmosphere are not all of one sort, but that there may be three or four differing kinds of Aerial Salts.

I know that divers learned Men, some Physicians, some Chymists, and some also Philosophers, speak much of a *Volatile Nitre*, that abounds in the Air, as if that were the only Salt wherewith it is impregnated. But though I agree with them, in thinking that the Air is in many Places impregnated with Corpuscles of

a Nitrous Nature; yet I confess I have not been hitherto convinc'd of all that is wont to be deliver'd about the Plenty and Quality of the Nitre in the Air: For I have not found, that those that build so much upon this volatile Nitre, have made out by any competent Experiment, that there is such a volatile Nitre abounding in the Air. For having often dealt with Salt-peter in the Fire, I do not find it easy to be rais'd by a gentle Heat; and when by a stronger Fire, we distill it in close Vessels, 'tis plain that what the Chymists call *Spirit of Nitre*, has quite differing Properties from crude Nitre, and from those that are ascribed to the volatile Nitre of the Air; these Spirits being so far from being refreshing to the Nature of Animals, that they are exceeding corrosive: And even when I caus'd Earth to be dug up in an old Pigeon-House, because that is accounted the most nitrous sort of Earth, and distill'd it with moderate Fires, I did not find the volatile saline Parts, that came over, to be like that, which these learned Men conceive the Air to be stored with. Nor have I met with among them any positive Proof, to evince the Truth of their Opinion; which yet, as I was saying, I am content to admit as an ingenious Supposition, till something be offer'd that shall prove it to be more; which I think not impossible to happen, at least as to some Times and Places. But I am not yet sure, that the Exhalations, that ascend from the subterranean Parts, and perhaps also the Sun-Beams themselves, may volatilize many of the nitrous Corpuscles they chance to act upon, and elevate them into the Air, without analyzing them, or destroying their Texture, as our Fires are wont to do. But however, I do not take the hitherto mention'd Nitre to be the only Salt, that impregates the Air: For when I consider how vast

vast a Portion of the Terraqueous Globe is cover'd with the salt Sea, and how vast Quantities of fossile Salt, as well fine and clear, as coarse, are dug up in *Poland*, especially near *Cracovia*; in *Hungary*, *Transylvania*, and in divers other Parts of the Earth: When I consider too, that we seldom find Salt-peter in the Earth, but that there is Sea-Salt mix'd with it, which puts the Salt-peter-men to a great deal of Trouble to separate it; and that even from Salt-peter, that passes for good, I had Trouble enough, when I had the Curiosity purposely to refine it, to free the purely Nitrous from the other saline Particles: I am prone to suspect, that in very many Places, especially maritime ones, the *Effluvia* of common Salt do, at least as plentifully as those of Salt-peter, abound in, or impregnate the Air: which Conjecture might be favoured by divers things, if I had leisure to insist on them.

That in some Places, that abound with Marchasites, there is a kind of fretting Vitriolate Salt, copiously dispersed through the Air, I have been inclin'd to think, partly by other Inducements, and partly by the Answers made me by a very observing Man, who liv'd in a Place, that I remember I visited; where being forced to reside a good while, he found the Hangings of his Chamber, and the Curtains of his Bed, rotted by the Vitriolate Steams exspir'd by the Soil, whose *Effluvia* had also very manifest and unwelcome Effects, on divers other things, that were kept near that Place; tho on the opposite Side of the River, in a Town that is not half a Mile distant from this Place, neither I, at my being there, heard any such thing complain'd of, nor the Relator, who had often occasion to repair thither, observ'd any such mischievous Effects; the Soil of this latter Place being chalky; whereas the other above

mentioned is vitriolate, insomuch that he observ'd, that when the moist and blackish Mould had been beaten upon by the Sun, that here and there the superficial Parts would be as 'twere besprinkled with a somewhat whitish saline Efflorescence.

Besides the hitherto-mention'd kinds of Salts, it seems not improbable to me, that the Air (especially about great Towns, and some other particular Places) may be impregnated with volatile Salts, that are of a Nature contrary to Acids. For that there may be Places in the Earth, even at a good Depth under Ground, that lodg such Salts, I have been induced to think by the Experience of an Acquaintance of mine: who, hoping to find in the Sale of what he supposed to be Virgin-Earth, the true Receptracle of an universal Spirit, from which he promised himself great and profitable Matters, caused to be dug up a great deal of a certain Clay, in a Place abounding with Minerals, and obtain'd thence by mere Distillation, no inconsiderable Quantities of Spirit and Salt, which in divers Qualities, as Smell, Taste, &c. I judg'd to be near of kin to the Spirit of Urine or Hartshorn. And yet this Earth was dug up at the Depth of many Feet, not to say Yards, beneath the Surface of the Ground, (as an ingenious Rötter, from whom the Chymist had the Clay, assur'd me upon the Place it self) which I once visited, to see some other choice Minerals, that innobled that Soil; whence I would have got a Quantity of the above-mentioned Clay, but that it being then the midst of Winter, the Rain had (as the Workmen speak) drowned the Pic.

In great Cities, and also Towns, where much Wood is burnt, 'tis probable that numerous Particles of volatile Salt may be disperfed through the neighbouring Air.

Air. For, as I have elsewhere shewn, the Soot of burn'd Wood, which is but that small part of the Smoak which chances in its passage upwards to stick to the Chimny, does very much abound in a volatile saline Spirit, which by many Trials are found to have so much Affinity to that of Urine and of Hartshorn, as not to be easily, but by the Smell distinguished from it.

Besides, in several Places the Putrefaction of Substances, that once were Parts of animal Bodies, may furnish the Air with volatile Salts, as I have elsewhere mentioned, that I found; that Urine, without Distillation, will by bare Putrefaction afford saline and spirituous Parts, that, whilst they yet swim in the copious Phlegm, that makes up the Body of the Liquor, will manifestly discover themselves to be volatile, not only by their Smell, but by their hissing with acid Spirits, and by their dissolving some Bodies, and precipitating others, according to the manner of volatile sulphureous Salts, as those that abound in Spirit of Hartshorn, Blood, &c. And I am apt to think, that 'tis not only in the parts of Animals, but also in those of many Vegetables; that Putrefaction may either extricate or produce volatile Salts. And I remember, I have observ'd in some succulent Vegetables, that chancing to lie in a Heap together, in a convenient Season of the Year, to make them rot; I observ'd, I say, when the Putrefaction was come to a certain Point, that the Stink did so resemble that of Carrion, that 'twas not easy for me to believe it came from Cadaverous Plants, not Animals. And that 'tis not impossible for a Vegetable to afford, without the Help of an Additament, a volatile Salt, even *in forma sicca*, may be gathered from what I elsewhere relate, of my having distill'd such a Salt from a certain spirituous Seed, though I freely confess, I ne-

ver obtained any (without previous Incineration) from above two or three Vegetables. But of this enough in this Place.

I shall now add, that besides the more simple Salts hitherto enumerated, 'tis not unlikely, that in some Places the Air may sometimes contain compounded Salts. For I have elsewhere shewn, that some sorts of saline Spirits, meeting one another in the Air, may there convene. And I elsewhere teach how to order a couple of Liquors so, that one will never of it self afford any thing in a dry form; and yet the spirituous *Effluvia* of this Liquor, meeting with those of the other, will exhibite a volatile and saline Body in a dry form; though the Liquors themselves being mingled, will not afford any such Substance. What I have elsewhere delivered concerning subterranean Steams, may make it probable, that at least now and then, and in some Places, there may be sent up from under Ground into the Air, among other *Effluvia*, store of saline ones, which needs not be supposed all of them to be of an uncompounded Nature. With which that agrees very well, that was related to me by a very intelligent Acquaintance of mine, that liv'd long in Parts of *America*, where there was a *Vulcan*, which he and some others having the Curiosity to visit, told me, that before they came any thing near the Fire, or were offended by the Heat, not only the Skin of his Face was almost corroded by the Sharpness of the Exhalations, but the Colour of his Hair was alter'd by it; which kept him from prosecuting his intended Discovery. 'Tis a known thing, and I have received Information of it from more than one Eye-witness, that about *Mount Vesuvius*, the ascending Exhalations, that issue out at some of the Holes, are of so saline and sulphureous a Nature, that
part

part of them stick about the Orifices of those Vents, in the form of Flower of Brimstone; of which a learned Acquaintance of mine brought away some Quantity. And I have had brought me from some of those Vulcans, a Stone, whose Cavities abounded with a white Salt, which, by fit Trials purposely made, was found near a-kin to *Sal-Armoniac*, and easily resolvable into a Salt, whereof one part was somewhat fix'd, and the other very volatile, which made it highly probable, that the Salt was compounded in the Bowels of the Vulcan: whence I have been credibly inform'd, that great Quantities of it have been cast up in the fiery Eruptions, and therefore Store of it might in Likelihood be dispersed through the Air, since I found the Salt it self to be sublutable.

But, besides the saline Substances hitherto mention'd, which may be referr'd to determinate *Species*, I think it not impossible, that the Air may, at least in some Times and Places, be impregnated with Corpuscles of a saline Nature, whether simple, or compounded, or of both kinds, not easily reducible to any of the sorts, we have been speaking of, or are acquainted with. For which Reason I shall not presume to give them any other Denomination, than that indefinite one of *Anonymous*. And I have been inclin'd to think, there may be such Bodies in the Air, by these two Inducements. The first; That the particular aerial Salts, that have been hitherto recited, are but few, as it seems probable, by what I have said in other Papers of subterranean Steams and *Mensurations*; and that therefore there may ascend out of the Earth into the Air, saline Fumes differing enough from those, whose kinds we have hitherto describ'd. But besides this Consideration *a priori*, (as they speak) Experience has presented us with some *Phenomena*, that seem

seems *a posteriori* to confirm this Conjecture. For there happen such Changes to some Bodies, by being exposed to the Air, as, though I am not sure, and therefore shall not be confident, that they are mainly produc'd by some nameless Substance of a saline Nature, may yet make it allowable to suspect them to proceed thence. And amongst these I shall take leave to insert some, which I deny not to be probably referrable, either to one or other of the formerly enumerated kinds of aerial Saltness. For laying these Instances before you together, they may, by appearing thus associated, give the stronger Probability to our Opinion, that there are saline Substances in the Air. And those Instances, that are not so proper to persuade you, that there are anonymous Salts, may serve to confirm that there are, at least in divers Places, differing sorts of aerial Salts. I remember I have more than once visited old Glass-windows, in high and ancient Buildings, and found some of the Panes of Glass here and there corroded, as if they had been worm-eaten; which probably enough argued the sharp and fretting Corpuscles, to have been carried along with the Winds to which they were exposed, as will not easily be reduced to any formerly nam'd Salts, whose being unable to corrode Glass, especially no finer than that was I speak of, is sufficiently known to Chymists.

Besides the above-mention'd *Phenomena*, others have occur'd to me, which possibly 'twould not be thought impertinent to subjoin on this occasion; but I chuse rather to reserve them for another Discourse; and now should put an End to this, but that I dare not conceal from you, that I sometimes had Thoughts of trying, whether a Discovery may not be made, what kind of Saltness there is to be found in the Air, and whether the

the

the aerial Saltness does or does not abound there, at least at this or that time. But this I freely confess to be so difficult an Attempt, that all that I can offer pretends but to dissuade you from rejecting it, as too desperate and extravagant a thing to be fit to be tried.

And I speak the less promisingly of what I am to say in the remaining part of this Paper, because I have not by me any Notes to assist my Memory, (which I dare not trust alone) concerning the Issues of the not numerous Trials, I had Opportunity to attempt in pursuance of those Thoughts. This I well remember, that among other ways of making the intended aerial Discoveries, I look'd upon this as the least unpromising, that such Subjects should be carefully chosen out, as being disposed to be differingly wrought upon, according to the differing sorts of Saltness, that may be found predominant in the Air.

This more general way of investigating the Salts of the Air, may contain divers particular Methods, of which I shall now touch upon the following three.

First, It may be worth while, to expose to the Air such Bodies, as we judge fittest to be wrought upon by the Salt, that we think likeliest to be met with in it. So where we guess the Air to be impregnated with Nitre, we may expose Lime to it, or some other Body that we think disposed to imbibe or retain such a Saltness. We may also hang up in such an Air, Clothes or Silks dyed with such Colours, that Nitrous (for Instance) or Salino-Sulphureous Spirits (as some Chymists call them) have been found peculiarly apt to make to fade, or to discolour them. In the Places where we suspect vitriolate Streams to abound, some appropriated Preparations of *Sulphur*, either common or metalline, may be exposed to try whether they will acquire a Black-

ness, as I have several times found some of those Sulphurs, though otherwise of no dark Colour, to do, upon the least Contact of vitriolate Corpuscles. In some Places also, which are judg'd likely to afford subterranean Steams, guesses may be made; whether this or that kind of Salt ascends into the Air, by spreading upon the Ground, in Places free from Dirt and Dusts, large Pieces of clean and white Linen Cloth, that has no Relish of Sope or Lees; and observing, after they have lain a competent while, whether, and how they are discoloured, and what kind of Saltness, if any, is to be found in the Moisture imbib'd by them, from the ascending Steams and falling Dew.

The next of the above-mention'd ways of inquiring after the Saltness of the Air, may be, to find, if it be possible, some one Body, that is both capable to be wrought on by several aerial Salts, and will be so differently wrought on by them, as to discover which kind of Salt it is, that has produc'd the Change. That 'tis very difficult to find such a Body, I will readily grant, but that it may be possible I will not be forward to deny. For having pitch'd upon Copper to make this Trial with, though the Attempt did not succeed according to my Wish, yet perhaps it was chiefly for want of Time and Accommodations that it miscarried.

Experiment
I.

For having taken Plates of Copper beaten thin, (without regarding their Bigness, or Figure, or Smoothness, as things not necessary to my purpose) I caus'd the Surfaces to be made very clean, that the Colours might be the more easily produced, and the better discern'd; then, keeping these over Glasses wherein were placed divers Spirits, as of common Salt, and of Nitre, partly sincere, and partly diluted with Water, I observ'd, as I expected, that though I put the Glasses in no Heat, yet there

there ascended fretting Particles out of the Liquors, and that within less than a Day, the Steams of the two above-mention'd Liquors had much darken'd the Surfaces of the Copper Plates, they met with in their way, the keeping them a while in the Air was not hard to know by the differing Discolorations that appear'd, which Plate had been invaded by the saline Corpuscles, and which by the nitrous: Which I did not at all wonder at, because I have formerly found, as I have elsewhere noted, that whereas Spirit of Nitre will make of Copper a greenish blew Solution, Spirit of Salt will, if duly imployed, dissolve that Metal into a grass-green Liquor; as the Spirit of Soot and that of Urine will into a deep Blew, almost like Ultramarine. But, as I said, the want of Time, of which good store may be requisite for such Trials, kept me from prosecuting my Attempt to an Issue. Notwithstanding which I look not upon the Design as desperate, not only because of the Incouragement I have already mention'd to resume it: But because I have observ'd Pieces of malleable Copper, brought me, to examine, out of an English Mine, (which is yet conceal'd) to be overcast here and there with a fair Verdigrease, which by Circumstances I judg'd to have been produc'd, not by gross Liquors, but by the Air impregnated with Steams fit to work on that Metal. And possibly there may be other subterranean Bodies, and even metalline ones, that by their Degree of Colour, or peculiar kind of Rust or Stain, that they will acquire in the Air, may help us to guess, what Substances, and among others what Salts the Air of that Place is impregnated with. I have been in a great and stately House, which being oddly seated, had this peculiar Inconvenience, upon the Score of the Steams that infested the Air, that those that dwelt in it, as one

of the chief of themselves complained to me, could not keep their Silver Plate, of which they had great Store, from being blemished by odd Discolorations, or as they seem'd to think it, Rust; though when it was not used, they carefully kept it in a Place judg'd convenient for such a Purpose. And I have been informed by an observing Man who liv'd there some time, that there is nothing more generally known in *Amsterdam*, than that their Silver Plate there, expos'd a little while to the common Air, tarnishes immediately, contracting a dirty Colour, partaking of yellow and black. Another Instance or two, though not afforded by Plate, I could mention to the same Purpose; but I reserve them for another Place; my Haste obliging me to pass on to the last of the three ways I propos'd, of investigating the Differences of aerial Salts.

The third way may be look'd upon, if you please, as a Variation of the second; but there is this Difference betwixt them, that here we make use of metalline Bodies, not crude, but already prepared by some Chymical Operations; so that being before-hand reduc'd to very small Parts, by the Intervention of saline Substances, the Operation of the Air upon them is wont to be much the sooner performed. In this third way then we employ such factitious Minerals or other Bodies, as having for the most Part an adventitious Colour already, will change that Colour by being expos'd to the Air. For it seems not impossible, but that by diligently observing what Difference may be found in the Discolorations, produc'd in these Substances by the differing kinds of Salts, as Nitrous, Salino-Sulphureous, &c. that we have shewn may be met with in the Air, some guesses may be made in a short time of this or that Salt, which has the chief Strোক in the Production.

on of the exhibited Colour. And I shall on this occasion mention two or three Bodies, without determining, till I be better satisfied, whether their Changes proceed only or chiefly from the Salt of the Air; but I am content not to pretermitt them, because if they do not prove what I propose, they will at least clear the meaning of it, and may however help us to guess at the Resemblance or Difference of Airs in several Places, by the Likeness or Unlikeness of the produc'd Changes of Colour, whether these Changes proceed from saline, or from any other Substance intermingled with the Air.

If we precipitate a strong Solution of good Silver made in *Aqua fortis*, with a competent Quantity of Spirit of Sea-Salt, we shall have a Pouder, which at first will be very white; but if the Liquor be not poured off, this being expos'd for a good while to the Air, it would acquire on the Surface a dark Colour, which perhaps an attentive Eye will discern somewhat various, as this or that kind of Saltness happens to be predominant in the Air. Experiment II.

We took an equal Weight of good Filings of Copper, and pouder'd Sal-Armoniac, which being well mix'd, were put into a cover'd Crucible, and kept in a moderate Fire over ignited Coals, till the Sal-Armoniac had either quite or almost done smoaking; then as much of the remaining Mass as could be parted, was taken out, and look'd of a dark Colour; but this Mass being grossly beaten, and expos'd for some time to the Air, look'd like a kind of Verdigrease, which is a Substance, whose Colour may be observ'd somewhat to vary, according to the Nature of the particular Salts, which by working on, and imbodying with the Copper, produce the Pigment. But a Parcel of the same Mass being, before the Air had time to work much upon it, grossly pouder'd, Experiment III.

der'd, and hermetically seal'd in a glass Egg, to fence it from the Air, and left in a South Window, did not appear discoloured, when the out-side of the other Parcel shew'd like Verdigrease: which seems to argue, the Change of Colour to have been made by the aerial Salt, if we suppose the Moisture of the Air to have had no Interest in the Change, or to have concurr'd to it, but as a kind of Vehicle assistent to the Salt.

Experiment
IV.

I also took Spirit of the Soot of Wood, and having poured a little of it on the Filings of Copper, my Expectations were answer'd by my finding, that the Liquor dissolved some Parts of the Metal into a deep and lovely Azur like Ultramarine; and that this Solution being suffer'd to grow dry in an open Glass, by the mere Operation of the Air, the *Ceruleous* Colour very soon degenerated, even before the matter was quite dry, into a *Cyanious* Colour, such as may be seen in good Turquoises. And to manifest that this Change proceeded not from any Peculiarity in the Spirit of Soot, and that this Spirit acted as abounding with a Salino-sulphureous Salt; I shall add, that I had the like Success in a Trial made with an urinous Spirit drawn from animal Substances, and put upon crude Filings of Copper. And in those Trials I sometimes observ'd the Differences of Colours, that did not discourage me from hoping, that the Prosecution of them might not be insignificant to my Purpose.

I have not been solicitous to describe the fore-mention'd Changes of Colours more particularly, because it had been very difficult to do so, and therefore I judg'd it more expedient not to attempt it. For there is so great a Variety of Colours, that few but Painters can exactly enumerate, and distinguish them by proper Names. And yet, besides those more noted ones, there are many others,

others, for which, though our Language, nor perhaps any other, is not copious enough to furnish us with distinct Appellations, yet our Eyes, especially when they have been attentively conversant with such Objects, are sharp enough to discern them: and by the Help of these nameless, as well as the stated Colours, I am apt to think a heedful Observer may perceive divers Variations in the Colours of the Bodies, we have been speaking of, that may assist him to guess, what Substance it is in the Air whereto these Diversities may be ascribed. And as Nature is much more rich in Things, than our Dictionaries are in Words, so has she furnished Men with Sensories capable of distinctly perceiving a far greater Variety of Objects, than they are able verbally to express. And this might be shewn by Instances, in the Organs and Objects of Senses less acute than Sight, whose Subtily in distinguishing things I could exemplify, not only by what is related, but by what has been perform'd by some Persons, not unknown to me, particularly our famous Doctor *Harvey*. But Examples of this kind I have not leisure to stay on; and therefore without spending more Words upon this third way of discovering aerial Salts, I shall barely recommend the Care of such Observations to their Curiosity, who shall think it worth while to make them.

With how little Confidence of Success, Trials that have the Aims of those I have been speaking of, are to be attempted, not only Consideration, but Experience hath made me sensible. But yet I would not discourage humane Curiosity from adventuring even upon slight Probabilities, where the Nobleness of the Subjects and Scope may make even small Attainments very desirable. Those adventurous Navigators that have made Voyages for Discovery in unknown Seas, when they

they first discern'd something of obscure near the Horizon, at a great Distance off, have often doubted, whether, what they had so imperfect a Sight of, were a Cloud, or an Island, or a Mountain: But though usually it were more likely to be the former, (as that which more frequently occur'd than the latter) yet they judg'd it advisable to sterve towards it, till they had attained a clearer Prospect of it: For if it were a deluding Meteor, they would not however sustain such a Loss in that of no great Labour, as in case it were a Country, they would in the Loss of what might prove a noble and rich Discovery. And if they desisted too soon from their Curiosity, they could not rationally satisfy themselves, whether they slighted a Cloud, or neglected a Country.

I do not perceive that the Air of our Inland Parts is considerably impregnated with Esurine Salt; since I do not find the Barrs and Casements of our Windows much impaired by Rust after near eighty Years standing; or that they are more rusty towards one Quarter than another; though the Air hereabout (viz. *Oakly* in *Buckingham-shire*) is very damp about the End of Autumn, and Beginning of Winter. So that I conceive this Salt either proceeds from the Sea-Vapours near the Sea-Coasts, or else from the Dissolution of this Esurine Salt in the Air, upon the burning of Sea or other mineral Coles. Mr. J. T.

Agricola de Re
Metallicâ, Lib.
duodec.

Mox ollam ex igni remouent; postea ex refrigerata
eximunt halinitrum purissimum: quod candidi marmo-
ris speciem gerit; atque tunc etiam id quod terrenum
est, in fundo residet. At terra, ex qua dilutum fuit
factum, & rami quernei vel consimilis arboris alternis
sub dio ponantur, & aqua quæ combibit halinitrum con-
spergantur:

spargantur : quò modo quinque vel sex annis rursus apta fit ad conficiendum dilutum. Halinitrum quodammodo purum, quod dum terra tot annos quievit interea, ortum fuit, & quod lapidei parietes in cellis vinariis & locis opacis exudant, cum primo diluto permixtum decoquatur.

Si verò locus aliquis talium venarum copiam suppeditaverit, ipsæ statim non conjiciantur in castella ; sed primo convehantur in areas, atque cumulentur : quanto enim diutius aeri & pluviis expositæ fuerint tanto meliores fiunt. Nam in ejusmodi cumulis, aliquot post mensibus, quam venæ in areas fuerunt congestæ, nascuntur fibræ longe venis bonitate præstantes : deinde vehantur in sex, plurave castella, longa & lata ad novem pedes, ad quinque alta.

Si verò dum dilutum recoquitur, separata non fuerint, mox ex minoribus vasis infundatur in majora, eaque concludantur : in quibus item atramentum sutorium separatum ab alumine concrefcit : utrumque excisum, & in hypocausto siccatum divendatur dilutum, quod in vasis & cupis non concrevit in cortinam refusum recoquatur : sed terra, quæ in fundo cujusque cortinæ refedit, ablata in castello unà cum venis, denuo aqua & urina diluatur. At terra quæ in castellis diluto, postquam effluxit, superfuit egesta & coacervata quotidie, rursus magis ac magis fit aluminosa, non aliter atque terra, ex quâ halinitrum fuit confectum, suo succo plenior fit : quare denuo in castella conjicitur, & aquæ affusæ ea percolantur.

A learned Observer, who practised Physick in one of the most Southern of the English Colonies, being ask'd
I by

by me about the Effects of the Air there upon Iron; affirm'd to me, that the great Guns there are so subject to become rusty, that after they have lain a very few Years in the Air, one may with a Hammer knock off whole Scales, or rather Cakes of *Crocus Martis*: and he observ'd, that those Guns, that lay only expos'd to the Air, did this much more than those that by Accidents were drown'd, and lay cover'd with the salt Water.

And since Dew is made of Steams of the Terrestrial Globe, which whilst they retain that Form, and were not yet conven'd into Drops, did swim to and fro in the Air, and made part of it; the *Phenomena* that shew the Power of Dew in working on solid Bodies, may help to manifest how copiously the Air may be impregnated with subtil saline Parts. Wherefore I shall here add, that having met with a Person that was bred as well a Scholar as a Traveller, and had visited not only some of the maritime Places of *Brasil*, but some of the inward Parts of that vast Country, I inquired of him about the Subtily of Brasilian Dew, and its Power to rust Metals, about which he told me, that it was certainly very great, and would not only rust Knives and such Instruments, but likewise Money, which he assured me he had particularly observ'd; adding, that in several Places the Portugals kept their great Guns cas'd over, that the Dew might not fall upon them, and by its Corrosiveness so rust them, as to be apt after a while to break in the Discharge. And when I demanded whether he tasted the Dew, to observe the Saltness of it? he replied, that he had not, but that he had in divers Places observ'd, that it left the Grass, or that it had rested on, cover'd over with a pure white Salt, as if it had been a hoar Frost.

An ingenious Traveller, and Student of Physick, being discoursed with by me about some Particularities of his Country (which is *Sweedland*) relating to Minerals, and their Effects upon the Air, assured me, that in a City, or notable Town called *Fahlun*, which is built on the lower Part of an Hill, containing one of the best Copper Mines in *Sweaen*, the Exhalations, that are copiously emitted by the latent Minerals, do so affect the Air in and about the Place, that their Silver Coins are oftentimes notably discolour'd by them, not seldom made even black or blackish, though the Money be kept well tied up in Bags or Purses, and these perhaps placed one within another, and the whole Aggregate be kept lock'd up in Coffers or Presses made of Wood of perhaps an Inch thick: He added, that these subterranean Steams have manifest Effects upon Brass, (wherewith that Country abounds) insomuch that there being kept in the principal Church seven Crowns made of that Metal upon a particular Occasion, the sulphureous Steams made those that look'd to them, take the Pains to cleanse and brighten them at a Months End, till finding that the Labour was every Month to begin again, they at length grew weary of it, and suffer'd these Crowns to grow, as they yet continue, as black (to use his own Phrase) as the Tunnel of a Chimney: This he averr'd to be true, as having a good Opportunity to be sure of it, in regard of his being a Native of this Town. And he further assured me, that the corrosive Exhalations did so penetrate the Bars and Vessels of Iron that lie exposed to the Air, that after a while, 'tis easy with a Hammer to knock off Scales of *Mars*, which are friable into a Pouder like *Crocus*, save that the Colour is more dark.

T I T L E XII.

Of Sulphur, and inflamable Particles in the Air; and of Lightning, and its Effect.

Yesterday a Neopolitan Lord, a Person of high Quality, and very curious, being ask'd by me some Questions about some natural Phenomena relating to *Vesuvius* and the adjacent Country? assured me, that having had occasion to stay for divers Months at a Country House, but little distant from *Naples*, he took much Pleasure, taking the Air on Horse-back upon a very sulphureous Soil, to take notice of divers Observables to be met with there; and that he often found, that when his Horse trod something hard upon the Ground, there would be produced a great, and as it were a crackling Noise, which would have frightened a Stranger; and that oftentimes he could discern, that where his Horse had trod, there would presently arise a Dust, and Fumes that were manifestly sulphureous and ready to take Fire: adding, that sometimes he thought that they actually did so. He further told me, that he sometimes for Curiosity sake, caused some Clods, or as it were Turfs, to be cut out of that Soil, and laid in a kind of Heap, and that then in the Night he could observe, that the Steams that plentifully issued thence would sometimes be kindled by or in the Air, as they ascended in it.

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The same Noble-Man told me, that when some Years ago there were Eruptions of Fire in *Mount Vesuvius*, he and others observ'd, with Amazement and Horror, that the Flame, which shot up into the Air from the *Volcano*, was of so prodigious a Height, as invited them to measure it with a Quadrant, by which they found it to be near two Miles high: And when I ask'd if he comprised in that Height the Altitude of the Mountain it self? he answered, that he did not, for the Flame that appear'd above the top of the Mountain, appear'd as high as the Mountain it self; and 'twas from the top of the Hill, and not the bottom, that they computed the Height of the Flame. He added, that sometimes the Earth would tremble, and there would be Discharges of such vast Stones, and other heavy things, that he saw some Masses of ignited Matter thrown up a great way into the Air, that were bigger than the Chamber he did me the Honour to visit me in, though that were a large Room for a Bed-chamber.

Voila tout ce qu' on peut dire de cette Isle, qui semble un enfer, car on voit la mer du port, & de la coste toute noire & Brûlée d' un petit escueil, qui paroist depuis environ soixante ans, & d' ou on vit sortir en ce temps-là une grande flamme, qui y a laissé une ouverture si profonde, que si on y jette une pierre, on ne l' entend point tomber. Mais ce qui est arriue depuis en ce port, n' est pas moins estonnant, je le rapporteray icy comme je l' ay appris de diuerses personnes en plusieurs endroits. Il y a environ 18. ans que durant la nuit d' un certain Dimanche, commença dans le port de Santorini un tres grand bruit lequel s' entendit jusques à Chio, qui en est éloigne de plus de deux cent milles, mais de telle sorte qu' on crut à Chio que c' estoit l' armée

Voyage de Levant, p. 203.

Accident extraordinaire à Santorini.

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mée Venitienne qui combattoit contre celle des Turcs, ce qui fit que dès le matin chacun monta aux lieux les plus éleuez pour en estre spectateur, & me souuient que le Reverend Pete Bernard Superieur des Capucins de Chio, homme venerable, & tres digne de foy, me conta qu' il y avoit esté trompé comme les autres, car il crut aussi bien qu' eux entendre plusieurs coups de canon ; cependant ils ne virent rien, & en effet ce fut un feu qui se prit dans la terre du fond du port de Santorini, & y fit un tel effet, que depuis le matin jusqu' au soir il sortit du fond de la mer quantité de pierres de ponce, qui montoient en haut avec tant de roideur & tant de bruit, qu' on eüst dit que ce fussent autant de coups de canon, & cela infecta tellement l' air, que dans ladite Isle de Santorini, il mourut quantité de personnes, & plusieurs de la mesme Isle en perdirent la veue, qu' ils recourerent pourtant quelques jours apres. Cette infection s' estendit aussi loin que le bruit qui l' avoit precede, car non seulement dans cette Isle, mais mesme à Chio, & à Smyrne, tout l' argent devint rouge, soit qu' il fut dans les Coffres, ou dans les poches ; & nos Religieux demeurans en ces lieux là me dirent que tous leurs calices en estoient devenus rouges. Autant de quelques jours cette infection se dissipa, & l' Argent reprit sa premiere couleur. Ces pierres de ponce qui sortirent de la coururent tellement la mer de l' Archipel, que durant quelque temps, quand il regnoit de certains Vents, il y avoit des ports qui en estoient bouchez, en façon qu' il n' en pouvoit sortir aucune barque, pour petite qu' elle fut, que ceux qui estoient dedans ne se fissent le chemin au travers de ces pierres de ponce avec quelques pieux ; & on en voit encor à present par toute la mer Mediterranée, mais en petite quantité, cela s' estant dispersé ca & là. Senecque raconte en une de ses Epistres que

que Santorini est bastie sur des mines de souphre, & ce-
 font elles qui fournissent asseurement la matiere pour al-
 lumer ce feu. On dit qu' Alexandre le Grand mesura la
 mer en cet endroit, & n' y trouua point de fond. Il y
 a pourtant une petite Isle appellée Firesia, á la pointe de
 laquelle on peut donner fonds, & point en aucun autre
 endroit.

It has been often observ'd, that upon the Falling of
 Thunder there has been produc'd in the Air, near the
 Places where it fell, a strong Odour of Burnt Brimstone.
 And I remember, that being one Night at a Town
 built almost upon the great Lake of Geneva, anciently
 called *Lacus Lemanus*: The Thunder was so violent
 as much frighted the Inhabitants; though (by reason
 of the Neighbourhood of the high Mountains of Sa-
 voy and *Switzerland*) Thunders be very frequent there:
 And the next Day I had a great Complaint made me,
 of the strong Strick of Sulphur, produc'd by the Thun-
 der that fell hard by, into the Lake, and was ready to
 overcome by its Smell, even a Souldier that stood Cen-
 tionel near it.

On July 24. An. 1681. The Ship *Albemarl*, whereof
 Mr. *Edward Lad* was then Master, being an hundred
 Leagues from *Cape Cod* in Latitude 48. about 3 P.
 M. met with a Thunder Storm, the Lightning burnt
 the Main-top-sail, split the main Cap in pieces, rent
 the Mast all along. There was in special one dreadful
 Clap of Thunder, in Report bigger than of a great
 Gun, at which all the Ships Company were amazed:
 then did there fall something from the Clouds upon the
 Stern of the Boat, which it broke into many small Parts,
 split one of the Pumps, the other Pump much hurt:
 it was a Bituminous Matter, smelling much like fired
 Gun-

Gunpowder : it continued burning in the Stern of the Boat. They did with Sticks dissipate it, and poured much Water on it, and yet they were not able, by all they could do, to extinguish it, until such time as all the Matter was consumed. But the strangest thing of all is yet to be mentioned.

When Night came, observing the Stars, they perceived that their Compasses were changed. As for the Compass in the Biddekel the North Point was turned clear South. There were two other Compasses unhung in the Locker in the Cabbin, in one of which the North Point stood South like that in the Biddekel. As for the other the North Point stood West, so that they sailed by Needle, whose Polarity was quite changed. The Seamen were at first puzzled to work their Vessel right, considering that the South Point of their Compass was now become North : But after a little Use it was easy to them ; thus did they sail a thousand Leagues. As for the Compass, wherein the Lightning had made the Needle to point Westward ; since it was brought to *New-England* the Glass being broken, it has, by means of the Air coming to it, lost its Vertue. One of their Compasses which had quite changed the Polarity, from North to South, is still extant in that Country, in the Hands of Mr. *Encrease Mather* ; the North Point of the Needle doth remain fixed to this Day as it did immediately after the Lightning caused the Alteration.

An industrious Gentleman that was long an eminent Planter of Trees, wherewith he furnished many of his Neighbours, presented me with a Piece of a Branch that seemed to have had a Slit, for it reached thorow the Bark almost to the very Wood, from one End to the other, but had now the Lips of the Wound overgrown on each side with new Bark : Of this kind of Gashes,
he

he told me, he found in other Branches of the same Tree, which made him think that some envious Knave had done this in Spite: but considering the Circumstances more curiously, he found that Conjecture much discountenanced by some of them, and suspected that these Wounds must have been made by some designless Agent. For by his own Observations, and those of his Friends, it appeared, that these Fissures are to be met with, not only in divers others of his own Trees, of differing kinds, and in differing Plantations, but also in the Trees of several others, which tho growing in the same Country, were remote enough from his: so that it having been observed with some Wonder, that in the foregoing Season, Lightnings had been very numerous and frequent, he and his Friends concluded, for Reasons that need not be here repeated, that the above-mentioned Gashes were some of the odd Effects of those Lightnings, which kept me from wondering at his negative Answer, to the Curiosity I had to know, whether all these Wounds of the Trees look'd the same way, as East or West, North or South. For I had formerly observed, that the same Fulmen or Flash of Lightning reaching to the Earth in the Form of Fire, appeared by the recent Effects as well of its impetuous Motion as of its violent Heat, to have moved in an irregularly winding-Line: which made me compare its Motion to that of a Squib, and help'd me to solve some odd Phenomena of Lightning, that this is not the fittest Place to discourse of: the foregoing Mention of what happened to the Trees, being designed, partly to preserve the Memory of an unusual Phenomenon, and partly to shew that whatever is wont to happen in Animals, Lightning is not always destructive or corruptive of

Vegetables, since the Wounds inflicted to Trees were happily cicatrized, and did not kill or poison the Plants. And whether this Phenomenon were produced, by some mineral Exhalations kindled in the Air, or by the violent and irregular Motion of some such Substance, or by both together, the Phenomenon will be pertinent to the Subject or Design of the present Tract.

T I T L E

T I T L E XIII.

Of Celestial Influences or Effluvioms in
the Air.

To Mr. HARTLIB.

Dear Sir,

I shall not I hope altogether forget the Charge which you have been pleased to lay upon me, in reference to the Consideration of all winy Liquors, their Affections, and the several Distempers incident to them, with my Thoughts about the preserving of them, so as may best retard the Quickness of their Motion, and hinder their Dyscrasy and Corruption.

To which End an exact Scrutiny into the Air, its Quality, Temperament and Motion, and an Inquiry of the Efficacy and Force that this hath upon all such Bodies, will be in some measure necessary.

And this puts me in mind to leave one Request with you, *viz.* to beg your Assistance and Countenance on all Occasions to Mr. *Streete*, when he shall at any time wait on you, who both as to his Undertaking, and to the Modesty and Simplicity of his Spirit, doth very much emulate our so much joint-esteemed Friend Mr. *Mercator*, who, though he may differ from the former, in reference to his Method, or to some of the profounder Parts of Learning: yet I think it very possible to reconcile them in the main, and cannot but expect something

extraordinary, in the asserting and perfecting of the Theory of the Planets, will be brought forth between them, which I should the more gladly see, by how much most Scholars complain of it, as of a thing hitherto wanting, by how much also I guess, that having the Examples of so many who have already attempted the same thing in vain, they will find themselves the more constrained to lay down some new choice, singular and undeniable Hypothesis, for the better Invitation of the Admittance of their Opinion among Learned Men, although such a Work be no less necessary also for other Reasons.

For if we assert not the Theory of the Planets rightly, and upon such Ground as are indubitably demonstrable, we shall never be free from Errors and Disagreements in Opinion about their Motions, and the right Calculation of them.

And if we mistake in either of these, we must mistake of the true Place in the Heavens, in which each Planet is, or constantly ought to be: And if we at all err in our Judgment of their due Places, it is impossible we should assert their several Aspects, and the mutual Influences and Virtues they have (through this) one upon another: And so the Physical Use of their Motions falls to the Ground wholly, or at least becomes subject to very much Uncertainty.

And truly, if there be no such Use at all of the Motions of these Bodies, as that which I may call Physical, *viz.* for predicting, and for (in some measure) determining the Affections, Dispositions and Alterations, that are introduced into several things here, either immediately, or into the Air immediately, by reason of the Course of these superior Bodies, it would very much lessen and depretiate with me, that Toil, Cost,
Pains,

Pains, Watchings, and continual Exercifes, and Indea-
vours, that have been ufed for the gaining of exact Ob-
servations in Astronomy. Seeing when we have done
all, and obtained all beyond the mere bare Knowledg
of them, we can propound no End, Benefit, Ufe or
Advantage, that may recompense the Trouble and
Pains beftowed upon them, (at leaft upon fome of them)
nor fo much as any real or particular Relation, between
us and them; and if fo, we know them only to know
them.

But we fhall at prefent prefume the contrary, and
therefore fhall crave leave to fay, that although feveral
Objections are commonly brought againft any fuch Ufe
or Application of thefe Bodies, or of their Power, In-
fluence or Motions, which are occafioned partly by the
Superftition and Paganifm incident to this kind of Do-
ctrine; partly by the Impofture, Ignorance, and want
of Learning, generally obferved in the Perfons pro-
fefsing this Knowledg; partly by the manifft Miftakes
and Uncertainty that there is in the Predictions of this
Nature; and partly by the Inexplicablenefs of the Way
or Manner how they come to affect one another, which
admits not, as many conceive, of an eafy vifible or fami-
liar Demonftration. Yet all thefe Objections, if through-
ly examined, do not, as we humbly conceive, really
null or take away the Poffibility of the thing fimplly,
but are raifed rather againft the Enormities and Imper-
fections that are confefsed to be in it: and it may, not-
withftanding all thofe Objections, ftill be certain, that
thefe Celeftial Bodies (according to the Angles they
make one upon another, but efpecially with the Sun or
with the Earth in our Meridian, or with fuch and fuch
other Points in the Heavens) may have a Power to
caufe fuch and fuch Motions, Changes and Alterati-

ons (stronger or weaker, according to the Nature of the Angle) as the Extremities of which shall at length be felt in every one of us : And this may be evidenced, *1st*. by undeniable Experiments, not only from things inanimate and vegetate, but from the undoubted Observations of Physicians, as well in several Chronical as acute Distempers, and more eminently in all Lunatick, Epileptick, Paralitick or Lethargick Persons. *2^{dly}*. It may further admit of a Demonstration : for if the extreme Motions of Physick be Generation and Corruption, and the mean Motions Rarefaction and Condensation, allowing then these Bodies to have a share in promoting the mean Motions, (*viz.*) of Rarefaction and Condensation, we shall or may soon be convinced, that their Effects then upon all other things here, cannot but be exceeding considerable.

For the better understanding of which, I shall offer a little more largely to you my Conceptions, *viz.*

That to speak properly and simply, I take Generation and Corruption to be the Extrems of Motion, rather than Motions themselves : for the Scope, Intentions or Effects of all Physical Motions (strictly so taken) are only to one of these Ends, *viz.* either for Generation or Corruption : and these two are they also which limit and bound all Motion ; for beyond these Meets there is no Physical Progression, and therefore these two must be the true *Termini*, as well *à quo*, as *ad quem*, of all such Motion, seeing all things are corrupted to be generated, and all things generated are at length corrupted.

But if these be rather the *Termini* and Extrems of Motion, then Motion itself. We must acknowledg, there are Motions, which Nature useth as Means, between these two Extrems ; which mean Motion must be

be as opposite also one to another, as the two Extreame. Otherwise we should never be at a Certainty, which way Nature intends by her Motion: otherwise also we must say one and the same Course, or one and the same thing in Nature, may simply and of it self, be the immediate Cause of Generation and Corruption, of Life and of Death, of Hardness and Softness, which is absurd and impossible.

Now as these two Motions of Rarefaction and Condensation, are opposite one to the other, as is required, so do they square to all other the Instruments and Phenomena in Nature, (*viz.*) the one answering to Heat, the other to cold; the one to Hardness, Compactness and Aridity; the other to Gentleness, Softness, Sweetness, Maturity, &c.

For which Reasons therefore, as well as for many other, which might be urged, (if insisted on) we do conclude, (submitting it nevertheless to be examined) that Generation and Corruption, Rarefaction and Condensation, is the simplest, plainest and truest Analysis, that can be found in Nature, for all Physical Motions, as unto some of which all Motion, purely Physical, may (as we humbly conceive) without straining, be immediately referred, and as by and through which all may likewise, with as little Difficulty, be resolved.

And having laid this as a second Argument; we say 3^{thly}. That it cannot be denied, but all the Affections and Dispositions of Moisture, Heat, Cold, Drought, the Course of all Winds, Showers, Thundering, or whatsoever else is used by Nature, to produce these two general and universal Effects of Rarefaction and Condensation, do in a great Measure, if not wholly, depend upon, and are altogether regulated by the Course, Motion, Position, Situations or Aspects of the Superior

riour and Celestial Bodies or Planets. And therefore, *4thly*. We say, that every Planet hath its own proper Light : And as the Light of the Sun is one thing, the Light of the Moon another ; so every Planet hath its distinct Light, differing from all the other. Now we must either say, that this Light is a bare Quality, and that the utmost Use and End of it is only to illuminate ; and there is no Light but is accompanied further with some Power, Virtue or Tincture, that is proper to it : which if granted, it will inform us then, that every Light hath its own Property, its own Tincture and Colour, its own Specificque Virtue and Power ; and that according to the several Bodies of Light, there are several Properties, Tinctures and Powers ; and that as one Star differs from another in Glory (according to the Apostle) so one Star and one Planet differs from another in its Virtue, in its Colour, in its Tincture, and in its Property.

And consequently, that those eminent Stars and Planets that are in the Heavens, are not to be considered by us as sluggish inertical Bodies, or as if they were set only to be as bare Candles to us, but as Bodies full of proper Motion, of peculiar Operation, and of Life. The Sun not only shining upon the rest of the Planets ; but by his quickning Warmth, awakening, stirring and raising the Motions, Properties and Powers, that are peculiar to them. According therefore to the Angles, they make with the Sun, and according as they are more or less enlightened by him ; according also as they are at the same time more directly or more obliquely, more remotely or more nearly situated and placed, in respect to us ; so must the Effects of the Powers, Virtues and Tinctures, that are proper to them, be more or less felt by us. *5thly*. For the manner of the Planets, trans-

transmitting these their Properties and Powers, and of their affecting other Bodies at so remote Distance, there is nothing begged or required in it, that is insuperable to a Man's Apprehension or Belief: (seeing,)

1. We affirm not any Property, Operation, Virtue, or Power, to be transmitted from any of the said Planets, but what doth descend with its Light, and is the real Property of its Light.

2. No Man judgeth, that the Light of any Planet, or of the Sun it self, is refracted, or by any other means weakened, hindred or impaired by the Æther (or that Substance which fills up the Space between one Planet and another) through which it passeth; but that it doth descend whole directly and unrefracted unto, or upon our Atmosphere.

3. But whatsoever is received by the Atmosphere, is also received by the thin and subtile Air, that is contiguous to the Atmosphere: And this Air therefore cannot but be capable of being moved, stirred, altered, and impressed by these Properties, Virtues and Lights, as penetrating each Part of it.

4. Not only the Air, by reason of its Thinness and Subtilty, is capable of being thus penetrated, moved and altered, by these Planetary Virtues and Lights: But forasmuch also as our Spirits, and the Spirits likewise of all mix'd Bodies, are really of an Aerious, Ethereal, Luminous Production and Composition; these Spirits therefore of ours, and the Spirits of all other Bodies, must necessarily no less suffer an Impression from the same Lights, and cannot be less subject to an Alteration, Motion, Agitation and Infection, through them and by them, than the other (*viz.*) the Air: But rather as our Spirits are more near and more Analogous to the Nature of Light than the Air, so they
L must

must be more prone and easy to be impressed than it. And if our Spirits, and the Spirits of all mix'd Bodies may be altered, changed, moved and impressed by these superiour Bodies, and their Properties; then these Spirits being the only Principles of Energy, Power, Force and Life, in all Bodies wherein they are; and the immediate Causes, through which all Alteration comes to the Bodies themselves. It is impossible therefore Spirits should be altered and changed, and yet no Alteration made in the Bodies themselves: and therefore a less Limit or Extream cannot be set to the Power or Operation, or Force of the superiour Bodies upon the Inferiour, than what must terminate at length into the very Bodies themselves.

5. As a further Confirmation or Proof of this, in reference at least to our selves, I shall offer to your Consideration the Accidents that often happen to Men, by the mere Air, as Convulsions, Cramps, Blastring, Lameness, Colds, many of which indure a Man's Life-time; and which (with many bitter Infirmities that sometimes seize upon a Man, while standing, walking, or lying in the Air) are rarely or never felt or discerned at the Instant of their Approach or Insults upon a Man, nor yet accompanied with the Sense of any Excess in the Air for Heat or Cold at that time, and therefore not well referable to any Cause in the Air, if not to the Power of those Properties and Operations of the Celestial Bodies that we speak of: And this I submit to the Judgment of common Experience.

6. Lastly; As the Sun-shining on the rest of the Planets doth not, as we said, only barely illuminate their Bodies; but besides this, through the Power, Virtue and Activity it hath, doth also raise, excite, awaken and stir up the several Properties and Dispositions that
are.

are in those several and respective Bodies, whereby they are more lively and effectually brought forth upon us ; so we are to suppose it is in reference to this our Planet, which is the Earth, which is not only enlightned, warmed, cherished and fructified by the Power, Virtue and Influence of the Sun ; but hath its proper Magnetical, Planetary Virtue, also fermented, stirred, agitated and awakened in it, which it remits back with the reflected Light of the Sun : and together with this Magnetick Planetary Property of the Earth, which is stirred and raised by the Sun, are awakened also the seminal Dispositions, Odors and Ferments that are lodged in, and proper unto particular Regions or Places, which do likewise emit and diffuse through the Air, as their several and respective benign, grateful, so their several malignant, congelative and fracedonous Natures and Qualities.

And hence therefore, though the Air, its Temperament, Disposition and Quality in general, is to be look'd at, according to the Motions, Influences and Aspects of the several superiour Bodies ; yet the particular Healthfulness and Unhealthfulness of Places, the evil Disposition of the Air, Evenings, Nights, and early in the Mornings, in some Parts more than in others ; the super-abundant Moisture, excessive Winds, Droughts or other Seasons, proper to one Country, and not to be observed in another neighbouring to it ; all these are rather to be allowed and referred to those Odors, Vapors and Exhalations, that are through the Power of the Sun, or other Planets, drawn forth from their particular Seats into the Air, from the Planets themselves.

And thus I have hinted, as well as I may, at the Solutions of all the Phenomena pertaining to this matter, that I can think of.

And if this be so, then wholly to neglect this Physical Use (and Consideration) of the Motion of these Bodies, and either to reject it, because of the Superstition that hath been mix'd with it; or to exclude it from all manner of Care, and from all other further Scrutiny, as a thing not worth our Inquiry or Search at all after, is as great an Extream on the other hand, and a Mistake, that must not pass untaxed among Learned Men.

You did not expect, I am sure, I should have adventured into so particular an Apology for Astrology; nor did I intend it, when I begun my Letter; nor do I now aim to justify any thing further, than what may properly, if not necessarily, fall into the Consideration of Natural Philosophy, being indeed much induced to think, that were the Theory of the Planets so exactly stated, so perfectly, or so undeniably demonstrated, that we might be sure we rightly understood the Place, Course and Position of each of their Bodies in the Heavens; this other Doctrine of their Physical Use, with the Weight, Dignity, Extent, Considerableness or Inconsiderableness of it, would soon confirm and demonstrate it self by the Evidence and Proof of it self, especially if any will please to take the Pains to calculate these Motions for his own private Use, and according to the Meridian he is in, and so compare them with his own Observations, of the Change and Alteration of the Air from Day to Day. Which doubtless, as it was the way at first taken by the Ancients, to find out their Efficacy, (I mean the making such a constant Observation, and keeping such a Diary) so the doing of that again, and giving us first an History or Diary of the Observations of the Weather, and its Changes in all Respects, and then an Account of the several Places, Motions, or
Aspects,

Aspects, each Day, of the several Bodies of the Heavens, with the Agreements, Doubts, or Disagreements, that these bear one to another, and that must necessarily rise thereupon, would be that, that could not but prove both satisfactory and delightful to us, in this great Point, about their Physical Power and Use.

And the Commodity of this in our Oeconomical or Civil Concerns in Husbandry, in Gardening, in Physick, and to the producing many other very stupendous Effects, cannot possibly be so well credited or discerned as it would, if some such plain Foundation and Demonstration of the Power of these Bodies, in general, were laid. Which methinks we should be much the more encouraged to undertake, having an Advantage given us in this Age, beyond what most Ages ever had, by the Use of those rare Instruments, that they call the Thermometers, or Weather-Glasses.

And truly when I consider, that things of the greatest Consequence do oft-times depend upon the most common Observations; and that Matters of the highest Improvement do receive their Beginning from mean, small, ordinary Experiments: I would have no Man, who hath Leisure, Opportunity and Time, to think it a slight thing to busy himself in collecting Observations of this Nature. It being much more commendable for a Man to preserve the History of his own Time, though but in the Observation of the Motions of this kind, than to say, upon every Occasion that offers it self, this is the hottest, or this is the coldest; or this is the rainiest, or this is the most seasonable or unseasonable Weather that ever he felt; whereas it may perhaps be nothing so.

And if there were no other Use, yet Observations of this Nature would much conduce to compleat the natural

tural History of any Place, as we may observe by that Learned Author who writ *Historiam Naturalem Brasiliæ*; and who, to prove not only the Habitableness, but Healthfulness of that Climate and Country, exhibits the Account of every Day's Weather, observed by him for many Years together, and so the Agreement of it to that Temper, which we account healthful.

But the instituting and perfecting of accurate Observations of this Nature, by the help of several large and exact Thermometers, placed in several Rooms, or exposed after some convenient Manner to the Air it self, would be a more noble and useful Undertaking, than ordinary. I say, the doing this accurately, by large and exact Glasses, by placing several of them, either together, or at some fit Distance one from another. It being much to be lamented, and that which I cannot but complain to my self of, that no Improvement considerable hath, as I can learn, been made by any Man, of these Glasses, either in our own Country, or any where else, since their first Invention, (but only to hang them in a Room for Ornament sake) there being many things yet wanting, that were much to be desired for the perfecting of them. For;

1. None hath hitherto given us the best Proportions between the Diameter of the Head, and the Diameter of the Bodies or Cylinder, although this be indeed the very first Consideration, and that which is most necessary in the Use of these Instruments; for as by how much the bigger the Cylinder is, and by how much the lesser the Head, by so much the more slow and imperceptible the Air's Alteration and Motion will be; so by how much the bigger the Head, and smaller the Cylinder is, by so much the more quick, subtil and discernable will every small Difference of the Air appear, which therefore

fore being on both sides capable of an Extream, ought to be regulated necessarily, according to some mean.

2. Admitting a mean or convenient Proportion between these two Diameters, to be as one to 16, or one to 24. We in the next Place do no less want the fittest Proportion for the Length of the Cylinder, which must doubtless also be varied answerably, as we vary the Proportion of its Diameter, the smaller Cylinder in Proportion to its Head, requiring the greater Length, the bigger Cylinder on the contrary the shorter Length.

3. I have not hitherto seen any Cylinder that hath been well graduated, 12 or 16 Degrees being the most that are set upon the common Weather-Glass: whereas to the making of accurate Observations, it would require a Cylinder to be divided into at least 360 Parts; though I think it neither unreasonable nor unpracticable, to have one divided into 1000 Parts, allowing but 10 Degrees to each Inch, which is no unusual Division, seeing such an one will much better discover, not only the small, but the more suddain and remarkable Changes of the Weather, (which are of chiefest Use) than any others that are common and ordinary.

4. Although no Liquor ought to be used in these Glasses, that is subject to Frost; yet we have little or no Account what those Liquors are, that might be best or fittest for the accurate making of those Experiments; whether those whose Property it is, somewhat to attract the Air, and so to preserve themselves in at least their first Quantity, as *Oleum Sulphuris per Campanam*, *Ol. Vitrioli*, *Liquor Salis Tartari*, &c. Or, 2dly. Whether those whose Parts are finest, subtlest, and nearest of kin to the Air, such as is Spirit of Wine, Spirit of *Terebinth*, well rectified, and according as there is occasion still fresh supplied. Or, 3dly. Whether those that are
of

of a middle Nature, as strong Spirit of Vinegar. Or, *4thly*. Whether instead of these, and beyond these, it may not be best to use only well-refined Quicksilver.

All which several Particulars, as they are necessary, and ought to be first ascertained, yet they are but preliminary to the Experiments themselves.

In the making of the Experiments themselves, therefore it would be convenient ; *1st*. That several Thermometers of one Proportion, Length and Graduation in their Cylinders in all Respects, as near as may be, were set in one Frame together, either with one and the same, or with Variety of Liquors. *2dly*. That several of these Frames were set in several Rooms, and that some were exposed immediately to the Air it self ; yet so as it may be conveniently sheltered from the actual Rays of the Sun, and from the Injury of Storms, Rain and Winds.

In the History it self, there cannot be too much Care and Exactness provided ; the Air of the Chimny, Cranny of a Wall or Door, Breath of People, or other such Accidents, do not interpose to deceive a Man's Observation, which must be circumspectly foreseen and considered.

The Proportion between the Warmth of the Day and Night, in constant Weather ; the Agreement or Disagreement of the Motion of the Air ; with the Motions of the superiour Bodies, in all uncertain, changeable and inconstant Weather ; the Efficacy or Inefficacy through these, in foretelling of Winds and Rain ; the Air its particular Disposition, under Thunder, under times of Mildews or Blasting, eminent Eclipses, Conjunctions ; with many other the like Particulars, which will of themselves be incident to an ingenious, diligent, apprehensive Person, may be the Subject of this History.

I shall not digress so far, as to tell you, what other things may be done by the Help of this excellent Instrument, this being not pertinent to our present Purpose.

Yet it is certain, that *Drebbel*, that great, singular, learned Mechanick, did by the Help of this Instrument, make a Dial continually to move of it self; regularly shewing both the times of the Day, and other Motions of the Heavens; did also make an Automatous Instrument of Musick; and found out a Furnace which he could govern to any Degree of Heat: but whether these have died with him, or how far the Meditations of others have wrought upon them, I shall humbly refer to a more leasurable Inquiry. And if you can inform me among any of your Acquaintance or Correspondents, I should be glad to hear and to learn any thing of this Nature, or relating to the further Use, Experiment or Improvement of this rare little Instrument, or to the further clearing, ventilating or discussing the Theory or Doctrine of the Planets, or the Physical Use and Power of these Bodies that we have thus briefly made an Essay of. Thus far that Letter.

They have a received Tradition in *Java*, and probably in divers other Islands of the South Sea, that the Beams of the Moon are wont to cause Contractures in the Body of those Men that stay too long exposed to them: The Truth of which Tradition was lately confirmed to me by an ingenious Doctor, that with Applause practised Physick in those Parts; who assured me, that he had observed, that upon the Account before mentioned some were made lame, or else had some of their Limbs contracted for divers Weeks, and some for many Months, or even a longer time. And when I asked him, whether he had at any time been

subject to that Mischief himself? He answered, that whilst he was a Novice in those Parts, after a very hot Day, he laid himself down very slenderly covered, to sleep (according to the Custom of the Place) near the Door of the House he lodg'd in; but being unacquainted with the Tradition, he unskilfully chose a Place upon which the Moon could fully beat for a good part of the Night, which being past before he wak'd, when he went to rise, he found his Neck so stiff, that he was scarce able at all to stir it; and his Mouth was so drawn awry, that 'twas hideous to behold, and continued so unsightly, that Shame forced him to keep within for some Days; during which he made Use of brisk Aromatick Medicines, by whose Help he got off a Contracture that used to stay very much longer with others. And when I asked him, if these Distempers were not occasioned rather by the Coldness of the Night and Subtily of the Air, than the Operation of the Moon's Beams? He answered me, that 'twas generally observ'd, that the other Causes, without the direct Beams of the Moon, were not wont to produce such bad Effects; and that his Landlord, when he saw his Mouth awry, told him, that if he had made him acquainted with his Design to pass the Night in the open Air, he would have prevented this Mischief, by lodging him in a Place unexposed to the Moon's Light.

(83)

T I T L E X I V .

Of the Height of the Atmosphere.

T I T L E X V.

Of the Motion of the Air, and of Winds.

*Extract of a Letter from Fort St. George, dated
January the 23d, 1663.*

Although the Bar of *Porta Nova* proved more shallow and dangerous than we were informed; yet she (our Ship) got safe in thither: and it was well she did so. Had we kept her here, there had been no Possibility of her Escape from perishing in a dreadful Storm, or rather Hurricane, which happened here the 22d of *November*: The like hath not been known here in any Man's Memory. The Tempest of Wind and Rain was so exceeding violent, that nothing could stand before it; Men and Beasts carried into the Sea by the Violence of the Winds and Floods: the Generality of the Houses in this and the Neighbour Towns were ruined: scarce any Trees left standing in Gardens or elsewhere: the Wall of this Town laid flat in several Places; your *Godownes* and other Houses in and about the Fort, uncovered and exceedingly shattered: no Place in the Fort where we could keep our Persons, Books or Papers free from the Wind or Rain: not scarcely any Doors could stand against the Violence of it: and we hourly feared the falling of the Fort down upon us, it was so exceedingly rock'd: and yet abroad we could

could have no Shelter, nor were able to stand against it. The repairing of the Damage will necessarily require a great Charge, which at first we thought would have amounted to 3000 Pagothes: but hope it will come short thereof.

Captain *Brookehaven* told me, that about the Island *Mauricius*, Hurricanes were the most frequent of any Place he knows; and that near that Island he met with one which lasted four Days in all: in one of which Days the Storm had seven Paroxysms or Exacerbations, which the Seamen call Frights of Weather, each of which he observed to differ two Points of the Compass from the preceding; by which Means the Surface of the Sea, by the Collision of the Waves, became to be all white, as if the Ship had been among Rocks. He added, that the Storm made the Day exceeding dark: And that the Noise was rather like that of Thunder, than of Wind, insomuch that those on the Shrouds could not hear those on the Deck.

A Learned Physician that travelled into *America*, affirmed to me, that those Countries only have constant Winds from the Land in the Night, which are furnished with Hills; and therefore the *Barbadoes* wants such Winds, because it has no Hills.

One of the *East-Indian* Committee (who had lived Years in the Island of *Teneriff*) answered me, that he usually observed there the Breezes to come in from the Sea about nine of the Clock in the Morning, and that about two Hours after Sun set, there blew a sharp Land Wind, every way from the Island to the Sea-ward, which continued all Night till the next Morning.

A Learned Traveller answered me, that though the Air were generally calm and clear at the Top of the Mountains, yet sometimes he had met there with Winds considerably strong.

In Lettere di Venetia.

MArtedi sui li 29. Agosto 1679. alle hore 19. incirca si leuolevò nelle Paludi della Villa di Fauis del Dominio Cesareo tre miglia lontana da Palma Noua Dominio Veneto un ucnto chiamato Biffa boua, che allargandosi per circa cinquanta passi scorse con tanto empito, e furore, che portò per aria diuersi huomini, che tagliauano il fieno in quei Prati, e anco alcuni Carri carichi di fieno con i Buoui precipitandoli assai lontano con la rouina delli animali, de Carri, e degli huomini, e passando per i Campi sbarbicando ogni sorte di Pianta le portò per aria gettandole molti passi lontano, rendendo la terra per oue scorse così arsa, che pare non ui sii mai stata piantata cosa alcuna. Arriud nella villa desta Bagnaria del Dominio Veneto doue gettò a terra molte Case sino a fondamenti, et altre discoperse, e rouinò portando per aria tauole, traui, et ogni altra cosa che era dentro esse Case restando mal trattate molte Persone senza però la morte di alcuno. Fuori di dettata Villa ui e una Chiesa chiamata S. Tomaso la quale restò scoperta, e rouinata una parte del muro portando uia il Campanile, e Campane che nel giorno seguente non si erano per anco trouate; — Di là si portò uerso Seuigliano Dominio Veneto e rouinò tutta la Campagna senza danno però della Villa, mentre li passò poco lontano, e girando poco lungi dalla Villa stessa spiantò da fondamenti un Palazzo del D. Co. Horatio Strafoldo, nel quale gli amazzò ogni sorte di animali che ui erano, portando per aria li mobili: sino le botti, esterminando parre della possessione. Non restorono però offesi Persone, perchè erano alla Campagna a laouare, e nel camino getto pure a terra due altre Case che sono nel Taglio per andare a
Stra-

Strafoldo spiantandole affatto con la morte di una Donna, d' un Fanciullo, e diuersi Animali.

Di là uoltò uerso Palma, et arriuando fino alle mura della Fortezza girò uerso la Villa di Priuano mezo miglio distante quale rouinò la meta, spiantando da fondamenti bellissimoi Palazzi, portando per aeria travi, tavole, et ogni altra cosa con la morte di molti, quantità di feriti, e diuersi strapazzati con far alla Campagna di molto male. Di poi scorfe nella Villa di Visco Dominio Imperiale, e tra li altri danni fatti roninò tutto il Palazzo nouo del D. Marco Foscolini Gentilhuomo di Cinidal nel quale essendoni una gran rimessa da Carozze, la di cui Porta hauena tre Cadenazzi, & entrando il Turbine per li balconi gettò la Carozza con tanto empito nella Porta stessa che la ruppe, e portò fuori la Carozza tutta fracassata gettandola sopra un muro della Corte assa alto, portando il Cielo della stessa mezo miglio lontano, e uertò nel medemo Palazzo ferito, e mal trattato un seruitore di esso Foscolini, di cui ronino pure una Braida, & un Brolo essendo in detta Villa restati due morti, e diuersi feriti; — S' inoltrò poi nella Villa di S. Vido di Crauglio stato Imperiale, la quale rouino tutta affatto senza restarui nemeno una Casa, portando per Aria coppi, travi, legne, sassi, e mobili con la morte di moltissime Persone, e moltissimi feriti e rouinati, et in detta Villa non si può anddare, ne con Carri, ne con Caualli per la grande moltitudine di rouinazzo, arbori et altro che hanno attrauer-sato le strade, essendo rimassi morti gran numero di animali—.

Da questo luoco si portò uerso Villes Villa Imperiale buona parte della quale gettò a terra per andar al Territorio di Monfalcone con la morte di molte persone, et quantità di animali con lasciar le Campagne per dove è passata senza piante, e come strada battuta—.

Hà danneggiato anco altre Ville ma leggiermente, ne

ne per anco si sà quello hauerà fatto piu avanti nel detto Territorio.

Questo successo hà lasciato un spauento grande in queste Parti, essendosi uedute cose incredibili mentre pioueuano sassi, tauole, arbori, traui, coppi, huomini, donne, fanciulli, botti, forghi, uua, galline, animali, et in conclusione ciò che incontraua portaua per aria con un rumore, e fracasso così gradne, che faceua terrore essendo per dette Ville un concorso grande di Popolo uicino per uedere cose che si rendono incredibili.

Doctor B. answered me, that though the Eastern Winds blow near $\frac{1}{4}$ of a Year at *Tangier*, yet they seem not to reach far into the Inland Country, where he observed them to be very unfrequent.

An ingenious Gentleman who is Owner of a Mine or two near the Sea, being asked by me, whether he could, by any peculiar Change appearing in the deeper Parts of the Mines, foretel any Alterations of Weather? He answered me, that the only Presage he had constantly observed, was of the Change of the Wind. For many Hours before the Wind was to shift from some other Corner, and get into the South, the Water at the bottom of the Mine would appear manifestly more troubled, or less limped than before; and when the Wind was to blow from the East, he was usually forewarned of it by an unusual Degree of Clearness in the Waters, which would appear more diaphanous than ordinary, though the South-Wind had not immediately before operated on the Waters. The Depth of the Mine was between fifteen and twenty Fathom.

He told me, that the Hurricans about *Goa*, are observed to come usually but at two Seasons, about the Beginning of *March*, and the 4th of *October*.

T I T L E

T I T L E X V I.

Of the Air as the Medium of Sounds, and of Sounds and Noises in the Air, and particularly Thunder; and of the Air's Operation on the Sounds of Bodies.

THIS Variety of the Air is the Cause of most dreadful Thunders, which, when *Gregory* described, he astonished his Hearers. For upon the rising of several Tempests altogether, the Sky is of a sudden covered over with black and thick, as it were Globes of smokey Clouds: By and by the Thunder breaks forth on every Side, ratling continually with Lightning, as incessantly flashing, enough to amaze the most resolute and most accustomed to the Noise. *Ludolph's Hist. of Ethiop. l. 1. c. 5.*

The String of a Viol has been by *Mr. F.* observed to give a sharper Sound against or in rainy Weather, by almost half a Note.

Mr. F. also assures me, that more than once or twice it has happened to him, that having put up false Strings in his Pocket, to make Frets of, as judging them useless for any other Purpose, the want of Strings having driven him to make Use of those, he has found them not false any more, but good Strings. And also that he observes some Strings apter to receive a Tension from the moist Air, than others are.

T I T L E XVII.

Of the Weight of the Air.

A short Account of the Statical Baroscope, imparted by Mr. Boyle, March 24. 1665. In a Letter to Mr. H. Oldenburgh.

AS for the new kind of Baroscopes, which I lately intimated to you, that my Haste would not permit me to give you an Account of, though the Necessity of preparing for an approaching Journey, gives me the same Excuse, I then had; yet since your Letters acquaint me, that you still design a communicating to the Curious, as much Information as may be, in reference to Baroscopes, I shall venture to send you some (though but an imperfect) Account of what I did but name in my former Letter to you.

Though by a Passage you may meet with in the Page of my *Thermometrical Experiments*; and though you may find, that I did some Years ago think upon this new kind of Baroscope; yet the Changes of the Atmosphere's Weight not happening then to be such as I wished, and being unwilling to deprive my self of all other Use of the exactest Ballance that I (or perhaps any Man) ever had: I confess to you, that successive Avocations put this Attempt for two or three Years out of my Thoughts, till afterwards returning to a Place, where I chanc'd to find two or three Pairs of Scales, I had

had left there, the Sight of them brought it again into my Mind; and though I were then unable to procure exacter, yet my Desire to make the Experiment some Amends for so long a Neglect, put me upon considering, that if I provided a Glass Bubble more than ordinarily large and light, even such Ballances as those might, in some measure, perform, that which I had tried with the strangely nice ones above-mentioned.

I caused then to be blown at the Flame of a Lamp some Glass Bubbles as large, thin, and light, as I could then procure: and chusing among them one, that seem'd the least unfit for my turn, I counterpoized it in a pair of Scales, that would lose their *Equilibrium* with about the 30th part of a Grain, and were suspended at a Frame. I placed both the Ballance and the Frame by a good Baroscope, from whence I might learn the present Weight of the Atmosphere: then leaving these Instruments together, though the Scales being no nicer, than I have expressed, were not able to shew me all the Variations of the Air's Weight, that appear in the Mercurial Baroscope; yet they did what I expected, by shewing me Variations no greater than alter'd the Height of the Mercury half a quarter of an Inch, and perhaps much smaller than those: nor did I doubt, that if I had had either tender Scales, or the means of supplying the Experiment with convenient Accommodations, I should have discerned far smaller Alterations of the Weight of the Air, since I had the Pleasure to see the Bubble sometimes in an *Equilibrium*, with the Counterpoize, sometimes when the Atmosphere was lighter, preponderate so manifestly, that the Scales being gently stirred, the Tongue would play altogether on that side, at which the Bubble was hung: and at other times, when the Air was heavy (that which was at the first but the Counterpoise)

terpoise) would preponderate, and upon the Motion of the Ballance, make the Tongue vibrate altogether on its side: and this would continue sometimes many Days together, if the Air so long retained the same measure of Gravity; and then again the Bubble would regain an *Equilibrium*, or a Preponderance. So that I had oftentimes the Satisfaction by looking first upon the Statical Baroscope (as for Distinction sake it may be called) to foretel, whether in the Mercurial Baroscope the Liquor were high or low. Which Observations, though they hold as well in Winter as the Spring, yet the Frequency of their Vicissitudes (which perhaps was but accidental) made them more pleasant in the latter of these Seasons.

So that the Matter of Fact having been made out by Variety of repeated Observations, and by sometimes comparing several of those new Baroscopes together, I shall add some of those Notes, about this Instrument, which readily occur to my Memory, reserving the rest till another Opportunity.

And, 1. If the Ground on which I went in framing this Baroscope, be demanded, the Answer in short may be; *1st*. That though the glass Bubble, and its Counterpoise, at the time of their first being weighed, be in the Air, wherein they both are weighed, exactly of the same Weight; yet they are nothing near of the same Bulk, the Bubble by reason of its capacious Cavity (which contains nothing but Air, or something that weighs less than Air) being perhaps a hundred, or two hundred times bigger, than the Metalline Counterpoise. *2^{dly}*. That according to an Hydrostatical Law, (which you know I have lately had occasion to make out) if two Bodies of equal Gravity, but unequal Bulk, were to be weighed in another Medium, they will

will be no longer equiponderant: but if the new Medium be heavier, the greater Body, as being lighter *in specie*, will lose more of its Weight than the lesser and more compact: but if the new Medium be lighter than the first, then the bigger Body will outweigh the lesser. And this Disparity arising from the Change of Mediums, will be so much the greater, by how much the greater Inequality of Bulk there is between the Bodies formerly equiponderant. *3dly*. That laying these two together, I consider'd, that 'twould be all one, as to the Effect to be produced, wherein the Bodies were weighed in Mediums of differing Gravity, or in the same Medium, in case its (specifick) Gravity were considerably altered; And consequently, that since it appeared by the Baroscope, that the Weight of the Air was sometimes heavier, and sometimes lighter, the Alteration of it in Point of Gravity, from the Weight it was of, at first counterpoising of the Bubble in it, would unequally affect so large and hollow a Body as the Bubble, and so small and dense an one, as a Metalline Weight; and when the Air, by an Encrease of Gravity, should become a heavier Medium than before, it would buoy up the Glass more than the Counterpoize, and if it grew lighter than it was at first, would suffer the former to preponderate. (The Illustration and Proof can scarce be added in few Words, but if it be desired, I may, God permitting, send you them at my next leisure.) And though our English Air, being about a thousand times lighter than Water, the Difference in Weight of so little Air, as is but equal in Bulk to a Bubble, seem'd to give small Hopes, that it would be sensible upon a Ballance; yet by making the Bubble very large and light, I supposed, and found the Event, I have already related.

2. The hermetically seal'd glass Bubble, I employed, was of the Bigness of a somewhat large Orange, and weigh'd about one Drachm and ten Grains. I thought it very possible, if I had been better furnished with Conveniences (wherein I afterwards found, I was not mistaken) to make (among many that might be expected to miscarry) some, that might be preferable to this, either for Capacity or Lightness, or both, especially if Care be taken, that they be not seal'd up whilst they are too hot. For though one would think, that it were advantageous to ratify and drive out the Air, as much as is possible, because in such seal'd Bubbles the Air it self (as I have elsewhere shewn) has a Weight, yet the Advantage countervails not the Inconvenience of being obliged to increase the Weight of the Glass, which when it includes highly ratified Air, if it be not somewhat strong, will be broken by the Pressure of the external Air, as I have sufficiently tried.

3. By reason of the Difficulties, and Casualties, that may happen, about the procuring and preparing such large and light Bubbles, as I have been lately mentioning, it may in some Cases prove a Convenience to be informed, that I have sometimes, instead of one sufficiently large Bubble, made Use of two that were smaller: And though a single Bubble of competent Bigness be much preferable, by reason, that a far less Quantity and Weight of Glass is requisite to comprize an equal Capacity, when the Glass is blown into a single Bubble, than when it is divided into two; yet I found, that the employing of two instead of one, did not so ill answer my Expectation, but that they may for a need serve the turn, instead of the other, than which they are much easier to be procured.

This

This Instrument may be much improved by divers Accommodations. As, *1st*. there may be fitted to the *Ansa* (or Checks of the Ballance) an Arch of a Circle, divided into 15 or 20 Degrees, (more or less according to the Goodness of the Ballance) that the Tongue resting over against any of these Divisions, may readily, and without Calculation, shew the Quantity of the Angle, by which when the Scales propend either way, the Tongue declines from the Perpendicular, and the Beam from its Horizontal Parallelism. *2^{dly}*. Those that will be so curious, may instead of the ordinary Counterpoise (of Brass) imploy one of Gold, or at least of Lead, whereof the latter being of equal Weight with Brass, is much less in Bulk, and the former amounts not to half its Bigness. *3^{dly}*. These Parts of the Ballance that may be made of Copper or Brass, without any Prejudice to the Exactness, will by being made of one of those Metals, be less subject than Steel to rust with long standing. *4^{thly}*. Instead of the Scales, the Bubble may be hung at one End of the Beam, and only a Counterpoise to it at the other, that the Beam may not be burden'd with unnecessary Weight. *5^{thly}*. The whole Instrument, if placed in a small Frame, like a square Lanthorn with Glass Windows, and a Hole at the top for the Commerce of the internal and external Air, will be more free from Dust and irregular Agitations, to the latter of which it will otherwise be sometimes liable. *6^{thly}*. This Instrument being accommodated with a light Wheel, and an Index, may be made to show much more minute Variations than otherwise. *7^{thly}*. The Length of the Beam, and Exquisitness of the Ballance, may easily, without any of the foregoing Helps (and much more with them) make the Instrument far exacter than those, I was reduced to imploy.

ploy. And to these Accommodations, divers other may be suggested by a further Consideration of the Nature of the thing.

Though in some Respects the Statical Baroscope be inferior to the Mercurial, yet in others it has its own Advantages and Conveniency about it.

At *first* it confirms *ad oculum*, our former Doctrine, that the falling and rising of the Mercury depended upon the varying Weight of the Atmosphere, since in this Baroscope it cannot be pretended that a *fuga vacui*, or a *Funiculus*, is the Cause of the Changes we observe. *2dly*. It shows, that not only the Air has Weight, but a more considerable one than some learned Men, who will allow me to have proved, that it has some Weight, will admit. *3dly*. This Statical Baroscope will oftentimes be more parable than the other, for many will find it more easy to procure a good pair of Gold Scales, and a Bubble or two, than a long Cane seal'd, a Quantity of Mercury, and all the other Requisites of the Mercurial Baroscope, especially if we comprize the Trouble and Skill that is requisite to free the deserted part of the Tube from Air. *4thly*. And whereas the Difficulty of removing the Mercurial Instrument has kept Men from so much as attempting to do it even to Neighbouring Places, the essential Parts of the Scale Baroscope (for the Frame is none of them) may very easily in a little room be carried wheresoever one will, without the Hazard of being spoil'd, or injur'd. *5thly*. There is not in Statical Baroscopes, as in the other, a Danger of Uncertainty, as to the Goodness of the Instrument, by reason, that in the Mercurial the Air is in some more, and in some less, perfectly excluded; whereas in *these* that Consideration has no Place. *6thly*. It being, as I formerly intimated, very possible

to discover Hydrostatically, both the Bigness of the Bubble, and the Contents of the Cavity, and the Weight and Dimensions of the glassy Substance (which together with the included Air make up the Bubble) much may be discovered by this Instrument, as to the Weight of the Air, absolute or respective. For when the Mercury in the Mercurial Baroscope is either very high, or very low, or at a middle Station between its greatest and least Height, bringing the Scale-Baroscope to an exact *Equilibrium* (with very minute Divisions of a Grain) you may by watchfully observing, when the Mercury is risen or fallen just an Inch, or a 4th, or $\frac{1}{4}$ of an Inch, &c. and putting in the like minute Divisions of a Grain to the lighter Scale, till you have again brought the Ballance to an *Equilibrium*, you may, I say, determine what known Weight in the Statical Baroscope, answers such determinate Altitudes of the ascending and descending Mercury in the Mercurial: And if your Ballance be accommodated with a divided Arch, or a Whele and Index, these Observations will assist you for the future, to determine, by seeing the Inclination of the Tongue, or the Degree mark'd by the Index, to conclude readily, what Potency the Bubble has, by the Change of the Atmosphere's Weight, acquired or lost.

Some Observations of this Nature I watchfully made, sometimes putting in a 64th, sometimes a 32^d, sometimes a 16th, and sometimes heavier parts of a Grain to the lighter Scale: But one that knew not for what Uses these little Papers were, coming to a Window where my Baroscope stood, so unluckily shook them out of the Scales, and confounded them, that he robb'd me of the Opportunity of making the nice Observations I intended, though I had the Satisfaction of seeing, that they

were to be made. 7thly. By this Statical Instrument we may be assisted to compare the Mercurial Baroscopes of several Places (though never so distant) and to make some Estimates of the Gravities of the Air therein. As if, for instance, I have found by Observation, that the Bubble I employ (and one may have made divers Bubbles of several Sizes, that the one may repair any Mischance that may happen to another) weighed just a Drachm, when the Mercurial Cylinder was at the Height of $29\frac{1}{2}$ Inches (which in some Places I have found a moderate Altitude) and that the Addition of the 16th part of a Grain is requisite to keep the Bubble in an *Equilibrium*, when the Mercury is risen an 8th or any determinate part of an Inch, above the former Station: When I come to another Place, where there is a Mercurial Barometer, as well freed from Air as mine (for that must be supposed) if taking out my Scale-Instrument, it appears to weigh precisely a Drachm; and the Mercury, in the Baroscope there, stand at $29\frac{1}{2}$ Inches, we may conclude, the Gravity of the Atmosphere not to be sensibly unequal in both those two Places, though very distant. And though there be no Baroscope there, yet if there be an additional Weight, as for instance, the 16th part of a Grain, requisite to be added to the Bubble, to bring the Scales to an *Equilibrium*, it will appear, that the Air, at this second Place, is at that time so much heavier than the Air of the former Place was, when the Mercury stood at $29\frac{1}{2}$ Inches. But in making such Comparisons, we must not forget to consider the Situation of the several Places, if we mean to make Estimates not only of the Weight of the Atmosphere, but of the Weight and Density of the Air. For though the Scales will show, as hath been said, whether there be a Difference of Weight

Weight in the Atmosphere at the two Places; yet if one of them be in a Vale or Bottom, and the other on the Top, or some elevated part of a Hill, it is not to be expected, that the Atmosphere in this latter Place, should gravitate as much as the Atmosphere in the former, on which a longer Pillar of Air does lean or weigh; so that the Bubble in both these Places should be precisely of the same Weight.

And the mention I have made of the differing Situation of Places, puts me in mind of something, that may prove another Use of our Statical Baroscope, and which I had Thoughts of making Trial of, but was accidentally hindered from the Opportunity of doing it; namely, that by exactly poizing the Bubble, at the Foot of a high Steeple or Hill, and carrying it in its close Frame to the top, one may, by the Weight requisite to be added to the Counterpoize, there to bring the Beam to its horizontal Position, observe the Difference of the Weight of the Air at the bottom and at the top; and in case the Hill be high enough, at some intermediate Stations. But how this may assist Men to estimate the absolute or comparative Height of Mountains, and other elevated Places, and what other Uses the Instrument may be put to, when it is duly improved, and the Cautions, that may be requisite in the several Cases, which shall be proposed, I must leave to more leisure, and further Consideration.

I caused to be made with great Care, by a skilful Mathematical-Instrument-maker, a hollow Cube of Brass, ^{Weight of a Cubick Inch of Water.} whose every Side was as exactly as could be procured, an English Inch. This we carefully counterpoised in a very good pair of Scales, and found it to weigh 11 Drachms, 1 Grain and $\frac{1}{4}$, (Troy-Weight) Then placing it in one of the Scales as horizontally as we were able, we

warily fill'd it with clear common Water, (of the best sort of that called Pump-water) till the Surface of the Water seem'd to lie as level, as we could make it, to the Brims of the Vessel: then weighing it carefully, we found the Water alone (for the Cube had been counterpoized before) to weigh $254\frac{7}{8}$ Grains: So that in regard 'tis scarce possible to know, that such a Vessel is so filled, as to come nearer Exactness, than within a Drop or two: I presume we may, without any sensible Error, suppose an Inch of Water to weigh 256 Grains, which latter Number I rather chuse, because its *aliquot* Parts make it more convenient, and it agrees well enough with some Trials, that I made with solid Cubes, to measure the true Weight of a Cubick Inch of Water.

This done, the Vessel was well dried within, and the same Scales being well counterpoized, the Instrument was so too, and being placed on one of the Scales as Horizontally as we could, Mercury (distilled to have it more pure) was warily put into it, till by Degrees it had filled the Vessel as to Sight; but we neither expected, nor found, that it would be brought to an exact Level, and exquisitly fill all the Corners of the Vessel. But when it seem'd to be so well filled, that even a critical Eye could not readily find fault with it, though the Mercury appeared capable of some Accession without overflowing, we weighed the Quicksilver it self (for the Vessel had been counterpoized before) and found it to weigh 7 Ounces, 2 Drachms, (Troy) which falling somewhat short (though not very much) of what the above-mention'd Weight of the Water required, we tried to add a little more Quicksilver, without making it run over, and found the Increase of 82 Grains; so that now the Quicksilver weighed 7 Ounces, 3 Drachms, 22 Grains; but it seem'd when the Eye was placed in a
Level

The Weight of a
Cubick Inch of
Quicksilver.

Level with the Brims of the Vessel, that it was rather a little of the highest, than any way depressed, and yet was not so full, but that we could add 112 Grains to the former Weight, without making it run over; and perhaps we might have added yet more, but I decline doing it, because the last mentioned Accession seem'd manifestly to make it so much swell above the Brims of the Vessel: By all which 'tis evident that 'tis scarce possible to determine precisely by such hollow Instruments, the true Weight of a Cubick Inch of Quick-silver. And therefore, since by other ways of Trial, I have found the Proportion of the Weight of Mercury to Water of the same Bulk, to be somewhat less than that of 14 to 1, I think we may, without any considerable Inconvenience, suppose the Weight of a Cubick Inch of Quick-silver to be 3580 Grains, which is near 14 times the above-mentioned Weight of a Cubick Inch of Water, and comes near enough to the second or middlemost of the three Estimates lately set down; and by the least Estimate of all it appears that a Cubick Inch of Quicksilver weighs $7\frac{1}{2}$ Ounces Troy Weight, that is 8 Ounces Averdupois Weight: And consequently when the Quicksilver of the Baroscope, kept up by the Counterpoize of the Air 30 Inches, (as I have observed it several times to be within a Month last past) the Weight of the Air that is incumbent on an Inch Square here below, amounts to $18\frac{1}{4}$ Troy Weight; that is in Averdupois Weight $15\frac{1}{4}$.

*The Weight of a
Pillar of the At-
mosphere.*

As 11 to 14, or rather as 355 to 452, so is the Area of a Square inscribed in a Circle to the Area of the circumscribed Circle.

Hence $355 : 452 :: 1 : 1,2732394$.

Hence if the side of an inscribed Square be an Inch, that

that multiplied by an Inch, renders a Cubick Inch for the solid Content.

In like manner if the Height of a Cylinder erected on the circumscribing Circle, be an Inch, the solid Content of that Cylinder is 1,2732394.

Wherefore 1, and 1,2732394 multiplied, by the Weight of the Cubick Inch of any kind of Metal, give the Weight of a Cubick Inch, and of a Cylindrick Inch that circumscribes the same, whence an Inch Table for both is easily made, by continual Addition, or for any Height propounded, multiplying both by the same.

Mr. Townly's Register, if I misremember not. (103)

Nov.	23	2	28.98		29	9	28.90
	24	8	29.54		9	P	71
		9	28.90		30	8	80
	25	3 $\frac{1}{2}$	80		31	9	30.12
	27	9	99	Febr.	1	12	22
	29	9	28.97		2	8 $\frac{1}{2}$	29.97
		9	29.09		15	9	28.99
Dec.	6	9	28.97		16	9	95
	7	9	60		17	8	29.10
	8	9	29.05	Mar.	2	9	28.98
	11	9	28.93		4	8 $\frac{1}{2}$	78
		3	29.01		9		86
	13	8 $\frac{1}{2}$	28.90		12	9	28.80
		9	95		9	P	66
	25	9	29.04	1671	13	8 $\frac{1}{2}$	29.03
	26	9	28.32	Apr.	16	P	28.99
	28	10	29.13		29	P	78
Jan.	1	9	28.99		3	8 $\frac{1}{2}$	29.03
	2	9	82	June	8	1	29.18
	3	9	29.08		8	P	28.86
		9	06		9	7	99
	5	10	28.70	Aug.	12	6	28.90
	6	10	29.09	Sept.	6	8 $\frac{1}{2}$	29.15
		9 $\frac{1}{2}$	28.62		7	10 $\frac{1}{2}$	28.65
	7	8	28.99		8	7 $\frac{1}{2}$	29.05
	12	10	28.88		12	9 $\frac{1}{2}$	28.98
		4	98		29	8	28.96
	16	1	29.13		3	P	29.08
		9	28.65		30	9	29.19
	17	10	14	Octo.	1	10	28.63
	21	9 $\frac{1}{2}$	29.05		3	8	29.10
	22	4	28.99				
		9	94				
	23	9	99				
	24	11	29.06				
	25	9	28.50				
		9	29.10				

In all those Papers the Mercury was still about $\frac{1}{2}$ of one Inch higher than is set down, for the Numbers signify only bottoms of the Cap.

d	h	Th.	Bar.	Wind.	Weather at Oxford.
1666					
June 24	9	70	29.	NE 2	Fair.
	22	76	29.1		Fair.
25	4	73	29.1	NE 1	Fair.
	10	74	29.1	E 1	Fair.
	15	77	29.1	SE 2	Fair.
26	9	73	28.8	N 1	Fair.
	12	75	28.7	NE 1	Thunder.
	13	75	28.7	SW 4	Thunder, Rain, Hail.
	14	74	28.8	N 0	Thunder, Rain.
	18	73	28.8	N 1	Clouds, dry.
	22	72	28.8		Fair.
27	7	70	28.8	NW 1	Rain.
	9	70	28.8	NW 1	Rain.
	16	68	28.8	W 1	Fair.
28	9	63	29.1	W 0	Clouds.
	17	67	29.1	N 1	Clouds.
29	9	63	29.2	N 1	Clouds.
	19	69	29.1	N 1	Clouds.
30	9	64	29.2	N 0	Clouds.
	20	64	29.2	N 1	Fair.
July					
1	9	57	29.4	W 2	Fair.
2	11	63	29.3	W 1	Clouds.

A Register kept by Mr. Locke, in Oxford. (105)

1666		July					
d	h	Th.	Bar.	Hy.	Wind	Weather.	
	21	67°	29 2.			Rain.	
3	9	66.	29 1.		W 1	Clouds.	
	22	66.	29 1.			Clouds.	
4	11	64.	28 8.		W 0	Clouds.	
	17	68.	28 7.		S E 2	Clouds.	
5	9	65.	28 7.		S W 2	Clouds.	
	23	65.	28 7.		S W 2	Rain.	
6	9	63.	29 1.		W 1	Fair.	
	16	67.	29 1.		S W 1	Clouds.	
7	9	67.	29 1.		S 2	Fair.	
	23	72.	28 7.			Lightning.	
8	9	70.	28 8.		S W 2	Clouds.	
9	9	66.	29 2.		S W 2	Fair.	
10	9	66.	29 1.		S 2	Clouds.	
11	10	67.	29 1.		S 2	Clouds.	
12	10	66.	29 2.		S 2	Fair.	
13	10	66.	29 3.		W 1	Fair.	
14	3	75.	28 8.		S W 2	Clouds.	
15	9	67.	29 1.		S W 1	Fair.	
16	11	70.	29 1.		S W 2	Fair.	
17	5	71.	28 8.		E 0	Clouds after Rain.	
	19	71.	28 8.		W 1	Rain.	
18	7	62.	29 2.		S W 2	Fair.	
	9	64.	29 2.		S W 2	Fair.	
19	9	65.	29 3.		S W 2	Cloudy.	
20	12	67.	29 4.		W 1	Fair.	
21	8	64.	29 4.		W 1	Fair.	
22	9	67.	29 3.		S W 1	Fair.	
23	9	67.	29 2.		E 1	Thunder, Rain.	

106) *A Register kept by Mr. Locke, in Oxford.*

1666 July						
d	h	Th.	Bar.	Hy.	Wind	Weather.
	15	71.	29 1°		NE 1	Fair.
	17	71.	29 1°		E 1	Rain.
	21	69°	29 2.		I	Clouds, Lightning.
24	9	67°	29 2°		N 1	Clouds.
25	9	67°	29 2°		N 1	Clouds.
26	6	64.	29 3°		N 1	Clofe.
30	23	69°	29 3°	15		Fair.
31	7	67°	29 3°	15	NW 0	Fair.
August						
15	10	60	29 2°	20		Clouds.
16	9	59°	29 2°	19	N 1	Fair.
29	21	64	29 2°	19		
30	9	59	29 3.	19	N 0	Fair.
31	7	61.	29 3.	20	NE 0	Fair.
	9	61	29 3.	20	NE 1	Fair.
September						
1	6	55	29 3°	17	NE 1	Fair.
	9	55.	29 3°	17	E 2	Clouds.
2	9	52°	29 3.	16	E 3	Clouds.
3	9	49°	29 4.	16	E 2	Fair.
4	9	47°	29 3°	15	E 1	Fair.
	13	50°	29 3.	15	E 2	Dim reddishSun-shine
	20	51.	29 2°	14		This unusual Colour of the Air, which without a Cloud appearing, made the Sun-beams of a strange red dim Light, was very remarkable. We had then heard nothing of the Fire of London: But it appeared afterwards to be the Smoak of London then burning, which driven this way by an Easterly Wind, caused this odd Phenomenon.
5	22	49.	29 1.			
6	9	44.	29 2.	15	NE 1	Fair.

A Register kept by Mr. Locke, in Oxford. (107

1666	Septemb.		Bar.	Hy.	Wind	Weather.
d	h	Th.				
8	9	44.	29 4.	15	NE 1	Fair.
9	9	46.	29 4.		SW 1	Thick, Sun.
	17	52.	29 2.	18	S 2	Rain.
	22	53.	29 --.	20		Rain.
10	9	52.	28 8.	20	SW 3	Fair.
	16	56.	28 8.	20	W 2	Rain.
11	11	53	28 8.	22	SW 2	Cloudy.
12	9	52	29 --.	23	S 3	Clofe.
13	9	50.	29 2.	23	W 2	Fair.
14	9	53.	29 1.	23	SE 2	Fair.
15	10	57.	29 1.	27	NE 1	Clofe.
	11	57.	29 1.	28	NE 1	Rain.
	23	61.	29 1.	35		Fair.
16	9	59	28 8.	34	E --	Mist.
	21	61.	28 7.	37		Rain.
17	9	54.	28 8.	35	NW 1	Clofe.
	22	49.	28 1.	30		Rain.
18	9	42.	28 8.	37	NE 4	Clofe after Rain.
	11	43.	29 1.	36	EN 3	Clofe.
	13	44.	29 2.	35	EN 3	Clofe.
	17	45.	29 3.	35	E 2	Fair.
	23	45	29 4.	35		Fair.
19	9	41.	29 5.	35	N 1	Fair.
20	9	46.	29 4.	37	N 1	Clofe.
21	8	47.	29 3.	36		Thick Mist.
	22	52.	29 4.	38		Fog.
22	10	48.	29 4.	37	SW 1	Clofe.
23	9	46.	29 5.	37	W 0	Clouds.
24	8	49.	29 4.	38	SW 1	Fair.

108) *A Register kept by Mr. Locke, in Oxford.*

1666 <i>Septemb.</i>						
d	h	Th.	Bar.	Hy.	Wind.	Weather.
	21	55.	29 2	39		2 Fair, h 19 few drops
25	6	53.	29 1.	38	S 1	Clouds.
	10	54	28 8.	39	S 3	Rain.
	21	50.	29 1.	38		0 Fair.
26	8	49.	28 7.	39	W 3	Clofe.
27	9	48.	29 2.	37	W 3	Fair.
	23	48.	29 4.	36		2 Fair.
28	7	45.	29 5.	36	W 2	Fair.
	19	47	29 4.	37		2 Rain.
29	7	51	29 4.	40	W N 1	Rain.
	12	53	29 5.	38	W N 2	Fair.
	18	53.	29 5.	35	NW 0	Fair.
30	9	48	29 6.	37	W S 0	Clouds.
	21	57.	29 5.	46		2 Fair.
<i>October</i>						
1	8	54.	29 5.	45	S 1	Clouds.
	19	61.	29 5.	43		0 Fair.
2	9	56.	29 5.	44	S W 2	Clofe.
3	7	54.	29 5.		S W 0	Clofe.
<i>November</i>						
25	10.	32.	29 1.			
26	9	31.	29 2.			0 Thick Fog.
	18	31.	29 1.			0 Fog.
27	11	33.	29 1.		W 0	Fair.
	18	34	29 2.			0 Clouds.
	22	34.	29 2.			2 Clouds.
28	10	39.	28 7.	63	S W 2	Rain.
	21	36.	28 7.	62		2 Fair.
30	9	31.	28 7.	60	W S 2	Fair.

A Register kept by Mr. Locke, in Oxford. (109)

1666		Novemb.					
d	h	Th.	Bar.	Hy.	Wind.	Weather.	
	22	31.	29 1	61		Fair.	
<i>December</i>							
1	9	29.	29 3	61	W 0	Fair.	
	22	29.	29 4.	61	0	Fair.	
2	9	27.	29 2.	60	SE 2	Clouds, Thaw.	
3	9	27.	28 7.	60	E 1	Clouds.	
	17	27.	29 7.	61	0	Rain.	
4	9	26.	28 8.	60	SE 0	Thick Fog.	
	12	26.	28 8.	61	S 1	Snow.	
5	9	30.	28 6.	63	S 1	Hard Rain.	
	21	34.	28 6.	63	2	Fair.	
6	9	34.	29 1.	64	WS 1	Fair.	
	18	36.	29 1.	64	0	Small Rain.	
7	9	32.	29 3.	63	W 0	Fair.	
8	9	32.	29 3.	65	WS 3	Small Rain.	
	23	35.	29 3.	64	0	Rain hard.	
9	9	31.	29 1.	63	N 2	Hard Snow.	
	17	29.	29 1.	63	0	Fair.	
10	21	26.	29 5.	63		Fair.	
11	9	24.	29 5.	63	WN 1	Hard Frost, fair.	
	21	21.	29 5.	60	2	Fair.	
12	9	20.	29 6.	59	N 1	Fair, hard Frost.	
13	10	21.	29 6.	61	N 1	Fair, hard Frost.	
14	9	22.	29 6.	63	NW 1	Little Mist, and slow Thaw.	
	11	24.	29 5.	63	NW 2	Clouds, Thaw.	
15	9	25.	29 6.	64	N 1	Fair, little Thaw.	
16	9	24.	29 6.	63	NE 0	Fog, hoar Frost.	

110) *A Register kept by Mr. Locke, in Oxford.*

1666	Decemb.		Bar.	Hy.	Wind.	Weather.
d	h	Th.				
	17	24	29 6.	63	NE 0	Thaw, Clouds.
17	9	22	29 6	63	N 0	Clouds, hard Frost.
	22	23.	29 5	64		Thaw, Clouds.
18	10	24.	29 5.	65	N 2	Small misty Rain.
	21	24	29 5	64		Small Rain.
19	9	23.	29 5.	64	NW	Small Snow, Thaw.
20	9	23.	29 5.	64	N 2	Mist, Thaw.
	22	22	29 5	64	0	Fair, freeze.
21	10	20	29 3	63	SW 2	Hard Frost, Clouds.
	21	22.	29 2	63	1	Snow.
22	9	22.	29 2	63	NW	Clouds, no Thaw.
	22	21	29 2.	63		Frost, fair.
23	8	21.	29 1.	64	N 0	Little Snow last Night, Frost, close.
	21	20.	29 3.	63	0	Fair, hard Frost.
24	10	17.	29 4.	62	NW 2	Fair, hard Frost.
	17	18	29 3	63	W 1	Snow.
25	9	18	29 4	62	NW 1	Hard Frost, fair.
	22	19.	29 4.	61		Fair, hard Frost.
26	9	18	29 3.	62	W 1	Fair, hard Frost.
	19	22.	29 2	63	0	Clouds, Thaw.
27	8	22	29 2	64	NW 1	Fog.
	16	22	29 2	63	NW 1	Close, Thaw.
	21	22.	29 2	63	NW 0	Close, Freeze.
28	9	20	29 3.	63	NW 0	Close, Frost.
	22	18.	29 3	63	NW 0	Close, Frost.
29	10	16	29 4	63	NW 0	Fog, hard Frost.
	22	15	29 5.	62	0	Thick Fog, hard Frost.

A Register kept by Mr. Locke, in Oxford. (111)

1666.		Decemb.		Bar.	Hy.	Wind.	Weather.
d	h	Th.					
30	9	15.	29 4'	62	NW 0	Very thick Fog, and hard Frost.	
	22	15.	29 4'	62	NW 0	Clear, hard Frost.	
31	8	14.	29 4'	62	NW 0	Fair, hard Frost.	
	15	15.	29 5.	63	NW 0	Fair, hard Frost.	
<i>January 1667</i>							
1	8	12.	29 4'	62	NW 0	Fog, hard Frost.	
2	10	13'	29 6'	63	SE 0	Fair, hard Frost.	
3	9	10'	29 5'	63	SE 0	Fair, hard Frost.	
	22	11'	29 3'	63	0	Clofe, hard Frost.	
4	10	13	29 3.	63	ES 1	Clofe, hard Frost.	
5	11	12.	29 2'	62	E 0	Snow, Frost.	
6	9	13.	28 8.	63	ES 0	Snow, Frost.	
	15	14'	28 7'	63	E 0	Clofe, Frost.	
7	9	16'	28 6.	64	E 0	Clofe, hard Frost.	
	17	18'	28 6.	64	E 0	Little dewy Rain, and Tendency to a Thaw.	
8	8	20'	28 6'	65	EN 0	Clofe, Thaw, little Rain.	
	21	21'	28 8.	64	0	Clofe, Thaw.	
9	8	21'	29 2.	65	EN 0	Little Snow, and little Thaw.	
	21	22.	29 3'	65	0	Clofe.	
10	9	21.	29 3'	65	NE 0	Clofe, Frost.	
	22	21'	29 2.	65	2	Clofe.	
11	8	20'	29 2'	65	NE 1	Clofe, Frost.	
	12	21.	29 2.	65	NE 0	Clofe, gentle Thaw.	

112) *A Register kept by Mr. Locke, in Oxford.*

1667	January		Bar.	Hy.	Wind.	Weather.
d	h	Th.				
12	9	21	29 2.	64	NE 0	Clofe, Frost.
13	11	22.	28 7	65	NE 0	Thick Fog, Thaw.
	22	23.	28 8.	65	0	Clofe, great Thaw.
14	8	24	28 7.	65	E 1	Fog, perfect Thaw.
	21	24	28 6.	65	2	Clofe.
15	10	22	28 6.	64	EN 2	Clofe, Frost.
	22	23.	28 6.	65	0	Small Rain.
16	8	23	28 7.	65	ES 1	Clofe.
17	8	25.	28 7.	65	EN 0	Fog.
18	7	25.	28 6.	65	NE 2	Snow, Thaw.
	21	23	28 8.	64	2	Little Snow.
19	8	21.	29 2.	64	NE 0	Frost, little Snow.
	22	20.	29 4.	64		Hard Frost.
20	9	18.	29 5.	63	N 0	Fair, hard Frost.
	22	20.	29 6.	63	0	Fair, Frost.
21	8	18.	29 6.	63	NW 0	Fair, hard Frost.
	17	21.	29 6.	63	W 1	Fair, Frost.
22	9	25.	29 5.	66	SW 2	Rain.
	23	28.	29 3.	66	3	Rain.
23	9	29	29 3.	67	WS 1	Clouds.
	17	32.	29 4.	67	W 1	Fair.
24	9	29	29 5.	66	WS 1	Fair.
	21	32.	29 3.	66	4	Clofe.
	23	33.	29 2.	66	4	Clofe.
25	8	36.	28 8.	67	SW 3	Little misty Rain.
	19	42.	28 6.	73	3	Little misty Rain.
26	8	38.	28 8.	72	WS 2	Clofe.
	12	37.	28 8.	73	WS 1	Rain.

A Register kept by Mr. Locke, in Oxford. (113)

1667						
<i>January</i>						
d	h	Th.	Bar.	Hy.	Wind.	Weather.
27	10	33	29 2	70	W S 2	Fair.
28	22	30	29 2	69	1	Rain.
29	6	30	29 2	70	1	Mist.
	16	31	29 3	70	N W 0	Clouds.
31	13	26	29 4	69	E 2	Clofe.
<i>February</i>						
1	9	26	29 5	69	E 2	Clofe.
2	9	28	29 5	70	E 1	Clofe.
3	9	31	29 4	72	S E 0	Thick Fog.
4	9	33	29 5	72	E 0	Fog.
	22	34	29 6	73	0	Clofe.
5	8	32	29 7	72	E 1	Clofe.
	22	31	29 7	71	2	Clofe.
6	18	26	29 7	68	NE 1	Clouds.
7	9	24	29 5	69	NE 1	Clouds, Snow in the Night.
	23	23	29 5	67	1	Clofe.
8	10	22	29 5	67	EN 2	Frost, clofe.
9	8	21	29 4	67	ES 1	Clofe, Frost.
	22	22	29 4	68		Snow.
10	9	23	29 3	69	SE 1	Rain.
	16	28	29 3	71	S W 2	Misty.
	23	32	29 2	73	2	Clofe.
11	9	34	29 2	73	S W 2	Milty.
	22	36	29 1	74		Clofe.
12	8	35	28 7	74	SE 2	Clofe.
	22	37	28 4	73	2	Fair.
13	8	34	28 4	72	S W 3	Fair.
	22	36	28 2	70	2	Clofe.

114) *A Register kept by Mr. Locke, in Oxford.*

1667 February			Bar.	Hy.	Wind.	Weather.
d	h	Th.				
14	8	34.	28 4.	69	WS 3	Fair.
	22	33.	28 6.	68		Fair.
15	8	32.	28 5.	69	S 2	Rain.
	23	32.	28 5.	69	S 2	Fair.
16	23	31.	28 7.	69	N 1	Clofe.
17	9	30.	28 8.	69	W 1	Fog.
18	11	32.	29 4.	66	NW 2	Fair.
19	9	28.	29 7.	64	NW	Hoar Frost, fair.
	15	33.	29 6.	56	S 2	Fair.
20	6	28.	29 6.	63		Fair.
21	9	28.	29 5.	63	ES 1	Fair.
22	8	29.	29 5.	62	NE 1	Clofe.
	15	29.	29 5.	60	NE 1	Rain.
23	8	27.	29 5.	63	NE 2	Clofe.
24	9	26.	29 6.	62	NE 2	Clofe.
25	10	25.	29 5.	62	NE 1	Snow.
26	7	23.	29 4.	61	NE 1	Frost, little Snow.
27	8	23.	29 2.	61	NE 1	Clofe, Frost.
28	9	21.	29 1.	60	NE 1	Fair, Frdft..
<i>March</i>						
1	11	22.	29 2.	59	E 1	Fair, hard Frost.
2	10	23.	29 3.	60	NE 1	Clouds, Fr st .
	17	26.	29 3.	59	NE 1	Hail.
3	9	24.	29 4.	60	NE 2	Clofe.
	21	25.	29 4.	62		Mifty, Rain.
4	9	25.	29 4.	60	NE 2	Clofe.
5	9	24.	29 2.	60	NW 2	Clofe, about 6 small Snow.
6	23	17.	29 4.	56		Fair, hard Frost.

A Register kept by Mr. Locke, in Oxford. (115)

1667	March		Bar.	Hy.	Wind.	Weather.
d	h	Th.				
7	9	15.	29 4.	55	NE 2	Fair, very hard Frost.
	13	16.	29 4	54	NE 2	Snow.
8	8	14.	29 2.	54	NE 2	Very hard Frost, <i>Tbames</i> frozen, Carts went over.
9	8	18.	28 8.	58	NE 2	Snow hard, already deep, hard Frost.
10	9	18.	29 2.	58	NE 2	Clofe, hard Frost.
11	8	19.	29 3.	57	NE 1	Hard Frost, little Snow.
12	8	21.	29 5.	57	EN 1	Frost.
13	9	21.	29 5.	56	NE 1	Clofe, Frost.
14	8	21.	29 4	56	SE 2	Clofe, Frost.
	16	23.	29 3.	55	SE	Clofe, Thaw.
15	8	23.	29 2.	57	E 1	Mist, Thaw.
16	8	27.	29 1.	59	SE 2	Rain.
	21	30.	29 0	60	0	Fair.
17	11	31.	29 2.	60	NE 1	Clofe.
18	8	28.	29 6.	61	NE 1	Fair.
	18	35.	29 6.	62	S 1	Fair.
19	8	33.	29 6.	61	SW 1	Clofe.
20	6	37.	29 6.	61	W 1	Fair.
21	10	35.	29 4.	55	SW 2	Small Rain.
	12	36.	29 4.	56	SW 2	Small Rain.
	23	38.	29 1.	59	3	Clofe.
22	9	37.	29 1.	58	W 2	Fair.
23	9	35.	29 1.	58	SE 1	Clouds.
	11	36.	29 1.	58	SE 1	Rain.

116) *A Register kept by Mr. Locke, in Oxford.*

1667 <i>March</i>						
d	h	Th.	Bar.	Hy.	Wind.	Weather.
24	9	35	29 2.	58	NW 1	Clouds.
26	7	30	29 5.	50	NW 1	Fair.
27	7	29	29 6.	49	NE 1	Fair.
28	9	28	29 5.	48	NE 2	Fair.

1669
December

I began to keep a Register of Heat and Cold at London, by a Thermometer of the Royal Society's Standard: This Thermometer I marked 2

d	h	T.2				
26	9	3				Extream hard Frost
1670						
<i>January</i>						
13	10	4				
	23	4				Clofe.
14	10	4				Clofe.
	22	4				Mix'd, i. e. Part Clouds, Part clear.
15	23	3				Fair.
16	10	2				Fair.
17	10	2				Mist.
18	9	2				Mist.
19	10	1				Clouds.
20	1	0				Clofe, Frost.
	9	0				Clofe.
21	9	1				Fair.
22	23	1				Fair.
23	9	1				Fair.

A Register kept by Mr. Locke, in London. (117)

1670	January		Bar.	Hy.	Wind.	Weather.
d	h	T.2				
24	9	1				Fair.
25	9	1				Clofe.
26	8	0				Snow.
27	10	0				Snow.
28	10	0				Snow.
29	23	0				Hard Frost.
30	11	0				Hard Frost.
31	11	0				Thaw.
<i>February</i>						
2	11	0				Frost.
3	10	0				Frost.
6	23	0				
7	9	0				Snow.
8	9	0				Fair.
9	10	0				Fair.
10	9	1				Clofe.
11	10	0				Fair.
12	10	1				Thaw.
13	9	1				Rain.
14	9	0				Fair, Frost.
17	23	3				Mist.
20	11	2				Fair.
<i>April</i>						
1	10	1				Clofe.

118) *A Register kept by Mr. Locke, in London,*

1670 | I here divided the Degres of the Gresham-Colledg-
 May | Thermometer, each into 4, so that 24 is now the same that
 6 was before.

d	h	T.2	Bar.	Hy.	Wind.	Weather.
27	9	24				Fair.
29	11	31				Fair.
	23	24				Fair.
30	7	22				Fair.
	23	29				Fair.
<i>June</i>						
1	9	28				Cloudy.
<i>1671</i>						
<i>May</i>						
29	8	20				Rain.
<i>June</i>						
5	8	31				Cloudy.
<i>1672</i>						
<i>January</i>						
31	9	4			NE	Fair.
<i>February</i>						
1	8	5				Fair.
<i>June</i>						
15	16	36				Cloudy.
16	9	33				Cloudy.
	17	37			SW 2	Fair.
20	9	29				Cloudy.
<i>August</i>						
15	6	24				
17	8	22				Clofe.

A Register kept by Mr. Locke, in London. (119)

1672						
<i>October</i>						
d	h	T.2	Bar.	Hy.	Wind.	Weather.
13	9	20.				
<i>December</i>						
23	22	20.				
27	17	18.				
1673						
<i>January</i>						
1	22	18.				
4	18	14.				
<i>April</i>						
3	17	5.				Snow.
<i>May</i>						
10	21	16.			E	
<i>June</i>						
9	22	22.			E	Rain.
10	9	21.				Cloudy.
12	9	23.				Fair.
13	22	22.				Rain.
14	9	24.				Clofe.
17	9	26.				
18	9	26.				Clofe.
20	9	22.		W		Fair.
21	9	24.				Fair.
2	6	23.				Fair.
27	10	26.				
28	9	25.				Rain.

120) *A Register kept by Mr. Locke, in London.*

1673 Memorand. That from the Beginning of May, till the middle of July, there was scarce one dry Day, but so great Rains, that produced greater Clouds than were known in the Memory of Man.

d	h	T.2	Bar.	Hy.	Wind.	Weather.
2	9	25				
8	10	26				
10	8	25				Fair.
14	17	31				Fair.
25	22	35				
28	12	33				Clofe.
30	9	24				Fair.
1674						
<i>March</i>						
9	8	1			NE	Frost and Snow.
19	6	5				Snow.
20	10	5			NE	Snow all Day.
<i>December</i>						
25	15	11				Fair.
27	16	11			W	Fair.
28	15	14			W	Clofe.
1675						
<i>January</i>						
3	16	14			W	Fair.
<i>April</i>						
25	9	12			NE	Fair.
26	10	12			N	Fair.
27	12	12			E	Fair.
28	9	12			E	Clofe.

A Register kept by Mr. Locke, in London. (121)

1675						
<i>May</i>						
d	h	T.2	Bar.	Hy.	Wind.	Weather.
2	9	16.				Clofe.
23	15	27.				Cloudy.
<i>June</i>						
8	22	21.				Cloudy.
9	13	21.				Clofe.
10	14	22.				Clofe.
13	10	22.			E	Clofe.
14	9	17.				Fair.

1681. *The Thermometer marked 3 is one, which I began now to use at my Return to Oxford.*

<i>March</i>						
d	h	T.3	Bar.	Hy.	Wind.	Weather.
14	14	46	29 4.		W	A little Mist.
15	8	36	29 6		NW	Fair.
16	12	45	29 5.		NW 2	Little Rain.
17	7	37	29 7.		E	Fog.
18	8	33	29 7.		E	Fair.
23	11	34	28 8.		NW	Clofe.
24	12	32	29 2.		N	Cloudy.
25	18	33	28 7.		NW	Cloudy.
26	15	32	8.		N	Cloudy.
27	13	28	29 2.		N	Fair, Snow this Morning.
	14		29 2.		N	Snow hard.
28	11	29	5.		N	Cloudy.
30	7	34	5.		W	Clofe: All the foregoing Week it rained in Showers every Day.
<i>April</i>						
6	18	49	4.		S	Very fair.
7	9	45	5.		S	Very fair.

122) *A Register kept by Mr. Locke, in Oxford.*

1681		<i>April</i>					
d	h	T.3	Bar.	Hy.	Wind.	Weather.	
	17	55	4		SW	Very fair.	
9	8	50	3.		SW	Clofe.	
	14	50	2		SW	Rain.	
10	11	44.	3		W 2	Clouds, and a little Shower this Morning.	
11	17	46	5		SW 2	Fair ever since Yesterday.	
12	15	51	2.		S 3	Fair since.	
13	14	49	3		W 2	Fair since.	
14	13	45	3		SW 3	Fair since.	
15	17	54	3		EN	Clofe all Day.	
16	8	45	3.		EN 1	Misty.	
	17	52	2.		EN 1	A little Shower between 4 and 5.	
17	6	49	2.		NE 1	Thick Fog, Showers between 6 and 7 last Night.	
18	7	46	2.		SW 2	Fair, and Clouds since.	
<i>May</i>							
3	14	50	29 4.		NE 2.	Clofe, no Rain since 18 <i>April</i> , but very hot and fair Weather till Yesterday, the Wind for the most part between N and E.	
4	10	44	4.		NE 1	Clofe since.	
5	8	37	4.		NE 1	Clouds.	
6	8	37	2		EN 1	Fair, Clouds Yesterday.	
	19	46	29		W 1	Cloudy.	
7	7	41	28 8		WN 2	Clouds.	
	11	43	8.		W 1	Rain.	
	16	47	7		W 1	Clofe.	

A Register kept by Mr. Locke, in Oxford. (123)

1681						
<i>May</i>						
d	h	T.3	Bar.	Hy.	Wind.	Weather.
8	9	41	29		NE 1	Cloudy since.
9	9	42	2		EN 1	Fair.
10	4	47	3.		N 1	Fair since.
11	9	48	3.		SE 1	Fair since.
	15	61	2.		SW 1	Fair since.
16	11	54	6.		SW 1	Fair, a little Shower or two since.
	18	65	5		W 1	Fair since.
17	8	55	6.		WN 1	Fair since.
19	17	70	2.		NE 1	Fair since.
20	6	64	3.		NE 2	Cloudy, no Rain from hence till June 20 the driest Spring that hath been known, there having been no Rain from the End of March to the End of June.
<i>August</i>						
2	6	65	3.	7	NW 1	Fair.
3	11	60	3.	8	N 1	Fair.
4	10	62	3.	9	W 1	Fair.
5	9	62	3.	8	E 1	Fair.
6	15	71	1.		S 1	Fair.
7	9	68	2.	9	S 1	Fair.
	15	72	28 8.	8	SW 2	Cloudy.
8	8	68	7.	9	S 2	Clofe.
	11	69	7	9	S 2	Rain a little.
9	9	64	8.	10	SW 1	Clofe.
	17	66	7.	10	S 1	Rain a hard Shower.
10	6	62	7.	11	SW 2	Clofe.
11	9	62	29 1.	11	SW 1	Clofe.
12	8	66	2.	17	SW 1	Mist.

124) *A Register kept by Mr. Locke, in Oxford.*

1681		<i>August</i>					
d	h	T. 3	Bar.	Hg.	Wind.	Weather.	
13	9	69	28 8'	18	S 1	Rain.	
	14	72	7	17	S W 1	Fair, Clouds.	
14	8	67	8	17	S 1	Fair.	
	16	72	6.	16	SE 1	Thunder Shower.	
16	9	69	29 2.	17	S.W. 1	Rain for 1 Hour, and then fair.	
17	6	69	2.	16			
18	4	67	3	16			
1682							
<i>February</i>							
10	12	25	29 5'		EN 1	Close, Frost.	
11	10	24	29 6'		NE 1	Fair, Ice.	
12	15	27	29 7.		NE	Very fair.	
13	11	24	29 7'	61	NE 1	Thick Fog.	
14	8	23	29 6'	68	NE 1	Fair.	
15	8	29	29 5'	65	EN 1	Close.	
17	8	31	29 0	72	S 2	Cloudy, and some Rain.	
20	17	42	28 7'	75	SE 2	Rain.	
21	8	44	28 6'	75	S 2	Rainy.	
22	9	42	28 7.	77	S 2	Close.	
24	10	41	29 2.	74	SE 1	Close.	
25	15	39	28 7'	75	NE 1	Rain ever since Ye- sterday in the Af- ternoon.	
26	10	38	29 1'	74	N 1	Close.	
27	7	37	29 3'	75	NW 1	Close.	
28	10	39	29 4.	73	W 1	Close.	

A Register kept by Mr. Locke, in Oxford. (125)

1682	March		Bar.	Hy.	Wind.	Weather.
d	h	T. 3				
1	9	42	29 3'	74		Fog.
5	16	30	29 1.	67	S 1	Very fair, hard Frost in the Morning.
6	10	28	29 2.	67	NE 1	Fair.
7	11	25	29 2.	65	N 2	Very fair.
22	13	29	29 2.	57	N 3	Cloudy, and a little Snow.
23	8	25	29 4	56	N 2	Clofe, Frost.
24	7	29	29 4.	57	W 1	Clofe.
25	9	36	29 2.	59	N 2	Clouds.
26	8	31	29 4	56	N 1	Clofe.
27	8	34	29 4.	57	W 2	Fair.
	13	39	29 3.	59	WN 1	A Shower.
28	7	35	29 4.	56	NW 1	Fair.
29	7	30	29 5'	50	N	Clouds.
30	8	30	29 5.	48	NE 2	Fair.
	11	31	29 5'	47	NE 3	Snow.
31	8	30	29 6.	48	NE 2	Fair.
<i>April</i>						
1	8	30	29 6.	49	NE 2	Clofe.
2	9	33	29 6.	50	NE 1	Clofe.
	19	36	29 6.	51	NE 1	Small Mist.
3	7	34	29 6.	51	NE 1	Small Mist.
4	9	34	29 6.	50	NE 1	Clofe.
5	7	34	29 5	50	NE 1	Fog, and Sun-shine.
6	9	39	29 4.	49	N 1	Fair.
7	9	39	29 5.	48	N 1	Fair.
8	8	39	29 5'	44	NE 1	Fog, and Sun-shine.

126) *A Register kept by Mr. Locke, in Oxford.*

1682		April					Weather.
d	h	T.3	Bar.	Hy.	Wind.		
	11	43	29 5'	44	SE 2	Fair.	
9	7	40	29 3.	40	SE 2	Thick Fog.	
	14	41	29 1.	41	S 2	Rain.	
	20	43	28 7	44	S 2	Rain till past 6, now fair.	
10	7	43	28 6'	47	SW 2	Clofe, Rain in Showers most part of the Day.	
11	8	43	28 6.	49	SW 2	Clofe Rain in Showers most part of the Day.	
12	7	41	28 5.	48	SW 1	Clofe, Shower about Noon.	
	16	44	28 6.	47	WN 1	Fair.	
13	6	37	28 8.	47	SE 1	Fair.	
	17	44	28 5'	47		2 Rain.	
14	7	42	28 2'	48	SE 2	Rain all the Morning, till past 12.	
	14	45	28 5.	50	W 3	Rain, more or less, almost all the Afternoon.	
15	6	40	29 1.	50	SW 2	Fair.	
16	7	43	29 1'	48		Fair, hard Shower about 18.	
17	7	47	28 8.	49	SE 1	Clofe, Showers several times in the Day.	
18	7	43	28 7'	50	SE 1	Rain the greatest part of the Day.	
19	6	44	28 7.	52	S 2	Clofe, Rain a great part of the Day.	

A Register kept by Mr. Locke, in Oxford. (127

1682	April		Bar.	Hy.	Wind.	Weather.
d	h	T:3				
20	6	44	28 6.	51	SE 1	Rain, and so in Showers several times of the Day.
21	4	45	28 6'	51	S 1	Cloudy, Rain most part of the Morning.
22	8	47	28 7	51	S 1	Rain.
	17	51	28 8'	52	N 1	Rain most part of the Afternoon.
23	7	46	29 2'	52	N 1	Clofe.
	13	49	29 3'	52	S 1	Clofe, Rain almost all the Afternoon.
	22	49	29 3'	52	N about 18	Hard Rain.
24	6	46	29 4.	52	E 1	Clofe, hard Rain at Night.
25	7	47	29 1'	52	ES 1	Clofe, some Rain.
	14	42	28 8'	53	SE 1	Dropping.
	22	54	28 7.	54	3	Hard Rain from 18.
26	7	52	28 6.	54	S 2	Cloudy, Rain often in the Day.
27	5	52	28 8.	55	SW 1	Clofe, a good deal of Rain before Night.
28	18	51	28	55	SW 1	Clofe, Rain a good part of the Morning, and some in the Afternoon.
29	8	47	29 1.	55	SW 1	Cloudy, a little Rain in the Afternoon.
30	5	47	28 8'	55	SW 1	Fair.
	18	46	28 6.	55	NE 1	Hard Rain, which began about 11, and lasted till 21 or 22.

128) *A Register kept by Mr. Locke, in Oxford.*

1682	May		Bar.	Hy.	Wind.	Weather.
d	h	T. 3				
1	4	42	28 8.	55	NW 2	Cloudy.
	21	47	29 2.	54	NW 1	Fair.
2	8	43	29 2.	54	SW 1	Cloudy, hard Rain from 19 or 20 all Night.
3	6	49	28 7.	54	SW 2	Clouds, Wind W. all the Afternoon, but fair, having a little Rain in the Evening.
4	5	52	28 7.	54	SE 1	Rain hard till 13.
	13	54	28 7.	54	N 1	Rain hard till Night.

Memorand. *That new fitting my Barometer, here the Mercury was raised by Addition of more in the Receiver about $\frac{1}{2}$ Inch, which is almost 2 of my Degrees, which are Eights, though I suspect it is still by reason of included Air, a Degree or two too low.*

	22	53	29 2.	54		Small Rain.
5	8	48	29 3.	54	E 1	Rain.
	20	51	29 3.	55	E 1	Clofe Rain most part of the Morning, and 2 or 3 Showers in the Afternoon.
6	7	48	29 3.	55	NE 1	Mist.
7	8	46	29 4.	55	E 2	Rain a great part of the Day.
8	4	53	29 2.	56	SW 2	Hard Rain till 7 or 8.
9	10	54	29 1.	55	E 1	Clofe.
	14	55	29 1.	55	SW 1	Rain.
10	9	50	29 2.	54	S 1	Cloudy, a little Rain about 17, and again about 22.
11	6	49	29 2.	54	SW 1	Clofe.

A Register kept by Mr. Locke, in Oxford. (129)

1682		May					
d	h	T.3	Bar.	Hy.	Wind.	Weather.	
11	9	50	29 2'	55	SW 1	Short Shower: several short Showers in the Afternoon.	
12	6	49	29 3.	54	SW 1	Clofe; a Shower in the Morning.	
13	4	51	29 2.	53	E 1	Clofe, several Showers in the Day.	
14	9	53	29 4.	54	SW 2	Clouds.	
15	7	51	29 4'	51	S 1	Fair.	
16	8	61	29 2.	48	SE 1	Fair, hard Shower about 18.	
17	5	60	29 3.	48	SW 2	Clofe.	
18	7	57	29 5.	47	W 1	Fair.	
19	8	58	29 5.	45	WS 1	Fair.	
20	5	63	29 3.	43	SE 1	Fair.	
	16	69	29 3.	43	WS 1	Very fair.	
21	8	59	29 3'	44	S 1	Fair.	
22	9	69	29 1'	42	SE 1	Fair.	
	17	47	29 1.	38	SW 2	Fair.	
23	7	64	29 2'	38	W 1	Fair, gentle Rain from 8 to 11.	
	10	63	29 2'	38	W 1	Rain.	
24	7	62	29 2.	39	N 1	Clofe.	
25	6	59	29 3.	42	NW 1	Fair.	
27	9	53	29 5.	42	W 1	Fair.	
28	14	67	29 3	33	S 1	Fair.	
<i>October</i>							
14	9	45	29 6.	49	W 1	Clofe, Rain last Night.	
16	13	48	29 4'	51	SW 2	Rain till Bed-time.	

130) *A Register kept by Mr. Locke, in Oxford.*

1682 <i>October</i>						
d	h	T.3	Bar.	Hy.	Wind.	Weather.
17	9	47	29 2'	51	W 1	Fair, little Rain.
18	10	41	29 1'	51	SW 2	Cloudy, hard Rain from 5 to Bed-time.
19	9	39	28 7'	51	W 1	Fair, Shower in the Afternoon.
20	9	34	28 7'	51	0	Rain.
27	22	38	29 7'	60		Clofe.
28	10	37	29 7.	60	EN 2	Fair.
<i>November</i>						
8	18		29 8.			Fair, hard Frost.
9	9	22	29 8.	57	N 1	Fog, gone before Noon: hard Frost.
10	10	26	29 8.	58	EN 1	Fair, hard Frost.
11	9	25	29 7'	56	NE 1	Clofe, hard Frost.
12						Fair, hard Frost.
13	10	26	29 5'	57	NE 1	Clofe, hard Frost.
14	13	23	29 7.	57		Thick Fog, fair in the Afternoon.
15	10	36	29 4.	56	SW 1	Clofe, Rain this Morning, hard Rain 22.
16	5	41	29 1'	66		Hard Rain, Rain most part of the Day.
	17	41	29 1.	65	SW 1	Rain.
17	11	39	29 1.	64	WS 2	Fair.
18	9	37	28 7'	64	0	Fog, Rain most part of the Day.
19	9	33	29 1'	62	W 1	Fair, Rain in the Night

A Register kept by Mr. Locke, in Oxford. (131

1682		Novemb.		Bar.	Hy.	Wind.	Weather.
d	h	T.3					
20	10	40	29 1'	64	WN 1		Fair, Rain in the Afternoon.
	22	42	29 2.	63		2	Fair.
21	6	42	29 1.	64			Hard Rain till 10.
	16	43	29 2'	64	W	2	Fair.
22	11	33	29 5	63	W	1	Small Fog, Frost this Morning.
23	9	28	29 5'	62	NW		Fog, thick Fog all Day.
24	9	25	29 5	62	NW		Thick Fog, little Rain in the Evening.
25	8	35	29 3	67	SW	1	Clofe, Rain in the Evening.
26	9	35	29 4.	65	WN	1	Fair.
27	10	31	29 7'	64	WN	1	Fair.
28	4	32	29 8'	65			Fair.
29	8	33	29 7'	65	WS		Small Fog.
30	9	35	29 7'	65	SW	1	Fair.
December							
1	8	35	29 6'	66	S	1	Mist.
2	9	34	29 6'	66	S	1	Clofe.
3	9	34	29 6'	66	SW	1	Foggy.
1683. June							
21	9	62	29 3'	46	W	1	Clofe.
22	8	65	29 2'	48	WS	2	Clofe, some Showers.
23	7	59	29 4'	46	W	1	Cloudy.
25	19	67	29 4'	44	WN	1	Fair, Mist in the Morning.

132) *A Register kept by Mr. Locke, in Oxford.*

1683 June						
d	h	T. 3	Bar.	Hy.	Wind.	Weather.
26	10	64	29 5.	43	S 1	Very fair.
	17	72	29 3'	43	SW 2	Fair.
30	13	62	29 3'	37	WN 3	Fair.

An Explication of the foregoing Register.

THE first Column with *d* at the Top, contains the Day of the Month. The second Column with *h* at the Top, contains the Hour of the Day, which beginning from Midnight, I count to 24, which is Midnight again; so that 13 stands for 1 Afternoon, and so on.

The third Column with *Th.* at the Top, marks the Degrees of my Thermoscope, which having been blown at a Lamp, though the Spaces of the Degrees were equally divided, yet because of the unequal Bigness of the small Tube, towards the Extremitities, where it grew bigger, it did not always in every Degree mark equally proportionable Degrees of Heat and Cold. The Points to be observed in that and the next Column, which is that for the Baroscope, shew the just Place where the Top of the ringed Spirit of Wine in the one, and the Mercury in the other, stood between the Line of the Degree marked, and the following, when the Observation was made. The Thermoscope I made use of till December, 1669, was a seal'd one, with all the Degrees increasing with the Heat in one continued Series. The Thermoscope which I used from Decemb. 1669. to June 1675. and is marked 2. was one of Mr. Cotgraves adjusting, which beginning the reckoning from the temper of freezing, hath the Numbers increasing both upwards and downwards; the Points shew it to be in the Degrees; above 0, if set over; and under 0, if set under: and . . . or . . . shew it higher or lower in each Degree. The Thermoscope used from March 1681, to the End, is marked 3, and is of the kind of that used first.

The Column having *Hy.* at the Top, contains the Degrees of Moisture, as marked by an Hygroscope made of the Beard of a wild Oat.

In the Column of the Wind, I not having the Convenience to observe the Points exactly, have marked but 8, but yet with this Variety, that where I set two Letters, the Wind was most from that Point whose Letter stands first; *v. g.* WN signifies more West than North. When I set only one Letter, it was in or very near that Cardinal Point.

The Strength is marked by 0, 1, 2, 3, 4. 0 signifies not so much Wind that mov'd any Leaf that I could see in a Garden I look'd into out of my Window, but the Letter join'd to it signifies which way the Weather-Cock then stood, whether the former Wind left it so, or the present Breeze blew that way. 1 signifies a gentle Gale, just perceivable by the moving of the Leaves or Plants. 4 signifies a very violent Storm: 2 and 3 the several Degrees between 1 and 4, as well as I could judg. These Degrees, though not so exactly measured as I could have wish'd, I yet thought better than nothing.

LE Tuyau recourbé estoit fermé au bout α et Ouvert a l'autre extremité B. La recourbure depuis G. Jusq' a C. estoit pleine de Mercure & tout le reste estoit plein d' air. La longueur Æ. C. estoit 4 Pouces ou $\frac{1}{2}$. J'echauffay cet air, et il feit baisser le Mercure Jusques en f. qui estoit $\frac{1}{2}$ plus bas, & en mesme temps il monta jusq' en H. qui estoit $\frac{1}{2}$ plus haut que G. ou C.

Pour sçauoir quelle hauteur de Mercure auroit este necessaire pour empescher la dilatation de l'air, & retenir le mercure en C. Je nay qu'à trouuer ce qui seroit necessaire pour repousser le mercure en C. Estainsy contenir l'air dans l'espace Æ. C. non obstant la Chaleur. Je pose pour principe ce que l'experience fait voir, Cest que quand une quantité d'air occupe un certain espace que j'appelle. Æ. et que la pression qui le retient dans cet espace soit B. si on vient a augmenter cette pression de telle quantité que l'on voudra comme X. on diminuera l'espace Æ. d'une certain quantité. D. Laquelle quantité est au restant. M. comme X est a B.

$$D. M :: X. B.$$

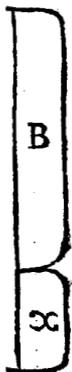
donc

$$M. D :: B. X.$$

Il est aisé d'appliquer cettereigle à l'experience cy dessus Car Æ. f. ou $\frac{1}{2}$ de pouce font l'espace Æ. La pression ordinaire de l'air qui est de 30 Pouces Jointe α un pouce de haut que se trouue entre f. et H. est B X 31 Pouces de mercure: et si nous y en adjoustons assez pour reduire l'air a l'espace. Æ. C. Ledit. Æ. C. sera M. X $\frac{1}{2}$ Et. f. C. Sera D. X $\frac{1}{2}$

Posant donc. M. D. . B.

$$32. 3. \quad 31.$$



La quatriesme proportionnelle sera. X. X 2 $\frac{3}{4}$ pouces, qui estants joints a B. X 31. Pouces feront 33 $\frac{3}{4}$ pouces dont l'air sera pressé en C. Æ. qui sont pres de 4 Pouces audeffus de la pression ordinaire.

Experiment made at the Spire of the Cathedral-Church in Sarum, by Colonel John Windham, assisted by Mr. Tho. Naish, Clerk of the Works, and John Warner, in November, 1684.

HAVING gotten together all the surveighing Chains the City afforded, and carefully examined their Truth, and having prepared a proper Frame for the Baroscope, we went into the Church, filled the Tube, and with all the Nicety we could use, purged it of the airy Particles, and then immersing it, as in the Forricellian Experiment, the Mercury was there suspended 30 Inches, and 50 Cents of an Inch, measuring it from the Surface of the *Stagnum*: Then drawing it up to the first Floor above the Vaulting, which is 1033 Inches and $\frac{1}{2}$ high from the Pavement, the Mercury subsided 9 Cents of an Inch: From thence drawing it up to the middle Floor, which is 935 Inches higher, the Mercury subsided 8 Cents lower than before: And from thence drawing it up to the Weather-Door, which is 2313 Inches higher than the last, the Mercury subsided 23 Cents below its last-Station. So the whole Height 'twas drawn up, is 4281 Inches and a half; and the whole Difference of the Mercury's standing is 40 Cents of an Inch. And letting it down again the same way, the Mercury reascended to its first Stations.

At

At another time with an inverted Baroscope, like that Figure in the Margin, having made a Mark where the Liquor stood when 'twas below in the Church, and drawing it up to the first Floor over the

	Inches.	Inc. Cen.
Vaulting	1033 and $\frac{1}{2}$.	1 25
To the middle Floor	1968.	2 39
To the 8 Doors Floor	2467.	3 22
To the Weather-Door	4281.	5 64
To the Top	4800, or 400 Feet.	6 40

{ which is above the Pavement of the Church }
 { The Liquor ascended }



If your Honour desires to have any other Experiments made at that Spire, Mr. *Naish* whom I have mentioned above, is a Person well skill'd in the practical Parts of Mathematicks, and a great Lover of Learning, but more especially natural and experimental Philosophy, having all or most of your Honour's Phylosophical Works. This Person I know would most gladly and heartily imbrace any Opportunity of serving your Honour, whensoever you'l be pleased to let me impart any thing to him in a Letter.

This is humbly advertised by, Sir,
 Your Honour's most Obliged,
 and most Obedient Servant,

4 Decembris 17.
 Anno 1685.

JONH WARNER.

At a Place in the great Continent in *Europe*, but not far from the Ocean, a learned Acquaintance of mine keeping a Baroscope some Years, and being discours'd with by me, about the Difference of the Phænomena that may be expected in Places situate upon the Continent, from what we find in this Country, as it is an Island: He related to me, that a few Years since, cast-
 ing

ing his Eyes upon the Baroscope, in ordinary Weather, and that was calm enough; he was surprized to see the Mercury so strangely raised, as to exceed above two Inches its wonted Station, which great Alteration he found within few Hours to have been the Fore-runner of so hideous a Storm as was generally wondred at, and did a great deal of Mischiefe both in the Towns and Country of those Parts, where it left sad Instances of its Fury. This Wind came all along the Continent: but my Relator divers times observed, that when very boisterous Winds blew from the Sea, and the Storms came thence, (which lying to the Southward) the Mercury in the Baroscope would considerably subside, as has likewise been often observed here in *England* by an ingenious Gentleman, living within less than two Leagues of the Sea, to whom I presented a Baroscope to make Observations with.

An industrious young Man, that whilst he was my Domestick, I bred up to Chymistry, (of which he now teaches Courses) related to me the other Day, that toward the latter End of the last Month (which was *June*) being at *Oxford*, where his House is, he had occasion to cast his Eyes upon his Baroscope, and was not a little surprized to find that the Quick-silver was in an extraordinary Measure alter'd from the Height it stood at but a while before: Whereupon, though the Weather were very hot and fair, as is usual in *June*, and had continued so for some Days; yet he took upon him to foretel from this great and quick Subsidence of the Mercury, that there would be ere long some notable Change of Weather. And accordingly it happened within about four or five Hours, that the Sky was all overcast; and there fell a hideous Storm of Rain, Lightning and Thunder, accompanied with such a Whirlwind,

wind, as scarce any remember to have seen in that City.

A Letter to the Author,

Honoured Sir,

I Have been able to do so little in the Attempts I have made to serve you, that I am ashamed to have been so well furnished to so small purpose. The Barometer I had from you was conveyed safe into the Country, and as soon as it came to my Hands, I rode to *Minedeep*, with an Intention to make use of it there, in one of the deepest Gruffs (for so they call their Pits) I could find: the deepest I could hear of was about 30 Fathom, but the Descent so far either from easy, safe, or perpendicular, that I was discouraged from venturing on it. They do not, as in Wells, sink their Pits strait down, but, as the Crannies of the Rocks, give them the easiest Passage; neither are they let down by a Rope, but taking the Rope under their Arm, by setting their Hands and Legs against the sides of the narrow Passage, clamber up and down, which is not very easy for one not used to it, and almost impossible to carry down the Barometer, both the Hands being employed. This Information I should have suspected to come from their Fear, had not an intelligent Gentleman, Neighbour to the Hill, assured me 'twas their usual way of getting up and down. For the Sight of the Engine, and my Desire of going down into some of their Gruffs, gave them terrible Apprehensions, and I could not persuade them but that I had some Design: So that I and a Gentleman that bore me Company, had a pleasant Scene,

T

whilst

whilst their Fear to be undermined by us, made them disbelieve all we told them; and do what we could, they would think us craftier Fellows than we were. But, Sir, I will not trouble you with the Particulars of this Adventure: but certain it is the Women too were alarm'd, and think us still either Projectors or Conjurers. Since I could not get down into their Gruffs, I made it my Business to inquire what I could concerning them: The Workmen could give me very little Account of any thing, but what Profit made them seek after; they could apprehend no other Minerals but Lead Oar, and believed the Earth held nothing else worth seeking for: besides, they were not forward to be too communicative to one, they thought they had Reason to be afraid of. But at my Return, calling at a Gentleman's House, who lives under *Minedeep-Hills*, and who had sent out his Son to invite me in; amongst other things he told me this, that sometimes the Damps catch them, and then if they cannot get out soon enough, they fall into a Swound, and die in it, if they are not speedily got out; and as soon as they have them above ground, they dig a Hole in the Earth, and there put in their Faces, and cover them close up with Turfs; and this is the surest Remedy they have yet found to recover them. In deep Pits they convey down Air by the side of the Gruff, in a little Passage from the Top; and that the Air may circulate the better, they set up some Turfs on the Lee side of the Hole, to catch, and so force down the fresh Air: But if these Turfs be removed to the windy side, or laid close over the Mouth of the Hole, those below find it immediately, by want of Breath, Indisposition, and Fainting: and if they chance to have any sweet Flowers with them, they do not only lose their pleasant Smell immediately, but stink

stink as bad as Carrion. Notwithstanding this ill Success, I had attempted some Trials once more, had not the spreading of the Contagion made it less safe to venture abroad, and hastened me out of the Country sooner than I intended. But I have some Hopes, the next Journey I make into those Parts, to give you a better Account than this that follows. Near the House where I sometimes abode, was a pretty steep and high Hill. *April. 3. hora inter 8 & 9. Matutin.* the Wind West, and pretty high, the Day warm, the Mercury was at 29 Inches and $\frac{1}{2}$, being carried up to the Top of the Hill, it fell to 28 Inches $\frac{1}{2}$, (or thereabouts, for I think it was a little above 28 Inches $\frac{1}{2}$.) Both going up and coming down, I observed that proportionably as I was higher or lower on the Hill, the Mercury fell or rose. At my return to the bottom of the Hill, the Mercury wanted of ascending to its former Height $\frac{1}{2}$ of an Inch, which I impute to the Sun's rarifying some Particles of Air that remained in the upper Part of the Tube, rather than to any other Change in the Air; for I find it harder to clear the Tube of Air perfectly, than at first I thought, or of Water, if that have been put in with the Mercury, and I fear liable to the same Inconvenience with Air inclosed. I know this is far short of what you might have expected, and has, I fear, but little answered your Desires, since I guess it was the perpendicular Height of the Place I made the Experiment in, that you would have had, and perhaps other Considerations of Air, inclosed, and liable to mineral Steams, would have made a Trial in one of the Gruffs more acceptable to you. I do not think any thing in this Letter worthy of you, or fit for the Publick. But since I find by the two last Philosophical Transactions, that Observations on the Torricellian Experiment are much look'd after, and

desired to be compared ; if for want of better, this should be thought fit to fill an empty Space in the Philosophical News-Book, I shall desire to have my Name concealed. But I fear that this very Caution of being in Print, where there is no Danger of it, has too much of Vanity in it. I'm sure 'tis Boldness enough, though allaid with Obedience, to venture such slight things to your Sight. I visited the incrusting Spring I formerly mentioned to you, and could not find any thing incrusted within at least 20 Yards of the Rise of it. The Place where it works most, is about 40 or 50 Yards from the Spring-head, and is at a Fall higher than my Head : there it sheaths every thing with stony Cafes, and makes the sides of the Bank hard Rock, and from thence all along its Stream, it covers Sticks, &c. with a Crust ; and some so candied I found above this Fall, but not so frequent ; whether the mixing of Air with the Water in the Fall, contributes any thing to the Effect, I cannot guess ; but that the Fall does, I suppose : for besides that at the above-mentioned Fall, it seems to operate most strongly, I observed, that though I could not find any thing incrusted within a good Distance of the Spring, yet that the Moss above the Spring was a little incrusted, (but not so firmly as at the other Place) : for the Water in the Winter, when the Springs are full, runs out also at a Hole two or three Yards above the Place, where now only it rises, and from thence falls perpendicularly into this lower Spring, from whence it runs by an easy Descent to the next Fall. A Gentleman in whose Field it rises, and by whose House it runs, told me upon Inquiry, that he uses it both in his Kitchen and Brew-house, without any sensible ill Effects, he being a pretty ancient, but healthy Man, and long Inhabitant of that Place. It will bear Soap, freezes quickly ; and waters his Grounds up
on

on Occasion, with Advantage. All the ill Effects of it, that he can guess, are, that his Horses are usually short-breathed, which he imputes to the drinking of that Water. I brought with me from *Minedeepe* some Oar, and some Stones; but I think them so inconsiderable, that I shall not judg them worth sending, unless you please to command them. I am, *S I R*,

Your most Humble

and most Obedient Servant,

Ch. Ch. 5^o May,
1666.

JOHN LOCKE.

POSTSCRIPT.

I had forgot to mention to you, that in their Gruffs, after burning, (when they meet with hard Rocks in their way, they make a Fire upon them, that they may dig through the easier) they find it very dangerous to go down into them, as long as there remains any Fire or Heat in any Chinks of the Rocks.

Some Days ago the King doing me the Honour to discourse with me about the Use of Baroscopes, was pleased to say, among other remarkable things, that at a time his Majesty then named, he went from *White-hall* about six in the Morning, towards the Mouth of the River, attended by divers of the Nobility, and particularly by one of the Lords then present, whom his Majesty put in Mind of the Adventure; and then he added, that though the Weather were exceeding fair, and likely to continue so, insomuch that some of the Courtiers congratulated to his Majesty so promising a Morning; yet when they were once gone too far to return,

turn, he told them he thought they would be much mistaken, and that they were to prepare for a Storm; which Conjecture his Majesty grounded upon his having, unknown to the Company, consulted a good Baroscope before he went out, and found the Mercury in it to have suddenly, and very notably subsided. And accordingly within a very few Hours the Event verified his Majesty's Prediction, a sudden Storm driving on the Yatch he was in, for divers Leagues, at a very unusual rate.

Nous apprenons de ces experiences, que puisque le poids de l' Air et le poids de l' eau qui est dans les Pompes se tiennent mutuellement en Equilibre, ils pesent precisement autant l' un que l' autre; & qu' ainsi en connoissant la hauteur ou l' eau s' eleve en tous les lieux du monde, nous connoissons en mesme temps combien chacun de ces lieux est pressé par le poids de l' Air qui est au dessus d' eux; et partant.

Que les lieux, qui sont au bord de la mer, sont pressés par le poids de l' Air, qui est au dessus d' eux jusques au haut de sa Sphere, autant precisement, que si au lieu de cet Air on substituait une colombe d' eau de la hauteur de 31 Pieds deux pouces.

Ceux qui sont plus élevez de dix toises, autant que s' ils portoient de l' eau de la hauteur de 31 Pieds un pouce.

Ceux qui sont élevez au dessus de la mer de 500 Toises, autant que s' ils portoient de l' eau à la hauteur de 26 Pieds onze pouces: & ainsi du reste.

Nous apprenons par ces experiences que l' Air qui est sur le niveau de la mer pese autant que l' eau, à la hauteur de 31 Pieds deux pouces; mais parce que l' Air pese

peſe moins ſur les lieux plus élevez que ſur le niveau de la mer ; et qu' ainſi il ne peſe pas ſur tous les Points de la terre également, & meſme qu' il peſe différemment par tout, on ne peut pas prendre un pied fixe, qui marque combien tous les lieux du monde ſont Chargez par l' Air, le fort portant le foible ; mais on peut en prendre un par conjecture bien approchant du juſte ; comme par exemple, on peut faire eſtat, que tous les lieux de la terre en general conſiderez comme ſ' ils eſtoient également chargez d' Air, le fort portant le foible, en ſont autant preſſez, que ſ' ils partoient de l' eau à la hauteur de 31 Pieds ; et il eſt certain qu' il n' y a pas un demy pied d' eau d' erreur en cette Suppoſition.

Or nous avons veu que l' Air qui eſt au deſſus des montagnes hautes de 500. toiſes ſur le niveau de la mer, peſe autant que l' eau à la hauteur de 26 Pieds 11 Poulces.

Et par conſéquent tout l' Air qui ſ' étend de puis le niveau de la mer juſqu' au haut des montagnes, hautes de 500 Toiſes, peſe autant que l' eau à la hauteur de 4 Pieds un poulce, qui eſtant à peu près la ſeptième partie de la hauteur entiere ; il eſt viſible que l' Air compris depuis la mer juſques à ces montagnes eſt à peu près la ſeptième partie de la maſſe entiere de l' Air.

Nous apprenons de ces meſmes Experiences, que les vapeurs qui ſont épaïſſes dans l' Air, lors qu' il en eſt le plus Chargé, peſent autant que l' eau à la hauteur d' un pied huit Poulces ; puisſque pour les contrepeſer, elles ſont houſſer l' eau dans les Pompes à cette hauteur, par deſſus celle ou l' eau contrepeſoit déjà la peſanteur de l' Air : de ſorte que ſi toutes les vapeurs qui ſont ſur une contrée eſtoient reduites en eau, comme il arrive quand elles ſe changent en pluye, elles ne pourroient produire que cette hauteur d' un pied huit poulces d' eau ſur cette contrée.

contrée. Et s'il arrive par fois des orages ou l'eau de la pluye qui tombe vienne à une plus grande hauteur; c'est parce que le vent y porte les vapeurs des contrées voisines.

Nous voyons aussi de là, que si toute la Sphere de l'Air estoit pressée & comprimée contre la terre par une Force qui la poussant par le haut, la reduisist en bas à la moindre place qu'elle puisse occuper, & qu'elle la reduisist comme en l'eau, elle auroit alors la hauteur de 31 Pieds seulement.

Et par consequent qu'il faut considerer toute la masse de l'Air en l'estat libre ou elle est, de la mesme sorte que si elle eust esté autrefois comme une masse d'eau de 31 pieds de haut à l'entour de toute la terre, qui eust esté rarefiée et dilatée extrêmement, et convertie en cet estat ou nous l'appellons Air, auquel elle occupe à la verite plus de place, mais auquel elle conserve precisement le mesme poids que l'eau à 31 pieds de haut.

Et comme il n'y auroit rien de plus aisé que de supputer combien l'eau qui environneroit toute la terre à 31 Pieds de haut peseroit de livres; et qu'un enfant qui scait l'Addition et la Soustraction le pourroit faire; on trouveroit par le mesme moyen combien tout l'Air de la Nature pese de liures, puisque c'est la mesme chose; et si on en fait l'épreuve, on trouvera qu'il pese à peu près huit Millions de Millions de Millions de Liures.

J'ay voulu avoir ce plaisir, et j'en ay fait le compte en cette sorte.

J'ay supposé que le Diametre d'un cercle est à sa circonference, comme 7 à 22.

J'ay supposé que le Diametre d'une Sphere estant multiplié par la circonference de son grand cercle, le produit est le contenu de la superficie Spherique.

Nous

Nous Scavons qu' on a divisé le tour de la terre en 360 degrez. cette division à esté volontaire, car on l' eust divisée en plus ou moins si on eust voulu, .aussi bien que les cercles celestes.

On a trouve que chacun de ces degrez contient 50000 toises.

Les licues autour de Paris sont de 2500 toises; et par consequent il y a 20 licues au degré: D'autres en comptent 25 mais aussi ils ne mettent que 2000 toises à la lieue; ce qui revient à la mesme chose.

Chaque toise a 6 pieds.

Un pied Cube d' eau pese 72 livres.

Cela posé, il est bien aisé de faire la supputation qu' on cherche.

Car puisque la terre a pour son grand cercle, ou pour sa circonference 360 degrez.

Elle a par consequent de tour 7200 lieues.

Et par la proportion de la Circonference au Diametre aura 2291 lieues.

Donc en multipliant le Diametre de la terre par la Circonference de son grand cercle; on trouvera qu' elle á en toute sa superficie Spherique 1649200 lieues quarrées.

C' est à dire 103, 095, 000, 000, 000, toises quarr.

C' est à dire: 3711, 420, 000, 000, 000, pieds quarr.

Et parce qu' un pied cube d' eau pese 72 livres.

Ils' ensuit qu' un prisme d' eau d' un pied quarré de base, et de 31 pieds de haut, pese 2232 livres.

Donc si la terre estoit couverte d' eau jusques à la hauteur de 31 pieds; il y auroit autant de prismes d' eau de 31 Pieds de haut, qu' elle a de pieds quarréz en toute

sa surface. (Je scay bien que ce ne seroient pas des prismes, mais des secteurs de Sphere; et je negligé exprés cette Precision.)

Et partant elle porteroit autant de 2232 livres d'eau, qu' elle a de pieds quarez en toute sa surface.

Donc cette masse d' eau entiere peseroit.

8283, 889, 440, 000, 000, 000, livres.

Donc toute la masse entiere de la Sphere de l' Air qui est au monde, pese ce mesme poids de

8283. 889, 440, 000, 000, 000, livres.

C' est à dire, Huit Millions de Millions de Millions, deux cent quatre vingt trois mille huit cent quatre vingt neuf Millions de Millions, quatre cent quarente mille millions de livres.

Mr. *Pascal* in his small Tract, either *De la Pesanteur de l' air*; or in that *Del' Equilibre des liqueurs*.

De cætero, feci haud ita pridem experimentum ponderandi aeris, quod pulchrè successit; nam sumptâ vitreâ lagenâ, valde levi et ad lampadem sufflatâ, ejus figurâ, qualem hic excusam vides, magnitudine parvâ pilâ quales habentur in sphæristeriis, non habente nisi minimam quandam aperturam per quam immittatur pilus in extremitate orificiî sui B. ponderavi eam in bilance valde exacta, & frigida pondus habuit 78 granorum cum dimidiò: Postea calëfeci eam carbonibus impositam, & reposui in bilancem eo situ quo hic descriptum vides, nimirum orificio in imum versò, & deprehendi eam vix habere pondus 78 granorum, tum immergendo orificium in aquam, refrigerescere feci, & dum aer se condensat pro modo quo refrigerescit lagena, intravit tantundem aquæ quantum aeris calor antea expulerat; denique ponderans eam cum omni illa aqua deprehendi



hendi eam habere pondus 72 granorum & dimidii plus quam antea : unde concludo aerem qui per ignem expulsus erat, se habere ad aquam quæ in locum suum regressa erat uti $\frac{1}{2}$ se habet ad $72\frac{1}{2}$, aut uti se habet 1. ad 145. sed potui in eo errasse difficile quippe est in ea re omnino exactum esse ; Id saltem certò scio, quòd pondus aeris hoc modo sit sensibile, & prolixè hic deduxi processum meum, ut si te eadem curiositas incessat, possis id eodem modo perficere experimentum. Vale.

T I T L E XVIII.

Of the Consistency of the Air ; its Rarity, Density, Fluidity, Subtility.

A Thin but large Bladder, wherein there was about the third part of the Air it was capable of containing, being strongly tied at the Neck, and at the opposite Part suspended and clog'd at the bottom, with a Weight of 14 Pound, so that it rested on the Floor, which sustained it ; the Strings that tied the Bladder were well stretch'd before, and could not shrink a quarter of an Inch without drawing up the Weight. Then two Fire-shovels, with small Coals and Ashes were applied at a convenient Distance, and kept moving to warm and rarify the included Air, without cracking the Bladder, by which means after some of the Wrinkles of the Bladder had been displayed, not without Noise, the Air being expanded, and consequently the Bladder a little swell'd, and the whole String shorten'd, the Weight was raised and made to swing like a Pendulum. The same Experiment being tried two or three times with a quarter of an Hundred, succeeded not, though with larger Bladders, the Heat still either breaking the Bladder with Noise, or occasioning some little Leak which hinder'd the desir'd Success, though once we came so very near it, that 'tis scarce to be doubted, that if we had had good Accommodations, it would have succeeded well, and that perhaps if the Weight had been greater.

To try whether the Corpuscles of the Air would dive into a Liquor that was exposed but to the ordinary Pressure of the free Air or Atmosphere. We cover'd the bottom of a Cylindrical Vial with Filings of Copper, and then pour'd on it an urinous Spirit, to the Height of about three Fingers breadth, and on this Liquor we poured Oil of Almonds to the Thickness of a Crown Piece of Silver, or that of about the fifth part of an Inch; then we stopp'd the Vial well, and left it in a quiet Place for several Days. The Event was such as we expected, namely, that the urinous Liquor did first acquire, and then lose a blew Tincture, both were done but slowly. And when the Colour was pretty well lost (for the Liquor was not clear, but somewhat troubled) we took out the Cork, and kept the Vial unstopp'd for one Minute of an Hour, and then stopp'd it again; that in that short time the upper Part of the urinous Spirit began to be ting'd with Blew, and within an Hour, though the Vessel were all the while kept stopp'd, the Sky-Colour reach'd to the lower part of the Liquor, which at this time is wholly and deeply of that Colour, the Oil that swims above it being clear.

T I T L E X I X .

Of the Heat and Coldness of the Air.

THough the Peripatetick Doctrine about the Limits and Temperaments of the three Regions, into which they divide the Air, hath been so plausibly proposed, that it has been readily entertained, not only by the Aristotelian Schools, but by the Generality of Philosophers, as well modern as ancient: yet since I think it becomes a Naturalist to consider, not so much how easy a Doctrine is, by reason of its Concinnity, to be *remembered* or *supposed*, as how strongly 'tis to be *proved*. I must not dissemble, that as to this vulgar Theory, I think it fitter we should wish it to be true, than that we should believe it is so: for I confess, that upon the best Informations I have been able to procure from Travellers by Land and Sea, or from Writers that relate rather what they have observed, than what they have been taught, I have been much tempted to question the received Doctrine of the Schools, about the Regions of the Air. And that you may judge, whether or no my Thoughts be rational, the ensuing Discourse shall acquaint you with several of the Particulars on which they are grounded.

What I have in other Papers written concerning Cold, does not only make it less proper for me to treat of it indefinitely in this Place, but would make it difficult for me to say much on this Subject without Repetition. And it were perhaps fittest for me to say nothing on an occasion wherein I have left my self little to say
that

that is new and pertinent ; but yet since this Title promises not any thing about Cold in general, but only some less heeded Particulars, relating to the Coldness of the Air: That I may not leave it wholly unfurnished, I will refer to it a few Instances that ensue.

The Physician, elsewhere mentioned, that was lately at *Morocco*, answered me, that notwithstanding the excessive Heat that reign'd there in the Day-time, he felt the Night very cold, and so he did the mountainous Air in those Parts.

An intelligent Gentleman that stay'd a Year in *Guinea*, and spent part of that time in the Land, answer'd me, that notwithstanding the excessive Heat of the Climate; he was divers times about four of the Clock in the Morning, reduced to be ready to tremble for Cold, as he lay in his Hammock, for about an Hour together.

A learned Man that lived at *Jamaica*, assured me, that when he laid in his Hammock, about three or four Foot from the Ground, though he had much Clothes under him, and little or none over him, he felt it cold beneath, and hot above.

'Tis obvious to every Man's Sense or Observation; that the greater Heat that is usually found in our Air, during the Summer, than in other Seasons of the Year, has manifest Effects upon such easily agitable Bodies as Liquors, and upon the Juices and Flesh of Animals, and the softer Parts of Vegetables. But that even in Places shelter'd from the Sun-beams, the Warmth of a temperate Summer should be able sensibly to rarify and expand so cold and compact a Body, as Glass it self, would not be easily suspected or believed. And yet that this is one of the Effects of the Temperature of the Air in Summer, seems very probable by this Experiment,

periment, that having two large factitious Crystal Vials, caused some Stopples of the same Matter to be exquisitely ground, and fitted this or that Vessel, exactly closed when the Stopple was in it; was very easy to be opened in Winter, and in the colder Parts of the Neighbouring Seasons; but in Summer 'twas oftentimes so difficult to unstop the same Vessel, that a Man's Force, though assisted with a String, was not able to pull out the Stopple: so that I was often reduced to cause the Necks of the Vials to be held under a Pump, or to be stirred to and fro in a Vessel full of Water, that the Coldness of that Liquor might take off the Expansion that the Heat of the Season had given the Glass, which being by this means made to shrink into its former Dimensions, the Vial and Stopple would be easily enough disjoined. This was tried in several Vessels, and in more than one Year. But to make this Experiment successful, two Parts must at first have been exquisitely adjusted to one another, which in those Glasses, with Stopples of the same Matter that are commonly sold, they are not usually found to be.

We are wont to attribute the Effects we feel of the Summers Heat, to the bare Warmth of the Air, and to the Agitations that such Warmth produces in the Parts of our Bodies, especially in the Blood, Juices and Spirits, whereas it may very well happen, that we may find odd Changes in our selves, upon very hot Weather, which proceed not from the Heat of the Air, as such, but rather from this Cause, that by such a Degree of Heat, divers Bodies that we think not of, may be solicited to send forth *Effluvia* that have emitted none by Force, or at least no such Quantity as could make them sensibly operative. And these *Effluvia* may be the true and immediate Causes of divers Effects that are

are unwarily ascribed to the mere Heat of the Air, and that which it produces in our Bodies. To illustrate and confirm this Conjecture, I shall propose the following Experiment.

Being in the Heat of Summer in the Country, I took a some-what large Piece of fine Amber, that I usually employed about Electrical Experiments; and when the Sun had reach'd a considerable Height above the Horizon, I placed it in a shaded Part of a Window, on which he shined freely, though I left the Amber here for a competent time, yet I could not find that it would draw a Piece of Straw, Feather, or other light Body, that at a convenient Distance was held to it. But when I removed it a very little further into a Part of the Window, into which the Sun-beams fell freely, they quickly put its Parts into such an Agitation as made it emit Electrical *Effluvia*, and readily attract those light Bodies that would not stir before, and which it would soon, though not immediately, lose the Power of drawing, as before, if it were removed back into the neighbouring shaded part of the Window.

May 26. Mr. *Nickson*, who was four Years Governour of the English Colony in *Hudsons-Bay*, answered me, that when they sail'd within a certain Distance of floating Islands of Ice, if the Wind blew from thence toward the Ship, or as the Seamen speak, if they were to the Leeward of the Ice, they could by the new and sensible Cold they felt, know that such Ice lay to Windward of them, sometimes even before they were able to discover it by Sight. And when I further asked, at what Distance that might be, he answered, that 'twas sometimes twelve or fifteen Miles, if not twenty. He added, that usually when the Wind blew from those great Masses of congealed Water, it brought along with

it a foggy Air, which he supposed to come (as well as the Cold) from the Ice.

The same Gentleman, answer'd me, that in that Part of *Hudsons-Bay* wherein he winter'd, the Rivers began to freeze about the latter end of *October*, or beginning of *November*, and usually were not free from Ice till about the middle or latter end of *May*, though he divers times took the Latitude of *Charleton Island*, the Place most frequented by the English, and seated at the bottom of the Bay, and found it to be near the same with that of *London*, and at most but about 52 Degrees.

When I inquired about the Depth of the Ice in the Rivers, he answered, that they had often occasion to observe it; for in the Winter they made their Wells there, (not in the Ground) and were obliged to dig about six Foot deep in the Ice, before they could come at unfrozen Water.

He answered me, that when they sent their Men up into the Country, their Bottles of Brandy would oftentimes so freeze, that about a fourth Part of it would be turned into Ice. And when I asked, whether the unfrozen Part of the Liquor was not exceeding strong, he answered me, that it was, and sometimes so much so, as to be too fiery and unpleasant to the Taste.

He answered me, that he always found the Ice fresh that floated upon the Sea-Water; and that when they wanted fresh Water, or had a Mind to spare what they had aboard, they often supplied themselves out of the Cavities of great floating Masses of Ice; in which hollow Places the Sun-Beams thawing some Parts of the Ice, they frequently found store of Liquor that was produced by the Action of the Sun-Beams upon the superior Parts of the Ice, whence the Water ran into these Cavities. He added, that when the Seamen were
in

in-haste, they used to relieve themselves by cutting or breaking off Pieces of the floating Ice, and presently melting it in their Pots.

A learned Traveller, that made some considerable stay among the high Pyrenean Mountains, answer'd me, amongst other notable things, about which I made Inquiry, that he had several times observed at the Top of one or other of those tall Hills, that the Air would be very hot, and that yet the same Day, and perhaps within very few Hours, the Place would be cover'd with Snow, though it were then Summer-time.

Doctor *N.* answered me, that the Winds he felt at *Morocco* were so very hot, that they were ready to stifle him, seeming to him like the Steams and Smoak coming out of the Mouth of an Oven.

The Russian Emperor's Physician confirmed to me, that at *Arch-angel* (where he was more than once) they averr'd to him, that in Winter-time a Northerly Wind (which comes from the Sea) produces a kind of Thaw, so as to make the Eves drop, though a North-East Wind rather confirms the Frost; but on the contrary, a Southerly Wind blows over a thousand or a hundred Mile of frozen Land, does rather increase the Frost than bring the Thaw.

A very inquisitive Person that visited the lofty Pyrenean Mountains, answered me, that he and his Company had more than once observed, from the Top or higher Part of one of those Hills, that though it were fair Weather there, yet a great way beneath them, the Hill was surrounded with thick Clouds, which produced Storms of Rain on the lower Grounds: and that (which was the chief Point I inquired after) they could manifestly see, that out of those Clouds, when it thunder'd, Lightnings flash'd upwards, as well as they are generally observ'd to do it downward. X 2 *Octo-*

October 19. Doctor *Stubbs* assured me, that having at *Jamaica* taken a Bolt-head about two Foot and a half in length, he usually found that betwixt 7 and 8 in the Morning, which they there call the faint time (of the Day) because for want of the daily Breezes, the excessive Heat makes them to faint away; the Water was wont to rise in the Neck but a quarter of an Inch and a half, though at that time by reason of the Winds, Men found the Heat very supportable: and after Noon was past, the Water would subside by Degrees till towards the above-mention'd time the next Morning. This happened in a South Window, where the fresh Winds come fully and freely in to beat upon the Bolt-head, without any Glass to skreen the Vessel from the Wind.

He added, that though the Bolt-head were not stopped, yet the Water did not even in that hot Country decrease sensibly in eight or ten Months.

A heedful Person that frequented the Coast of *Sumatra* in the South-Sea, answered me, that he never observed Ice or Frost, or Snow, in that great Island, but that he had known Hail fall even in that torrid Climate.

Though the famous Island of *Ceylon* lies almost in the midst of the torrid Zone, namely, between the 6th and 10th Degrees of Northern Latitude, yet an observing Man that lived many Years upon it, told me, that in Hills not so high, but that we might easily ascend to the Top in half an Hour, the Inequality of the Air's Temperature, as to Heat and Cold, was very great: for he had divers times observed in himself and others, that though at the bottom of the Hill the Heat was so great, as to oblige them to go almost stark naked, yet when they ascended the Hill, they found the Air quite alter'd;

ter'd ; and as they went up higher and higher, the Cold increased upon them ; so that notwithstanding the Heat, so uneasy a Motion as Climbing, had given them, the Coldness of the Air obliged them to put on unusually warm Clothes ; and at the Top of the Hill they would for all that be ready to quake for Cold.

Captain *Knox* answered me, that in 18 Years that he spent in the Inland of *Ceylon*, he never observ'd any Ice or Snow, nor any more than a little kind of Meteor that was between Dew and hoar Frost, which sometimes in Winter-Mornings appeared very oddly, but quickly vanished. And when I asked if he had not seen Hail it self ; he answered, that he never saw it but once, but the Inhabitants look'd upon it as a wonderful thing, unseen by them before, that the Hail was as large as a black Cherry, but not very round, and seem'd to have the Corners melted, which made him think it had been form'd high in the Air ; that for fear of mistaking, he not only gather'd some of it, but champ'd it between his Teeth, and found it cold and hard, like our European Hail ; and that he was fain to be nimble in making his Trials, because when the Hail came to touch the Ground, it would melt away much more suddenly than one would have expected.

Gregory being ask'd, upon a very sultry Day, whether it were not very hot in *Germany*, made Answer, To Day has been something hot : Such is the Winter in *Suaquena*. *Ludolf. Hist. of Ethiop. l. 1. c. 5.*

The Heat of the Island *Suaquena*, *Gregory* used to call *Infernal* : For, says he, it excoriates the Skin ; melts hard Indian Wax in a Cabinet, and sears your Shoes like a red hot Iron. *Ludolf. Hist. of Ethiop. l. 1. c. 5.*

The higher you ascend the Mountains of *Ethiopia* from the Coast of the red Sea, the more temperate you shall *Ludolf. Hist. of Ethiop. l. 1. c. 5.*

I shall feel the Air, inſomuch, that as *Tellezius* witneſſes, in many Regions of *Ethiopia* the Summer Heats are more mild than in *Portugal*, ſo many Degrees diſtant toward the North; nay there are ſome Mountainous Countries, as in *Samen*, where the Cold is more dreaded than the Heat. Nevertheleſs there falls none or very little Snow in theſe Parts, only a certain ſmall ſort of Hail ſometimes covers the Ground, which at a Diſtance looks like Snow.

An intelligent Perſon, that was for many Years Conſul of the Engliſh Nation at *Tripoli* in *Barbary*, being asked ſome Queſtions about the Air, and the Winds in thoſe Parts, answered me, that when in Summer-time the Wind blew over the great Sandy Deſerts that reach very far into the Country, the Wind, and the Sand it brought along with it, oftentimes felt as hot as the Steams that come out of an Oven when the Mouth is opened, inſomuch that he could not, without great Inconvenience, turn his Face towards the Quarter whence the Wind blew.

An ingenious Gentleman, that was employed in the French Colony, on the Coaſt of *Africk*, and liv'd in thoſe Parts about five Years, answered me, that in the Iſland of *St. Louis*, or near it, at a certain Season of the Year, when the hot Winds blew from the Continent, the Sand on the Shores would be ſo ſcorching hot, that he was not able to ſtand upon it, but it would, through the Soles of his Shooes, ſcorch his Feet, unleſs he walked very faſt. And then the Air ſeem'd to him to be thick, and as he expreſſed it, heavy and hot, as if it came out of an Oven. And when the Wind blew from a Wood, where divers Elephants and other wild Beaſts lay dead; the Steams of their Carcaſſes would make the Air ſo ſtinking and offensive, that it was ſcarce ſupportable.

In

In summo ejus montis, Idæ sc. fastigio sacellum est quod ædificiolo duntaxat constat faxis sibi invicem impositis & sine calce cohærentibus fornix in modum constructo, ad tectum prebendum. Sublimi adeo loco est, & à vehementioribus ventis interdum ita perflato, ut lapilli inde transferantur. Paulo infra id sacellum planities conspicitur montibus undique cincta, in qua multa sunt pascua, ubi Arietes & Capræ Cretenses æstate pinguescunt. Si quis ex summo montis vertice undique prospiciat parum aberit, quin totius Insulæ ambitum videat cum aliis vicinis Insulis, Miso, Cerigo, sive Cytherareliquisque Archipelagi. Aeris intemperies in hoc monte adeo magna est quemadmodum ut in cæteris præcellis montibus, ut in ipsis Caniculæ ardoribus meridie, nullo etiam spirante vento, ingens sentiatur frigus: quæ de causâ nec hyeme, nec æstate quisquam eum incolit. Nam licet pastores interdum ovium greges ad pascua agunt noctu tamen in valles se recipiunt.

Petri Bellonii,
lib. I. cap. 16.

In the next Chapter.

Latè porro patet hic mons ejusque radices utrinque maris littora, ut ante diximus attingunt; nam licet urbi Candix sunt vicinæ, meditullium tamen insulæ occupat ipse mons, adeo in sublime evehctus, ut nives ejus verticem perpetuo tegant; tamque frigida aura mediis etiam æstatis ardoribus isthic est ut vix ferri queat: tametsi in convallibus magnus sit æstus.

Contigit id meæ experientix, quod etiam aliis contigisse audivi, ut ascenderem ad summitatem usque montis Veneris, qui omnium in Paravino agro altissimus est, ibi per totum diem habui aerem serenissimum, sed infra circiter medium montis vidi nubes, quæ me visio-

Jacobi Zabarella de Regionibus Aeris, c. 8.

ne vallium prohibebant, vesperi autem postquam de illo monte descendi, inveni factam eo die infera parte magnam pluviam cum in montis cacumine nihil pluisset; ex eo intellexi me transisse per mediam aeris regionem, in qua est facta pluvia, nec tamen eam sensi frigidissimam, imò vix aliquam animadverti differentiam frigidioris & calidioris aeris, nam æstivum tempus erat, pro æstivo tempore eram vestitus, nec tamen tantum frigoris, quod me læderet, ex eo loco percepi, pars igitur illa non est absolutè frigida, sed solum comparatione inferi, aeris calidioris.

Idem de Alpihus proprio exemplo edoctus testatum reliquit Bartholinus Syst. Phys. Instit. Succinct. de Terra, Aere & Igne, C. 4. Resp. 1.

Doctor B. answered me, that being at and near *Morocco*, he could see *Mount-Atlas* cover'd with Snow, though it was then in the Heat of Summer, and excessively hot where he was.

An intelligent Traveller that had visited some high Mountains, and particularly the *Alpes*, and the *Pico of Teneriffe*, answered me concerning this prodigious Hill, that he found it very cold in ascending towards the Top; and that as for the *Mount Cenes*, one of the famousst of the *Alpes*, when he passed over it into *Italy*, though it were in *August*, and the Weather very clear, yet he felt at the Top a Wind so cold, that he could scarce possibly indure it, and seem'd to him the coldest that in all his various Travels he had ever felt; and yet some of the Mountains seem'd much higher, being then covered with Snow.

An intelligent Gentleman that had been a Traveller into the *East-Indies*, told me, that he never saw nor heard of any Snow or Ice in *Guinea*, but that in some
Parts

Parts of *Barbary*, where in the Plains and Vallies he found the Heat scorch insupportable, he could see the Top of the Mountains covered with Snow, in which State they continued all the Year.

A Man of Letters that lived in many Countries of the *East-Indies*, being ask'd by me divers Questions, partly about other things, and partly about the Temperature of the Air in several Regions, gave me among other Answers, this, That on the high Mountain in the Island of *Ceylon*, notwithstanding the Heat of the Country, there was Snow; and the like he saw on the tops of the Mountains of *Congo*, though in the lower Parts of the Country they never have, that he heard of, either Ice, Snow or Hail.

About Mid-summer, 1688, I placed in the Cave a Glafs, with Spirits, which stood above temperate, about $\frac{2}{3}$ of one of the small Divisions: Another Glafs placed without, in a common Room, stood at hot.

The Christmas following, I placed the same Glasses in the same Places, and the Glafs in the Cave stood as before, about temperate, that without stood at Frost.

The Cave is cut into the bottom of a Clift that fronts to the Sea, the Earth is about 80 Foot above it, and it is cut right in about 130 Foot.

The other Day two Gentlemen belonging to the Province of *New-Hampshire* in *New-England*, (whence they came not long since) and imployed by that Colony to his Majesty here, answer'd me, that in the Winter the coldest Wind that blows in their Country, is the North-West; and being ask'd again, what was their hottest Wind in Summer, they told me, it was likewise the North-West. At which Answer being surprized, I ask'd them, whether they could give any Reason of so odd a Phenomenon. Whereto they answered, that
 Y they

they ascribed it to the large Tract of the Continent, and the great Woods that lay to the North-West; which Woods, they said, in the Winter had their Branches, through which the Wind past, all laden with Snow: And in the Summer, they said, the close Air of the Vallies, and the thick Steams that fill'd it, would conceive so intense an Heat, that sometimes in the Heat of Summer, when a sudden Puff of Wind blew upon their Faces from those sultry Vales, it seem'd to them as if it came out of the Mouth of a Furnace, and would be ready to overcome them with the Faintness produced by the Heat and Vapours it brought along with it.

Balbini Hist. Bohem. l. 1.

c. 9. De montibus, & de valle Lauezka,

p. 29.

Chanowsky in vestigio Boh. pia, C. ult.

Montes parte alterâ æstatem, altera hiemem referentes.

Id. ibid.

De montibus ad Bavariam stantibus mira est Alberti Chanovii nostri narratio: post Bergreichensteinam (oppidum fodinis hodie quæ nobile) esse montes non tam situ (alii enim ad septentrionem, alii ad meridiem latus obvertunt) quam Cælo & temporibus adversantes, vallibus fatissimis montes illos dirimentibus; monstri instar est (quod se vidisse, & Anno 1639. in rem præsentem venisse religiosissimus ille & Apostolicus vir asserit) in altero monte sapius æstatem, in altero appposito hiemem dominari, ita ille sicus æstivat, hic altissimis nivibus obsitus à viatore superari non potest; ob eamque causam Messes ipsæ variant, & dum in montibus ad nos obversis demessa sunt omnia, altera Montium parte seges virescit: Mirius illud quod in Biessinensibus & Czachroviensibus Agris in tractu Pilsnensi, contiguus, quos unus tantum sulcus dirimit ac dividit, deprehenditur: Czachrovienses adhuc hibernant, cum in Biessinensi Cælum ardeat, ibi caput attollit humo frumentum, cum Czachrovii adolescit in culmum; elemento quoque dispari, illud riger, hoc tepet & fervet, eaque ex causâ, dum Czachrovienses bene pelliti ingrediuntur, Biessinenses

nenses pedibus onerari se sentiunt, villosque deponunt. Aliquid tale Anno 1652. mihi quoque accidisse memini: nam cum Glacio Zambergam in Bohemia contenderem, & Glacio ob nives altissimas certum vehiculi genus, quod trabas dicimus, sumpsissem, superatis montibus, qui comitatum Glacensem a Bohemia dividunt, subito alia rerum facies apparuit: altero enim montium latere viridia omnia reperimus, sic ut Trabæ nulli jam rei & usui essent, & cursum petere cogeremur, nisi in luto natare placuisset; at incolæ montium illorum quotannis id sibi accidere confirmabant, ut unum latus montium profundissimæ nives contegerent, quando alterum latus lectissimos flores præferret, & cum ibi omnia ventis verti videntur apud se è floribus suavissimos odores efflari.

I learned, by Inquiry, of an ingenious Gentleman, who several times went down into the Hungarian Gold-Mine at *Cremnitz*; that when he was drawn up out of the deep Pit, or perpendicular Groove, whose Depth exceeded 100 Feet; when he had ascended above half the way, he found the Air sensibly warm, and so it continued till he came by many Foot nearer the Day, as the Workmen call the Orifice of the Pit. And when I ask'd whether this notable and suddain Heat did not proceed from some Mineral through which he passed in that Region of the Earth, or part of the Groove; He answered me, that he believed it did, in regard he was there surrounded with a Vein or Bed of native Vitriol, some of one Colour, some of another, which he found to be soft under Ground, though it soon after harden'd in the Air: and of these differinglly colour'd sorts of Vitriol he brought up thence several Pieces, some of which he presented me. And when I ask'd whether the new Heat he found in that Part of the Mine, did not proceed

from its being much nearer than the lower Part to the Air, which at that time was hot; and whether he found the Heat to increase as he came nearer the Day: He answered in the Negative, and told me, that after he had in his Ascent left beneath him that warm Region, he found himself cold again in the superiour Part of the Groove, to which the Vitriolate Region did not reach.

I remember on this occasion, that asking an intelligent Person, who had more than once crossed the Torrid Zone, what Expedient they used in his Ship, to keep their Beer and other Liquors, cool enough to be drinkable in those sultry Climates: He answered, that their way was to take the Bottle they mean to use, and wrap it about with a course Linnen Cloth dipp'd in the Sea-water, and then in some convenient Place of the Ship hang it in the Wind, which beating freely and incessantly upon it, would in no long time cool it to be potable enough. And this Gentleman, who was an observing Person, added farther, that having sometimes for Curiosity sake taken away a Bottle before it had been expos'd above half the usual time, he was able to find by the Taste, that part of the Beer, or Wine, that was next the sides of the Bottle to be refrigerated, whilst the more inward Parts of the Liquor did yet continue hot.

The *Czar's* chief Physician confirm'd to me, that in the Year 1664, or 63, extraordinary dry and great Scopes of Land were set on Fire, and miserably wasted by the great Heat of the Sun. And he added, that the very last Year he found the like to have happened in *Norway*, particularly in a Place call'd by us *Bear-haven*; where having seen the Ruine of divers Wood-houses burnt, and inquiring into the Cause, he was answer'd, that the Weather being very dry and hot, not only the
Grass

Grass and other Vegetables were scorch'd up, but those wooden Houses among others, were set on Fire; which was confirmed to him by the Governor of the Place, and countenanced by this Circumstance, that he saw the Country covered with a fresh and verdent Livery of new Grass, brought up, instead of that which was burnt, by some Rains that fell a while before.

A Traveller and Scholar being ask'd by me, whether at *Mozambique*, which is thought the hottest Place in the known World, he had never observed the Houses to be set on Fire with the mere Heat of the Sun? He answered me, that in the three Months he stayed there, he saw no such thing, but the Inhabitants affirmed it not to be very unfrequent; and as he passed to and fro, shewed him divers Houses that had been so burnt: which was the less strange, because the Houses are not built of ordinary Stone, whereof they have none there, but fetch'd from another Place he named, where the Stone is mingled with a Substance, much of the Nature of a *Sulphur Vivum*. And he added, that he himself had divers times seen the Stones so heated in hollow Places, that Musket-Bullets being exposed there to the direct Beams of the Sun, were in no very long time melted. He said farther, that much of the excessive Heat of *Mozambique* proceeded from the Soil, which is exceeding bare and dry, consisting of white Sand; and that it is not covered with Grass, nor shaded with Trees.

An observing Traveller that had been at *Mozambique*, being for the most part where 'tis not shaded with Trees, sandy, he found the Sun, which was almost in the Zenith, to heat the Ground so much, that he was not able to stand still for some time, but was fain to keep walking to avoid burning the Soles of his Feet.

Un Gentilhomme de mes amis plein de merit et digne de creance me mande entre plusieurs choses extraordinaires qu' il a observées proche de Barege aux Pyrenées. Qu' il y a des ponts de neige d' un rocher à l'autre par dessus les quels passent des torrents. Il en a vu un qui embrasse deux torrents, et qui a vint neuf toises de long et autant de large par dessus. Il y a par dessous ce pont Neuf toises et demi entre les Naissances de la vouë. les ponts sont tellement forts qu' il estime que du Canon y passeroit, et il a fait rouler de grosses pieces par dessus.

Le tremblement de Terre que souffrit la Syrie l'an 750. ne fut gueres moins surprenant ; puisque la Terre s'estant ouverte de toutes parts, plusieurs Villes furent abimées, d'autres renversées, et quelques unes qui estoient élevées sur des hauteurs transportées dans des plaines éloignées de six mille de leur situation. On en peut dire autant du froid extreme qui l'an 753. glaça le Pont-Euxin à la longueur de cent mille, et toute l'estendue de la mer voisine, jusqu' à 30 condées de profondeur, quoy qu'on ne fût encore qu'au commencement de l'automne. *Journal de Scavans III. 1685.*

Asking an intelligent Person that liv'd a good while in *Guinea*, how they did to keep their Water cool in so hot a Place ; he told me, that in some Corner of their Hutts they were wont to make Holes in the Ground, in which they buried over Night the long Earthen Jarrs, or other Vessels, so as that the Orificè of the Vessels might be lower (though not very much so) than the Level of the Ground. By this Means the Water would become drinkable, with some Coolness, from the Beginning of the Morning to nine or ten of the Clock ; after which 'twould grow distastefully hot. He added, that when they were abroad in the Fields, he

he did as well cool his Water by putting it into Callibashes, and hanging them all Night upon the Branches of Trees, especially where they were exposed to the Wind.

February. Since now I have spoken so much of the Cold, I hope it will not be too coldly taken, if in a few Words I make it some way to appear unto our Readers.

We made three Differences of the Cold, all according to the Places: In our House, in the Woods, and in the open Air, upon the Ice, in our going to the Ship.

For the last, it would be sometimes so extrem, that it was not indurable; no Clothes were Proof against it; no Motion could resist it. It would, moreover, freeze the Hair on our Eye-lids, that we could not see; and I verily believe, that it would have stifled a Man in a very few Hours: We did daily find by Experience, that the Cold in the Woods would freeze our Faces, or any part of our Flesh that was bare; but it was yet not so mortifying as the other. Our House on the out-side was cover'd two third Parts with Snow; and on the inside frozen and hung with Ice-sickles. The Clothes on our Beds would be cover'd with hoar Frost, which in this little Habitable was not far from the Fire. But let us come a little nearer to it. The Cook's Tubs wherein he did water his Meat, standing about a Yard from the Fire, and which he did all Day ply with melted Snow-water; yet in the Night-season, whilst he slept but one Watch, would they be firm frozen to the very bottom: And therefore was he fain to water his Meat in a brass Kettle close adjoining to the Fire; and I have many times both seen and felt, by putting my Hand into it, that side which was next the Fire, was very warm, and the other side an Inch frozen. I leave the rest to our
Cook,

Cook, who will almost speak Miracles of the Cold. The Surgeon, who had hung his Bottles of Syrups, and other liquid things, as conveniently as he could, to preserve them, had them all frozen. Our Vinegar, Oil and Sack, which we had in small Casks in the House, were all firm frozen. It may further in general be conceived, that in the Beginning of *June*, the Sea was not broken up; and the Ground was yet frozen; and thus much we found by Experience in the burying of our Men; in setting up the King's Standard towards the latter End of *June*; and by our Well, at our coming away in the Beginning of *July*; at which time, upon the Land, for some other Reasons, it was very hot Weather. Capt. James.

*Observations on
the Top of the
Pyreneans.*

Monfieur L. J. confirmed to me what he had formerly told me, that upon the highest Mountain of the Pyreneans, called *Pic De Midi*, he ascended at the End of *August*, or the Beginning of *September* (in the Morning) to the very Top, where he and his Company spread a Tent, and staid till the Evening: He says, he found the Air temperate where the Sun did not beat; but on that side of their Bodies whereon the Sun shone, the Heat was exceeding great, and was offensive, even to them that sat in the Tent of Oil'd Cloth, if they sat too near the Sunny side of the Tent: they sometimes had Wind at the Top of the Hill, which they found to blow cool enough, (and found it very cold when they returned to the Bottom.) This Hill is so high, that it may be seen from *Montauban*, which is 27 Leagues distant.

When I asked whether the Air in those Places, where the Sun did not beat, was considerably cold? He told me, that the Exercise they had been put to in ascending the Top of the Hill (for the most part of the way they rid up)

up) kept them from being very competent Judges of that; but they found the Wind Northerly, though weak, yet very cooling; and the North Side of the Mountain was even then cover'd with Snow, and scarce at all passable.

An ingenious Physician, Dr. B. that has been in divers of the Inland Parts of *Africa*, among other Answers that he return'd to the Questions that I ask'd him, about the Temperament of the Air in those Parts, gave me this memorable one, That having had occasion at *Morocco* to use some good dried fine Jalap that he had brought with him out of *England*, he found it by the Heat of the Air to be melted; and by Consequence to be impulverable; in which State it continued whilst he liv'd in that Country: but when he was returned to *Tangier*, he found it both there, and in the neighbouring Parts, pulverable again.

Nel capo di Comorino si termina così l'esta, come P'inverno dalla parte, di la dal capo verso Notte, & dal'altra parte correspond ill tempo assai contrario è diverso, di maniera che, chi va navigando, per quella costa nel mese di Ottobre, sino ad Aprile naviga nel esta, e non puo in tutto questo tempo, passare il capo per Esser lui la stagione dell inverno, et ill Padre, che reside nelle Chies che appartengono al Capo di Comorino ne Alcune la state, il che è cosa di gran Meraviglia, essendo cio nel medesimo tempo nella distanza sola mente di due, o tre miglia.

P. Francesco Barretto Relatione della Provincia di Malavar. p. 52.

An eminent Virtuoso answer'd me, that in *Tirol* he had visited a very deep Mine into which he descended three hundred Klasters, which by his Computation makes about eighteen hundred of our Feet: That he

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pass'd not through, that he took notice of; one hot Region by the way. That at the Bottom of the Mine he breath'd very freely, because of the Air-Shafts, by which Access was given laterally to the superiour Air; and that being thinly clothed with one of the Digger's Habits, he found at the Bottom the Air temperate, as to Heat and Cold, though it were then Summer-season of the Year: so that notwithstanding what is said of Antiperistasis, no intense Cold was retreated thither, to shun the Heat of the superiour Air.

An ingenious Gentleman, very conversant in our English Mines, of one of which he is Owner, answer'd me, that the deepest Mine he had particularly visited, was a Tin Mine, whose Depth was sixty six Fathoms, that is almost four hundred Foot. That descending into this Mine in Summer, he found it very cold at the Bottom, and the greatest part of the way going down, without perceiving any hot Region. And when I ask'd him how soon he begun to find a sensible Cold in descending, he told me, that he found it within two Fathom or less of the Orifice of the Pit; and that in this and divers other Mines he perceived a sensible Cold to begin before he got down a Yard, or perhaps half a Yard beneath the upper Part of the *Fast*, as the Minemen call the solid Earth, in which they distinguish from the loose Earth that lies above it; and is, if I may so call it, the Scurf of the Earth, that is far more light and porous than the other, though it be upon this loose Earth that Plants grow, and into which even great Timber-trees themselves shoot, and spread their Roots seldom or never reaching to, or penetrating into the *Fast*, though this lie sometimes near enough to the external Surface of the crusty Earth.

*An exact Relation of the Pico Teneriff, taken from
Mr. Clappham.*

A Bout the 20th of *August*, 1646, Mr. *Clappham*, together with Mr. *Philip Ward*, *John Webber*, *John Cowling*, *Thomas Bridge*, and *George Cove*, all of them very considerable Merchants, and worthy of Credit, with one Guide, Servants and Horses to carry their Wine and Provisions, did set out from *Oratava*, a Port-Town in the Island of *Teneriff*, situated on the North, at two Miles Distance from the main Sea: They travelled from twelve at Night till eight in the Morning, by which time they got to the Top of the first Mountains towards the *Pico de Teraira*; here, under a very great and conspicuous Pine-tree they brake their Fast, dined, and refreshed themselves till two in the Afternoon, and then proceeded through much sandy way, over many lofty Mountains, but naked and bare, and not covered with Pine-Trees, as their first Night's Passage were, which exposed them to excessive Heat, till they arrived to the Foot of the *Pico*, where they found many huge Stones which seemed to have been fallen down from some superiour Part. But before we proceed further, to give any Account of this Journey, give me leave here to insert the Opinion of *Dr. Pugh*, a Person of very great Reputation, at this time in the City, who lived twenty Years himself on the Place, both in the Quality of a Physician, and a Merchant, and was very curious and inquisitive into all that was in the Island: His Opinion is, that the whole Island of *Teneriff*, being a Ground mightily impregnated with Brimstone, did in former times take Fire,

and blow up all, or near upon all at the same time; and the many Mountains of huge Stones calcined and burnt, which appear every where about the Island, especially in the South-West Parts of it, were raised and heaved up out of the Bowels of the Earth, at the time of the general Conflagration; and the greatest Quantity of this Sulphur lying about the Center of the Island, raised up the *Pico* to that Height, at which it is now seen. And he says, that any one upon the Place, that shall carefully note the Situation and Manner of these calcined Rocks, how they lie for three or four Miles almost round the bottom of the *Pico*, and in such Order one above another, almost to the very Sugar-Loaf (as 'tis called) as if the whole Ground, and rising up together with the Accension of the Brimstone, the Torrents and Rivers of it did with a suddain Eruption roll and tumble them down from the rest of the Rocks, especially (as was said before) to the South-West; for on that side, from the very Top of the *Pico*, almost to the Sea-shore, lie huge Heaps of these burnt Rocks, one under another: and there remain to this time the very Tracts of the Rivers of Brimstone, as they ran over all this Quarter of the Island, which has so wasted the Ground beyond recovering, that nothing can be made to grow there, but Broom. But on the North Side of the *Pico*, few or none of these Stones appear; and he concluded hence, that the *Vulcano* discharged itself chiefly to South-West. He adds further, that Mines of several Metals were broken and blown up at the same time: These calcined Rocks resembling some of them Iron Ore, some Silver, and others like Copper, particularly at a certain Place in these South-West Parts, called the *Azuleros*, being very high Mountains, where never any English but himself (that he ever heard of) was.

was. There are vast Quantities of a loose blewish Earth, intermix'd with blew Stones, which have on them a yellow Rust, as that of Copper and Vitriol; and likewise many little Springs of vitriolate Waters; here he supposes was a Copper-Mine. And he was told by a Bell-founder of *Oratava*, that out of two Horse-Loads of Earth, he got as much Gold as made two large Rings: And a *Portuguese* told him, who had been in the *West-Indies*, that his Opinion was, there were as good Mines of Gold and Silver there, as the best in the *Indies*. There are likewise hereabouts nitrous Waters and Stones cover'd with a deep Saffron colour'd Rust, and tasting of Iron. And further, he mentions, one *Mr. Gilbert Lambell*, a Friend of his, who of two Lumps of Earth or Oar, brought from the Top of this Side the Mountain, made two Silver Spoons. All this he confirms from the late Instance of the *Palm-Island* eighteen Leagues from *Teneriff*, where a Vulcan was fired about twelve Years since, the Violence whereof made an Earthquake in this Island, so great, that he and others ran out of their Houses, fearing they would have fallen upon their Heads: They heard the Noise of the Torrents of flaming Brimstone, like Thunder, and saw the Fire as plain by Night, for about six Weeks together, as a Candle in the Room; and so much of the Sand and Ashes brought from thence, by the Wind, by Clouds, fell on his Hat, as filled a Sand-box for his Ink-horn. Thus far he.

To resume therefore the Narrative of their Journey; about six a Clock this Evening, they began to ascend up the *Rico*; but being now a Mile advanced, and the way no more passable for their Horses, they quitted and left them with their Servants. In this Mile's Ascent some of their Company grew very faint and sick: and from

from Dr. *Pugh's* Report of eighteen in his Company, that went up about the middle of *August*, long after this, but ten got up, and these had all drank very plentifully below; the rest so disorder'd by Fluxes, Vomitings, and aguish Distempers, they could go no farther: Their Horses Hair stood upright, like Brittles, with the vehement Cold, who stood shaking, and refused to eat any thing till they came down. But calling for some of their Wine, which was carried in small Barrels on a Horse, they found it so wonderfully cold, that they could not drink it, till they had kindled a Fire to warm it, although yet the Temper of the Air was very calm and moderate; but when the Sun was set, it began to blow with Violence, and grew so cold, that taking up their Lodging under certain great Stones in the Rocks, they were constrained to keep great Fires before the Mouth of them all Night. About four in the Morning they began to mount again, and being come about a Mile up, Mr. *Cowling*, one of the Company, failed, and was able to proceed no further. Here begin the black Rocks. The rest pursued their Journey till they arrived to Sugar-Loaf, where they begin to travel again in a white Sand, being fore-shod with Shoes, whose single Soles are made a Finger broader than the upper Leather, to incounter this difficult and unstable Passage, till they are half way up; and a Spaniel that went up afterwards with Dr. *Pugh*, (as he relates) went crying all the way, having his Skin burnt off his Feet; and then being ascended as far as the black Rocks, which are all flat, and lie like a Pavement, they climbed within a Mile of the very Top of the *Picco*: but Mr. *Clappham*, who was the formost, would have perswaded Mr. *Cowie* to descend again, as imagining the Top of all on Fire: but at last overcoming that

Appre-

Apprehension, and persisting, they gained the Summit, where they found no such Smoak as appeared a little below, but a continual Breathing of a hot and sulphurous Vapour; which made their Faces extremely sore.

In this Passage they found no considerable Alteration of Air, and very little Wind; but being at the Top, it was so impetuous, that they had much ado to stand against it, whilst they drank the King's Health, and fired each of them a Piece: Here they also brake-fast, but found their Strong-Waters had quite lost its Force, and was become almost insipid, whilst their Wine was rather more spirituous and brisk than it was before.

The Top on which they stood being not above a Yard broad, is the Brink of a Pit called the *Caldera*, which they judged to be about a Musket-shot over, and near fourscore Yards deep, in shape like a Cone, within hollow like a Caldron, and all over cover'd with small loose Stones, mixed with Sulphur and Sand, from Heat; and stirr'd up with any thing, puffs and makes a Noise, and so offensive, that Dr. Pugh was almost stifled with the sudden Emanation of Vapours, upon the removing of one Stone of these; these Stones are so hot, as they are not to be easily handled: They descended not above four or five Yards into the *Caldera*, in regard of its sliding from their Feet, and the Difficulty; but some have adventured to the Bottom. Other observable Materials they discovered none, besides a clearer sort of Sulphur, which looks like Salt upon the Stones.

From this famous *Pico* they could ken the *Grand Canaries*, fourteen Leagues distant; *Palma* 18, and *Gomera* 7 Leagues; which Interval of Sea seemed to them no larger than the River of *Thames* about *London*: they discerned

discerned also the *Hierro*, being distant above twenty Leagues; and so to the utmost Limits of the Sea much farther.

So soon as the Sun appeared, the Shadow of the *Pico* seemed to cover not only the whole Island, and the *Grand Canaries*, but the Sea to the very Horizon, where the Top of the Sugar-Loaf, or *Pico*, visibly appeared to turn up, and cast its Shadow into the Air it self, at which they were much surprized. But the Sun was not far ascended when the Clouds began to rise so fast, as intercepted their Prospect, both of the Sea, and the whole Island, excepting only the Tops of the subjacent Mountains, which seemed to pierce them through.

Whether these Clouds do ever surmount the *Pico*, they could not say; but to such as are far beneath, they sometimes seem to hang above it, or rather wrap themselves about it, as constantly when the North-West Winds blow: This they call the *Capp*, and is a certain Prognostick of ensuing Storms.

Mr. *John Webber*, one of this Company, who had made a Journey two Years after, arriving at the Top of the *Pico* before Day, and creeping under a great Stone to shroud himself from the cold Air, (after a little space) found himself all wet, and admiring whence it should proceed, perceived it at last to come from a perpetual Trickling of the Water from the imminent Rocks above him.

Many excellent and very exuberant Springs they found issuing from the Tops of most of the other Mountains, gushing out in great Spouts, almost as far as the huge Pine-tree which was mentioned.

Having stayed some time upon this Top, they all descended by the sandy way, till they came to the Foot of the Sugar-Loaf, which being steep, even to almost

a Perpendicular, they soon passed: and here they meet a Cave of about ten Yards deep, and fifteen broad, being in Shape like an Oven or *Cupola*, having a Hole at the Top, which is near eight Yards over; by this they descended (an active Spaniard shewing them the way) by a Rope, which their Servants held at the Top, whilst the other End being fastened about his middle, he swings himself, till being over a Bank of Snow, he slides down and lights upon it. They are forced to swing thus in the Descent, because in the middle of the bottom of this Cave, opposite to the Overture at the Top, is a round Pit of Water, resembling a Well, the Surface whereof is about a Yard lower than the Snow, but as wide as the Mouth at the Top, and is about six Fathom deep, as Mr. *Lambell* reports, who plumbed it. They suppose this Water not a Spring, but dissolved Snow, or Water blown in; for some Years it lies so full, one cannot get into the Cave for Water trickling through the Rocks.

About the Sides of the *Grotte*, for some Height is Ice, and Icecles hanging down to the Snow: but being quickly weary of this excessive cold Place, and drawn up again, they continued their Descent from the Mountains by the same Passages they went up the Day before; and so about five in the Evening arrived to *Oratava*, from whence they set forth: their Faces so red and sore, that to reduce them and cool them, they were forced to wash and bathe them in Whites of Eggs, &c.

The whole Altitude of the *Pico* in Perpendicular, is vulgarly esteemed to be two Miles and a half.

No Trees, Herbs or Shrubs in all the Passage, but Pines; and amongst the white Sands a kind of Broom, being a bushy Plant; and at the Side where they lay all Night, a kind of Cardon, which has Stems of eight

Foot high, the Trunk near half a Foot thick, every Stem growing in four Squares, and emerging from the Ground like Tuffets of Rushes; upon the Edges of these Stems grow very small red Buttons or Berries, which being squeezed, produce a poisonous Milk, which lighting upon any part of a Horse, or other Beast, fetches off the Hair from the Skin immediately: Of the dead Part of this they made their Fires all Night. This Plant is also universal over the Island, and is happily, and as I conjecture, a kind of *Euphorbium*.

In some part of this Island also there grows a crooked Shrub, which they call *Legnan-well*, which they bring for *England* as a sweet Wood. There are likewise Apricocks, Peaches, and in Standards, which bear twice a Year: Pear-Trees also which are as pregnant; Almonds of a tender Shell, Palms, Plantanes, Oranges and Lemons, especially the *Pregnadas*, which have small ones in their Bellies, from whence they are so denominated. Also they have Sugar-Canes, and a little Cotton and Colloquintida; the Roses blow at *Christmas*; there are good Carnations, and very large, but Tulips will not grow or thrive there: Sampier clothes the Rock in abundance, and a kind of Clover the Ground. Another Grass growing near the Sea, which is of a broader Leaf, so luscious, as it will kill a Horse that eats of it, but no other Cattel. There is also an Herb which they make Thread of. Eighty Ears of Wheat have been found to spring from one Root, but it grows not very high; the Corn of this is transparent and bright, like unto the purest yellow Amber; and one Bushel has produced 130 in a seasonable Year.

The Canary-Birds (which they bring to us in *England*) breed in the *Barrancos* of *Gills*, which the Water has fretted away in the Mountains, being Places very cold.

cold. There are also Quails, Partridges larger than ours, and exceeding beautiful; great Wood-Pigeons, Turtles at Spring, Crows; and sometimes from the Coasts of *Barbary* appears the *Falcon*. Bees are carried into the Mountains, where they prosper wonderfully.

They have wild Goats on the Mountains, which climb to the very Top of the *Pico* sometimes. Also Hogs, and Multitudes of Conies: Camels are brought from *Lancerote*, besides other Cattel.

Fish. The *Cherna*, a very large and excellent Fish, better tasted than any we have in *England*. The *Mero*, Dolphin, Shark, Lobsters without the great Claws, Mussels, Periwinkles, and the *Clacas*, which is absolutely the very best Shell-fish in the World; they grow on the Rocks, five or six under one great Shell, through the Top whereof they peep with their Nebbs, from whence (the Shells being broken a little more open with a Stone) they draw them forth. There is likewise another Fish like an Eel, which has six or seven Tails of a Span in length, united to one Head and Body, which is also as short. Besides these they have Turtles and *Cabridos*, which are preferable before our Trouts.

The Island is full of Springs of pure Water, tasting like Milk; and in *La Laguna* (where the Water is not altogether so limpid and clear) they percolate it through a kind of spongy Stone cut in form of a Basin.

The Vines which afford those excellent Wines, grow all about the Island, within a Mile of the Sea; such as are planted farther up, are nothing esteemed, neither will they thrive in any other Islands.

For the *Guanchios*, or the ancient Inhabitants, *Dr. Pugh* gives this full Account.

September the 3d. about twelve Years since, he took his Journey from *Guimar*, a Town inhabited for the most part by such as derive themselves from the old *Guanchios*, in the Company of some of them, to view their Caves, and the Bodies buried in them. This was a Favour they seldom permit to any, (having in great Veneration the Bodies of their Ancestors, and likewise being most extremely against any Molestation of the Dead) but he had done many several Eleemosinary Cures amongst them, (for they are generally very poor, yet the poorest thinks himself too good to marry with the best Spaniard) which endeared him to them exceedingly; otherwise it is Death for any Stranger to visit those Caves or Bodies.

These Bodies are sewed up in Goat-skins, with Thongs of the same, with very great Curiosity, particularly in the incomparable Exactness and Evenness of the Seams; and the Skins are made very close and fit to the Bodies: most of these Bodies are entire, the Eyes closed, Hair on the Head, Ears, Nose, Teeth, Lips, Beard, all perfect, only discoloured, and a little shrivled: likewise the *Pudenda* of both Sexes. He saw about three or four hundred in several Caves, some of them are standing, others lie on Beds of Wood, so hardened by an Art they had, (which the Spaniards call *Curar*, to cure a Piece of Wood) which no Iron can pierce or hurt. He said, that one Day being a Hunting, a Ferret (which is in use there) having a Bell about his Neck, ran after a Coney into a Hole, where they lost the Sound of the Bell; the Owner being afraid he should lose his Ferret, seeking about the Rock and Shrubs, found the Mouth of a Cave, and entering in, was so affrighted, that he cried out: it was at the Sight of one of these Bodies, very tall and large, lying with
his

his Head upon a great Stone, his Feet supported by a little Wall of Stone, the Body resting on a Bed of Wood, as before was mentioned.

The Fellow being now a little out of his Fright, enter'd in, and cut off a great Piece of the Skin that lay on the Breast of this Body, which the Doctor says was more flexible and pliable than ever he felt any Kids Leather Glove, and yet so far from being rotten, that the Man made Use of it for his Flail many Years after.

These Bodies are very light, as if made up of Straw : and in some broken Limbs he observed the Nerves and Tendons, and also some Strings of the Veins and Arteries very distinctly.

His great Care was to enquire of these People, what they had amongst them of Tradition, concerning the embalming and Preservation of these Bodies? From some of the oldest of them (above a hundred and ten Years of Age) he received this Account: That they had of old one particular Tribe of Men that had this Art amongst themselves only, and kept it as a thing sacred, and not to be communicated to the Vulgar; these mix'd not with the rest of the Inhabitants, nor married out of their own Tribe; and were also their Priests and Ministers of Religion : that upon the Conquest of the Spaniard, they were most of them destroyed, and the Art lost with them, only they held some Traditions yet of a few Ingredients that were made use of in this Business.

They took Butter of Goats Milk, (some said Hogs Grease was mingled with it) which they kept in the Skins for this Purpose; in this they boiled certain Herbs; *1st.* A sort of wild Lavender, which grows there in great Quantities on the Rocks. *2dly.* An Herb called *Jara*, of a very gummy and glutinous Consistence, which

which now grows under the Tops of the Mountains only. 3dly. A kind of a Cyclamen or Sow-Bread. 4thly. Wild Sage growing plentifully in this Island. These, with Stones bruised and boiled in the Butter, render'd it a perfect Balsam. This prepared, they first unbowelled the Corps; and in the poorer sort, to save Charges, they took out the Brain behind: and these Poor also were sewed up in Skins with the Hair on, whereas the Richer were (as was said before) put up in Skins so finely and exactly dressed, as they remain most rarely pliant and gentle to this Day. After the Body was thus order'd, they had in a Readiness a Lixivium, made of the Bark of Pine-Trees, with which they washed the Body, drying in the Sun in Summer, and in Stoves in Winter; this repeating very often. Afterwards they began their Unction with the Balsam, both without and within, drying it again, as before: This they continue till the Balsam had penetrated it self in the whole Habit, and the Muscles in all Parts appeared through the contracted Skin, and the Body became exceeding light; then they sewed them up in the Goat-skins, as already mentioned. He was told by these ancient People, that they have above twenty Caves of their Kings and Great Persons, with their whole Families, yet unknown to any but themselves, and which they will never discover. Lastly, he says, that Bodies are found in the Caves of the *Grand Canaries*, in Sacks, and quite consumed, not as those in *Teneriff*. Thus far of the Bodies and Embalming. Anciently when they had no knowledge of Iron, they made their Lances of Wood, harden'd as before, some of which the Doctor has seen: he has also seen Earthen Pots so hard, that they cannot be broken, of these some are found in the Caves, and old *Barrancos*, and used by the

poorer sort of People that find them, to boil Meat in; likewise they did *Curar Stone* it self, that is to say, a kind of Slate now called *Tabona*, which they first formed to an Edg or Point, as they had occasion to use them, either as Knives, or Lancets to let Blood.

Their Food was Barly roasted, and then ground with little Mills, which they made of Stones, and mix'd with Milk and Honey; this they still fed on, and carried it on their Backs in Goat Skins.

To this Day they drink no Wine, nor care for Flesh; they are generally very lean, tall, active, and full of Courage.

He himself has seen them leap from Rock to Rock, from a very prodigious Height, till they came to the bottom, sometimes making ten Fathom deep at one Leap. The manner is thus.

First, they tertiate their Lance, (which is about the Bigness of a half-Pike) that is, they poise it in their Hand, then they aim the Point of it at any Piece of a Rock, upon which they intend to light, sometimes not half a Foot broad; at their going off they clap their Feet close to the Lance, and so carry their Bodies in the Air; the Point of the Lance first comes to the Place, which breaks the Force of their Fall; then they slide gently down by the Staff, and pitch their Feet upon the very Place they first designed, and from Rock to Rock, till they come to the bottom.

Their Novices sometimes break their Necks in Learning. He added several Stories to this Effect, of their great Activity in leaping down Rocks and Clifts, and how eight and twenty of them made an Escape from the Battlement of an extraordinary high Castle in the Island, when the Governour thought he had made sure of them.

He

He told also (and the same was seriously confirmed by a Spaniard, and another *Canary*-Merchant then in the Company) that they whistle so loud, as to be heard five Miles off; and that to be in the same Room with them when they whistle, were enough to endanger breaking the Tympanum of the Ear: And added, that he being in the Company of one that whistled his loudest, could not hear perfectly for fifteen Days after, the Noise was so great.

He affirms also, that they throw Stones with a Force almost as great as that of a Bullet, and now use Stones in all their Fights, as they did anciently.

Mr. *Sydenham* told me this Day, that upon the 18th of *August*, he and his Company began their Journey toward the Pike of *Teneriff*, setting out from *L' Oratava*, a Town seated on the lower Part of the Mountain, from which Town to the Sea there are three Miles of way always descending.

He began his Journey on Sunday about 10 a Clock at Night, and travell'd till five in the Afternoon of the Monday following, resting two Hours by the way; the Ground was continually rising, and during this time they travelled about 10 Miles of their way upon Mules.

Resting upon Monday till 12 a Clock at Night, they resumed their Journey, and travelled till about 9 in the Morning, at which time they arrived at the Top of the Sugar-Loaf, or highest Pile of the Mountain.

They went up on the South Side of the Hill, on which Side there was no Snow, though on the North Side there were much. They staid about two Hours on the Top of the Sugar-Loaf, and then returned to that Part of the Hill where they had lodg'd the Night before.

I ask'd Mr. *Sydenham* what was the Estimate made by the most knowing Persons of the Island, of the Height of the Hill? and he told me, that the Guides accounted it to be one and twenty Miles high from the Town, which, as was noted before, is seated three Miles above the Sea. And he added, that a Sea-man with great Confidence affirming himself to have accurately enough measur'd by Observations made in a Ship, and to have found the Perpendicular Height of the Hill to be about seven Miles.

I asked him also from what Distance the Top of the Sugar-Loaf could be seen at Sea, according to the common Opinion of Sea-men? He answer'd, that the Distance was wont to be reckoned threescore Sea-Leagues, of three Miles to a League; adding, that he himself had seen it above forty Leagues off, and yet it appeared exceeding high, and like a bluish Pyramide, manifestly a great deal higher than the Clouds. And he also told me, that sometimes Men could from thence see the Island of *Madera*, though distant from it 70 Leagues; and that the great *Canary*, though 18 Leagues off, seem'd to be very near them, as if they might leap down upon it.

He told me, that the higher Part of the Region of Snow was two Miles, or two Miles and a half lower than the Foot of the Sugar-Loaf; and that on the upper part of the Hill they felt no Wind.

Mr. *Sydenham* told me, that being at the Top of the Sugar-Loaf, drinking the King's Health, he endeavour'd to shoot off a Birding-Piece he had carried up with him, but though he snap'd it above twenty times, he could not make it go off; whereas when he came down into the ordinary Air, the first time he tried to shoot, it went readily off. I ask'd him whether he had taken

notice that the Flint struck out any Sparks of Fire or no at the Top of the Hill, and whether he had mended and alter'd the Flint coming downwards? To the first he answered he did not remember, to the other that he remembered he did not.

He also told me, that having carried up a Borracha of Sack, when they came to the Top of the Mountain, they drank divers Healths very freely, but could not find themselves heated, or sensibly discomposed by the Wine; whereas when they were come down into a thicker Air, they manifestly felt the heady Operation of the Liquor, which then made their Guide and one of their Company drunk.

He described the Sugar-Loaf to be in the midst of a barren Plain, in the upper Part of the Mountain, and to be exceeding steep. The Top of the Sugar-Loaf is made shelving inward almost like a Dish. But in many Places of it there appear little Holes (regularly placed) as it were so many little Vents to a great Fire burning in or below the Bowels of the Mountain. He told me, that the Guide dissuaded him from going to the middle of this shelving Top, affirming it to be exceeding dangerous: but he ventur'd to thrust the scowring Stick of his Gun somewhat deep and rudely into one of those Holes, from whence there arose a hot Steam, which had like to have killed him, and hindred him from further Trials. He added, that the Top of the Mountain seem'd to be little else than Stones and Sulphur, and that there were great Store of Picces of Brimstone, which are guessed to be sublimed up from the internal Parts of the Hill.

Being asked, whether he was sick or no in the Ascent? he said, that both he and all his Company, which were about a dozen Men, were sick for three or four Hours, when

when they came into the subtile and piercing Air of the upper Part of the Mountain: but as they went down again, they were not sick. And being asked what kind of Sicknels it was they felt? he said it was like Sea-sick-ness.

He told me, that the Sack they carried up with them to refresh themselves, seem'd to them at the Top of the Mountain so very cold, that they were not able to drink above two or three Drops at a Draught, by reason of the Operation of the excessive Cold upon their Teeth. He added upon my Inquiry, that his Feet were not more than ordinarily warm, and yet one of the two Pair of Pumps he carried up with him were burnt off his Feet by the Brimstone.

When I asked him about the Difference of Seasons at the same time in the same Mountain, he told me, that he pass'd over one of them by Name.

On the one Side of which it was excessively hot near the Top or Ridg, as well, though not quite so much, as in the lower Regions on the Side of the Mountain; but within a Mile or two on the other Side of the Ridg he found Winter-Weather, as to Cold and Storminess, and yet there was Snow as well on the other Side as on this.

To what Depth the Water will be frozen in hard Winters.

To what Depth the Earth will be frozen in that Season.

Whether Muscovian Ice be considerably, or at least sensibly harder than English Ice.

Whether by casting up Water, or by spitting, the Liquor will freeze before it comes to touch the Ground.

Whether Brandy, Sack, &c. will freeze in *Russia*.

Whether Instruments of Iron and Steel be much more brittle there than here.

Of the cracking of the Timber in wooden Houses, and the Causes of it.

Of the Preservation of Flesh, Fish, Herbs, Eggs, &c. in hard Weather.

Of the curing of those whose Nose, Cheeks, &c. are frozen.

Of the Symptoms of those that are frozen to Death.

Of the keeping of dead Bodies.

T I T L E

T I T L E XX.

Of the Air in reference to Light ; its Perspicuity, Opacity, Reflections, Refractions, Colours, Light, and Lightning.

A Very learned Traveller affirmed to me, that having occasion to reside sometimes on the *Riviera* or Coast of *Genova*, he had often observed, that from a high Place he could both Morning and Evening clearly discern the Island of *Corsica* ; and sometimes also other Places in that Sea, though he could not see them at Noon, how fair and clear so ever the Weather was, when the Sun was in or near the Meridian.

His late Majesty K. *Charles* the Second, doing me one Day the Honour to discourse about several Marine Observations, was pleas'd among other things to acquaint me with this rare Phænomenon. He was one Day walking upon the Beach on the Strand, not far from *Dover*, to enjoy the fresh Air, and the Prospect of the Sea, when casually looking forwards to the Verge of the visible Horizon, he was very much surprized to discover there a new Coast, with rising and falling Grounds, newly, as it were, emerged out of the Ocean, in a Place where no such thing had been seen before. The Strangeness of this unlook'd-for Apparition made Him suspect something of Illusion offer'd to his Eyes by the Beams of the Sun that shone upon the Neighbouring Objects ; wherefore he rubb'd his Eyes, and the

new

new Scene not vanishing, he call'd to his Royal Highness the Duke of *York*, (who was present when his Majesty was pleased to make me the Relation) and to some of the attending Courtiers that were nearest at hand, to make them Partakers and Witnesses of this delightful Spectacle, which after it had been gazed on a little while, did somewhat slowly disappear, as if it had sunk down again into the Ocean. Of the Cause of this rare Phænomenon, I ventur'd to propose to the King this Conjecture: That the Place where it was seen lying the same way that the Coast of *France* did, and that Coast being but a little too far off to be discern'd before, it might very well happen, that either by Action of the Sun, or rather by subterranean Steams, the Air interposed between the Shore and his Majesties Eyes, was fill'd with Vapors and Exhalations that made it much more refractive than formerly; and by Help of this supervening Refraction, the French Coast that lay beyond it was rais'd, and as it were lifted up, in reference to the Sight, and so became visible as long as that new Refraction lasted: And when the Steams that occasion'd it, were either got up too high, or were by the Winds or Sun too much dissipated or dispersed, the Apparition ceased, together with the unusual Refraction that caused it. And in favour of this Conjecture I alledg'd that familiar Experiment in which a Piece of Gold, or the like convenient Object, being put into the bottom of an empty Cup, and the Eye being so placed, that the Object is but just hid from it by the Interposition of the Side of the Cup, if Water be poured into the Vessel, though neither the Eye nor the Object be at all removed, yet the Piece of Gold will be plainly seen, because the Surface of the Water, which is a thicker Medium than the Air, breaking the Rays that tend from the Object

Object towards the Beholder's Eye, according to the Laws of Refraction, that is from the Perpendicular they are so bended, that those fall now into the Pupil, that if it were not for the Water, would either fall upon the Side of the Cup, and so be hinder'd from passing forward; or else would fall upon the Eye-lids or Eye-brows, or some other Part above the Pupil, and so would not make the Object visible.

The Duke of York was also pleas'd to tell me, that he was somewhat surprized, when being near the Borders of *Scotland*, in a Season that did not promise much fair Weather, he saw one Morning the Sky very red, and thereupon said, that he fear'd they should have foul Weather, according to the usual Prognostick of Country-men and Mariners: but some of the Scottish Nobility that attended his Highness, told him, that in that Country such red Mornings did not bode a foul Day, but rather promise a fair one; which Prediction of theirs was justified by the Event. Upon which occasion I enquired of a very intelligent Scottish Noble-man, how far the Observation held in his Country? To which he answer'd, that with a due Limitation it was most commonly true; for though when the Redness seems to be very near the Ground, and appears in somewhat narrow Streaks of an intense Red, it signifies bad Weather; yet if the Morning Redness appears elevated in the Air or Sky, especially if the Wind be Easterly, it usually foretels a fair Day.

Some Observations of Capt. James, in his Northern Voyage, Mr. J. T. and others.

February. I practis'd some Observations by the rising and setting of the Sun, calculating the time of his rising,

rising and setting, by very true running Glasses. As for our Clock and Watch, notwithstanding we still kept them by the Fire-side in a Chest, wrap'd in Clothes, yet were they so frozen, that they could not go: My Observations by these Glasses, I compared with the Stars coming to the Meridian: By this means we found the Sun to rise twenty Minutes before it should; and in the Evening to remain above the Horizon twenty Minutes (or thereabouts) longer than it should do: And all this by reason of the Refraction. Capt. James.

March. This Evening the Moon rose in a very long Oval alongst the Horizon.

April. The Weather continued with this Extremity until the fifteenth, at which time our Spring was harder frozen than it had been all the Year before. I had often observed the Difference betwixt clear Weather and misty refractious Weather, in this manner: From a little Hill which was near adjoining to our House, in the clearest Weather, when the Sun shone with all the Purity of Air that I could conceive, we could not see a little Island, which bare off us South-South-East some four Leagues; but if the Weather were misty, (as aforesaid) then we should often see it from the lowest Place. This little Island I had seen the last Year when I was on *Danby-Island*. The 13th I took the Height of it instrumentally, standing near the Sea-side, which I found to be 34 Minutes, the Sun being 28 Degrees high. This shows how great a Refraction here is. Yet may this be noted by the way, that I have seen the Land elevated by reason of the refractious Air; and nevertheless the Sun hath risen perfect round.

January 6. I observed the Latitude with what Exactness I could, (it being very clear Sun-shine Weather) which

which I found to be 51, 52. This Difference is by reason that here is a great Refraction.

January 21. I observed the Sun to rise like an Oval alongst the Horizon; I called three or four to see it, the better to confirm my Judgment, and we all are agreed, that it was twice as long as it was broad. We plainly perceived withal, that by Degrees as it got up higher, it also recovered Roundness.

Attending upon Sir *Peter Wyeh*, in his Journey for *Warsaw* the Beginning of *June, 1672*, whilst we lay about three Polish Miles from the City, attending the Preparations for his Reception there, we had very clear and extream cold Weather; and for two Days together we observed the Sun and two Parhelions, or three Suns, from above ten a Clock to near twelve, not the least Cloud appearing in the Air, but that so serene, that we took notice of the Icy Spangles in the Air, flying about like Atoms in the Sun's Beams. This is also worth taking notice of; that whereas in ordinary frosty Weather any smooth Iron, or other Metal, whether Heads of Sticks, Pomels of Swords, or Barrels of Guns, being brought out of the open Air into a warm Room, there will presently, first a Dulness in the Glasse, and then Drops of Water appear: At this time there would immediately appear the Likeness of an hoar Frost. Now whether the Particles of Cold be so subtil as to pierce or enter into polished Metal, I will not determine; tho the Experience of wetting one Finger with his Spittle, and forthwith laying it to Iron when it freezes hard, by its immediate Adhesion, even in the Moment of touching it, would make some way for the Affirmative. That same Month returning back from *Warsaw*, I saw, upon my Journey, the Sun rise with a large Pillar,

lar, coloured like a Rain-bow, perpendicular over it, out of a clear Horizon; and I remember Monsieur *Hævelius* told me, he observed it once set with the like, N.

In *Cornwall* they observe in their driving home Levels or Sink, the Waters do also manifestly partake of the Minerals, for in some Mines they are Sanative, where Iron is observed; and in others apt to cause Wounds to fester and rankle. As the first was most manifest at *Karne Key*, the latter at *Relistian*, both famous Tin-Works.

Asking of a Chymist that travelled with a famous Virtuoso of my Acquaintance over part of the *Alpes* that is said to be much subject to Thunders, divers Questions about Thunder, I had among other Answers, this, That he and my Friend being together at the Top of a forked Mountain, between whose Parts there lay a Valley, that seem'd almost cover'd with a thick Cloud; and though the Weather were clear at both the Tops, he observed that the subjacent Cloud being big with Thunder, the Lightning appeared quite through it, and seem'd to lie deep in it, so that casting his Eyes down upon the Cloud, he fancied that what he saw, was, (to use his own Comparifon) as if a shining Fish were moving to and fro very swiftly in a somewhat troubled Water. If I had seasonably had the Relation, I had enquired of my Friend about it; but I was the more inclined to believe it, because I remember, that passing over a part of the *Alpes*, less high than that where the recited Observation was made, though it was very fair Weather, and a clear Sky at the Top of the Mountain where we were, yet a great way beneath us we saw dark Clouds, through part of which we afterwards in our Descent were obliged to pass, though then (whether

ther part of the Matter had been in the mean while discussed, I examine not) it seem'd to us little different from a thick Fog, which when we had pass'd thorow, we found the Weather fair and clear enough to the Foot of the Mountain.

Meeting with an inquisitive Noble-man that liv'd long at *Naples*, I asked him whether he had ever seen any of those famous Apparitions that are said sometimes to shew themselves in or near the *Sicilian Strait*, and is known by the Name (if I mistake not) of *Morgane*? To this he answer'd me, that during the Spring-time, he had once the Curiosity to try whether this Tradition had so much Ground as was commonly believed; and that accordingly on several fair Mornings he rose before the Sun, and look'd solicitously along the Coast, without seeing any thing that answer'd his Expectation: But not being discouraged by these Disappointments, he one Morning perceiv'd, as he thought, two Steeples in a Neighbouring Town where he knew there was but one; which Phenomenon inviting him to continue his Curiosity, he chose the first fair and cloudless Morning to rise early on; and casting his Eyes towards the lately mentioned Town, and the Coast it was not remote from, he was surpriz'd with a delightful Prospect of a new Town beyond the other, and incomparably greater than it, and furnish'd, as it seem'd to him and a Doctor of Physick that accompanied him, with Walls and Towers, and Steeples and Houses, and other things that were delightful, as well as wonderful to behold. But he answer'd me, that the Colours were not near so lively as the Figures, being for the most part somewhat dim, though adorned here and there with some Redness: but this odd Spectacle, as it was not invariable during the whole time it last'd, did not continue very

long ; for when the Sun was gotten up to such a Height above the Horizon as made his Beams powerful, they quickly confounded all these Airy Structures in a kind of Chaos, and made the fantastick City vanish.

Moist Vapours are not the only Cause or Sign of the Opacity of the Air, since that dry blighting East Wind, which from the Effects Country People call a red Wind, makes the Air at a Distance seem blewish and thick. This is the Wind which these two Years last past, has been so pernicious to Apples, and indeed to all sorts of Trees, not only to blast the Fruit, but the very Leaves of such Trees as it met withal, just in the *Tender* (as the Woodmen call it) *i. e.* when they are newly expanded out of the Buds. Mr. J. T.

That Air is sometimes more clear and transparent, and sometimes more dark, and, as it were, muddy, being clogg'd and opacated with terrestrial Steams, is every Man's Observation. But there are some Phenomena that depend upon the Density, Diaphancity, &c. of the Air, that are not so vulgarly taken notice of: For besides those that require Skill in the Doctrine of Refractions, on which therefore I shall not now insist; there are some others that may be worth your notice, which I shall give a Taste of.

Considering the differing Accounts that are given by good Authors, of the number of the Fixed Stars, and comparing them with some Observations of our own, I was thereby, and upon some other Grounds, induced to suspect that the differing and unheeded Constitutions of the Air might occasion a Difference in assigning the Number of the Stars: which made me inquire of several Navigators and Travellers, some into the torrid Zone, and others into the frigid ones, what Difference they

they found in contemplating the Stars in those Climates, and in ours; and by this Inquiry, I learned that in some Places where the Air is very pure, Celestial Observations may be more happily made. And particularly because I supposed that intense Cold, by precipitating the darkning Vapours out of the Air, may probably make it more defecate and clear. I desired an ingenious Physician that travelled in *Muscovy*, to take notice of any thing that should favour or disfavour this Conjecture. In Compliance with which Request of mine he informed me, that travelling one Night in a Sled in the more mediterranean Parts of *Russia*, the Weather being extraordinary cold, he was invited to quit his Sled a little to consider the Sky, where he saw so many Stars, and so much brighter than he had ever seen before, that he was almost as much surprized as delighted with so glorious a Spectacle, which he shewed to some of his Fellow-Travelers that shared in his Wonder.

And this brought into my Mind, that remembering that the ingenious Capt. *James* being forc'd to winter in *Charlton-Island*, which though but of the Latitude almost of *Cambridge*, is but little, if at all, less cold than *Nova Zembla* it self, I should probably find something pertinent to our present Subject in so diligent an Observer. I resorted to his Voyage, where I met with these notable Observations.

January 30 and 31, there appeared in the Beginning of the Night more Stars in the Firmament than ever I had seen before, by two thirds. I could see the Cloud in *Cancer* full of small Stars: and amongst the *Pleiades* a great many small Stars. About ten a Clock the Moon did rise, and then a quarter of them was not to be seen. The Wind for the most part of this Month
hath

hath been Northerly, and very cold, &c. Capt. James, p. 62.

The Russian Emperor's Physician confirmed to me by word of Mouth, what he had some Years since told me in a Letter, that one Night which was exceeding cold and clear, being awakened out of his Sleep by a Shake that had like to have overturn'd his Sled, he look'd out and saw more Stars by far than ever he saw in *England*; or the Neighbouring Parts of *Europe*, and particularly that he saw many about the 7 Stars, or the *Pleiades*, and divers others he had not seen before in several other Parts of the Sky. He farther told me, that these Stars seem'd far more beautiful and bright than was usual, inso-much that he doubts not, that if it had not been for the Snow, some of them would have cast a discernable Shadow. For Confirmation, he saith, that the Phænomena were not only taken notice of by him, but by others that travelled with him; and that though he often gazed at the Sky, since that time he never could see there near so many Stars, nor so bright.

December 4. I had not time the last Week to tell you of something, that to us that have not been long in this Country seems strange, but the People of this Place say happens very often.

On the 29th of the last Month, after I had written and sent away my Letters, looking out of the Dutchesse Window to see what Weather it was, I saw towards the N E. alongst the Horizon, it look'd as light, and just as if it had been Break-of-Day, (it was then about a quarter past eleven) and gave as great a Light; I went then into the Drawing-Room, and looking out of that

that Window, could look more Northerly, and saw it was more light due N. and saw several Streaks of Light, like the Tail of the Blazing Star, all pointing N. and S. one of which was as long or longer than that we saw last Year, for it reached from the Horizon, and pass'd between *Charles's Wain* and the N. Star, and reached up just over our Heads. The small ones sometimes disappeared: and then we saw others of the same Dimensions appear in other Places, they were all near the great one; two of them seem'd as if their Light had come from the two Guards in *Charles's Wain*; and when they vanished, others appeared more South. I went to the other Side of the House, and saw that the Light reached from the W. or W N W. by the N. to the E. or E N E. I did not go out, because it blew very hard, and was very wet, contenting my self to see it out of the House, but sent *Geo. Man* up the Hill, who saw the same, and it was so clear they could see the *Frith*.

About the New Moon before, there was such a Light as this seen by Lord *Belcarus*, as he came in the Night from *St. Andrews* to his House, and by the Seamen of the Yacht at *Leith*, and by some here in Town: But though the Sky was not then so clear, there being broken Clouds, yet it gave such Light, as they could read very plainly, as they told me; that began about 7, and lasted till 9. This last I did not see till after 11, and at a quarter of 12 it began to lessen, at which time I went to Bed, and the Tails were then no more to be seen. Tell Dr. *Flamsted* of this, and know of him, whether he has seen or heard of such kind of things.

This was from his Royal Highness the Duke of York, then High Commissioner in *Scotland*.

An.

An intelligent Gentleman that liv'd in *Africk*, being asked by me, how far off he was able to see the Top of the *Pico of Teneriff* at Sea? replied, that by the Estimate of the Captain of the Ship, it was near 50 Leagues, and yet it appear'd to him so high above some Clouds, and so near, that he was fain to cast his Head up to see it.

T I T L E

T I T L E X X I .

Of the Operation of the Air on the Consistency of Animal Substances.

AS on the one side the Schools teach the Air to be a simple and elementary Body, that is, only hot and moist; so on the other Side, the Generality of Men are so accustomed to judg of things by their Senses, that not finding the Air to be a visible Body, they ascribe less to it than even the School-men do; and what is invisible, they think to be next Degree to nothing. And indeed both the one sort of Men and the other, are wont to consider the Air only as a Receptacle, that barely harbours the visible and palpable Bodies committed to it, or as it were deposited in it, without acting upon them, unless it be perhaps a little upon the Account of its manifest Qualities, Heat and Moisture. But for my part, who look upon the Air under another Notion, and think it may as well alter as receive the Bodies that lie exposed to it; I am apt to allow it in reference to some Bodies, certain other Faculties and Powers, among which some may be called Generative and Maturative, and others Corruptive; and this not only in respect of Animals and other Bodies of a slighter Texture, but even of Salts and Minerals themselves.

An observing Man that had sailed to and fro between *Europe* and the *East-Indies*, answered me, among other things, about their way of transporting Cheese; That the Cheese they used to take along were *Cheshire*, of a very considerable Thickness, which they inclosed in

leaden Boxes fit for them, and thereby were able to preserve them sound till they came to the *East-Indies*. But in case they were not able, or neglected to make use of such Boxes, he several times observed, that cutting a Cheese in two, when they were any thing near the Equinoctial, that most part of it would be very dry and brittle, and seem'd as if it were spoil'd: Whereas the Parts about the middle were so fat and soft, as if all the unctuous Parts that were wanting in the dried Portion of the Cheese had retired thither, and was between Cream and Cheese. Which Conjecture was not contradicted by this, that if they cut some of them Cheeses, when having left the Torrid Zone behind them, and had made a good Progress in the Temperate Zone, they found the external Portion good, and the Consistence of the Cheese uniform enough.

Quere, Whether the moist Particles that flie in the Air, be not the great Cause of all Corruption of Bodies, since *Acosta* says, that in *Peru*, where it seldom rains, all things, like dead Bodies, keep a great while uncorrupted? The like may be observed of *Egypt*, if it be not to be rather imputed to the Nitrous Salt with which the Air of that Country so much abounds. Mr. J. T.

A Man of Letters, that divers times crossed the Line in great *Portugal Ships*, answered me, That when they came near it and under it, he observed among other things, that there was a very manifest Change made in the Consistence of their Bisket; that most of their Mèat, and even their Salt Fish was much impaired, so that they were scarce able to eat it; and that their Pilot, who had been 23 times in the *Indies*, assured them, he observed when they came to the Equinoctial, that
fresh

fresh Water would not there be at all troubled or stinking, but clear and sweet, as if it were but newly put into the Cask.

Doctor *Stubbs* being inquired of by me concerning, &c. told me, that in *Jamaica* the silken Stuffs that were brought thither, will rot even whilst they keep their Colour, if they be shown to the Air; though if they be not show'd thereto, but kept up close, they were not observed to rot, or be discoloured.

T I T L E XXII.

Of the Operation of the Air on the Consistency of Vegetable Substances.

MAY 16. We opened a small Glass-Receiver ground to a Plate of Glass, in which there had been included for three Years and some Months, (though I know not how many) the half of a Lemon cut transversly, together with a Mercurial Gage: The Lemon kept its Colour pretty well, and its Shape very well, save that at the Orifice the upper Part of the Pulp was depressed, seeming as it were dried up by the Recess of the Liquor contain'd in it; which Liquor did now stagnate upon the Glass Plate. When this began to be disjoined from the upper Glass, there rush'd in, not without Noise, a pretty deal of external Air, which argued that the Air afforded by the included Lemon in so long a time, had not been near sufficient to fill the Cavity of the Receiver. Neither the half Lemon nor the Liquor had any ill Scent, or other sign of Putrefaction or Corruption; neither of them had the least Mould, which gave me a Suspicion, as far as it could be grounded upon this Experiment, that such a Mould as might have been expected, being (as may be guessed by the Microscope) a *Congeries* of a very small kind of Vegetables, could not any more than many greater ones, be produced without the Concurrence of the Air. The Liquor was clear enough, and without *Faces*, being in Colour between brown and reddish. It contained an acid Taste; and when I put a little of it upon Sirrup of
Vio-

Violets, it turned it to a Purplish Colour ; and which is more, being put upon small Fragments (not Poudre) of red Coral, presently began manifestly to corrode them, and that in the Cold.

To the Heat and piercing Moisture of the Air combin'd together, may be referr'd the Observation of an intelligent Scholar, from whom, when I ask'd him what he had taken notice of about these Qualities, when he sail'd under or near the Line, (which he did several times) he told me, that divers Pastils or Lozanges that he was wont to carry in his Pockets, were so dissolved, that they spoil'd his Pockets, and obliged him to cut them out, though the Pastils of the same kind did never lose their old Consistence till he came near the Equator, nor keep their new Consistence after he had passed some Degrees beyond it, but grew solid again as before.

TITLE

T I T L E XXIII.

Of the Operation of the Air on the Consistency of Mineral Substances.

INquiring of an ingenious Swedish Gentleman that was a great Dealer in the Metals his Country abounds with, whether the great Cold of sharp Winters in those Northern Climates had not a sensible Operation upon Iron: I learned from him, that in the chief Copper Mine (which he had *curiously* visited) being to draw up the Oar from an exceeding great Depth, they fastned their Baskets, not as they use in other Mines, to Iron Chains, but to Ropes made of Ox or Bull-Hides; and that chiefly for this Reason, That during the hard Winter-Frosts that are there usual, the Links of their Iron Chains were very subject to be broken by the great Cold joined to the Weight of the Oar, to the great Danger, and oftentimes the Destruction of the poor Workmen that were digging beneath: which Inconvenience was avoided by employing Leather, which the Cold could not make brittle, instead of Iron.

Asking an ingenious Master of a Glass-House, whether he had not observed that Glasses, though as well neal'd as is ordinary, would sometimes of themselves break with a Noise long after; he answered me affirmatively: adding, That particularly having one time had an occasion to lay by for about half a Year or longer, a numerous Parcel of Glasses, when he came to take them out, he found that about a fourth Part of the whole Batch was frozen of themselves; and that in most
or

or all of them, the Cracks proceeded from some seeming Stone or great Grain of Sand, which yet indeed was not Sand, but some part of Salt that had not obtained a sufficient Comminution.

A learned Gentleman that is Owner of an Iron Mine, informs me, that he has a House in *Suffolk* within 6 Miles of the Sea; and though the House be but 80 Years old, yet the Iron Bars of the Window that look towards the Sea, are swelled, and (as he calls it) rotten, being brittle, and easy to be crumbled into Powder. And when I asked him whether the Wind that came from the Sea to these Windows were not Southern, he answered affirmatively. And to confirm what I was saying of the Operation of Sea-Salt upon Iron, he told me, that having had occasion to cause many Bars of Iron to be laid in a Place upon the Neighbouring Shore, above the high-Water-mark, a great Storm chanced to increase the Tide so far as to drench those Bars for some Hours after; which remaining in the Air, they were very much impaired, great thick Flakes being easy to be struck off from them when they came to be hammer'd.

A very experienc'd Mafon informed me, that the Cathedral of *Salisbury* is made of *Purbeck*-Stone, which in the Air grows softer and softer, and will moulder away; and so will some *Blechington*-Stone, though not expos'd to wet; whereas the Stones dug up at *Painf-wick*, within four Miles of *Glocester*, being very soft and friable at first, will by lying in the Air (as he has particularly observed) acquire a Crust-hard and Glassy like Marble; and the oftner 'tis washed, the sooner will it acquire this hard and yellowish Crust, which reaches but a very little way (scarce the Thickness of half a Crown) beneath the Surface contiguous to the Air.

TITLE

T I T L E XXIV.

Of the Air in reference to Fire and Flame.

A Gentleman of my Acquaintance being ask'd by me about the burning of Candles in Grooves (or Sutts) that are not furnish'd with Air-shafts, he told me, that the Depths I desired to be inform'd of were very uncertain, and varied considerably, according to the different Nature of the Soil, and perhaps other Circumstances, so that sometimes a Candle would go out much sooner, and sometimes it would continue burning, though it were let down to the Depth of eight, ten or more Fathom. That when they come into close Ground, though their Candle will burn at first, yet after a while working, (more especially if the Stone be full of Mundick) the Dust rais'd by their Working will make their Candles go out, so that they must leave working for a time, except they will be at the Charge of conveying down Air by Pipes. I mention this as different from other sorts of Damps. N.

Experiments touching the Relation between Flame, Air.

THE burning of Candles, &c. under a Glass Bell.
 The burning of Spirit of Wine under a Glass Bell.
 The burning of Match, Touch-wood, Sponck, &c. under a Bell.

The

The keeping of Animals under the same Instrument whilst the Flame is burning.

The burning of Bodies to Ashes in seal'd Glasses.

The doing the like in exactly closed Receivers.

The burning of Cotton in a seal'd Glass.

The burning of the Mixture of Flames under Water in an E. R.

The burning of Spirit of Wine and Oil of Turpentine in Glass Vessels with slender Necks.

The Experiment of burning Gun-Powder.

Another of the Pistols not firing in an E. R.

The burning of a saline Substance in an E. R.

The burning of Mixtures of Salt-peter in an E. R.

T I T L E XXV.

Of the Air in reference to Fermentation.

Novemb. **W**E took a small handful of Raisons, and having put them into a Bolt-head, (not large, but half filled with Water) we drew out the Air, and then we removed the Portable and exactly closed Receiver, and put it on the Digestive Furnace, that the Warmth of that Place might promote the Fermentation in spite of the Unfavourableness of the Season of the Year. After a while there appeared Signs of Fermentation by the emerging of the Raisons, which swam for some Days on the Top of the Water, most of them beset with numerous Bubbles; nor did above very few of them subside at last, though after some Days the Bubbles grew fewer and fewer, and there appeared a Sediment at the Bottom of the Glass.

A Fortnight after they were first sealed up, the upper part of the Glass was accidentally broken whilst I stood by; whereupon the external Air rushed in with some Noise: and I taking the Vessel in my Hand, perceived the Surface of the Liquor to be overspread with Bubbles, almost like the Froth of Bottle-Drink: there seem'd to me to come out at the little Orifice made where the Apex was broken off, a visible Fume, which had a somewhat languid Smell. The Liquor was high colour'd of the Raisons, and seem'd to have extracted something from them that gave it a better Consistence than that of Water.

T I T L E

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T I T L E XXVI.

Of the Air as the Receptacle of Odours.

T I T L E XXVII.

*Of the Operation of the Air on the O-
dours of Animal Substances.*

MAY 23. We opened an exhausted Receiver, wherein was pretty Store of Verjuice, or green and four Grapes. And though they had lain there we are sure about three Years, and possibly much longer, yet there appear'd no Mouldiness at all upon any of them: But the Surfaces of the uppermost Grains were somewhat discoloured, perhaps by a saline and confusedly formed Efflorescence, which having look'd upon through a Glass, and also tasted, I guessed to be a kind of Tartar. The like Liquor that the Grains had afforded had an acid Taste, and would in the Cold corrode Coral, but the Grains smell'd somewhat musty. In all this time the Verjuice had produced so little Air, that we could scarce take notice of it by the Mercurial Gage that had been shut up with it.

I inquired of my Lord of *Sandwich*, and a couple of Gentlemen that accompanied him, whether it be true which is reported of the Purity of the Air at *Madrid*, that though they have no Houses of Office, but every Night throw out their Excrements into the Streets; yet by the Morning there remains no more Smell of them. To which I was answered; That 'twas true the Excrements were so disposed of, but that *Madrid* is the stinkingst Town they ever came into; yet that 'twas difficult to discern in the Morning any peculiar Smell of what had been cast into the Street by Night; but

but they jointly affirmed, that the Place where the Ambassador's numerous Family resorted to make Water in, did not smell of Piss ; and that they often observed the Dogs and Cats that lay dead in the Streets were deprived of Stench : and his Lordship supposed that the Stench of a dead Mule would in few Hours vanish.

T I T L E

T I T L E XXVIII.

*Of the Operation of the Air on the Odours
of Vegetable Substances.*

MAY 16. At the same time we opened another small Receiver, wherein above three Years before some large Pieces of Orange had been included: The Rinds of these were much discolour'd, their Surfaces being almost black. They had scarce afforded any Liquor, and yet we could not perceive the least Mould in any of them, nor had they a putrid Smell.

T I T L E

T I T L E XXIX.

*Of the Operation of the Air on the Odours
of Mineral Substances.*

T I T L E X X X .

*Of the Operation of the Air on the Tastes
of Animal Substances.*

HE answered me, that they could very well preserve Meat, as Beef, without salting it, as long as the Frost lasted, that is, during the whole Winter. But when it was once thorowly frozen, they could not dress it so as to make it relish like good Meat.
Mr. Nickson.

T I T L E

T I T L E XXXI.

*Of the Operations of the Air on the Tastes
of Vegetable Substances.*

T I T L E X X X I I .

*Of the Operations of the Air on the Tastes
of Mineral Substances.*

T I T L E X X X I I I .

Of the Operations of the Air on the Colours of Animal Substances.

ENquiring of a Man of Letters, that had the Curiosity to travel into the Inland Parts of *Brasil*, whether in that Countrey the Air had not a great Influence upon the Colours of Clothes: He told me it had, and even upon Black; infomuch that a kind of black Taffety, which is the usual wear of the better sort, will, after it hath been worn a very few Days, degenerate into an Ironish Colour: yet he answered me, that in the Shops where 'tis carefully kept from the Air, the Taffety continued of a good Black.

Now is it only upon the Colour of Stuffs, but of Animals too, that he says the *Brasilian* Air has an Operation; for he says, that at a Place 50 Leagues beyond *Parigna*, there is a Region where white People do in a very short time grow *Basannex* (or tawny,) though a little way out of that particular Region, as for Instance beyond it, they quickly recover their wonted Colour.

He told me, that upon *Charleton* Island they have Flocks of certain Birds, which the English there call Partridges, though they resemble ours more in Bulk than Shape, being somewhat like wild Pigeons, but a good deal bigger: These he says are white in the Winter, and gray in the Summer.

T I T L E XXXIV.

Of the Operations of the Air on the Colours of Vegetable Substances.

A Learned Man that was Physician to the Governor of *Jamaica*, being at his Return ask'd divers Questions by me, concerning that Island, gave me among others, the following Answer: *Lignum Vita*, said he, and most other Trees at *Jamaica*, when they are newly cut down, where-ever you cut the Wood, that part which is exposed to the Air will quickly grow green, though that which is a little beneath it be yellow, or of another Colour; and this *Lignum Vita*, when green, is as soft as Oak, or softer; and many other *Jamaica* Woods that are soft, when newly cut down, will afterwards so harden in the Air, that ordinary Tools will make no Impression upon them; and the Nails that pierced them easily before, can no more be forc'd out of them; and this is chiefly conspicuous in the Cabbage-Tree, which being a Wood soft enough when 'tis cut down, the Pith which is very copious will quickly rot of it self, and the rest of the Tree serves for a Pipe of perhaps 100 Foot long, that will not corrupt under Ground, but grow almost as hard as Iron.

Enquiring of an inquisitive Traveller, what he had observed about the Power of the Air, which I had been inform'd was great, in working upon divers Bodies at the Island of *St. Jago*: He told me, that he and his Company had not staid long enough there to make much Observation of that kind; but that seeing Aloes growing

growing plentifully there, they had gathered some Plants of it, whose Juice he found, as I have here in *Europe*, to be very clammy, and excessively bitter, and, which was wondred at, of a very dark Colour; but having carried them in the Ship towards the Equinoctial, they found for a time the Juice to be altered, having lost almost all its Bitterness, and acquired a green Colour.

Stains of Linen will best go out at the time of the Year, when the Fruits or Plants whose Juice made them, are in their Prime: This a Gentlewoman assured me she had tried in new Linen stain'd with Juice of Quinces; and the Lady *N. N.* affirmed, that she had particularly tried it in Stains made with the Juice of Hopps, which she says are the worst Stains of all; and which having in vain tried to get out of her Linen, she laid up her Linen in her Chest, and at the time of the Year when Hopps flourish, she found the Stains vanish of themselves.

TITLE

T I T L E X X X V .

Of the Operations of the Air on the Colours of Mineral Substances.

A Considerable Instance of the Changes that the Contact of Air is able to produce even upon solid Minerals, I gave those that saw it by the following Experiment. We took one part of *Lapis Calaminaris*, and about four Parts of good Salt-peter; these being well powder'd and mix'd, were put into a strong Crucible, and kept in a vehement Fire some Hours, by which means the Matter, as we expected, was alcaliz'd: upon the thus prepared *Lapis Calaminaris* we poured a convenient Quantity of fair Water, which afforded us a Solution that was somewhat muddy, but appear'd of a deep red: this we pour'd into a wide-mouth'd Glass, which we set in a Window, that it might be the more accessible to fresh Air. There after a while our darkish red Solution turn'd quite green, and more Diaphanous than before; but continuing for some Days to keep the Glass in the same Window, (which respected the South) we found our green Solution to lose its Colour by Degrees, and at last to be resolv'd into a transparent Liquor, and a subsiding Poudre, that was not at all green, but red, or like Brick-Dust. These Changes of Colour succeeded in more than one Parcel of our Mineral Solution.

We took a very strong Spirit of Vinegar, and boiled it a while on crude Filings of Copper, without finding that 'twas manifestly coloured by that Operation, nor yet

yet by letting it lie some Hours in the same Glass Egg wherein it had been boiled. Wherefore supposing this want of Coloration to depend upon the Air's not co-operating in the best manner it might easily be made to do, we poured the Liquor and the Filings together into a broad flat Glass, (which we plac'd in a Window shelving) so that though the Filings were wet, yet but one part of them was cover'd to any Depth by the *Menstruum*. This done, we observed, as was expected, that the Filings expos'd to the Air, chang'd Colour, and became of a greenish Blew; whilst those that were under the Liquor manifested no Change of Colour, but kept that which belongs to Copper, till the *Menstruum* evaporating by Degrees, they also being accessible to the Air, acquir'd the same Colour with the former Vinegar. Q. Whether in a longer time the Coloration would not have been made?

We took some Filings of Copper, and divided it into two Parcels; one we put into a flat and shallow Glass with a wide Mouth, and the other into a Glass Viol, whose Neck was of the Breadth usual to such Vessels. Upon each of these Parcels of Filings we pour'd a convenient Quantity of one and the same strong Solution of *Sal Armoniac* made in fair Water, and without covering each of the Vessels, let them stand by one another for a competent time. Of which Trial the Event was such as was expected; namely, that the Liquor in the Viol was but faintly colour'd, when that in the open Glass, that had a large Surface expos'd to the free Air, was very richly tinged. And this Circumstance is not to be forgotten, that whereas all the lower part of the Solution was of a deep Blew almost like Ultra-Marine, that part which was contiguous to the Air was cover'd over with a kind of Film like thin Ice, which was of a very

very differing Blew, exceeding like that of the finer sort of Turcoices.

We took two small Parcels of Filings of Copper, and put each of them into a small Piece of Paper, with the Edges turn'd upward, and then put upon each of them three Drops of good Spirit of *Sal Armoniac*. One of these Papers we left in the Window, the other we put into a small Receiver, which by help of our Engine was emptied in little more than a Minute of an Hour. At the End of two Minutes, after the putting on of the Spirit, there appeared a manifest Blew on some Parts of that Paper that was left in the Window; but that which was in the exhausted Receiver, being deprived of the Air that should befriend its Operation, continued there full a quarter of an Hour or more (by a Minute Clock) without appearing to be at all colour'd: Wherefore taking off the Receiver, we remov'd the Paper to the same Window where the other stood, and within about two Minutes it began to disclose a Blewness, which within about two Minutes more was considerably heightned.

Into a slender Viol, wherein we put a convenient Quantity of the Volatile or Urinous Spirit of the Lees of Wine (elsewhere by us described) which was of a yellow Colour, we let fall some Filings of Copper; and stopping the Glass well, we drew a Tincture, which according to Expectation was manifestly green, but not of the pleasantest and most transparent sort of green Liquors; then suffering the Viol to rest in a Window for many Days, we observed that the Liquor did then but slowly return to a yellow Colour, which when it had acquired, without any Mixture of Greenness; we open'd the Viol for a very little while to let in the Air, and then stopp'd it well again; the admitted Air quick-
ly

ly began to change the Surface of the Liquor into a green Colour; which, though slowly, extended it self downwards, till it had tinged the whole Liquor. This Colour afterwards, by long standing, did by Degrees grow to a pale Yellow.

The 19th of *August* presented me with some Phenomena that made me almost despair of reducing all those of our variable Liquors to a settled Theory. For coming that Day at about ten a Clock in the Forenoon to a Closet where I kept several Vials furnish'd with this Liquor, I perceived one of them that stood in the Window, that had once almost quite lost its Colour, to have re-acquired a very fair Blew, at least as deep as that of the Sky in a fair Day. This Viol I the rather watch'd, because I had taken notice, not without some what wondering at it, that for two Days before, instead of losing, according to Custom, the little Remains of Colour, that after many Days standing it yet retained; the Colour began again to increase, though the Viol were constantly kept stopp'd as before; and that which made this regaining of the Colour seem more strange, was, that there stood just by it another Viol furnished with the Spirit, and with Filings taken out of the same Parcels, yet the Liquor of this Parcel continued colourless. Wherefore suspecting that some Accident might have happened, whereby some little Portions of Air might have insinuated themselves thorow the Cork of the altered Liquor, I cast up my Eyes to another Viol that stood in so high a Place that was not easy to reach it, and where it had long rested, and lost its Colour: But upon this View I was confirmed, that the Change lately mentioned in one of the Viols, was not from the Cork, but from some unobvious Cause: For though this upper Viol was furnish'd with a good Glass Stop-

ple ; yet the Liquor it contain'd was again grown Cæruleous, though the Liquor of another Viol that stood just by it continued colourless. Wherefore to satisfy my self further, I presently went to a private Place, where I had in a Cavity made in the Thickness of a Wall set aside two Viols, that several Days before had quite lost their Colour ; and my former Surprize was increased, when I found that one of them which was stopp'd with a Cork, continued colourless ; yet the other that had a Glass Stoppel, and stood just by it, had regain'd a fair Cæruleous Colour. Both these were fitted for Trial, with the same Spirit and Filings, and the same Day with the others above-mentioned ; and the Heat of the Weather had so little Influence upon this Effect, that this Day was remarkably cold, being made so by a Northern Wind, which made me observe it more so than I had found it for some time before.

I must not forget on this occasion, that I was invited by the foregoing Phenomena, to look upon some Spirit, not Oil of Amber, that I had kept in a Viol for several Days upon Filings of Copper, and had sometimes exposed to the Air by unstopping the Glass, and found, that though formerly the Spirit kept its native Colour better than I desired, yet it had acquired a green Colour, which whether it will lose again by longer standing, Time must determine.

The slender Viol, with Spirit of Honey mention'd N^o the though it had been wont to exchange its yellow Colour for a blew, by the Contact of the external Air in a very short time, and sometimes within a Minute or two ; yet being open'd this Afternoon, in the same Place where it used to be so, did not in above an Hour's time turn blew, but remain'd a transparent yellowish Colour.

The

The Viol with a Glass Stopple, mentioned N^o 945. being for divers Weeks left unstirred in the Window where it stood before, I several times observed it to lose and regain Colour; and though sometimes it would only appear of a more faint or a more rich Blew, yet sometimes also it would appear either quite or almost colourless, and perhaps in a Day or two after it would be again as blew as the Sky. And this, though I could not find that any thing in the Weather was the true Cause of this Change, since the Liquor would not only gain, but lose Colour in colder Weather; and so it would also do in warmer: But on Michaelmas-Day I found it to have attained a deep Blew; and though since it has been now and then somewhat more dilute, yet during all the past Month of *October*, I remember not to have seen it any thing mere *colourless*; and this Day being the first of *November*, I found it to have resumed a high Colour, though a Viol with a Glass Stopple, which had for many Weeks stood just by it, and formerly did divers times correspond with it in its Changes, has continued all the last Month of a very pale Blew, without either deepning its Colour, or growing quite colourless.

An inquisitive Gentleman of my Acquaintance, being ask'd by me about a Mountain in *Wales*, called
 , where solid Stones are said to change their Colour very oddly, told me, that within sight of that Hill, in a large Piece of Ground that was then newly put under Tillage, he saw good Numbers of Stones that look'd like Flints, and were full as hard, if not harder; the Colour of most of them was dark, the rest grey: these Stones, which when the Ground was newly turn'd up, were Rust-coloured, he observed afterwards to grow lighter and lighter coloured; so that after three or four Years, being invited by this Observation to take notice

of it at his coming to that Plate again, he found these Stones almost all of them turn'd white. About which Phænomenon, questioning the ancient Inhabitants, with some Expressions of Wonder, they seem'd to make little of it, and assured him, in the Neighbouring Mountain almost all the Stones that were exposed to the Air, underwent the like Changes, and within a few Years were blanch'd.

Having put some *Mercurius sublimatus dulcis*, and *Vitriolum Romanum* (tied up in several Papers apart) into one Box, at the end of twenty two Months I found the sublimate Mercury wholly changed into a Substance so like Antimony, that some not ignorant of the *Materia Medica*, have taken it for the same: and the Superficies only of the Vitriol had acquired the same Colour, but was not at all altered within. This from a credible Reporter.

TITLE

T I T L E X X X V I .

*Of the Air destroying or introducing other
less obvious Qualities into Animal Sub-
stances.*

T I T L E XXXVII.

*Of the Air destroying or introducing other
less obvious Qualities into Vegetable
Substances.*

AN intelligent Gentleman that staid a Year in *Guinea*, related to me, that he and his Company found the great Heat and Moisture of the Air to dispose Bodies so to Putrefaction, that he observed the white Sugar to be sometimes full of Maggots; and found that divers Drugs, Salves, and other medicinal things that were brought with him, had quite lost their Virtue; and some of them, especially Ointments, were verminous. And he added, that in the Island *St. Jago* (one of those of *Cabo-verde*) they laid store of Sweet-Meats upon Tables to the Heat of the Sun, to dry up the superfluous Moisture, which in strange Abundance they had contracted the preceding Night, which otherwise would quite spoil the Sweet-Meats, and bring them to putrify.

Oxford, though seated for the most part of it on a gravelly Hill, I have known to be very disagreeable to some moist Splenetick and Valetudinary Bodies, who I have heard complain, that they could not be so well there as elsewhere, especially in the Spring; so that I take the Air of that Place to be generally moist. Mr. *J. T.*

Air too dry, though sufficiently hot, is not favourable, for the Production of divers Insects: for I have observed these two last dry Springs, that there has been no soft Garden-Snails to be found abroad, and very few Fleas bred in the House, which I impute to extraordinary long Driness of the Air, for want of moist Vapors to nourish them; since in wet Summers we always swarm with Snails, Gnats, Fleas, &c. whereas this Year we have few or none.

TITLE

T I T L E XXXVIII

*Of the Air destroying or introducing other
less obvious Qualities into Mineral
Substances.*

Zwelfer, pag.
800.

Observandum etiam quod Antimonium Diaphoreticum quocunque modo, sive cum solo Nitro aut addito etiam Tartaro, paratum sit, tractu temporis aeri expositum pravam, & quasi malignam induat naturam, sumptumque intra corpus cordis angustias, cardialgias, lipothymias, vomitusque & similia prava Symptomata procreet, quæ facile tamen evitabimus, si ~~vel singulis diebus vel tribus mensibus recenter illud conficiamus~~, vel jam paratum Antimonium diaphoreticum vetustum additâ portiunculâ Nitri, aut etiam absque Nitro, per unam vel alteram horam Vulcano tradamus, penitusque igniamus, iterumque si Nitrum additum fuerit, edulcoremus, & parumper reverberemus.

Purchas's 2d
Part, lib. 6.
cap. 8.

*A vulgar Experiment generally
assumed, as by
Alpinus in
Med. Egypt.
l. 4. c. 8. who
long liv'd here
upon the Testimo-
ny of Paulus
Moucilus, the
French Consul,
Baptista Elianus a Jesuit, and
John Varot an
English Man.*

To prove that it proceedeth from a natural Cause, this one, though strange, yet true Experiment, will suffice. Take of the Earth of *Egypt* adjoining to the River, and preserve it carefully, that it neither come to be wet nor wasted; weigh it daily, and you shall find it neither more nor less heavy until the 17th of *June*, at which Day it beginneth to grow more ponderous, and augmenteth with the Augmentation of the River, whereby they have an infallible Knowledge of the State of the Deluge, proceeding, without doubt, from the

Humi-

Humidity of the Air, which having a Recourse through all passible Places, and mixing therewith, increaseth the same as it increaseth in Moisture.

A learned Physician of the Colledg of *London* confessed to me, that he found by his own Observati-
on, that *Antimonium Diaphoreticum*, being kept some Years, though in a cover'd Vessel, acquir'd a Vomitive Quality, which it had not before; and that having long kept in a stopp'd Glafs a Parcel of his own Cerus of Antimony, of which he used to give 12, 15, or more Grains, without finding it Emetick; he found that in process of time it was so degenerated, that when he gave four or five Grains, it would cause Vomits.

Earth laid up together in the Air for four, five or six Years, does make far better Pots for Closeness, and holding of the Fire, than that which has lain but one Season above Ground, though that it self be much better than that which is newly dug up, which will be very apt to crack in the Fire, or when it comes to wet; as also those Bricks that lie at the Top of the Furnace, and therefore are not so thick covered as they burn, and are apt to deceive Builders when they come to be exposed to the Rain and Weather.

T I T L E X X X I X .

*Of the Air in reference to the Propagation
and Vegetation of Plants.*

AN ingenious Traveller that frequented the Pyrenean Mountains, especially that which many count the highest of them, and is known by the Name of *Pic de Midi*, affirmed to me, that he, as well as several others, had manifestly observed a scarce credible Difference between that Side of those Mountains that regards *France*, and that which reaches to *Spain*; for at the same time the former was verdant and flourishing, and yielded a delightful Prospect to the Traveller, as well as plentiful Provisions to the Inhabitants: the Spanish Side of the Hills was parch'd, and ruffet, and barren, and look'd dismally, like a Wilderness: Which great Difference of Countries, observable in the same Hills at the same time of the Year, he imputed to the fierce Parching, and sometimes blasting Winds beat upon the Spanish Side, and made that look so squalid, whilst the Hills that suffer'd this Mischief on one side, did by their Height check these hurtful Winds, and skreening from them, the French Side of the Mountains left them to enjoy Advantages that the Soil and Climate furnished them with.

T I T L E

T I T L E XL.

*Of the Air in reference to the Generation,
Life and Health of Animals.*

DE vita igitur ac morte, & iis pene omnibus quæ huic considerationi affinia sunt, dictum est. De sanitate verò morboque non solum medici sed & Physici est, causas quadantenus referre. Quatenus verò hi differant, & quatenus diversa contemplantur ignorare non convenit. Equidem quòd confinis sit quadantenus hæc Medici Physicique Tractatio, & res ipsa testatur. Nam & Medici, quicumque paulò elegantiores & diligentiores sunt, de natura dicunt, & artis sua principia inde sumere dignantur; & Physici omnes fere, qui concinnitatis aliquid habent, tractationem naturæ usque ad medicinam persequuntur.

Aristot. de Respiratione. cap. 21. & parag. 87.

August 13. The Temperature of the Air, both as to Salubrity and other Regards, may be deriv'd as well from the subterranean Steams, as the superficial Effluvi-ums of the Earth, and both these sorts of Steams being variously transported and shuffled; and compounded by the Winds and other Motions of the Air, upon the Mixtures of them, the local Qualities of the Air, in differing Places, may be supposed to result.

About three Months before the late great Plague began in *London*, (in the Year 1665) there came to Dr. *M.* a Patient of his, to desire his Advice for her Husband; and the Doctor having inquired what ail'd him, she answered, that his chief Distemper was a Swelling

in his Groin, and upon that occasion added, that her Husband assured her of his being confident that the next Summer the Plague would be very rife in *London* : for which Prediction he gave this reason, That in the last great Plague he fell sick of that Disease, and he then had a Pestilential Tumor ; so in two other Plagues that since happened, though much inferiour to that great one, each of them had a rising in his Body to be its Fore-runner ; and now having a great Tumor in the fore-mentioned Place, he doubted not but it would be followed by a raging Pestilence, which accordingly ensued. Having heard much Talk of something of this Nature, as related by the Doctor, I inquired of him how much of it was true, and received for Answer the foregoing Narrative.

You did not perhaps expect that the mere local Motion of the Air should be mentioned by me among the Causes of the Effects of its Changes: And indeed the Phenomena I have yet met with reducible to this kind, have been but very few, notwithstanding which I shall take notice, that this local Motion may in certain Cases operate on other Bodies, either as it turns the Air into a Wind, or as the tremulous Motion of the Air is modified into sound, or as the Air is put into a vehement and disorderly Motion by Thunder.

As to the first of these 'tis evident, that upon the Vehemence or Slackness, and the Places whence and where the changing Wind happens to blow, there may divers Effects ensue, especially in animated Bodies. And this not only as the Wind is accompanied with Cold and Heat, or Moisture, or Driness, but (to restrain our selves to Instances more closely pertinent to our present Purpose) as the Wind is *flowing* Air, or an *Aireal Stream*, for only as such it may ventilate the Places
through

through which it passes, and by expelling the Stagnant Air, and introducing other Air, may contribute to many of those Changes (especially as to the Health of Animals) that we see to depend upon the Alteration of Air, and perhaps among the more tender sort of Animals, there may be found some in which the Motion of the external Air, though excluded by Walls and Windows, may have a considerable and immediate Operation: For I have learned by Enquiry from some curious Natives of *Languedoc* (where I had the Curiosity to look after Silk-worms, abounding in that Province) that in case it happened when the Worms having eaten their fill, began to dispose themselves to work their silken Eggs; in case, I say, it then happened to be thundering Weather, a great part of the Worms, especially the less vigorous, would be destroyed.

He affirmed to me, that in some Mines of above a thousand Foot deep, he saw Horses that had been let down by Ropes to the 3^d part of the Depth, that is above a hundred Yards, and that several of them died either in the letting down, or by the Change of Air; yet several of them survived, and were employed about the Engines belonging to the Mines, and seem'd not to have any sensible Inconvenience as to Respiration, though in the Receptacles they wrought in, they were furnished with Air but from the Groove through which they were let down, and by a moderately big Shaft.

An ingenious Traveller that has had the Curiosity to visit the Mines of several Countries, as *Bohemia*, *Saxony*, *Swedeland*, &c. answered me, that the deepest Mine he saw in *Bohemia* was of about 2000 of our Feet.

An intelligent Person that was for many Years Consul of the English Nation at *Tripoli* in *Barbary*; and at another

another time Governour of the *Castle* (called) of the *Coast*, belonging to the English African Company in *Guinea*, being discoursed with by me, about the Diseases incident to that very unhealthy Place, and about the Worms that bred in Mens Legs, told me, That the great Noxioufness of the Air was not constant, but frequently ceased, and return'd within no long Compass of time; insomuch that all his Men would continue in Health for many Days together, and then on a sudden divers of them would fall sick, especially of Feavers and Fluxes that usually killed them in forty eight Hours or less.

Dr. C. chief Physician to the Russian Emperor, confirmed to me, that being in *Russia* in the Winter, when the Frost was very hard, and the East or North-East Wind blew cold, if he turned his Face toward the Wind, and walked against, (which at other times he was wont, and took a Delight to do) he found himself unable to fetch his Breath, and almost stifled, as if the Air were very thick, or rather a great Stiffness brought upon the Organs of Respiration, whereby he was unable to move them as at other times, so that he was fain to turn his Head from the Wind that he might be able to fetch his Breath.

An observing Person being ask'd about a Tradition of Sea-men, that the Lice of Europeans die when the Ships pass the Line: answered me, that he did not find it to be true, as it is wont to be delivered; but this he plainly observed in several of our English with whom he sailed, that all the Lice quitted their Bodies, and got up into their Heads, whence they dispersed themselves again when the Ship had left the Equator a pretty way behind it.

But

But I remember that another Acquaintance of mine; that divers times passed the Equinoctial in Portugal Ships, which use to go to the *Indies* well crouded with People, many of them more poor than cleanly, answered me, that he had heedfully observed those Peoples numerous Lice to die away as they cross the Line, though in no long time after the same sort of Cattle would begin to molest them again.

His Royal Highness the Duke of York, at his Return out of *Scotland*, having been pleased to discourse with some of us, that had the Honour to be then near him, of some Observations he made in his Journey, mentioned among other things, that Agues were very unfrequent in *Scotland*, which yet that Year were very rife over almost all *England*. This gave me afterwards the Curiosity to inquire of a studious Person, who is one of the chief of the Scottish Nobility, what he knew about the Unfrequency of Agues in his Country. To which his Lordship replied, that as to Quartan Agues it was generally taken notice of; insomuch that when News was brought, that a Gentleman whom he named fell sick of that Disease, amongst them in the Country it was look'd upon as a strange and remarkable thing. And though divers Persons bring Quartans out of *England* to *Edinburg*, yet they so seldom keep them long there, that a Scottish Physician, whom he named to me, offered to lay five to one of the quick Recovery of several Patients of his, if they would make some reasonable Stay in that City.

Aer autem corrigetur causa corruptionis ablata, & quod jam inductum est mali extinguendo, si igitur ex nimio humore aer putrescit, ignibus accensis qui omni putredini remedio sunt, exsiccandus, sic ignes, per vias &

Roderici Fonti
de Sanit. tu-
end. pag. 105.
106.

& domus fiant ex odoratis plantis, qualis Laurus est, Mirtus, Pinus, Cupressus, Rosmarinus, & reliquæ ejus generis, qua ratione pestem Athenis Hippocrates extinxit; vapores præterea maligni per aerem sparsi, dissipandi sunt, id quod a magnis ventis fieri solet. Sic Olysi-
 poni, cum trium dierum ingens procella venisset pestis extincta nuper est & in Maroco ingens pestilentia vento quodam evanuit; qui veluti è fornace (adeo calidus erat) exire videbatur, aerem autem nos imitando ventos commovere poterimus; si bombardarum strepitus multos fieri curemus; si verò vapores ex paludibus, ac stagnantibus aquis fieri videntur; eas reficcare aut novare oportet frequenter, maximè per æstatem. Renovantur autem novis supervenientibus aquis quas è fluminibus per canales traducere oportet; aut siccandæ sunt factis rivulis, & fossis per quæ superfluant ad flumina; quod cum primus magnus Etruriæ Dux Cosmus Pisis fecisset; & magna animi contentione, nunc faciat Ferdinandus, factum est, ut saluberrimus ejus urbis aer per omne anni tempus sit redditus verum si cadaverum inhumatorum multitudo aerem inficit; magna & profunda facta fovea sepeliantur; si ab immunditie, & excrementis, quæ per urbem & domos sparguntur, id quod, ut reor Bisantii, & Olysi-
 poni, in causa est, cur pestis adeo sæviat, ac duret, mundare oportet omnia; viæ ac domus quotidie, vel saltem semel in septimanâ repurgandæ.

1. *Joh. Beguinus in Tyrocin. Chymic. lib. 2. cap. 13.*
 Dignum admiratione est, quod quamvis in viciniâ Hydriæ Comitatus Goriciensis, ubi reperitur copiose Mercurius, singulis ferè annis Lues pestifera grassatur, illa tamen semper immunis ab hac manere solet, idque viri provec-
 tæ ætatis se observasse, & à majoribus suis accepisse,

piſſe, mihi ſanctè confirmarunt. Hinc patet, Mercurium eſſe ſummum omnis putredinis ac corruptionis alexipharmacum. 2 *Michael Majerus in luſu de Mercurio.* Argentum vivum eſt plurimorum morborum alexipharmacum, & ut teſtantur quidam, ipſius Peſtis (cum eo loco ubi Mercurius effoditur, & tractatur, nunquam aut rariffimè hoc Contagium graſſetur) dummodò maneat in ſuâ propriâ naturâ, & non à ſalibus aut aquis corroſivis inficiatur, ac venenofus reddatur.

A very ingenious Phyſician that travell'd much in the *East-Indies*, and viſited ſome Iſlands in the South-Sea, to which our Engliſh were not permitted to have Acceſs, being ask'd of me ſome Queſtions about the Effects and Changes of the Air in thoſe Parts, related to me, that having made ſome ſtay in the fam'd Iſland of *Ternate*, he learned, that the Dutch (who had maſter'd the Inhabitants) did, upon a Compoſition made with the King for his Damages, cut down almoſt all the numerous Clove-trees that grew in that Iſland, that thereby they might keep up the high rate of that Spice, as indeed they have done. Whereupon there happened a Change in the Temperature of the Air, that gave cauſe to conclude, that the Exhalations of the Bloſſoms which (being dried) afford the Cloves, were not only very pleaſant, but very healthful too: For no long time after the Excision of theſe fragrant Trees, the Iſland became very unhealthful, which this Phyſician very probably imputed to the corroſive and noxious Streams, which plentifully iſſuing out from a kind of Vulcan, or ſmoaking, and ſometimes burning Hill, depraves the Air of that Iſland that is but little, but had their hurtful Effects formerly prevented by the Aromatick and benign Emanations of thoſe numerous Bloſſoms

and Trees that richly impregnated the Air, and by their volatile and oily Salts, opposed and hindred the Effects of the sulphureous, and other sharp Steams of the Vulcan. And my Relator assures me, that this Change of the Air's Constitution was so remarkable, and acknowledged when he was there, that whereas formerly sick and valetudinary Persons used to be sent thither from *Batavia* to recover their Health by the Goodness of the Air (as we often send consumptive Persons into *France*) the Air at his being in *Ternate* had been for divers Years so unhealthful, that the Dutch were fain (from *Batavia*, or other more healthy Places) to send Men twice a Year to relieve the Garisons, and bring back the many sick they usually found at their Arrival in that formerly healthy Island.

An observing Physician lately return'd from *Tangier*, answered me, that though otherwise it be a healthy Place, he took notice that 'twas not unusual for new Comers to find themselves feverish for many Weeks, or some Months after their Arrival, especially if the piercing easterly Wind happened to reign. This, he says, he found in himself, not only by a constant Heat and some other Symptoms, but by that main one of the præternatural Quickness of his Pulse. He added, that this Disease, though very mild, held him near four Months: When the Easterly Winds happened to blow, on which his Feaverishness so depended, that he could easily, when he awaked in the Morning, know without asking whether that Wind blew or not.

May 16. We put into a small Receiver five or six little Ants, which run about very briskly; but the Air being pump'd out, they presently lost their Motion, which they soon recovered upon the restoring of the Air to them. Then the Air was again withdrawn, and
the

the Insects thereby brought to lie (some upon their Backs) as stark dead: in which Condition they were suffered to remain about five or six Hours; after which the Air being let in upon them, they nevertheless continued seemingly dead for many Minutes, (as we guessed between 15 and 30) but at length all recovered, running nimbly up and down the Glass, though it were late at Night.

Si Patrono queste barche dalla costa della pescaria, e vanno all'isola di Ceilam, nella costa della quale per la lunghezza di venti miglia, tre sole miglia lontane da terra, sette braccia abbasso arrivando sino alli dieci nel fondo, si ritrova infinita quanta di madreperle, escono per questa pesca le barche la mattina col vento di terra, & arrivando al posto delle madreperle, gettare l'ancore, e fermatesi in quel posto, cominciano a tuftarsi nel mare i marinari, de quali ogni barca ne ha quindeci, e venti, e ciascuno di essi lega nel mezzo, con una fune, della quale ha cura uno, che resta in barca e con un'altra fune legandosi una pietra alla gamba, un'altro ha pure cura di quella, e cingendosi un' sacco di cuoio dinanzi, mettendosi le guante alle mani, cosi legato si tufta con violenza nel mare, lentando quelli le funi, e col peso della Pietra, va con grandis' violenza giu, & arrivato ch' e, scioltasi dalla gamba quella fune, con la quale sta legata la pietra, resta egli libero, & la pietra viene subito tirata sopra da quello, che n' ha cura, et il marinaio poi comincia con molta sollecitudine a pigliare quelle madreperle, che li vengono dinanzi, e le mette nel sacco, e sentendosi mancare la respiratione, tocca la fune, con la quale sta legato nel mezzo, e quello subito con grandis' velocita lo tira et arrivando nella barca, scaricando le madre perle ripiglia fiato, e dopo torna a legar-

Relatione della
Provincia di
Malavar. pag.
64 & 65.

fi di nuovo la pietra, e di nuovo si tufta come sopra's 'e detto, e fempre cofi per tutta la giornata. Et è tanto faticofa quefta pefca, ch' effendo, tanto profunde le Madre perl nel mare, molti mancando loro la refpiratione fi trovano affogati.

It is, by long Observation and often repeated Experience, found certain, that if any Foreigner lie on fhore all Night at *Johanna*, they feldom mifs to be taken with Sicknefs there, or within a few Days after their Departure from the Ifland, and are commonly feized with putrid Feavers, whereof moft die in two or three Days, though thofe that have remained upon the Place all Day-long, for feveral Days together, are almoft always fafe, if they go on board of Ship every Night about a Mile, or a little further, from the Shore. The Ifland abounds with the greateft Variety of Plants and Trees that can be almoft imagined in that Circumference, and is generally exceffive hot in the day-time, but cold after Sun-fet. Whence it may poffibly be fupposed, that the moft volatile Parts of thofe promifcuous (and probably many of them poifonous) Plants, exalted in the day-time by Degrees, and fuddenly condensed at Night, may by Infpiration infect the Mafs of Blood much after the fame manner as in Peftilential Airs. The Inhabitants themfelves are very much fubject to Feavers, (of what fort I could not learn) for which they cut or fcarify their Breaft or Abdömen in feveral Places: but they obferve that few live, except their Feaver terminates in a confiderable number of Botches in divers Parts of the Body. There is one Hill there remarkable for Height, which is feldom or never free from thick Fogs or Clouds hovering over the Top of it, fometimes higher, fometimes lower, according as the Weather alters. Upon

Upon the Coast of *Cormandell*, and most maritime Places of the *East-Indies*, there are sometimes (I think yearly) Fogs so thick (notwithstanding it is then very hot) that all, or most Inhabitants from other Nations, and the tenderer sort of the Natives, are necessitated to keep their Houses, with the Doors and Windows fast shut, there being little or no Commerce at that time.

At *Balassore* in the Bay of *Bengale*, and in divers other Parts in that Country, there happens after great Rains, so great Corruption of the Air, that the stinking Smell is very nauseous to the Inhabitants: which I presume may be chiefly occasioned by a great number of Frogs, and other Reptiles (wherewith those Places abound) left upon the dry Places after the Inundation, and then putrified by the excessive Heat of the Sun. At this time there is great Sickness and Mortality amongst the Natives, chiefly by violent Feavers.

In the return of English Ships from the *East-Indies*, they generally put their sick People on Shore at *St. Helena*, where they find so sensible Alteration, that altho carried thither, there are few that do not recover so much Strength as to walk about in two or three Days, which, in all Probability, must chiefly be attributed to the Alteration of Air, not of Food, there being in most Ships much the same Benefit of fresh Provision for those that are diseased.

Le chemin plus court de Mosul a Bagdad, est par la Mesopotamie; mais on n'y trouve aucun Village, & le Samiel y regne tout l'Été depuis Mosul jusques a Sourat; ce qui oblige a prendre l'eau, sur le Tigre où ce vent ne Souffle point. Le nom de ce vent et composé des mots, *Sani* et *jel*, c'est a dire poison et vent comme qui diroit vent de poison. Ce pourroit être le vent urens,
dont

dont parle Job xxvii. 21. Lorsque quelqu' un a respiré ce vent, il tombe mort subitement quoi qu' il en ait quelques uns qui ont le temps de dire qu' ils brûlent au dedans. D' abord qu' on est mort, on devient tout noir, et si on tire le mort par le bras où par la jambe où par un autre endroit la chair quite les os et reste entre les mains de ceux qui la touchent. Thevenot dans le Bibliotheque Universel Tom. xiii. p. 266.

Doctor *Collins* relates, that in *Muscovy* their Horses are much subject to a very scurvy Disease, whose Russian Name I have forgot, from which the Natives are wont to preserve them, by keeping Goats in their Stables: And being ask'd by me, whether he had this by Tradition, or upon his own Trial? He affirmed, that he had found it true himself, and that he therefore was wont to keep Goats in his own Stable.

The ingenious Mr. *Rycant*, English Consul at *Smyrna*, being ask'd of me, whether at *Smyrna* as well as at *Aleppo*, he observed that the Plague that uses to rage in the former part of the Summer, degenerates into other Diseases about the latter End of *June*, and beginning of *July*: He answered me, that at *Smyrna* the Observation does not hold so much as at *Aleppo*; but yet at *Smyrna* they generally observe, that about that time of the Year, though exceeding hot, that the Malignity of the Plague does notably lessen, for it is not quite so infectious, nor near so generally mortal as it was in the former part of the Summer. When many Years ago I heard of this strange Phænomenon of the Pestilence at *Aleppo*, I began to think whether a possible, though not perhaps the true Cause of it may not be such as this: That the Pestilential Corpuscles that rove up and down in the Air, during the former part of the Summer, require

quire such a Bulk or Grossness to enable them to exercise their pernicious Operations; but when the Weather grows to be exceeding hot, that Heat of the Air becomes able to dissipate those Corpuscles, and deprive them of that Bulk that we have supposed necessary to their destructive Efficacy. For Illustration of this Conjecture, we may take notice of the Smoak that issues out of the Wick of a Candle newly blown out; for whilst the sooty Corpuscles retain their Bigness and Texture, they are able to offend the Nostrils very much by their Stink, and sometimes to cause Convulsive Motions and Abortions in teeming Women; but if you apply a Flame to this Smoak, it presently discusses this fuliginous Matter, and dissipates it into Particles of quite another Nature, which by this means are deprived of all their offensive Smell, and some other ill Qualities. It may also be said, that the great Increase of Heat in *July*, may enable the Sun-beams, by penetrating the Earth deeper, and agitating its lower Parts stronger, and producing Crevisses, and other new or formerly obstructed Passages in the upper Parts of it, may elevate into the Air divers saline and other new Corpuscles, which may either divide or dissipate the Pestilential ones, or else by associating themselves with them, make up new Concretions, differing from the Pestilential Corpuscles, in Bulk, Shape, Texture or Motion, in most or all of these, by which means the morbidick Corpuscles being much altered, their Operations on the humane Bodies they invade, may be so too, and the Diseases they produce may become less malignant, or degenerate into some other Disease. And if it be demanded why this does not happen elsewhere as well as at *Aleppo* and *Smyrna*? it may be answered, That the Concourse of Causes may not be the same, and particularly that
the

the Soil of those two Places may be peculiarly disposed to emit Pestilential Corpuscles of such a determinate Nature, with such a Degree of Heat, and dissipable by a greater, or with a more intense Heat, to afford also Exhalations capable to correct the former, as 'tis delivered by good Authors, and ingenious Men have confirmed it upon their own Observation, that yearly, at *Grand Cairo*, in the Heat of Summer the Plague ceases to be mortal, and almost to be infectious, when the *Nile* begins to overflow, which wonderful Change I should not so much ascribe to a Frigeration of the Air, that usually accompanies the Swellings of the Waters, (since Pestilences rage in much cooler Weather than can be supposed in so hot a Climate as that of *Egypt* in *July*) as to some nitrous and other corrected Exhalations that are plentifully emitted by the freshly arriving Waters.

There is an Account that has not, that I know of, been taken notice of, upon which the supervening *Coldness* and *Heat* of the *Air* may *pro tempore* very much alter the Qualities of it, in reference to the Bodies and Health of Men: For the Air being a fluid Body as well as Water, and impregnated with Salts of different kinds, some merely saline, and others associated with sulphureous and other kinds of Particles; it seems not improbable, that what happens in that grosser fluid *Water*, impregnated with differing sorts of Salts, and alter'd by succession of Heat and Cold, takes place also in the *Air*. I purposely tried in Water, that by dissolving in it convenient Quantities of two differing Salts, though whilst the Liquor was *hot*, or perhaps so much as *lukewarm*, they would swim together undistinguishably in the Liquor, and so were in a Capacity to act jointly, and as the Schools speak, *actione communi*,
on

on divers Occasions: yet when the Liquor was cold, and sometimes when there was only a considerable Remission of the *Heat*, the saline Particles of one kind, being not capable of being any longer sufficiently agitated by so faint a Degree of Heat, would convene into Grains or Crystals; and losing their Fluidity and Motion, visibly separate themselves from the other kind of Salts, which yet continued fluid in the Water where it could now act but by its own particular Qualities, and not as formerly, *actione communi*.

The clearest Instance I found of this Observation was afforded me by an Experiment made with the Solutions of Alum and Nitre; a Relation of which I find among my *Adversaria*, in the following terms.

Equal Parts of Alum and Nitre being dissolv'd in the same Portion of fair Water; and the Liquor being in good measure evaporated, the Earthen Vessel that contain'd it was set in the cold, by which means, at the bottom and the lower part of the sides, the Alum appear'd to be first coagulated in many Octaedrical Grains, no Crystals of Nitre yet being visible. Afterwards, upon a further Evaporation of the Water, and the Removal of the Vessel from the Fire, there appear'd more Grains of Alum, but as yet no Nitre: wherefore having yet further evaporated the Liquor, at length the Nitre shot plentifully into fine little Crystals of the Shape proper to that Salt.

This is the Account my Note-Book contains of this Trial, which seems to invite us to conjecture, that of the numerous sorts of saline Corpuscles that rove up and down in the Air, whilst it is well heated by the Sun, or other Causes, some sorts may by the Absence of that Heat, or some supervening Causes of Coldness, be made to separate from the others, which were thereby

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contempered, or perhaps enabled to co-operate to divers Purposes that they were not fit for alone; and to form Concretions, which though not singly visible, may be too great to be kept in a State of Fluidity by the diminish'd Heat of the Air.

A Mouse lived ten Minutes at least with a quarter Air, and three afterwards.

T I T L E

T I T L E XLI.

*Of heavy Bodies sustained in, or taken
up into the Air.*

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T I T L E XLII.

Of Dew.

T I T L E XLIII.

Of Rain.

AN eminent Virtuoso informed me, that in the Country of *Campen*, he had seen divers Pits that are digg'd for Turf, or rather Peat, which were not deep, for the most part, but reach'd to a kind of quick Sand, upon which the Rain falling, did by Degrees in some Years, form a kind of slimy Earth or Clay, which was much of a martial Nature; and being skilfully handled, would yield good Iron.

The same Person assured me, that he had divers times distilled the Water of *Campen* in new and fine Glasses, and still found them to leave a considerable Quantity of stony Matter at the Bottom, notwithstanding the Rectification.

Quicquid erit, sine fucō significat, velut Rottenberg, Silesiæ compactum appellant, perinde Milefow Temporum prognostes, jure merito dici posset. Vidi ex proximo totum aliquando montem densissimis Nebulis contactum, eâ prorsus imagine, qua Mons Sinai Moysè in Nebula latente depingitur, at cæteri circum Montes, innubes & hilares velut rerum gerendarum ignari stabant, Sol ipse formosissimus ibat; at accolæ locorum domum fugiebant, pecora urgebant, meque, ut domum protinus recipirem, properarem, & equos currum trahentes concitari juberem, monebant, neque horæ quadrans intercessit, jam Cœlum obduci, Sol contegi, eripi omnis aspectus.

L. i. c. 8, De Mont. Bohe-
miæ, p. 26.

A Milefow
monte tempo-
rum præfagia
capiuntur.

Virg.

Virg. Immenſum Cœlo ruit agnem aquarum ;
———ruit arduus æther,
Et pluvia ingenti ſata læta, boumque labores.

Diluit, implentur foſſæ, & quæ diuinus Poeta proſe-
quitur. At contra etiam accidere vidi, ut cæteri fumâ-
rint montes, Mileſſow nihil ſe commovente, nihil aut
nubilum, aut turbidum minante ; Iacolæ rogati, nihil
eſſe magnopere timendum à cæteris ſpondebant, hunc
unum intuendum eſſe, horum nubila omnia à Mileſſow
quodammodo devorari.

TITLE

T I T L E XLIV.

Of Hail.

ON écrit de l'Isle en Flandres le 25 May, style nouveau, qu'il tomba dans cette ville la une graille dont les moindres grains estoient comme des œufs de Pigeon. Cet orage a passé sur la Citadelle & la ville, & na pas laissé une vitre entiere du coste du vent : les maisons sont toutes decouvertes, & les arbres rompus, les bleds coupez, & les perdrix & les lieures morts. On a pese plusieurs grains de cette graille, dont les uns estoient d'un quarteron, de demi livre, de trois quarterons, et les plus gros d'une livre & d'avantage. Il y en avoit un entr' autres qui avoit dans le milieu une espece de matiere brune qu'ou mit dans le feu, qui fit faire un grand bruit. Il y en avoit un qui estoit diaphane, lequel estant mis aupres du feu, fondit tout aussi tost comme du plomb, quoy qu'il fut beaucoup plus dur que les autres.

T I T L E

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T I T L E XLV.

Of Snow.

T I T L E XLVI.

Of other things falling out of the Air.

EO ipſo anno quo Dux Eboraceniſis poſtremo rediit e Scotia Londinum, depluere tanta copia piſciculi halecibus colore, figurâ, ſapore quam ſimillimi in ſuperiore Gallocidiæ in Scotia parte non procul a mari, ut duo terræ jugera ad Robertum Murray de Brughton equitem pertinentia nunc Londini, ut audio, degentem, cooperuerint. Rem autem totam ſereniſſimo Duci Eboraceniſi prius de eadem ab eo interrogatus, quod tum certior ab aliis de hâc pluvia factus eſſet, tanquam teſtis oculatus, ut qui aliquos horum piſciculorum videram, confirmavi: is porro ingenioſiſſime, ſummâque veri ſpecie nodum ita ſolvit, ut diceret hos piſciculos unâ cum aquis furentium ventorum gyro in turbinem actis evectos eſſe nubes, e quibus non procul inde pondere rurfuſo ſuo relapſi fuerint in vicinam terram.

T I T L E XLVII.

Promiscuous *Experiments and Observations of the Air.*

T I T L E XLVIII.

*Defiderata in the History of the Air, and
Proposals towards supplying them.*

Books Printed for, and Sold by A. and J. Churchill, at
the Black Swan in Pater-Noster-Row.

T*itus Livius's* Roman History.
Boccaccio's Novels and Tales.
Sir Paul Ricaut's Lives of the Popes of
Rome.
 —History of the *Turks.* Two Vol.
Rushworth's Historical Collections.
Lloyd Dictionarium Historicum, Poe-
sicum, Geographicum.
Statutes of Ireland.
Bolton Justice of Ireland.
Sir George Wheeler's Travels into
Greece.
Leybourn's Dialling.
Buchanan's Chronicle and History of
 the Kings of *Scotland.*
Machiavel's Works.
Theſaurus Brevium.
Sir Simon Dew's Journal of Parlia-
 ment, *Q. Elizabeth.*
Dr. Brady's Introduction to the Histo-
 ry of *England.*
Milton's Paradise regain'd.
Leybourn's *Cursus Mathematicus.*
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Drelincourt of Death.
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Proteſtant Reconciler, Compleat.

Homer's *Iliads.*
Poeta Minores.
Royal Grammar.
Gibbon's Heraldry.
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Bp. Wilkins of Prayer and Preaching.
Thibault's Chymiſtry.
Glaſier's Chymiſtry.
Valerius Maximus, Engliſh.
 Two Treatiſes of Government.
 The Three Letters for Toleration.
 Some Conſiderations of the Conſe-
 quences of Lowring Intereſt, and
 raiſing the Value of Money.
Sir William Temple's Obſervations on
Holland.
 —Miſellanea.
Dr. Burnet's Travels.
Plato Redivivus.
Selden's Table-Talk.
Debates of Oxon and Weſtmiſter Par-
 liaments.
Titi Petronii arbitrii Satyricon, cum
fragmentis Attæ Græcæ recuperatis.
 Anno 1688.
Livii Orationes ſelectæ. 12°.
Sleidan de quatuor ſummis Imperiis ſve-
Ariſtole's Rhetorick, Engliſh.
Dr. Whiſby's ſeveral Pieces.
Partridge's Aſtrology.
Iſocrates Orationes, large 12° Lat.
 Guide to Heaven. 24°.
 Latin Teſtament, the *Cambridge* Edition.